FEASIBILITY OF A WINTER WATERFOWL WETLAND HABITAT USING AGRICULTURAL DRAINAGE WATER

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EXECUTIVE SUMMARY

The Tulare Lake Drainage District (TLDD) has identified a 305-acre site northwest of Corcoran, California as a potential location for a winter wetland habitat site. The site has been in active agricultural production for several decades. This site, most recently planted in cotton and safflower, has saline-alkali soils typical of lower Central Valley floodplains and lakebeds, with high clay content and thus poor drainage and low permeability. There is low-selenium saline subsurface drainage water available to this site during the period when winter waterfowl are present in the region for use as a water supply to the wetland. The site is currently devoid of wildlife habitat.

This evaluation explores the potential feasibility for this site to be converted to a seasonal wetland for winter waterfowl, specifically addressing issues related to:

- Species of interest (target species)
- Potential wetland design
- Management of water supply and water quality
- Vegetation management
- Predator management
- Disease management
- Mosquito management

The objectives of this feasibility assessment include:

- Identify design criteria for managed winter wetland habitat using agricultural subsurface drainage water supplies. This task begins with an evaluation of the suitability of the site for various species, followed by development of design criteria for a multi-species wetland complex suitable for the target species.

- Develop a conceptual design and operations plan for winter wetland habitats. This task involves prioritizing cover, foraging, and loafing habitats for target species to optimize benefits for the species group, including variables such as surface water area, water depth(s), vegetation mix, and predator control while providing for management access for on-going maintenance and repair, monitoring, and vector management.

- Assess the feasibility of developing a wetland with appropriate characteristics on the selected site with the available water supply.

- Assess the potential for adverse effects of wetland establishment and management on target species, other species, and adjacent or nearby commercial poultry operations.

Results of the preliminary evaluation suggest that a seasonal wetland complex for winter waterfowl is feasible on the 305-acre site. There should be an adequate supply of low-selenium, low to moderate salinity subsurface drainage water in most years to provide for an estimated initial fill of 193 acre-feet, 1,016 acre-feet to provide for flow through during annual operations, and 548 acre-feet for irrigation and leaching. The quantity of water available for use in the wetland is expected to vary among years in response to hydrologic conditions (e.g., drought) and agricultural practices within the northern regions of the TLDD service area. Given that an adequate water supply having suitable water quality characteristics is available, the conclusions of this preliminary evaluation of winter wetland feasibility are:

- Surface clay layers are deep enough to allow main channel excavations of up to 3.5 feet below existing land surface without penetrating the low-permeability zone;

- There is adequate soil available from excavations of the wetland pond complex to create about 24 acres of levees, perimeter uplands, and internal islands in a matrix of 281 acres of ponds with a depth of 0 to 12 inches;

- There are wetland vegetation types suitable for the target species that will readily germinate and grow on the soils of the site and in water with a mean salinity of from 3,000 mg/l TDS to 4,000 mg/l TDS;

- There are no sensitive species or habitats for sensitive species on the site in its current condition and no adverse impacts to biological resources would occur as a result of conversion of the field to wetlands;

- The proposed site is approximately 4,000 feet (0.76 miles) from the nearest commercial poultry

operation and this isolation reduces the potential for interaction between domestic and wild birds and resulting disease transmittal to a very low level;

- Water management construction techniques have been developed that should reduce the potential for the seasonal wetland to produce mosquitoes, and on-going monitoring will ensure that supplemental mosquito treatments may be made in a timely manner when and if needed;

- The wetland can be designed to provide suitable access to exterior and interior areas for maintenance and disease monitoring;

- Encircling the wetland using a fence is feasible and would be effective in reducing unwanted access;

- With independent delivery drainage, the wetland can be designed and operated to minimize potential for waterfowl to be affected by common avian diseases, particularly avian botulism; and

- Preliminary wetland design, based on the general criteria provided in this evaluation, should be initiated in cooperation with USFWS, CDFG, California Waterfowl Association, and other interested parties.

Based on these findings, we conclude that a winter wetland is feasible at the proposed site. The wetland is expected to benefit the target species (dabbling and diving ducks) by providing wintering wetland habitat and islands for loafing. The proposed design would also provide incidental benefits to other migratory waterfowl and wildlife.

As part of the feasibility study, a California Environmental Quality Act (CEQA) Checklist and Negative Declaration were prepared and circulated for public review and comment (State Clearinghouse No. 2005 051105). The public comment period extended from May 18 to June 16, 2005. Notices of availability were published in the Corcoran Journal and posted at the TLDD offices. The feasibility study and environmental documentation were also provided to the U.S. Fish and Wildlife Service (Thomas Maurer, Chief, Investigations and Prevention Branch, Environmental Contaminants Division, Sacramento, California) for review and comment. Copies of the environmental documents are included in Appendix B. Based on these documents, TLDD certified the Negative Declaration on June 24, 2005.

I. INTRODUCTION & BACKGROUND

Prior to 1850, there were over 1 million acres of permanent and seasonal freshwater and saline wetlands in California's Central Valley. The Tulare Lake basin was a major feature of this wetland system, which supported millions of wintering waterfowl and large numbers of summer-breeding shorebirds. Such shallow-water wetlands have high biological productivity because nutrients are exposed to long periods of solar radiation and high water temperatures, resulting in conversion of primary nutrients to algae, phytoplankton (Jassby, Cloern, and Muller-Solger 2003) and vascular plants.

At present, only about 5% of these historic wetlands remain, therefore beneficial efforts to sustain and manage waterfowl are focused on (a) restoration of habitat, and (b) enhanced agricultural and urban water management practices to provide incidental benefit to waterfowl (O'Brien, Hetrick, and Dusault 2002). There are hundreds of wetland/marsh complexes, which have been designed and operated to enhance habitat for migratory and resident waterfowl, including the Federal government's extensive National Wildlife Refuge system and California's system of refuges and ecological reserves. There are also numerous wetlands designed and managed by organizations such as the California Waterfowl Association (CWA) in addition to local waterfowl hunting clubs. Management of these wetlands has been refined over decades, and the habitat and management requirements for the major species of waterfowl that winter in California are well established. There is thus an extensive body of literature regarding the topography, soils, water depth and quality, food plants, predator control, and other factors influencing the effectiveness of created/restored wetlands for waterfowl (SRCD 1998).

As part of the feasibility analysis, information available in the scientific literature on design, operations, and management of winter waterfowl wetland habitat was compiled and reviewed. In addition, individuals experienced in the design and management of wetland habitat were also consulted. Among these sources,

information on management and performance of wintering wetland waterfowl habitat in the Suisun Marsh region of the San Francisco-San Joaquin delta was identified as a useful model to provide guidelines and criteria for use in this feasibility study. Suisun Marsh has been managed over a number of decades using low-salinity (brackish) water supplies, similar to those that would be available for use in the Tulare Lake wintering wetland. The area provides extensive habitat for a diverse assemblage of wintering waterfowl and other wildlife species and has proven successful as a managed winter waterfowl habitat enhancement area. As a result, general similarities and salinity of available water supplies, topographic features, general regional proximity within Central California, and the extensive body of information that has been compiled regarding soil and salinity, suitable vegetation and cultivation techniques, performance of a wintering habitat, and water management, the Suisun Marsh was identified as one of the primary sources of information to be used in developing design criteria and the framework for evaluating feasibility of a winter wetland habitat within the Tulare Lake area using low-salinity water supplies. Detailed information on the design and management of the Suisun Marsh wetlands is available from the Suisun Resource Conservation District (SRCD 1998). The proven success of the Suisun Marsh management practices and extensive experience of wetland managers provided, in large part, the technical foundation for this feasibility analysis. In addition to consultations with the Suisun Marsh Resources Conservation District staff, site visits were periodically conducted to Suisun Marsh and other managed wetlands during various seasons of the year to observe wetland conditions and associated management techniques. Photographs showing the general managed conditions within these wetlands are included in Appendix A.

In addition to management focused primarily on habitat, over the last three decades the nutrient processing/conversion function of wetlands has been used in over 800 bioremediation projects in which wetlands have been primary or secondary elements of systems to remove high levels of nitrates, phosphates, and other dissolved solids from agricultural, urban, and industrial pollutant streams. Examples of such "polishing marshes" include final treatment of secondary urban wastewater discharges, agricultural discharge from wineries, agricultural food processing plants, and runoff from dairies (O'Brien, Hetrick, and Dusault 2002). A majority of these treatment wetlands are associated with urban wastewater treatment. Similarly, winter flooding of rice fields is an example of a multi-purpose agricultural practice that both provides winter forage for migratory waterfowl and enhances breakdown of rice straw. The integration of water treatment and biological objectives in wetlands management is a relatively new focus, but there has been substantial study of factors affecting the function of wetlands for bioremediation and there are formal government guidelines for their design and management (for example, see Hammer 1996, and USEPA 2000).

In their 2002 report, O'Brien, Hetrick, and Dusault explored the general opportunities for the use of agricultural return flows in created wetlands. They note that although treatment wetlands may not entirely mimic natural wetland function and value, these wetlands may nonetheless have significant habitat value, a finding also supported by USEPA (1999) and Knight, Clarke, and Bastian (2001).

In the Tulare Lake area, summer-breeding shorebirds and winter waterfowl may utilize evaporation ponds used by the Tulare Lake Drainage District (TLDD) to capture water from subsurface agricultural drainage systems. These evaporation ponds receive and confine drainage water that contains selenium leached from local soils. Semi-impervious soils prevent this water from penetrating to groundwater as it slowly evaporates.

Since 1994-1995, TLDD has successfully designed, constructed, and operated a seasonal wetland for summer breeding shorebirds, using low-salinity agricultural subsurface drainage water (SJVDIP 2000; Davis, Hanson, and Hansen in prep). Over this 10-year operation period, TLDD has managed subsurface agricultural drainage water quality to provide low-selenium saline water supplies to the wetland complex by allowing drainage water to flow through the wetland continuously and then discharging it to evaporation ponds. A combination of enhanced wetland conditions at the constructed wetland, and physical and management measures to make nearby evaporation ponds less attractive to shorebirds, has resulted in a shift of shorebird use away from the evaporation ponds and into the managed wetland, where nesting density and nest success have been consistently high during the initial 10 years of operation.

TLDD has identified a 305-acre site northwest of Corcoran, California (Figures 1 and 2) as a potential location for a winter wetland habitat site. The site has been in active agricultural production for a number of years (decades). This site, most recently planted in cotton and safflower, has saline-alkali soils typical of lower Central Valley floodplains and lakebeds, with high clay content and thus poor drainage and low permeability. Results of the Soil Conservation Service (1986) soil mapping of Kings County showed that the dominate soil type at the proposed wetland site is partially drained Armona loam (estimated to represent 80.3% of the soil by area within Section 3) with 12% characterized as partially drained Vanguard sandy loam, and 7.7% as partially drained Pitco clay. Armona loam, Vanguard sandy loam, and pitco clay are characterized as deep, poorly drained, saline-alkali soils. There are low-selenium saline subsurface drainage water supplies available to this site during the period when winter waterfowl are present in the region, and the site is currently devoid of wildlife habitat (Figure 2).

This paper explores the potential feasibility for this site to be converted to a seasonal wetland for winter waterfowl, specifically addressing issues related to:

- Species of interest (target species)
- Potential wetland design
- Management of water supply and water quality
- Vegetation management
- Predator management
- Disease management
- Mosquito management

These issues are addressed in terms of both potential benefits and adverse effects of the potential wetland. The project objectives are to:

- Identify design criteria for managed winter wetland habitat using agricultural subsurface drainage water supplies. This task begins with an evaluation of the suitability of the site for various species, followed by development of design criteria for a multi-species wetland complex suitable for the target species.

- Develop a conceptual design and operations plan for winter wetland habitats. This task involves prioritizing cover, foraging, and loafing habitats for target species to optimize benefits for the species group, including variables such as surface water area, water depth(s), vegetation mix, and predator control while providing for management access for on-going maintenance and repair, monitoring, and vector management.

- Assess the feasibility of developing a wetland with appropriate characteristics on the selected site with the available water supply.

- Assess the potential for adverse effects of wetland establishment and management on target species, other species, and adjacent or nearby commercial poultry operations.

The following sections summarize results of a review of available scientific literature and data from monitoring at the TLDD compensation wetland habitat and evaporation basins, in addition to information from monitoring and observations at other managed wetland facilities and consultation with wetland managers regarding the design, management, and operations of wetlands having similar site characteristics, species of interest, water quality conditions, and other features for use in this feasibility assessment. Information from these various sources has been used to identify target species for the wetland and develop basic wetland design and management criteria for use in assessing the potential feasibility and identifying significant environmental impacts or fatal flaws in developing a winter wetland at the proposed site.

II. WINTER WATERFOWL TARGET SPECIES

Site conditions affect the selection of target species. The potential site being considered for a winter wetland is essentially level, with moderately saline soils. Historically, native vegetation was probably Valley Sink Scrub and/or Valley Saltbush Scrub. It is likely that the site flooded in many winters and, given its impermeable subsoils, retained surface water into the spring. The proposed area is currently devoid of trees and shrub habitats (Figure 2). The site is within a regional landscape characterized by a matrix of various seasonal and permanent crops. According to the Tulare County Agricultural Commissioner (TCAC 2003), only about 60,000 acres of the total 1.1 million acres of rangeland and field crops in the county is in a seed crop

(wheat), but there are about 225,000 acres in silage of various types. Cotton and safflower are common annual crops in the area. Wheat and rangeland tend to be located along the eastern margin of the valley in Tulare County, at some distance from the potential wetland site.

Although lacking trees and shrubs, the potential wetland site is otherwise similar to the Kern National Wildlife Refuge (KNWR) near Delano (Figure 1). The winter waterfowl data for KNWR suggest that migratory waterfowl that forage in dry grain fields, such as geese, are not a major component of the biota (Table 1). Of five goose species observed at KNWR, one is listed as uncommon (Canada goose), two are noted as occasionally seen (greater white-fronted goose and snow goose), one is listed as rare (Ross' goose), and one is listed as an accidental visitant (brant). The relative absence of geese in the KNWR may reflect the natural range of these birds, as well as the current limited availability of grain crops adjacent to the wetlands. The three mergansers, which require relatively deeper water, are seen rarely (hooded merganser), occasionally (common merganser), and not at all (red-breasted merganser). Greater sandhill cranes may also be observed at KNWR, though they are rare this far south and wintering areas are concentrated north of Fresno (Pogson and Lindstedt 1991).

The most commonly observed species at KNWR are dabbling and diving ducks, with abundant species being: green-winged teal, mallard, northern pintail, northern shoveler, gadwall, and American widgeon (Table 1). Common but not necessarily abundant winter waterfowl species at KNWR include cinnamon teal, ring-necked duck, and ruddy duck. Other common winter visitants to KNWR include great blue heron, black-crowned night heron, killdeer, black-necked stilt, ring-billed gull and California gull.

At about 11,000 acres, KNWR includes a variety of marsh, riparian wetland, upland forest, and grasslands. KNWR is thus a more diverse habitat than could be established on a seasonal basis at the proposed 305-acre wetland site, particularly given the relative lack of grain crops adjacent to the proposed wetland site. This suggests that the proposed wetland should be designed for dabbling and diving ducks, with some provisions for anticipated occasional visits by geese, bitterns, herons, egrets, and cranes. Given that some shorebirds may remain in the region over winter, it may also be appropriate to provide shallow-water habitats for species such as killdeer and black-necked stilts. Target species for the proposed wetland, based on observations of

FIGURE 1. Site location of potential 305-acre seasonal wetland for winter waterfowl, approximately 7 miles west northwest of Corcoran, CA.

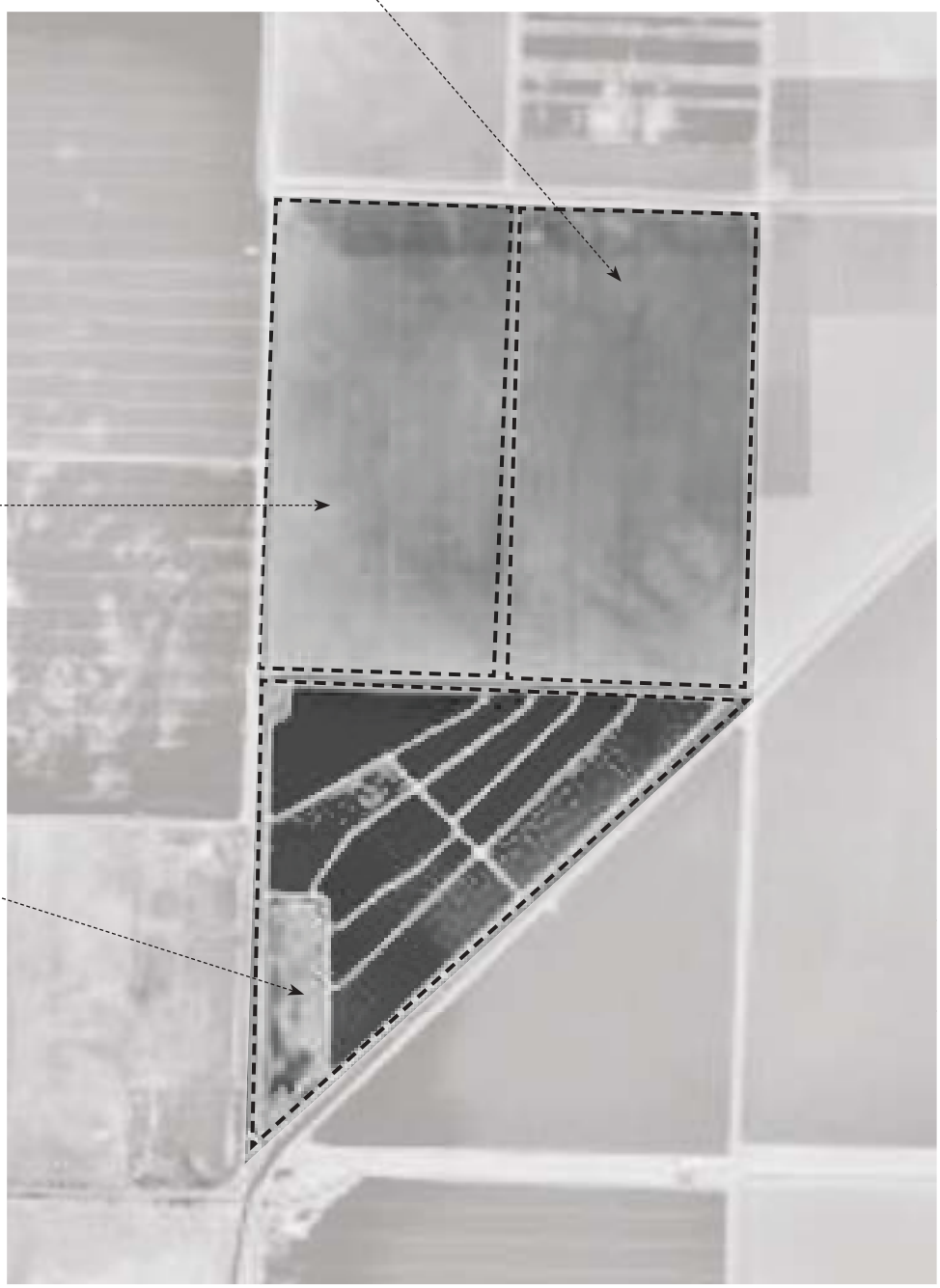


FIGURE 2. Aerial photograph of the existing site, showing the existing North Evaporation Basin, Compensation Habitat, as well as the proposed winter wetland habitat.

TABLE 1. Waterbird abundance at TLDD habitats and Kern Wildlife refuge.

SPECIES	2001											
	TLDD N. EVAPORATION BASIN*				TLDD COMPENSATION HABITAT*				KERN WILDLIFE REFUGE			
	SP	S	FA	W	SP	S	FA	W	SP	S	FA	W
Grebes	x	x	x	x			compensation habitat closed		x	x	x	x
Waders	x	x	x	x					x	x	x	x
Geese									x	x	x	x
Dabbling Ducks	x	x	x	x	x	x			x	x	x	x
Diving Ducks	x	x	x	x					x	x	x	x
Waterfowl	x	x	x	x	x	x			x	x	x	x
Hawks and Falcons	x		x	x					x	x	x	x
Rails and Moorhens									x	x	x	x
Coots	x	x	x	x	x				x	x	x	x
Plovers	x	x	x	x	x	x			x	x	x	x
Recurvirostrids	x	x	x	x	x	x			x	x	x	x
Sandpipers	x	x	x	x	x	x			x	x	x	x
Shorebirds	x	x	x	x	x	x			x	x	x	x
non-Recurv. Shorbrds	x	x	x	x	x	x			x	x	x	x
Gulls	x		x						x	x	x	x
Terns	x	x	x						x	x	x	x
Waterbirds	x	x	x	x	x	x			x	x	x	x
Landbirds	x	x	x	x	x	x			x	x	x	x

LEGEND
* = data from October 2000 - September 2001
x = observed
[blank] = 1-0 observed

species occurrence at the KNWR and TLDD evaporation basins and compensation wetland habitat (Table 1), are therefore:

- Green-winged teal,
- Mallard,
- Northern pintail,
- Northern shoveler,
- Gadwall,
- American widgeon.
- Cinnamon teal,
- Ring-necked duck,
- Ruddy duck,
- Great blue heron, and
- Black-crowned night heron.

III. TLDD WINTER WATERFOWL WETLAND HABITAT DESIGN CRITERIA

There are a number of official and semi-official guides to the design of wetlands for winter waterfowl, each reflecting differences in target species, local conditions, and the regulatory environment. As part of this feasibility study, wetland managers were consulted and the scientific literature reviewed to identify design and operational criteria that would be representative of conditions occurring at the proposed TLDD site. Wetland design and management within the Suisun Marsh region of San Francisco Bay were identified as a useful model. The Suisun Marsh wetlands have proven to be successful in providing wintering waterfowl habitat using low-salinity water similar to that available at the TLDD site. Based on these similarities, information on the plant species successfully propagated within Suisun Marsh and the water and land management practices were used as part

of the basis for identifying and evaluating the potential feasibility of developing a successful managed winter wetland given the site characteristics, water supplies, and opportunities and constraints at the proposed TLDD site. Table 2 summarizes major physical facility design criteria for various winter waterfowl wetlands. The rationales for the various design criteria are discussed below.

A. Wetland and Adjacent Habitats

The target species list includes species that would forage almost exclusively within the wetland, in part due to the lack of available off-site agricultural foraging areas. In the northern Central Valley, for example, northern pintail would forage in the wetland and in adjacent flooded or dry rice fields (Miller and Newton 2000). Miller and Newton (2000) estimate that without dry rice forage for northern pintails, the Central Valley would require an additional 10,000 hectares of active wetland to support the current northern pintail population. Although the target species may forage exclusively on the complex of wetlands and uplands/islands provided for in the proposed design, high energy needs following the fall migration could result in depletion of wetland resources, particularly if large numbers of waterfowl utilize the habitat early in the season (Miller and Newton 2000). Miller and Newton (2000) document a greater than 10-fold daily food intake from wetlands and a corresponding increase in food intake from adjacent rice fields, with the shift to rice fields occurring in late October to early December. CDFG (1981) also notes that large numbers of early migrants may utilize a substantial portion of forage resources within the saline wetlands of Suisun Marsh, and note that many of the waterfowl migrate off the marsh to nearby flooded fields once significant precipitation occurs in the late fall and early winter. Austin, Humburg, and Fredrickson (1999) also document a balanced use of native wetlands vegetation and high-energy commercial grains in adjacent fields. Balanced use of these two potential foraging habitats is important, because commercial grains may not have adequate protein or mineral constituents needed by waterfowl (Miller *et al.* 2000; Austin, Humburg, and Fredrickson 1999). Miller *et al.* (2000) document invertebrate consumption accounting for about 25%

TABLE 2. Preferred foraging depth and pond size for target species.

SPECIES	SOURCE	POND SIZE	POND DEPTH (INCHES)	VEGETATION DENSITY
Green-winged teal	SRCD (1998)	NA	4-8	NA
	WRP (1999)	0->5 acres	<5	Sparse to moderate
Mallard	SRCD (1998)	NA	2-6	
	WRD (1999)	0->5 acres	<5	Sparse to moderate
Northern pintail	SRCD (1998)	NA	5.5-8	
	WRP (1999)	0->5 acres	<5	Sparse to moderate
Northern shoveler	SRCD (1998)	NA	6.5-9.5	Sparse to moderate
	WRP (1999)	0->5 acres	<5	
Gadwall	WRP (1999)	0->5 acres	5-10	Sparse to moderate
American widgeon	WRP (1999)	>5 acres	>10”	Sparse
Cinnamon teal	WRP (1999)	0->5 acres	<5	Sparse to moderate
Ring-necked duck	WRP (1999)	>5 acres	>10”	Sparse
Ruddy duck	WRP (1999)	>5 acres	5-10	Sparse
Great blue heron	SRCD (1998)	NA	4-7	
	WRP (1999)	0->5 acres	> 10	Sparse to moderate
Black-crowned night heron	WRP (1999)	0->5 acres	<5	Sparse to moderate
Killdeer	WRP (1999)	0->5 acres	<5	Sparse
Black-necked stilt	WRP (1999)	>5 acres	<5	Sparse to moderate

to 30% of total food intake for mallards, gadwalls, and widgeons, with agricultural crops amounting to 45% to 60% of total food intake for these three waterfowl.

In the absence of adjacent foraging areas, the wetland must sustain the birds, which utilize it. A focus on these species does not preclude wetlands, which support a broader range of waterfowl. As WRP (1999) indicates, waterfowl have overlapping life histories and there are many species, which may utilize wetlands over a range of habitat conditions. Wetland productivity and function would therefore be enhanced significantly by (a) effective production of invertebrates and (b) grain production in adjacent areas or supplementation on site.

B. Pond Size, Depth, and Cover Density

These fundamental physical characteristics affect site use by various species, and small variations in these variables may alter the community of a constructed wetland (WRP 1999). Since winter wetlands function primarily as loafing and foraging habitat for the target species, these characteristics may be considered primary.

In its guidelines for moist soil habitat in the Suisun Marsh area, the Suisun Resource Conservation District (SRCD 1998) notes that only 10% of winter waterfowl (primarily American coot) forage effectively below a depth of about 12 inches. California Waterfowl Association (CWA 2005) concurs that most waterfowl using winter seasonal wetlands cannot forage effectively in water deeper than 10 inches. The Wetlands Research Program of the US Army Corps of Engineers (WRP 1999) also notes that various species prefer different pond size and depth. Preferred pond sizes, forage depths, and vegetation densities for the proposed target species are shown on Table 2. The WRP (1999) notes that water depth control is critical because changes in water depths of only a few inches may affect site use. WRP (1999) also notes that many migratory waterfowl utilize water of varying depth.

Note in Table 2 that a majority of the target species can utilize small to large ponds, water depths of less than 5 inches, and sparse to moderate vegetation density.

WRP (1999) and CDFG (1981) generally concur with the SRCD recommendations for pond depth, CDFG noting that depths of 3-12 inches are preferred, with some potential for small areas of deeper water. They emphasize the need to maintain as much shallow-water perimeter as possible. Minnesota NRCS (2001) suggests a general rule that 50% of surface water area should be less than 18 inches deep.

During the transition from winter to spring, female ducks may shift from a plant diet to a diet focused on aquatic invertebrates to enhance the protein content of their diet and support egg formation and growth. In addition, mallards, gadwalls, and widgeons have been shown to utilize aquatic invertebrates during winter, with invertebrates accounting for 25% to 30% of total food intake by volume (Miller *et al.* 2000). Wetland design affects invertebrate production, depending on the group of invertebrates involved and their life history strategies (Eldridge 1990). Four basic groups of aquatic invertebrates have various water management needs (Eldridge 1990):

- Group 1: Passive dispersal invertebrates such as leeches, earthworms, zooplankton, amphipods, isopods, and gastropods. These are resident on the site and have elaborate strategies for surviving drought and freezing.
- Group 2: Some beetles and midges. These require water for egg laying in the spring.
- Group 3: Dragonflies, mosquitoes, and phantom midges. These require wet mud in spring and summer for egg laying.
- Group 4: Some aquatic true bugs and beetles. This group cannot withstand drought or freezing and utilize deep bodies of water to oversummer. They thus must either reside on site or there must be available deep water nearby.

Because mosquitoes are not a desired aquatic invertebrate, the wetland complex should be designed and managed to avoid conditions that would result in abundant exposed mud in spring and summer. Habitat may be provided for groups 1, 2, and 4, utilizing deep ponds of limited size to provide for seed populations of these invertebrates and thus enhance potential for the wetland to provide some high protein food sources for female ducks as they prepare

for migration to summer breeding grounds.

C. Water Quality

Water quality is important for several reasons. First, poor water quality may affect the health of target species. Second, water quality may affect the growth of vegetation and/or macroinvertebrates and thus influence food supplies for target species. Third, some species prefer low turbidity water for foraging.

EPA National Recommended Water Quality Criteria for Freshwater (EPA 1999) provide initial criteria for water supplied to the proposed wetland. TLDD has monitoring data on water quality at its summer-breeding shorebird compensation wetland and North Evaporation Basin that are representative of water quality conditions for the proposed wetland, for a number of key water quality parameters from sampling between 1998 and 2003. Table 4 compares measured values for these parameters to the EPA criteria.

EPA (1999) notes that the above criteria "are national guidance [and] they are intended to be protective of the vast majority of the aquatic communities in the United States." As such, they address water quality for aquatic communities including species such as fish, aquatic invertebrates, and amphibians that live and forage in an aquatic environment. Official numeric standards have not been formulated for many of the constituents on Table 4. Among the various water quality constituents of interest in evaluating the feasibility of developing a winter wetland within the San Joaquin Valley the effects of selenium on waterbirds has received the greatest attention. The EPA water quality criterion for selenium (freshwater continuous criterion) is 5 µg/l.

Bioaccumulation of some constituents in subsurface agricultural drainage water is also of concern, including accumulation of selenium in waterfowl related to buildup of selenium salts in marsh soils and subsequent increases in concentrations through the food chain. Bioaccumulation would have the greatest effects on waterfowl that feed within the wetland environment, as opposed to birds like geese, which forage on grains in adjacent farm fields. Potential for accumulation of selenium salts in soils and in the invertebrate community is of special concern.
Elevated levels of selenium have been documented to have adverse effects on wildlife (CH2M Hill *et al.* 1993, Skorupa and Ohlendorf 1991, Skorupa 1998, Adams *et al.* 2004, Ohlendorf 2004, and others). Most of the research has been conducted on waterbirds, and selenium effects range from subtle sublethal changes, such as weight loss, to reduced hatchability (i.e., the portion of a clutch of eggs that develops to the hatching stage) and teratogenesis (i.e., developmental malformations of embryos). The levels of selenium at which the probabilities of these effects are likely to increase (referred to as threshold levels) have been analyzed and calculated for breeding birds inhabiting the San Joaquin Valley (Skorupa and Ohlendorf 1991, CH2M Hill *et al.* 1993, Maier and Knight 1991 in H. T. Harvey & Associates 1997, Ohlendorf 2004, Adams *et al.* 2000, Parametrix 2002, and others). These thresholds are reported as the amount of selenium in the water (waterborne selenium), food chain biota (dietary selenium), and bird tissues (avian eggs, breasts, and livers) resulting in adverse affects (e.g., impaired egg hatchability).

Over the past several years, extensive investigations have been performed to further evaluate selenium toxicity thresholds for waterbirds. These investigations have included reanalysis of both laboratory and field data on selenium concentrations in water, food, and waterbird eggs using sophisticated statistical analyses and modeling techniques to identify ecologically significant selenium threshold concentrations resulting in reproductive risk. Many of these investigations have also focused on evaluating site-specific variability in selenium risk thresholds for both fish and wildlife, reflecting unique environmental conditions that occur within a site affecting selenium pathways, site-specific biogeochemical cycling, the relationship and concentrations of organic and inorganic selenium within and among sites, and their effects on selenium toxicity and risk of adverse impacts. Examples of these investigations and analyses include Adams *et al.* (2000), Adams *et al.* (1998), DeFrost *et al.* (1999), Fairbrother *et al.* (1999), Ohlendorf (2004), and other investigators. Results of these investigations suggest:

- Selenium bioaccumulation varies from site to site for both waterbirds and aquatic organisms in response to a variety of site-specific conditions including biogeochemistry selenium cycling processes, and the resulting

TABLE 3. EPA National Recommended Water Quality Criteria (1999) and results of TLDD surveys of inlet water quality at summer-breeding shorebird wetlands.

CONSTITUENT	UNITS	FRESHWATER CRITERIA MAXIMUM CONCENTRATION	FRESHWATER CRITERIA CONTINUOUS CONCENTRATION	MEAN VALUE AT WETLAND INLET (NUMBER OF SAMPLES)	RANGE AT WETLAND INLET (NUMBER OF VALUES)
Arsenic	µg/l	340	150	135.9 (10)	110-180 (10)
Boron	mg/l	No numeric standard		2.6 (10)	1.7-4 (10)
Carbonate	mg/l	No numeric standard		253 (3)	48-400 (3)
Bicarbonate	mg/l	No numeric standard		535 (4)	330-930 (4)
Chloride*	mg/l	860	230	752 (4)	360-1,300 (4)
Magnesium	mg/l	No numeric standard		81 (4)	34-190 (4)
Molybdenum	µg/l	No numeric standard		167 (10)	110-380 (10)
Nitrate	mg/l	No numeric standard		28 (4)	ND-57 (4)
PH		6.5-9	6.5-8.5	8.8 (2)	8.7-8.9 (2)
Selenium**	µg/l	24**	5.0	1.65(15)	ND-4.0 (15)
Sodium	mg/l	No numeric standard		1532 (4)	730-2,800 (4)
Sulfate	mg/l	No numeric standard		2075 (4)	900-4,700 (4)
TDS	mg/l	No numeric standard		4850(4)	2,400-9,100 (4)

Notes: *Chloride standards reflect tolerances of freshwater aquatic species rather than waterfowl.

**EPA calculates selenium as a weighted average of selenite and selenate. The criterion used here represents a hypothetical 50% selenite and 50% selenate mix.

concentrations of selenium in organic and inorganic forms (e.g., bioavailable selenium concentrations);

- The risk of adverse toxicity is greater for organic forms of selenium when compared to inorganic selenium. The ratio of organic to inorganic selenium varies from one site to another based on a variety of factors (e.g., redox, pH, biological productivity, oxidation, and biotransformation of selenium), which affect the risk of ecologically significant impact, but are not necessarily reflected in the measurement of total selenium concentrations; and

- Toxicity thresholds vary substantially among waterbird species.

One of the first series of analyses designed to evaluate selenium toxicity thresholds for waterbirds within San Joaquin Valley was a statistical linear regression model developed by Skorupa and Ohlendorf (1991). The model included two separate linear regressions designed to assess trophic pathways from water into the aquatic food chain and then consumed by waterbirds and ultimately transferred maternally to waterbird eggs. Selenium concentrations within the waterbird eggs were then used as a predictor of the potential for adverse impacts such as an increased probability of embryonic abnormalities. The relationship developed between waterborne selenium and food chain selenium concentrations was based on field data collected from several sites within the San Joaquin Valley. The relationship between dietary selenium and mean egg selenium was based on experimental studies with farm-raised mallards exposed to a selenomethionine-spiked diet. For purposes of the model, food chain selenium and dietary exposure to selenium were assumed to be equal. Mean egg selenium values were based on data for eared grebes, assuming a value of 3 ppm dry weight was equal to

TABLE 4. Impacts of wetlands on influent water quality (from O'Brien, Hetrick, and Dusault 2002).

WETLAND	WATER QUALITY PARAMETERS		
	Constituent	Influent Concentration	Effluent Concentration (change)
New River, Imperial Valley CA (Ag. Return flows)	TSS	480-760 mg/l	15-60 mg/l (-95%)
	Dissolved oxygen	8.64 mg/l	19.84/ mg/l (+130%)
Prado/Santa Ana River (Dairy drainage)	Total Nitrogen	8.69 mg/l	6.77 mg/l (-22%)
	Dissolved Oxygen	7.78 mg/l	8.97 mg/l (+15%)
Everglades Construction (Stormwater treatment)	Phosphorus	98 µg/l	19 µg/l (-80%)
Raccoon River Watershed Project (Tile drain water)	Nitrates	4-13 mg/l	1.0-10 mg/l (20-85%)

natural background concentrations. Using the regression models, Skorupa and Ohlendorf (1991) estimated waterborne selenium concentrations of 0.5 – 2.3 µg/l as the range not exceeding the egg selenium contaminant threshold assumed to be 3 ppm. Based upon results of these analyses, a waterborne selenium criterion of 2 µg/l was recommended by USFWS as a chronic selenium water quality criterion for the protection of waterbirds.

Since publication of the original selenium risk analyses by Skorupa and Ohlendorf (1991) and Ohlendorf and Santolo (1994), data from a wide variety of field and laboratory experiments have subsequently been compiled and have been subject to rigorous statistical reanalysis to further evaluate potential relationships between waterborne selenium, dietary selenium, and egg selenium concentrations resulting in various biological endpoints characterizing various levels of reproductive impairment (e.g., reduced egg hatchability, embryonic deformities and abnormalities, increased juvenile mortality) for various species of waterbirds. Mean egg selenium concentrations used in many of the earlier analyses related to toxicity threshold concentrations resulting in embryonic abnormalities (teratogenesis). The estimated egg selenium concentrations (EC10) resulting in teratogenesis for ducks, stilts, and avocets have been found to be significantly different, with egg threshold concentrations for mallards of 23 ppm, black-necked stilts of 37 ppm, and American avocet egg selenium concentrations of 74 ppm (Ohlendorf 2004). In the more recent analyses, a more sensitive biological endpoint based on reduced egg hatchability has been used for evaluating selenium risk. Egg concentrations resulting in reduced hatchability have been found to be lower than those causing embryo deformities. Using the more sensitive reduced hatchability criterion, Fairbrother *et al. (*1999, 2000) statistically reanalyzed available laboratory and field data on the relationship between egg selenium and reduced hatchability for mallard ducks. Results of these analyses showed an egg selenium threshold concentration for reduced hatchability (EC10) of 16 ppm. Ohlendorf (2004) conducted further analyses of available data for mallard ducks and concluded that the geometric mean egg selenium threshold concentration resulting in reduced hatchability (EC10) was 12.5 ppm.

Adams *et al.* (2000) compiled and synthesized available information regarding water quality criteria for selenium, identifying site-specific differences between lotic (flowing) and lintic (standing) water bodies. Results of these analyses demonstrated significant differences in the bioaccumulation of selenium by fishes and invertebrates from flowing and standing water, and that selenate was

found to be much less bioaccumulative than selenite. Considerable variation in selenium accumulation by waterbirds was also identified as a site-specific factor to be taken into account when establishing water quality criteria. The Environmental Protection Agency (U.S. EPA) has also recognized variation in water quality criteria for the protection of fish and wildlife between flowing and standing water bodies. Further consideration has also been given in establishing water quality criteria to differentiate bioaccumulation and potential toxicity between freshwater and saline water bodies. The U.S. EPA chronic criterion for selenium is 5 µg/l, which is substantially greater than the water quality criterion for protection of wildlife of 2 µg/l identified by USFWS.

A site-specific water quality criterion of 2 µg/l selenium has been applied to wetland water supply channels in the grassland area of the San Joaquin Valley (Mauer 2005; Appendix B).

Available scientific information from a variety of laboratory and field studies, representing a range of environmental conditions, is continuing to be reviewed and analyzed for the purpose of developing water quality criterion applicable for various site-specific environmental conditions.

Adams *et al.* (2004) reported results of additional statistical analyses of data available from field and laboratory studies used to derive selenium toxicity thresholds for mallard ducks. Results of the statistical analyses of the relationship between egg selenium concentrations and mallard duckling hatchability and mortality (hatchability EC10 7 days post-hatch) estimated a toxicity threshold (geometric mean concentration) of 14-15 ppm dry weight using probit and logit models and an EC10 toxicity threshold of 12 ppm dry weight using a hockey stick regression threshold model. Results of these analyses are similar to the toxicity threshold for egg selenium based on hatchability derived by Ohlendorf (2004).

Results of statistical analyses performed by various investigators to assess egg selenium concentrations associated with an increased risk of impaired hatchability and embryonic teratogenesis, developed using field and laboratory data for mallard ducks, black-necked stilts, and American avocets, are summarized in Table 5:

TABLE 5. Summary examples of egg selenium threshold response analyses.

SPECIES/RESPONSE	REPORTED EGG SE THRESHOLDS (PPM/DW)	REFERENCE
Stilt clutch inviability	6 (1)	Skorupa and Ohlendorf 1991
Stilt impaired hatchability	8	Ohlendorf and Santolo 1994
Duck teratogenesis	23(2)	Ohlendorf 2004, Skorupa 1998
Stilt teratogenesis	37(2)	Ohlendorf 2004, Skorupa 1998
Avocet teratogenesis	74(2)	Ohlendorf 2004
Duckling mortality (7 day)	16(2)	Fairbrother *et al.* 2000
Duck impaired hatchability	12.5(2)	Ohlendorf 2004
Stilt teratogenesis	15.5-24.3(2)	Adams *et al.* 2004
Duck teratogenesis	21(2)	Adams *et al.* 2004
Duck teratogenesis	23(2)	Adams *et al.* 2004
Stilt egg inviability	21-31(2)	Adams *et al.* 2004
Stilt egg inviability	24.2(2)	Adams *et al.* 2004
Duckling mortality (7 day)	14-15(2)	Adams *et al.* 2004
Duck egg inviability	12.3(2)	Adams *et al.* 2004

(1) EC_3
(2) EC_{10}
Note: Results reflect statistical analyses of field and laboratory-derived data using a variety of statistical techniques.
Source: Adams *et al.* 2004; Ohlendorf 2004.

TABLE 6. Summary of electrical conductivity and salinity at North Evaporation Basin, 2000-2004.

LOCATION	MEASURE	UNITS	2000*	2001*	2002*	2003*	2004*	2000-2004 AVERAGE
Cell 1	Well Average Electrical Conductivity	µmhos/cm	3,309	2,950	2,975	3,958	not available	3,298
Inlet	Salt Concentration	ppm	2,368.00	not available	1,845.33	2,336.00	2043	2,148

* Water year

Impacts on birds outside the breeding season associated with dietary exposure to selenium have not been studied as much as those on birds during the breeding season, partly because of the difficulty and cost associated with studying these effects (Barnum pers. comm.). Laboratory studies on non-breeding mallards have demonstrated both lethal and nonlethal effects, including weight loss, atrophy of feather follicles, and atrophy of lymphoid tissue. Lethal impacts from selenosis have not been observed at evaporation ponds during winter (Barnum pers. comm.). It is unknown whether other nonlethal impacts on waterbirds during winter, such as atrophy of feather follicles, atrophy of lymphoid tissue, and several other sublethal effects, contribute to lower reproductive success at breeding grounds.

Results of laboratory studies (Heinz *et al.* 1990) have demonstrated that waterbirds not only rapidly accumulate selenium, but also rapidly depurate selenium when a low-selenium diet is available. Rapid depuration of accumulated selenium would reduce the risk of adverse effects on transient and migratory waterbirds.

For purposes of this feasibility assessment, a waterborne selenium concentration of 5 µg/l, consistent with the EPA criterion, has been used in this analysis. The proposed wetland would be designed and operated as a flow through facility that reduces the potential for adverse effects. Operation of the proposed wetland as a wintering habitat, rather than a reproductive site, further reduces the potential for adverse effects on waterbirds.

Additional Water Quality Component Considerations

The operation of a winter wetland for the target species may also be expected to reduce levels of some constituents in the inlet water, particularly nitrates and phosphates. O'Brien, Hetrick, and Dusault (2002) provide input-output data on water quality at four wetland/marsh complexes where the marsh has been designed to treat various types of discharges. Woltemade (2000) finds that wetlands can remove up to 68% of nitrate-nitrogen and 43% of phosphorus. Hammer (1993) cites data showing that wetlands can remove more than 90% of suspended solids, more than 85% of total phosphorus, over 90% of BOD5, and over 90% of total nitrogen from influent flows. SJVDIP (2000) further notes that wetlands may even assist in removing selenium salts from water flowing through them, primarily via bacterial action, which volatilizes the selenium through methylization. O'Brien, Hetrick, and Dusault (2002) describe several recent wetlands projects and their effects on water quality (Table 4).

The effectiveness of wetlands at reducing total suspended solids and total dissolved solids (nitrates, phosphates, and sulfates) is a function of residence time and insolation, and phytoplankton production which, during winter, is low. Nonetheless, shallow wetlands with moderate rates of flow may convert primary nutrients into phytoplankton and zooplankton and aquatic plants and thus provide nutrients for waterfowl.

The proposed wetland would have saline-alkaline soils and thus salinity levels in inlet water quality are an important factor in design of the wetland. Electrical conductivity (EC) and salinity levels in the subsurface agricultural drainage water supplies available for use in the proposed wetland, based on observed water quality conditions in inflow waters to the TLDD North Evaporation Basin and compensation wetland are summarized in Table 7. SRDC (1998) marshes in Suisun Bay provide some guidance on selection of wetland plants based on food value, cover

TABLE 7. Evaluation of wetland plant "values" for winter waterfowl wetlands (from SRCD 1998) with CWA (2005) recommendation related to each plant indicated.

PLANT	CWA EVAL.	FOOD VALUE	COVER VALUE	NEST VALUE	SOIL/WATER SALINITY TOLERANCE	
					mS/cm	mg/l
Pickelweed (*Salicornica virginica*)	YES	Good	Mod.	None	85 5	56,000
Fat Hen (*Atriplex triangularis*)	YES	Good	Good	Mod.	62	41,000
Brass buttons (*Cotula coronopifolia*)	NA	Good	Poor	None	44	29,000
Alkali Bulrush (*Scirpus maritimus*)	YES	Good	Good	None	<10-15 germinate) 42 (growth)	<6,750-10,000 28,000
Watergrass (*Echinochloa crussgalli*)	YES	Good	Good	None	7	4,600
Smartweed (*Polygonun* spp)	YES	Good	Good	None	5	3,300
Swamp timothy (*Crypsis schoenoides*)	YES	Good	Good	None	5	3,300
Cattail (*Typha* spp.)	OK but Control	Poor	Good	Good	15	10,000
Tules (*Scirpus acutus*)	OK but Control	Poor	Good	Good	17	11,340
Baltic rush (*Juncus balticus*)	AVOID	None	Mod.	None	15	10,000
Sago pondweed (*Potamogeton pectinatus*)	NA	Good	Good	Good	15	10,000
Widgeongrass (*Ruppia maritima*)	NA	Good	None	None	44	29,000
Dodder (*Cuscuta* spp)	AVOID	None	None	None	42	28,000

value, nesting value, and soil and water salinity tolerance. CWA (2005) also published a list of plants to utilize in seasonal wetlands. These data are summarized on Table 7.

The data on Table 7 suggest that it is necessary to maintain salinity levels within the seasonal wetlands at not greater than about 3,500 to 5,000 mg/l in order to maintain conditions suitable for germination and growth of key seasonal wetland plants: alkali bulrush, fat hen, cattails, tules, watergrass, smartweed, and swamp timothy. SRCD (1998) also notes that salinity effects are greatest on germinating plants and that soil leaching to reduce soil salinity prior to planting in the spring is necessary. CDFG (1981) notes that optimal germination of key aquatic plants for seasonal wetlands occurs well below the salinity tolerance of the adult plants. Based on CDFG evaluations, salinity at germination should be: <10,000 mg/l for alkali bulrush: <15,000 to 20,000 mg/l for fat-hen; <9,000 mg/l for brass buttons; 8,000 to 10,000 mg/l for barley, <5,000 mg/l for watergrass and/or millet; <5,000 mg/l for widgeongrass; and <9,000 mg/l for sago pondweed. SRCD (1998) emphasizes that leach water with substantially lower salinity than the ambient soil salinity is necessary to effectively leach accumulated salts; they recommend leach water with salinities of 0.05 the salinity of the soil being leached. Results of these comparisons indicates that salinity within the subsurface agricultural drainage water supplies available for use in the proposed wetland are within a range considered to be suitable for propagation and growth of desirable plant species to provide both cover and forage for wintering waterfowl.

Finally, several target species, notably pintail ducks, prefer clear water for foraging and thus it may be important to construct a marsh, with a settling basin if needed, to minimize turbidity and suspended sediment concentrations in the main wetland.

D. Operations and Management Criteria

CWA (2005), SRCD (1998) and others have specific recommendations regarding operating procedures for seasonal wetlands (Appendix C). These operations

and management criteria applicable to evaluating the feasibility of the proposed wintering waterfowl wetland are summarized below, by category.

Forage

Seasonal wetlands depend on moist soil management to provide an abundance and diversity of seeds for waterfowl. CWA (2005) notes that commercial grains in adjacent farmlands lack the vitamins, minerals, and proteins required for waterfowl survival and subsequent reproductive success. For a diverse assemblage of waterfowl, including dabbling and diving ducks as well as incidental use by other waterfowl such as cranes and geese, CWA (2005) suggests a diverse plant community including seed species and species that meet waterfowl needs for cover and thermal protection as well as enhancing invertebrate production. SRCD (1998) provides typical schematic wetland/pond cross sections (Figures 3, 4, and 5) which emphasize a diverse topography with ponds of varying depth and gradient, reflected in varying aquatic and riparian vegetation.

Forage would also be significantly enhanced if adjacent growers planted seed crops (wheat, barley, oats, and rice) on some portion of their lands.

Seasonal Water Management

Water management should be timed to reflect the timing of target species arrival and departure from the seasonal wetland, which may vary by location and from year to year. CDFG (1981) notes that the wetlands in the Suisun Marsh are flooded early (October) to provide temporary habitat for waterfowl which then abandon the marsh in November and December when fall and winter precipitation creates larger areas of seasonal wetlands in fallowed agricultural fields, such as rice fields. Early flooding may thus draw target species to a seasonal wetland, with birds leaving the wetland as more foraging habitat becomes available due to winter rains. Except in wet years, this is less likely to occur in the Tulare Lake area because of very low annual rainfall. The Tulare Lake area also is not primarily a grain producing area, and there is less alternative forage available for waterfowl.

The general pattern of water management for seasonal wetlands described in SRDC (1998), CWA (2005), and CDFG (1981) involves actions to (a) provide ponded habitat, (b) leach salts from the soil, and (c) maintain moist soil conditions for germination and growth. These general functions are carried out at varying times at various seasonal wetland complexes reflecting soil conditions, water availability, water quality, target species, water use regulations, mosquito abatement regulations, and local weather conditions. The general sequence of these water management events is:

- A growing season, in which ponds are drained and crops of key forage plants are germinated and grown under moist-soil conditions. In the San Joaquin Valley, the growing season (April through July) requires several irrigations in the summer months to maintain moist-soil conditions and provide for forage plant growth (CWA 2005); however, swamp timothy can be grown in the San Joaquin Valley without spring-summer irrigation.

- CWA (2005) recommends early fall flooding if possible for locally reared mallards and early migrant pintails.

- Flooding and maintenance of ponds, sometimes involving flooding and drawdown for leaching followed by re-flooding. Ponds should generally remain flooded from October 15 through early March (depending on year and observed conditions and target species behavior). Pond water should be circulated, not stagnant for salinity control and production of aquatic invertebrates.

- Drainage of ponds and a leaching flow, while maintaining moist soil conditions for seed germination and early plant growth. As CWA (2005) notes, timing of the drawdowns should coincide with optimum germination conditions (primarily soil temperature) and discing periodically to maintain the successional stage required for the target vegetation. The rate of drawdown also affects moist-soil plant composition, seed production, soil-salt levels, and the duration of food availability for waterfowl (CWA 2005). Slow drawdowns concentrate aquatic invertebrates, allow for greater plant community diversity, and if done in mid-spring, may enhance seed production. Rapid drawdowns enhance leaching and improve soil salinity conditions[1]. Because different forage plants

1. Wetland management at the 305-acre site will need to employ a combination of slow and fast draw downs based on yearly conditions.

require different cultivation practices, a wetland complex with variable water management regimes for various portions of the overall wetland may be necessary (CDFG 1981). Fat-hen cultivation, for example, may require drier conditions than those for alkali bulrush, and thus be particularly appropriate as an element of wetlands in the chronically dry southern San Joaquin Valley.

- Drainage of ponds and irrigation ditches with a leaching flow during the summer. SRCD (1998) stresses that a sequence of rapid (1-week) drawdowns followed by re-filling of irrigation ditches will result in (a) effective leaching and (b) mosquito larvae being drained off and killed. In addition, such a drainage pattern will deprive mosquitoes of an opportunity to lay eggs on moist soils in the irrigation ditches.

E. Other Management Techniques

Spring and summer management of forage crops is necessary to maintain an appropriate mix of forage and to prevent invasions of exotic plants or conversion of the wetland to a single-species area. CDFG (1981), SRCD (1998), and CWA (2005) all recommend that exotic invasives be monitored closely and removed immediately following each spring drainage event. They note potential problems with Baltic rush, various mustards, tamarisk, and the expansion of tules and cattails. All recommend against use of grazing. Vegetation management recommendations include:

- Discing of dense stands of tules and cattails using a stubble disc followed by a finish disc (provided discing does not affect the integrity of the underlying clay soils);

- Finish discing in strands or patches prior to fall flooding to break up dense stands of moist soil

TABLE 8. Management parameters for key seasonal wetland species (CWA 2005, SRCD 1998, and CDFG 1981). Applies to San Joaquin Valley conditions (CWA 2005).

MANAGEMENT ACTION	TYPE AND TIMING OF MANAGEMENT, BY SPECIES					
	Fat-hen	Alkali bullrush	Smartweed	Widgeon-grass	Swamp timothy	Watergrass and millet
Target Species	All	Dabbling Ducks, (pintail mallard)	Dabbling ducks (mallard)	Diving ducks	Dabbling ducks (pintail, teal)	Dabbling ducks
Location in Wetland	Mid-elevation	Pond 0-6 inches	Variable	Submerged 2-4 feet	Variable	Mid pond elevation
Soil preference	Well drained	Clay	Sandy	Variable	Variable	Variable
Spring drawdown	1/20-2/20	4/1-5/30	2/20-3/10	Variable	3/20-4/10	4/15-5/15
Drawdown rate	NA	NA	SLOW	Maintain ponded	SLOW	SLOW
Irrigation required	NO	NA	Moderate	YES	Low	High
Post-drawdown discing?	YES, 4-5 year cycle	NA	YES, 3-6 year cycle	NA	YES, 3-7 year cycle	YES, monoculture
Planting needed	NO	NO	NO	NO	NO	YES
Spring-summer irrigation needed?	NO	NO	YES, as needed	YES	1-time, flash 1 month post drawdown	YES, flooding 4-6 weeks post germination
Flooding	November	8/15 on	8/15 on	8/15 on	8/15 on	8/15 on

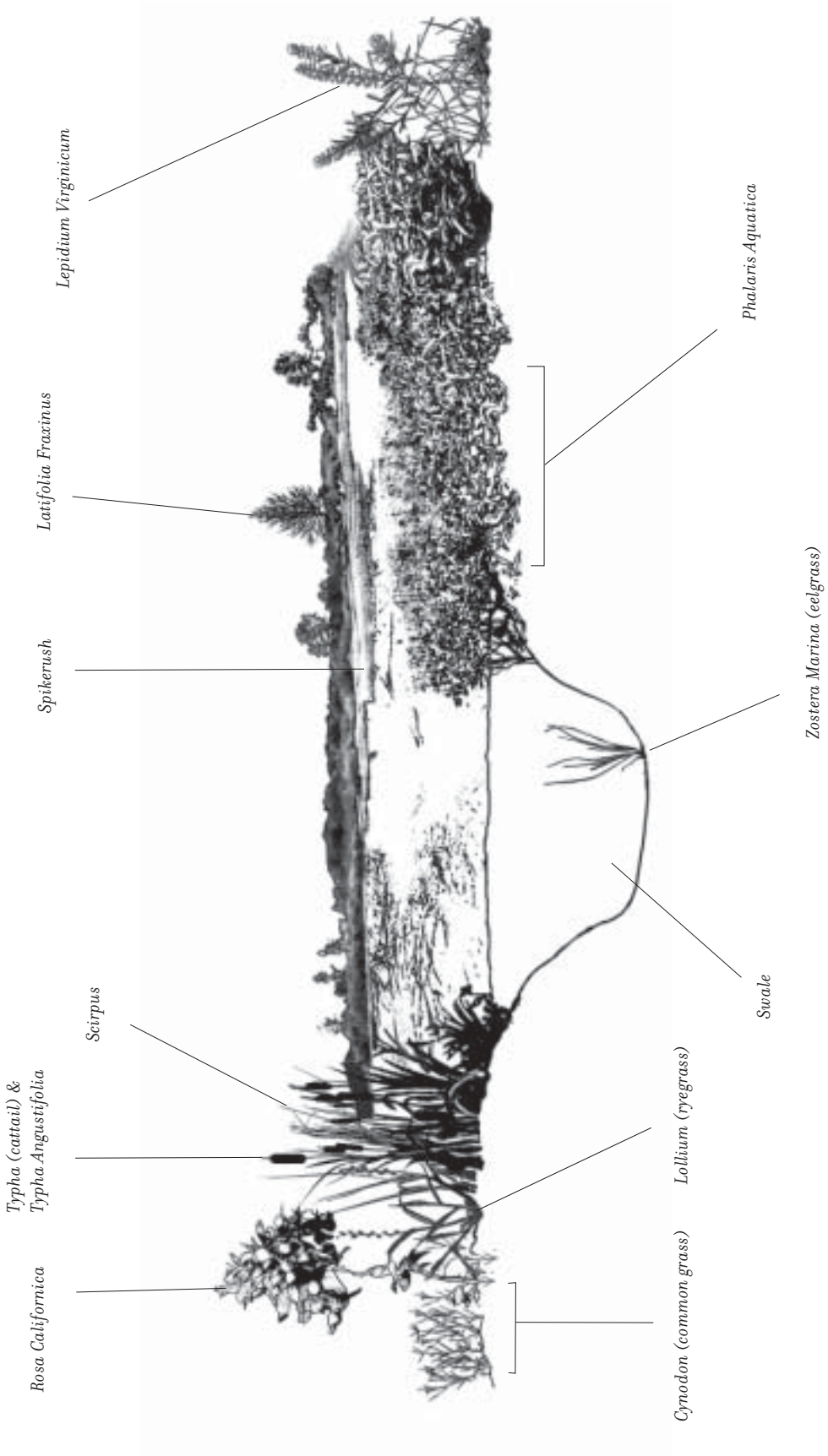


FIGURE 3. Typical seasonal wetland cross-sections showing grade and associated plant communities (SRCD 1998). The vertical scale has been exaggerated for illustration purposes. Ponds would have much more gentle slopes (averaging about 1V:30H).

FIGURE 4. Aerial photograph of City of Davis multi-unit wetland (from www.city.davis.ca.us/pw/water/wetlands.cfm)

plants and create diverse aquatic habitats;

- Herbicides should be avoided to the extent feasible;
- Burning and discing should be used to manage very dense vegetation only and only used periodically. Mowing should be considered as an alternative for alkali bulrush management.

The timing and nature of vegetation management depends on the target crop. Some general notes on management of key wetland plant species are summarized on Table 8.

F. Invertebrate Production

Aquatic invertebrates are primary forage for numerous waterfowl in the spring (Eldridge 1990) such as northern shoveler, mallard, gadwall, and pintail ducks, with different species utilizing different fractions of the aquatic invertebrate community. The literature is relatively vague regarding management for aquatic invertebrates, probably because aquatic invertebrate production is a function of water availability and residence time; eggs and larvae of most common aquatic invertebrates are readily available in untreated waters and/or soils and production is a function of nutrient loading and conversion.

G. Criteria Summary

Based on the available data, the criteria shown on Table 9 have been used for the conceptual design and operations of the proposed wintering wetland evaluated as part of this feasibility assessment. There are numerous wetland configurations and management scenarios that would meet these criteria, and conceptual designs based on the criteria should be considered preliminary. For example, the ratio of open water surface to islands and other upland areas may vary depending on the availability of soil for levees.

TABLE 9. Summary of design and operations criteria for a winter waterfowl wetland complex in Tulare Lake Irrigation District.

PARAMETER	UNITS	PROPOSED CRITERION	RATIONALE
General Design	NA	Multi-cell or multi-unit wetland with various units under different water management and vegetation management regimes Independent water delivery and drain to wetland units Waterfowl can take advantage of local grains to provide supplemental forage	Ensures flexibility in terms of water use and vegetation communities, reflecting the differences in target species migration timing and foraging behavior. Offsets potential for resource exhaustion due to early high energy requirements of waterfowl.
Open water area	Acres	50-70% of total site area	Protected upland loafing and feeding areas are needed.
Pond depths	% by depth	45% < 6 inches; 45% 6-12 inches; 10% deeper swales	Most target species are shallow-water feeders.
Number of ponds	3	0-12 inch depth; >12 inch swale area	Optimize drainage and flow through; maintain invertebrate production.
Vegetation density	Density	60% sparse; 30% moderate; 10% dense	Target species adapted to sparse/moderate densities; incidental species may utilize more dense habitats.
Islands	Shape	Irregular, sinuous	Optimize habitat diversity related to orientation to sun and wind; minimize erosion by creating complex geomorphology.

TABLE 9. (CONTINUED)

Islands	Elevation	1-2 feet	Provide for vegetated cover and loafing areas.
Islands	Slope	10:1	Provide for variable forage crops.
Drainage	Swales	Main drain swale 1-1.5 feet in depth throughout ponded areas	Maintain integrity of low-permeability soil layers. Maximum fill and drainage control.
Levees	Configuration	Minimum 12 foot crown, 4:1 sideslopes, and 1 foot freeboard	Maintain summer nesting habitat for resident mallards; provide loafing area for birds.
Water Quality	Flow Through	Average residence time	Flow-through adequate to prevent selenium concentrations within wetland (random sampling) in excess of "Low" risk category (2-3 µg/l).
Water Quality	Inlet Mean TDS	<4000 mg/l	Maximum level for germination and growth of key aquatic plants.
Water Quality	Inlet Mean pH	<9.0	Protection of aquatic species.
Water Quality	Inlet selenium	<2.5 µg/l	Protection of aquatic species from selenium build up.
Water Quality	Turbidity	Secchi disk reading ≥ 12 inches in 40% of wetland	Enhance foraging (especially for pintails).
Water Quality	Other mean values	< EPA national recommendations, except for chloride	Protection of aquatic species.
Water Quality	Leach water salt concentration	10% of soil salt concentration at time of spring and fall leaching	Eliminate salt buildup in soils and adjacent plant material; ensure successful long term plant growth.
Vegetation	Shallow water ponds	Emphasize watergrass, smartweed, fat-hen, swamp timothy, and alkali bulrush	Optimize variety of aquatic and marginal riparian plants and protein value of grain crop.
Vegetation	Management triggers	Disc cattails and tules when > 30% concentration along shoreline. Disc pond vegetation on 3-6 year cycle, depending on density of growth. Disc in alternating patches.	Maintain optimum mix of vegetation for a varied target species list and to provide some benefit to incidental visitants. Minimize potential for monocultures. Ensure low density cover for detection of diseased birds and other animals.
Water Management	Duration of Seasonal Ponding	30% of ponds flooded September-May; 50% of ponds flooded October - March; 20% of ponds flooded Late October - early February	Maintain habitat diversity; maintain forage reserves as waterfowl move in and out of region.
Water Management	Summer Irrigation	Irrigate 40% of ponds twice Irrigate 40% of pond once Do not irrigate 20% of pond	Meet irrigation demands of varying aquatic and riparian plants in a variable manner to promote forage plant diversity.
Disease Management	Distance from domestic poultry	Maintain 1,200 foot buffer zone between wetland and domestic poultry operations	Minimize potential for contact between waterfowl and domestic birds.
Disease Management	Monitoring	Monitor daily during operations	Detect and prevent major disease outbreaks.

IV. FEASIBILITY ASSESSMENT OF THE CONCEPTUAL HABITAT DESIGN AND OPERATIONS

A. Site Plan and Water Timing

Based on the criteria shown on Table 9, the 305-acre site for a proposed wetland development appears to be feasible in terms of several key characteristics. First, low permeable clay soils occur at the site. It may thus be feasible to excavate the required main irrigation to a depth of 3.5 feet and ponds to a depth of 1 to 1.5 feet, using spoil from these excavations to create narrow islands and the required perimeter levees and uplands. If it is assumed that ponds are on average 800 feet wide, then excavation of each 30 linear foot of swale will create enough spoil to construct an island 12 feet wide, 1.5 feet high, having 10:1 slopes. Remaining swale excavations will be used for levee building.

If the wetland is constructed in such a manner, the ponded area (Figure 5) will be approximately 281 acres. A typical pond-island configuration is a series of sinuous swales separated by islands, divided into blocks of habitat (habitat units) with water control structures so that wetlands can be flooded and drained at different times and at different rates to create a mosaic of habitats and to reflect the needs of target species. Habitat units may be sub-divided into cells, which can be hydraulically isolated and managed independently to reflect water availability and target species behavior. For example, individual cells may be flooded to different depths to reflect the relative abundance of various target species during the overall winter migration period. Given the target species and vegetation diversity objectives, three or more separate hydrologic units may be considered, each subject to different filling, drawdown, and leaching/irrigation schedules. General operation of these three units is described on Table 10.

B. Water Supply

Given a ponded area of about 281 acres, with an average depth of about 8 inches (taking into account the small area of deep irrigation canals and ponds), the wetland will hold about 130 acre-feet of water when all units are operating at full water elevation. Based on experience at the TLDD summer shorebird compensation wetland, the flow-through rate for the wetland should be (at minimum) from 1.8 to 4.5 cfs in order to minimize the potential for evaporation to concentrate salts. Actual flow through may vary from month to month based on evapotranspiration calculations, and evapotranspiration in the late fall, winter and early spring is generally lower than that in the summer by several hundred percent. The basis for this estimate of required flow-through rate is outlined below.

Basis for Estimate of Flow-through Rate

A rough estimate of water supply needs can be made by assuming inlet water quality, desired outlet water quality, and evapotranspiration. Because selenium and salt accumulations are probably the critical water quality constituents, wetland flow-through rates should be at least adequate to maintain mean selenium and salt concentrations at or below the levels established by EPA and provide suitable water quality for seasonal plant germination and growth. That is, waterborne salt concentrations should not concentrate because of

TABLE 10. Characteristics of three primary seasonal pond units

POND	TARGET VEGETATION	INITIAL FILL	DRAIN
1	Fat-hen	Late Oct	January-February
2	Smartweed and swamp timothy	Late Sept	February-March
3	Alkali bulrush and watergrass	Late Sept	April-May

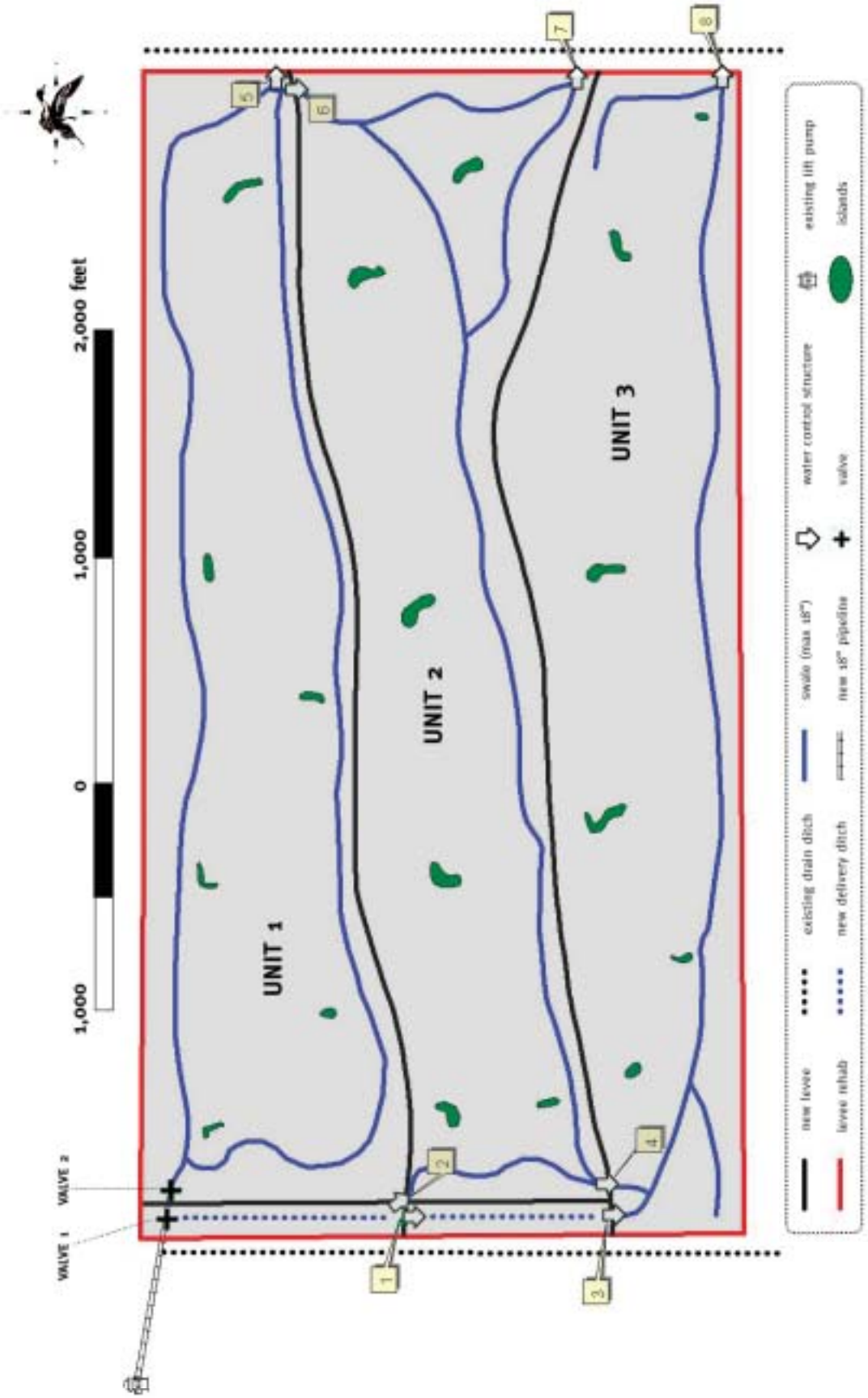


FIGURE 5. Conceptual wetland design.

evaporation to the point where they exceed standards for suitable plant growth.

Inlet selenium concentrations for TLDD's summer-breeding shorebird wetland are an indicator of potential inlet selenium concentrations at a seasonal winter wetland. From 1995 through 2004, they ranged from 0.9 µg/l to 2.0 µg/l. The EPA water quality criterion for selenium is 5 µg/l. If it is assumed that (a) waterborne selenium concentrations should be maintained at no more than 5 µg/l, (b) that evaporation/evapotransporation rates for open water and wetland would be approximately double those for alfalfa, and (c) that seepage would be offset by annual rainfall during the months of October through March, a flow through rate can be calculated based on evapotranspiration. For the highest use crops, evapotranspiration rates in the San Joaquin Valley are (DWR 2004):

October:	3.97 inches
November:	2.22 inches
December:	1.22 inches
January:	1.29 inches
February:	2.10 inches
March:	3.48 inches

If these rates are doubled to reflect maximum evapotranspiration rates (and ensure that daily fluctuations do not result in short term violation of standards particularly when inlet values are close to maximum EPA selenium standards), then monthly evapotranspiration rates would be (rounded to next highest whole number):

October:	3.97 inches x 2	=	8 inches (0.67 feet)
November:	2.22 inches x 2	=	5 inches (0.42 feet)
December:	1.22 inches x 2	=	3 inches (0.25 feet)
January:	1.29 inches x 2	=	3 inches (0.25 feet)
February:	2.10 inches x 2	=	5 inches (0.42 feet)
March:	3.48 inches x 2	=	8 inches (0.67 feet)

After an initial fill of 193 af [18.5 af/day (9.25 cfs]), these deliberately protective evapotranspiration rates result in net volume of water lost to evapotranspiration each month of:

October:	0.67 feet x 281 acres	= 127 af =	4.1 af/day	(2.1 cfs)
November:	0.42 feet x 281 acres	= 80 af =	2.6 af/day	(1.3 cfs)
December:	0.25 feet x 281 acres	= 47 af =	1.5 af/day	(0.8 cfs)
January:	0.25 feet x 281 acres	= 47 af =	1.5 af/day	(0.8 cfs)
February:	0.42 feet x 281 acres	= 80 af =	2.8 af/day	(1.4 cfs)
March:	0.67 feet x 281 acres	= 127 af =	4.1 af/day	(2.1 cfs)

Hydraulic inefficiencies in side channels and along the margins of the wetland ponds may require greater flushing flow than would be required to offset evapotranspiration alone, particularly in December and January. If flows are again doubled to address problems with mixing and edge effects, then daily flow through would be:

October:	4.2 cfs	(254 af/month)
November:	2.6 cfs	(160 af/month)
December:	1.6 cfs	(94 af/month)
January:	1.6 cfs	(94 af/month)
February:	2.8 cfs	(160 af/month)
March:	4.2 cfs	(254 af/month)
TOTAL		1,016 af

Given an average flooded period of about 6 months (October through March) and flow through adequate to provide for complete exchange of water in 182 days, the total volume of water needed to maintain the full wetland for the winter season will be 1,016 acre-feet. Adequate water supplies exist within the TLDD drainage area in most years to meet this water requirement.

Water quality at the inlet and interior locations within the wetland will be monitored routinely (monthly) and flow through rates may be adjusted to reflect changes in inlet water quality and evapotranspiration rates. Review of selenium monitoring results for the TLDD North Evaporation Basin and Compensation Habitat shows relatively little seasonal or annual variation. The frequency of water quality monitoring would be increased if selenium concentrations were observed to increase substantially. In particular, if mean selenium and/or salt concentrations in samples rise and monitoring determines that this is reflected in increased selenium and/or salt concentrations within the wetland

itself, then flow-through rates may need to be increased. This may be accomplished by a combination of increasing water supply and closing and draining of various wetland units. Thus, it is important that the wetland be constructed to permit cells to be hydraulically isolated and managed differentially. Key water quality parameters to be monitored at inlet and in the wetland complex include selenium, arsenic, pH, TDS/electrical conductivity, and turbidity. Given the sensitivity of seed and germinating wetland plants, control of the salinity/electrical conductivity of subsurface drainage water will be particularly important in the spring when plants are germinating. Water for leaching must also be of adequate quality to remove any salt build up from pond soils.

To minimize the potential for evaporation ponds to attract waterfowl during operation of the seasonal wetland, drainage from the wetland should be conveyed to evaporation ponds at some distance from the winter wetland (e.g., South and Hacienda Evaporation Basins) and the evaporation ponds should be managed to preclude development of conditions suitable for the winter wetland target species.

Suitable water supplies exist within the TLDD service area in most years to meet the seasonal water requirements for maintenance and management of the proposed wintering waterfowl wetland habitat.

C. Vegetation

As CWA (2005), SRCD (1998), and CDFG (1981) all indicate, the target wetland plant species may not need an initial seeding, depending on whether their seeds have been retained in the soil. Tules and cattails will not need to be planted, as their seeds are carried into all areas served by the State Water Project and the Central Valley Project. This is also likely for most of the aquatic and pond margin plants which are the primary focus of the vegetative community planned for this wetland; such plants exist in the Sacramento-San Joaquin Delta and their seeds are probably carried to SWP and CVP contract areas on a routine basis. Given that there is no necessity for target species to dominate the wetland within a short time period, it may be feasible to design, construct, and initially operate the wetland under the assumption that target species seed will be available in the wetland soils or will be transported into the wetland in the water supply. If this does not occur, then monitoring will detect the problem and management action can be taken to correct it. Seeds of desirable wetland plant species are available and can be purchased or harvested from other wetlands to supplement planting and germination at the proposed wetland. Maintenance of ponds on the site, combined with management of only a percentage of habitat in each unit at any given time, will ensure that once vegetation is established a seed bank can be maintained in the soil.

The target species generally tend to be adapted to sparse to moderate density vegetation, and vegetation management should reflect this. Tules and cattails should be thinned routinely (water level management including periodic drying, discing or burning; no grazing). Exotic shrubs should be removed at the end of each season. No permanent shrubs or trees should be planted because their roots could extend through the clay layers of the wetland and adversely affect drainage.

Establishing and maintaining suitable vegetation at the wetland to provide cover and forage for wintering waterfowl is considered to be feasible based on characteristics of water quality within the subsurface agricultural drainage water supplies to the site, topography of the site, and water level management and control within the created wetland.

D. Other Features for Management

Management of the wetland complex will require ready access to all portions of the wetland for monitoring, vegetation management, water management, and disease control. Access to major cells and water management features can be provided via perimeter levees, which would have a minimum crown width of 12 feet and minimum side slopes of 4H:1V. Access to islands and other elements of the wetland should be via boat or hovercraft, and thus drainage canals should extend along the mid-line of all ponds. Swale widths of 12 feet will allow shallow draft boats/hovercraft to survey the entire interior wetland.

Design of the wetland to accommodate access to both exterior

perimeter and interior areas of the wetland for maintenance and disease monitoring is feasible and can be developed as part of wetland construction. Access is routinely provided to evaporation basins along levee roads and interior access that would be similar to that included in the wetland design.
The winter wetland may attract human trespassing and illegal waterfowl hunting. To reduce access and hunting the wetland would be encircled by a fence.

V. EVALUATION OF POTENTIAL ENVIRONMENTAL IMPACTS

A. Avian Disease

The proposed wetland site is at the corner of Nevada and 12th avenues, about 7 miles west northwest of Corcoran, California. The site is within a matrix of row crops and the nearest current commercial poultry operation is 4,000 feet from the proposed wetland site; this is almost seven times the separation recommended by USFWS (1990). Given that physical contact of waterfowl and domestic poultry is necessary for the transmission of most avian diseases (NRCS 2000, USFWS 1990), there is little opportunity for the wetland to cause disease in domestic poultry. The target species do not include species that fly distances to reach grain sources, there is no potential that hunting, if allowed, will result in birds falling onto a commercial poultry site after being shot, and there is little possibility of transmission via small mammals and other animals that may come in contact with waterfowl and carry bacteria or spores to a commercial facility. Large predators which may have large home ranges will be excluded from the facility with a fence, minimizing the potential for disease transmission via these mobile predators. Smaller predators on eggs and juveniles (rats, for example) do not have large home ranges and thus are unlikely to carry disease between the wetland and distant commercial poultry operations.

Waterfowl Diseases and Recommended Management Strategies

Avian Botulism

Avian botulism (*Clostridium botulinum*) is endemic to the Western United States and can cause episodes of very high mortality in waterfowl populations (Locke and Friend 1989). The disease organism develops in dead organic matter under anaerobic conditions from spores, which are resistant to heat and drying. The bacteria grow particularly well on animal protein in anaerobic conditions in warm shallow water and marsh soil. Botulism also thrives in decaying animal carcasses. Waterfowl are most affected by Type C botulism. Prevention recommendations (Locke and Friend 1989; Hunter 1970; USFWS 1990; Hunter *et al.* 1970) are:

- Summer water management to reduce (dewater) water levels and thus avoid creating conditions for growth and subsequent death of invertebrates, fish, and other aquatic species which provide a medium for bacterial growth and toxin production;
- Construction of wetlands complex facilities to reduce or eliminate ponding during drawdown, where fish, invertebrate, and animals may concentrate and die as water levels are drawn down;
- Immediate clean-up of carcasses from managed wetlands (with burial or burning to remove them from potential contact with waterfowl);
- Monitoring flies, as an abundance of flies may indicate high levels of decaying organic matter and maggots;
- Maintenance of wetlands to prevent dense stands of shoreline vegetation (e.g., tules and cattails) which make carcass location difficult;
- Maintenance of ponds to prevent algal mats from building up (resulting in fish kills);
- Flood seasonal ponds as late as feasible to avoid over exploitation and declining water conditions;
- Draw seasonal ponds down rapidly;
- Disc drying ponds if mats of vegetation are observed.

In the literature, there is considerable emphasis placed on carcass identification and prompt removal as a primary means of limiting waterfowl exposure to botulism. The carcass-maggot consumption linkage is considered a primary pathway for the development and transmission of avian botulism in California. As part of the wetland design and prior to initiating operation of the wetland, an avian disease control and contingency plan will be developed.

Table 11. Common diseases of domestic poultry/waterfowl in the United States (Sources: USFWS 1990; NRCS 2000; MSUES 2004)

DISEASE	WATERFOWL SPECIES AFFECTED	ETIOLOGY	POTENTIAL FOR TRANSMISSION TO DOMESTIC POULTRY
Newcastle Disease	Cormorants, pelicans, gulls, others	Virus	No known transmission
Avian cholera	Numerous	Bacterial; contact with infected animals, their excretions, or their carcasses. Transmission possible via small mammals	Endemic in poultry industry; no evidence of transmission from waterfowl
Ornithosis	Numerous	Bacterial; pigeon is most common carrier	No known transmissions
Avian influenza	Numerous	Virus, wild strain is different from domestic strain	Potential, but virus incidence is low in winter; target species not likely to utilize adjacent habitats extensively
Botulism	Numerous	Type C most affects wintering waterfowl; transmission via consumption of maggots or other materials where bacterium or toxin is concentrated	Minimal, separation of wild and domestic animals precludes significant transmission
Duck plague (virus enteritis)	No evidence of the disease in wild waterfowl	Direct contact with infected animals or their excretions	Minimal
Fowl typhoid	Many	Close contact with infected animals	Minimal
Coliform infections	NA	Locally contaminated environment and ingestion and/or inhalation of bacterium	Minimal
Mycoplasmosis	Many	Spread through egg or during hatching	Minimal
Necrotic enteritis	Unknown	Direct contact with droppings of infected birds	Minimal
Ulcerative enteritis (quail disease)	Domestic fowl	Direct contact	Minimal
Pullorum disease	Some wild fowl	Egg transmission and direct contact	Minimal
Infectious coryza	Chickens	Direct contact or airborne inhalation	Minimal to none
Omphalitis	Chickens	Poor incubation conditions	None
Erysipelas	Ducks and geese	Contaminated soil contact; open lesions	Minimal

General guidelines for avian disease management are included in Appendix C.

Avian Influenza and Other Diseases

Avian influenza is caused by a virus that affects young birds, primarily in the summer and early fall (USFWS 1990); its incidence in adult birds is low and transmission from wintering waterfowl is probably low. As Table 11 indicates, many important diseases of domestic poultry are species specific and/or related to on-farm conditions which concentrate bacteria and viruses and provide for transmission via direct contact and/or inhalation of the disease organism.

Given the potential for remote transmission of avian diseases through fecal contamination of transient water such as runoff from seasonally heavy rains, examination

of management at the turkey ranch located 4,000 feet from the site of the proposed wetland is crucial for evaluating potential impact on winter waterfowl populations. Taking into account: (1) the downslope location of the turkey ranch with levees located in between the turkey ranch and the constructed wetland; and (2) management policies at the turkey ranch which prohibit the storage of manure on-site—fecal matter is moved immediately off-site and transported to the fields where it has intended use as manure—transmission of disease through fecal matter from the turkey ranch is infeasible.

Literature recommendations related to other waterfowl diseases stress monitoring and an adaptive approach to disease management (NRCS 2000; USFWS 1990). Efforts to physically isolate wild birds from domestic poultry are stressed, because most transmissions result from overlapping distribution. NRCS (2000), citing USFWS (1990), includes a list of isolation techniques intended to ensure separation of wetlands and commercial poultry (turkey) operations. These isolation recommendations include:

- Separation of wetland ponds and turkey barns by at least 600 feet to prevent waterfowl-to-poultry contact;
- Remove any trees within the 600-foot perimeter;
- Plant low-growing vegetation within the 600-foot perimeter to avoid rodent and small animal habitats;
- Locate duck blinds so that birds injured or killed during waterfowl hunting (if any) fall away from the poultry property;
- Install woven wire perimeter fencing to restrict movement of people, dogs, coyotes, and other animals;
- Create an impermeable barrier between the ranch and wetland (along the fence line)to reduce movement of rodents through/under the wire-mesh fence;
- Restrict contact between poultry operation personnel and the wetland area; and
- Post warning signs along ranch perimeter to prevent access from the wetland to the ranch.

An ongoing monitoring program is an essential element of a disease management strategy.

NRCS (2000) and (USFWS) 1990 stress that "There is no known direct relationship between the number of migratory birds in an area and the amount of mortality that occurs within those populations when a disease is present." Thus increasing total waterfowl population in an area is not likely by itself to increase the risk of disease or disease transmission to domestic poultry.

Disease Transmission to Poultry

Literature recommendations related to other waterfowl diseases stress monitoring and an adaptive approach to disease management (NRCS 2000; USFWS 1987). Several studies have been conducted to examine and evaluate the potential for disease transmission between domestic poultry and wild waterfowl inhabiting wetlands in the general proximity to poultry producers. The studies have identified buffer zones and biosecurity measures designed to reduce or eliminate the risk of disease. Efforts to physically isolate wild birds from domestic poultry using a buffer zone (e.g., 600 feet or greater) are stressed, because most transmissions result from overlapping distribution. An ongoing monitoring program is the initial essential element of a disease management strategy to detect and identify the potential for disease outbreak.

The proposed wetland site is at the corner of Nevada and 12th avenues, about 7 miles west northwest of Corcoran, California. The site is within a matrix of row crops (primarily cotton and safflower). There are no commercial poultry operations within a perimeter buffer zone less than 600 feet from the proposed wetland site. The nearest current commercial poultry operation is approximately 4,000 feet (0.76 miles) from the proposed wetland site. The poultry production facility is more than six times the length of the recommended buffer zone from the proposed winter wetland site. In addition, the EPA National Agricultural Compliance Assistance Center has identified a number of biosecurity measures designed to reduce the potential for avian disease transmission that include:

- Establish quarantine periods for new animals introduced into a facility
- Washing and disinfection of equipment

TABLE 12. Wildlife (vertebrate animals) observed at proposed wetland site, April 2004.

SPECIES	COMMON NAME	EVIDENCE OF SITE USE
MAMMALS		
Canus domesticus	Domestic dog	Sighted
Citellus beecheyi	Beechey's ground squirrel	Sighted
Thomomys bottae	Pocket gopher	Burrow
BIRDS		
Agelaius phoeniceus	Red-winged blackbird	Sighted
Anas platyrhynchos	Mallard	Sighted
Ardea herodias	Great blue heron	Sighted
Athene cunicularia	Burrowing owl	Sighted
Buteo jamaicensis	Red-tailed hawk	Sighted
Buteo swainsoni	Swainson's hawk	Sighted
Calidris minutilla	Least sandpiper	Sighted
Carpodacus mexicanus	House finch	Sighted
Cathartes aura	Turkey vulture	Sighted
Charadrius vociferous	Killdeer	Sighted
Columba livia	Rock dove	Sighted
Corvus corax	Common raven	Sighted
Eremophila alpestris	Horned lark	Sighted
Euphagus cyanocephalus	Brewer's blackbird	Sighted
Falco sparverius	American kestrel	Sighted
Fulica americana	American coot	Sighted
Hymantopus mexicanus	Black-necked stilt	Sighted
Lanius ludovicianus	Loggerhead shrike	Sighted
Mimus polyglottis	Mockingbird	Sighted
Petrochelidon pyrrhonota	Cliff swallow	Sighted
Recurvirostra americana	American avocet	Sighted
Sturnella neglecta	Western meadowlark	Sighted
Tyrannus verticalis	Western kingbird	Sighted
Xanthocephalis xanthocephalis	Yellow-headed blackbird	Sighted
Zenaida macroura	Mourning dove	Sighted
REPTILES		
Uta stansburiana	Side-bloched lizard	Sighted
AMPHIBIANS		
Rana catesbieana	Bullfrog	Sighted

- Vaccination
- Allowing only essential personnel access to the facilities
- Secure building (e.g., netting) to exclude undesirable domestic and wild animals
- Maintain sanitation
- Identify and segregate sick animals and disposal of dead animals.

Discussions with the local poultry producer in the area documented that the biosecurity measures identified above are routinely practiced. These actions reduce the possibility of disease transmission among waterfowl and domestic poultry.

Given that physical contact of waterfowl and domestic poultry is necessary for the transmission of most avian diseases (NRCS 2000), there is little opportunity for the wetland to cause disease in domestic poultry. The target species do not include species that fly distances to reach grain sources, there is no potential that hunting will result in birds falling onto a commercial poultry site after being shot (hunting on the wintering waterfowl wetland will not be permitted), and there is little possibility of transmission via small mammals and other animals that may come in contact with waterfowl and carry bacteria or spores to a commercial facility. Large predators, which may have large home ranges, will be excluded from the facility with a fence, minimizing the potential for disease transmission via these mobile predators. Smaller predators on eggs and juveniles (rats, for example) do not have large home ranges and thus are unlikely to carry disease between the wetland and distant commercial poultry operations.

Based on a review of the available scientific literature regarding the risk of disease transmission from the wetland to the adjacent poultry facility, the distance between the wetland and the poultry facility, and consultation with pathologists from CDFG, it was concluded that the risk of disease transmission is minimal and does not pose a significant environmental impact or risk.

B. Sensitive Habitat and Species

In April 2004, Paul Pruett & Associates conducted a biological assessment of the proposed wetland site. Their findings included:

- No sensitive plant species occur on the project site, which has been actively farmed through 2003;
- There is no native habitat on the site;
- Review of the California Natural Diversity Data Base, RareFind2 for the region shows no sensitive species within 4-5 miles of the site. This finding is consistent with the maintenance of active agriculture, including periodic double cropping on some parcels, throughout the region;
- Spring surveys of the site found site use by Swainson's hawk (foraging) and burrowing owl (resting in a drainage pipe; no nesting sites were found on site);
- No other sensitive species were found on the site during 2004 surveys and no suitable resident habitat was found; and
- Thirty wildlife species were sighted on the site during 2004 surveys (Table 12), 25 of the 30 were birds, with waterfowl observed near irrigation canals and other birds observed foraging on the plowed fields or simply flying/perching near the site.

Based on these findings, the site appears to provide only incidental wildlife benefit and conversion of the agricultural field to a seasonal wetland with some areas of permanent upland habitat would substantially increase wildlife value of the site. No resident sensitive species would be displaced by the conversion process, and it is likely that sensitive species may utilize the wetland complex when it has been constructed and is in operation.

C. Mosquito Control

Mosquitoes are vectors for a large number of human and domestic animal diseases, including West Nile virus, malaria, encephalitis, and canine heartworm. Mosquito

abatement districts recommend water management as a primary tool in mosquito control in managed wetlands (SRCD 1998). Mosquitoes lay eggs on dry to damp (but unflooded) soil, and flooding then triggers hatching and growth. SRCD (1998) recommends an early fall leaching flow to cover all ponded areas, followed by a rapid drawdown and re-filling. The drawdown creates turbulent water and prevents the mosquito larvae from maturing and the rapid re-filling prevents adults from laying eggs. Refilling and then maintaining water surface elevations at constant levels minimizes the potential area for egg laying, and a steady flow of water through the wetland helps destroy any larvae which may develop in the wetland (Kwasny *et al.* 2004).

In addition, management of any ponds is necessary to prevent resident Anopheles and Culex species from developing. Good circulation of water through ponds, which may be accomplished with only the major drainage ditches being flooded, reduces the potential for these species to develop. On-going monitoring of mosquitoes is required, and if necessary spraying may be required.

Results of the feasibility assessment support a conclusion that mosquito control can be effectively accomplished within the wintering waterfowl wetland habitat through water level management. Mosquito control is considered feasible.

D. Waterfowl Exposure to Contaminants

TLDD's 10-year experience with use of low-selenium saline subsurface drainage water for summer-breeding shorebirds suggests that water quality of the subsurface drainage water can be managed to ensure that potential exposure to waterborne contaminants is managed effectively. Water quality in TLDD's summer compensation wetland was consistently below EPA National Criteria of 5 µg/l. The subsurface drainage water supply available in the northern region of the TLDD service area that would be used as the supply source for the winter wetland would have characteristics similar to water supplied to the compensation habitat (waterborne selenium concentrations typically less than 2 µg/l). Based on characteristics of the available subsurface agricultural drainage water supplies it was concluded that operation of the proposed winter wetland is feasible.

Salinity/electrical conductivity may be a concern for germination of plants, but salinity levels will not have adverse effects on waterfowl themselves, where toxicity occurs at conductivities 20 to 30 times as high as those likely to be experienced in the constructed wetland.
It was concluded that water quality can be effectively monitored and managed to provide suitable conditions within the proposed wintering wetland habitat for waterfowl and vegetation. The operation of the wetland using low salinity and low selenium subsurface drainage water as a water supply for the wetland is considered feasible.

VI. CONCLUSIONS & RECOMMENDATIONS

A. Conclusions

Results of this preliminary evaluation suggest that a seasonal wetland complex for winter waterfowl is feasible on a 305-acre site south of Nevada Avenue and west of 12th Avenue near Corcoran, California. There should be an adequate supply of low-selenium, low to moderate salinity subsurface drainage water in most years to provide for an estimated initial fill of 193 acre-feet, 1,016 acre-feet to provide for flow through during annual operations, and 543 feet for irrigation and leaching. The quantity of water available for use in the wetland is expected to vary among years in response to hydrologic conditions (e.g., drought) and agricultural practices within the northern regions of the TLDD service area. A hydraulic analysis of flow through the wetland as finally designed would be needed to ensure that the preliminary estimates of needed flow through for maintenance of water quality throughout the wetland are accurate. Assuming an adequate water supply of suitable water quality is available, the conclusions of this preliminary evaluation of winter wetland feasibility are:

- Surface clay layers are deep enough to allow main channel excavations of up to 3.5 feet below existing land surface without penetrating the low-permeability zone;

- There is adequate soil available from excavations of the wetland pond complex to create about 24 acres of levees, perimeter uplands, and internal islands in a matrix of 281 acres of ponds with a depth of 0 to 12 inches;

- There are wetland vegetation types suitable for the target species that will readily germinate and grow on the soils of the site and in water with a mean salinity of from 3,000 mg/l to 4,000 mg/l TDS;

- There are no sensitive species or habitats for sensitive species on the site in its current condition and no adverse impacts to biological resources would occur as a result of conversion of the field to wetlands;

- The proposed site is approximately 4,000 feet (0.76 miles) from the nearest commercial poultry operation and this isolation reduces the potential for interaction between domestic and wild birds and resulting disease transmittal to a very low level;

- Water management techniques have been developed that should reduce the potential for the seasonal wetland to produce mosquitoes, and on-going monitoring will ensure that supplemental mosquito treatments may be made in a timely manner when and if needed;

- The wetland can be designed to provide suitable access to exterior and interior areas for maintenance and disease monitoring;

- The wetland can be designed and operated to minimize potential for waterfowl to be affected by common avian diseases, particularly avian botulism.

Based on these findings, we conclude that a winter wetland is feasible at the proposed site and is expected to benefit the target species (dabbling and diving ducks). The proposed design would also provide incidental benefits to other migratory waterfowl and wildlife.

B. Recommendations

Preliminary wetland design, based on the general criteria provided in this evaluation, should be initiated in cooperation with USFWS, CDFG, California Waterfowl Association, and other interested parties. A more detailed analysis of the water budget requirements, site-specific engineering design of the wetland and water delivery and management system, and requirements for permitting and environmental documentation should be developed. Opportunities for state and federal funding for wetland design and construction should also be explored.

The proposed wetland should be designed to supplement winter waterfowl wetlands at existing regional wildlife refuges. To the extent feasible, the seasonal timing of operations should be coordinated with the managers of these reserves to assist in accomplishing overall regional management goals and objectives.

VII. Literature Cited

Austin, J.E., D.D. Humburg, and L.H. Fredrickson. 1998. Habitat management for migrating and wintering Canada geese: a moist-soil alternative. Pages 291-297 in DH Rusch, MD Samuel, DD Humburg, and BD Sullivan, eds. Biology and management of Canada geese. Proc. Canada Symp., Milwaukee, WI.

California Department of Water Resources (DWR) 2004. Crop water use 1992-1996, Appendix A. Division of Planning and Local Assistance, Sacramento, CA.

California Waterfowl Association (CWA). 2005. Principles of Central Valley Wetland Management. http://www.calwaterfowl.org/management_guide.htm.

Eldridge, J. 1990. Aquatic invertebrates important for waterfowl production. Fish and Wildlife Leaflet 13.3.3. U.S. Fish and Wildlife Service Waterfowl Management Handbook. National Wildlife Health Research Center, Madison WI. 6 pp.

Hammer, D. 1996. *Creating Freshwater Wetlands.* CRC Press.

Harrington, B. and B. Streever. 1999. Foraging habitat for bird species or bird diversity in wetland design. *WRP Technical Notes Collection* (TN FW-RS 3.1). U.S. Army Engineer Research and Development Center, Vicksburg, MS.

Hunter, B.F. 1970. Ecology of waterfowl botulism toxin production. Transactions of the thirty-fifth North American Wildlife and Natural resources Conference, March 1970. Wildlife Management Institute, Washington D.C. 9 pp.

Hunter, B.F., W. E. Clark, P. J. Perkins, and P. R. Coleman. 1970. Applied botulism research including management recommendations. Wildl. Manage. Progress Rep. Calif. Dept. of Fish and Game. Sacramento. 87 pp.

Jassby, A.D., J.E. Cloern, and B.E. Cole. 2002. Annual primary production: Patterns and mechanisms of change in a nutrient-rich tidal ecosystem. Limnol. Oceanogr. 47(3): 698-712.

Kwasny, Dean C., Mike Wolder, and Craig R. Isola. 2004. Technical Guide to Best Management Practices for Mosquito Control in Managed Wetlands. CDFG and USFWS, June 2004.

Locke, L.N. and M. Friend. 1989. Avian botulism: geographic expansion of a historic disease. Fish and Wildlife Leaflet 13.2.4. U.S. Fish and Wildlife Service Waterfowl Management Handbook. National Wildlife Health Research Center, Madison WI. 6 pp.

Miller, O.D., J.A. Wilson, S.S. Ditchkoff, and R.L. Lochmiller. 2000. Consumption of agricultural and natural foods by waterfowl migrating through central Oklahoma. Proc, Okla. Acad. Sci. 80: 25-31.

Miller, M.R. and W.E. Newton. 1999. Population energetics of northern pintails wintering in the Sacramento Valley, California. Journal of Wildlife Management 63(4): 1222-1238

O'Brien E., M. Hetrick, and A. Dusault. 2002. Wastewater to wetlands: Opportunities for California Agriculture. Sustainable Conservation. http://www.sustainableconservation.org.

Parish, J.M. and B.F. Hunter. 1969. Waterfowl botulism in the Southern San Joaquin Valley, 1967-1969. *California Fish and Game* 55(4): 265-272.

Pogson, T.H. and S.M. Londstedt. 1991. Distribution and abundance of large sandhill cranes, *Grus Canadensis*, wintering in California's Central Valley. The Condor 93: 266-278.

Pruett, P. and Associates. 2004. Biota Report 320 acres±, NO1/2, SEC 3, T21S, R21E, MDBM SW COR, NEVADA AVE & 12TH AVE KINGS COUNTY, CALIFORNIA. Tulare Lake Drainage District, Corcoran, CA. 20 pp.

Rollins, G.L. 1981. A guide to waterfowl management in Suisun Marsh. California Department of Fish and Game. Sacramento, CA. 109 pp.

Smith, G.R. 1982. Botulism in Waterfowl. *In*: Animal Disease in Relation of Conservation. Academic Press: 129-138.

Sovada, M.A., M.C. Zicus, R.J. Greenwood, D.P. Rave, W.E. Newton, R.O. Woodward, and J.A. Beiser. 2000. Relationships of habitat patch size and predator community and survival of duck nests. Journal of Wildlife Management 64(3): 820-831.

Suisun Resources Conservation District. 1998. Individual ownership adaptive management habitat plan. SRCD, Suisun CA. 99 pp.

Tulare County Agricultural Commissioner (TCAC). 2003. Crop Production Report 2003. Visalia, CA.

U.S. Department of Agriculture, Natural Resources Conservation Service (Indiana). 2001. Conservation Practice Standard Wildlife Wetland Habitat Management Code 644. Washington, D.C.

U.S. Department of Agriculture, Natural Resources Conservation Service. 1992. Engineering Field Handbook, Chapter 13, *Wetland Restoration, Enhancement, or Creation.* Washington, D.C.

U.S. Department of Interior Fish and Wildlife Service. 1990. The importance of carcass removal for avian botulism prevention. Research Information Bulletin 90-71. National Wildlife Health Research Center, Madison WI. 2 pp.

U.S. Department of Interior Fish and Wildlife Service. 1990. Final Environmental Impact Statement, Patoka River Wetlands Project. Appendix J Report of the Avian Disease Task Force.

USEPA. 1999. National Recommended Water Quality Criteria—Corrected. EPA 822-Z-99-001. Washington, D.C. 25 pp.

Vonk, J.R. 2000. Task Force Report, Westside Turkey Ranch/Kulwant Somal Wetland Project. U.S. Department of Agriculture, Natural Resources Conservation Service. Washington, D.C. 4 pp.

APPENDIX A

Seasonal Wetland Design & Management

CALIFORNIA WATERFOWL ASSOCIATION CONSTRUCTION DESCRIPTION

Project Name: TLDD Winter Waterfowl Habitat

Landowner: TLDD – Doug Davis (559) 992-3145

California Waterfowl Association:
Rich Wright office: (209) 826-5188 cell: (916) 275-1020 fax: (209) 826-4984

Project Description

The TLDD Winter Waterfowl Project is being constructed for the Tulare Lake Drainage District. Wetlands are to be constructed to have approximately 18 inches of water in the low ends of the wetland units and 6 inches of water in the high ends. The wetland units will be outlined onsite which depicts the pond locations specified on the attached map. Water control structures, swales, and islands are also depicted on the map and are expected to be placed in the depicted locations.

Delivery Ditch: The new delivery ditch to be constructed will have 2:1 slopes on the interior and 10:1 on the exterior. Ditch bottom shall be 8 foot at a minimum. A wider bottom width will be accepted based on the contractor's equipment. The delivery ditch levee will need to have a 15 foot crown width and 10:1 slopes. The exterior slope on the western levee will not be required to have a 10:1 slope. The contractor will be required to slope the exterior portion of this levee as feasible based on the site conditions. The delivery ditch will also have 2 above ground valves to be able to deliver water independently to the ditch and also to Unit 1. This will enable the ditch to be dry during winter maintenance flow, discouraging rank vegetation.

Levees: All levee heights and slopes are identified within the plans as well as their constructed elevations. Exterior slopes of wetland levees will need to be sloped to the extent feasible. Existing levees will need to disked to remove vegetation that is currently growing on the levees. Excess dirt shall be used for island construction in the pond bottoms. See levee construction specifications for details.

Swales: Material for the levee construction will come from a series of swales that will be constructed from the inlet to the outlet structures within each unit. Swales will have a minimum bottom width of 12' and have 10:1 side slopes. Swales will average 1' in depth and follow the grade of the fields. All swales will fall from the inlet to the outlet to ensure complete drainage of the unit. Swales within the construction plans are conceptual, cut swales will match the material needed for the levee refurbishment. All units must have at least one swale from the inlet to the outlet. Existing swales will be tied into the new swale system to ensure that they will drain completely during draw downs.

Islands/Loafing Bars: Material unsuited for levee construction shall be used for island construction. Islands will be constructed in thirds with 1/3 being 0.5' off the pond bottom, 1/3 being 0.75' off the pond bottom and 1/3 being 1-1.5' off the pond bottom.

Risers: The lift pump is expected to pump 7200 GPM into the ditch system and through the water control structures. 30" water control structures will be installed in the ditch and 24" structures will be installed throughout the wetland units. Risers will be provided by CWA and installed by the contractor. Water control structures will be prefabricated twin track

concrete risers with either ADS or Hancor Surlock pipe. The difference between Hancor and ADS is primarily the joints in connecting the pipe to the structure. See riser installation specifications for details.

Construction Specification Guidelines

Levee Construction:

1. The footing of all new levees will be disced to remove all vegetation and cave in rodent holes. Material removed may be lost as fill material for islands.

2. All vegetation will be stripped or disced from borrow sites (swales) prior to excavation of fill material. Material removed may be used as island fill.

3. All levees to be reconstructed shall be free of vegetation and disced to collapse all holes or voids.

4. Levee fill shall be free of debris, rocks, or large clods.

5. Compaction shall be achieved by traveling equipment over layers no more than 6" in height. Water trucks will be used when the fill material is too dry to achieve the necessary compaction. Compaction will be achieved when levee material reaches between 80 – 85% compaction.

6. Levee side slopes shall be a minimum of 10:1 on the inboard side (pond side) and 10:1 outboard side (field side) unless indicated otherwise by CWA. (see attached cross-section drawing for typical dimensions).

7. Top width shall be a minimum of 15 feet wide unless indicated differently on the attached design.

Swales Construction:

1. See attached Typical Swale Cross-Section drawing for typical dimensions.

2. All vegetation will be stripped or disked from swales when borrow material is used as levee fill. Stripped material can be used to create islands throughout the field.

3. Swales will be laid out based on the direction of CWA. Swales need to have meander built into them. Straight swales will not be accepted. Swales should range from 12 – 24 feet in width and have side slopes of 10:1. Material from the swales will be used to supply the material for the levees and island construction.

Installing Water Control Structures and Culverts:

1. Setting water control structures at proper elevations is critical. The footing on which a structure is set must be as firm and level as possible. Structures are set in trenches created by excavating levee fill. Water control structures must be placed at the lowest point in the upstream ponds. Excavate the structure pad 0.5' below the incoming swale grade and the structure will sit approximately 0.2'-0.3' below the swale when completed.

2. To avoid ponding and siltation problems make sure there is at least 0.2' of fall in the pipe leading to the next field.

3. Use backfill material that is free of any plant material. Avoid using sandy soil.

4. Use moist soil to improve soil compaction around the structure and discharge pipe. Dampen fill material if necessary with a water truck. Break up large earth clods and use a tamper bar if necessary. Fill and compact soil in increments of less than 1 foot.

Construction Completion:

Upon completion of construction the contractor will notify the project manager (CWA staff) in charge for a final check of grades and the projects completion. No equipment will be removed by the contractor from the project site until there is a final meeting between the project manager, landowner and contractor. At this time approval by the project manager and the landowner will be given if the project is truly completed. Following this final meeting if the project meets all specifications spelled out in the construction plans then the contractor will be released from the site.

It is the contractor's responsibility to notify the CWA project manager of his expected completion date for the final check.

MANAGEMENT PLAN

Tulare Lake Drainage District – Winter Waterfowl Habitat

Introduction:

Tulare Lake Drainage District – Winter Waterfowl Habitat

This management plan describes the type and extent of activities that will be conducted each year to improve wetlands on the project area. Due to the fact that wetland conditions often change rapidly, adjustment of these management practices may be needed from year to year. Periodic site visits to assess habitat improvements by qualified individuals from Tulare Lake Drainage District and other organizations/agencies will assure habitat goals set forth by this management plan are being conducted and realized.

The Tulare Lake Drainage District – Winter Waterfowl Habitat (320 acres) is located northwest of Corcoran, California. The property is to be managed as a wetland using saline water for the purposes of providing wildlife habitat, primarily for waterfowl and other waterbirds. The soils on the property are saline-alkali soils typical of lower Central Valley floodplains and lakebeds, with high clay content and low permeability. Flooding of the property will occur through a lift pump (adjacent to the property) that connects to the header ditch and water delivery distribution system.

Seasonal Wetland Management. The wetland habitat, managed in three different wetland units, shall be primarily comprised of seasonal marsh. Seasonal marsh refers to a fall flood-up and a spring draw-down of units to allow for wetland plant germination of moist soil plants. Typical moist soil plants would include Atriplex spps., swamp timothy, alkali heath, and other plants common to more saline environments. Moist soil plants typically germinate in spring and produce seed in the summer. The three units should be managed to provide a diversity of habitat types. The diversity of habitat types shall be achieved through variable flooding schedules. By having a variety of flooding schedules, a diversity of moist soil plants will be possible to attract a variety of waterfowl and waterbirds. Management should try to flood one unit September – March, another unit October – March and the last unit November – March. This type of flooding schedule will not only encourage a variety of wildlife, but also provide new food sources that will minimize the wetlands from being “fed out”, which may occur if all of the wetlands are flooded concurrently.

In addition to a variable flooding regime, water depth will play a large part in the diversity of wildlife using the wetlands. It is recommended to manage the higher ends of the ponds approximately 1-3 inches in depth and the lower ends approximately 1 foot in depth. The swales being constructed will provide deeper areas in the ponds for species that prefer deeper water habitats.

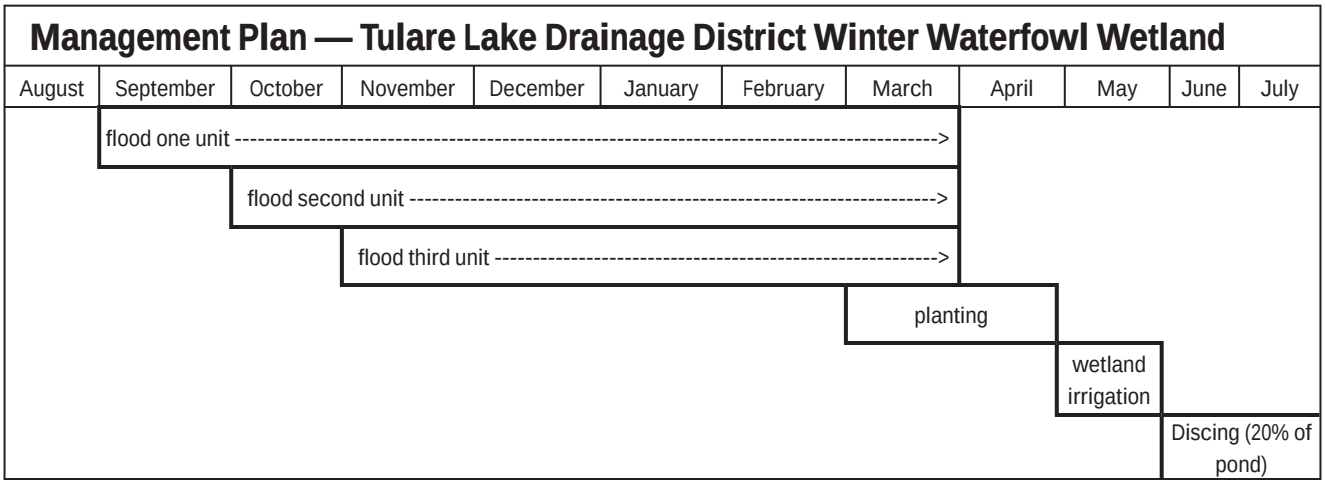
A wetland irrigation may occur in late April/early May, approximately 1 month after seed germination. Irrigations should not cover plants for longer than 10 days to avoid plant death. Depending on the temperature and the rainfall of a particular year, some wetlands may be irrigated 2 times to maximize seed production. Typically wetland mangers will irrigate 2 times if water is abundant and costs are feasible within management budgets.

Disking a percentage of moist soil plants on a 5 year rotation will encourage strong seed production. This can be achieved by disking approximately 20% of the wetlands on a yearly basis.

Maintaining Open Water. Approximately 50 percent of pond surface area should be maintained as open water areas. Some tule and cattail emergent vegetation is desirable for waterfowl and other wildlife to seek thermal protection and avoid predators. Ponds with tule growth in combination with open water areas, maintained by discing, attract more waterfowl. Cattail, tules, and wiregrass (Baltic rush) are typical emergent vegetation requiring periodic discing with a large tractor (120+HP) and a stubble disc (at least 32" blades) to adequately turn over roots and tubers. Tubers and roots shall be exposed throughout the summer to promote good kill. Discing should be done in late spring/early summer with about 20% of the pond disced during any one year. A smaller "finish disc" and/or ring roller can be used to smooth out dirt clods to make walking easier under flooded conditions. Double discing or two-way discing will also reduce the number and size of dirt clods. Wiregrass is a perennial that can also be managed by flooding over exposed disced roots with 12-14 inches of water.

Islands (Uplands). The islands within the seasonal marsh should be cleaned of vegetation to provide loafing areas for the birds. Islands with little cover typically receive more bird use than islands with cover on them. This is mainly due to the fact that birds feel much safer when they can see on all sides of them. Islands shall be disked, mowed, or sprayed prior to fall flood-up.

Wildlife Wetland Habitat Management. Wetland habitat shall be managed primarily for waterfowl and provide benefits for other wildlife as well. Wildlife habitat management includes managing water to maximize food production. Irrigations shall occur at appropriate times to germinate and encourage desired waterfowl food plants. The shallow areas can be managed to provide a variety of food plants such as swamp timothy, atriplex spps., and smartweed. This diversity attracts dozens of species of waterfowl and shorebirds to the area.



APPENDIX B

California Environmental Quality Act (CEQA)

CEQA ENVIRONMENTAL CHECKLIST FORM

1. **Project title:**

   Winter Waterfowl Wetland Habitat Project Using Agricultural Drainage Water

2. **Lead agency name and address:**

   Tulare Lake Drainage District
   P.O. Box 985 (1107 Norboe Avenue)
   Corcoran, CA 93212

3. **Contact person and phone number:**

   Douglas Davis, *General Manager*
   (559) 992-3145, email: tldd@lightspeed.net

4. **Project location:**

   Tulare Lake Drainage District: North ½ of Section 3, T21S R21E; South of Nevada Avenue, and West of 12th Avenue, approximately 7 miles West of Corcoran, California

5. **Project sponsor's name and address:**

   Tulare Lake Drainage District
   P.O. Box 985 (1107 Norboe Avenue)
   Corcoran, CA 93212

6. **General plan designation:** Wetland habitat

7. **Zoning**: Agricultural

8. **Description of project**: The proposed project would convert 305 acres of agricultural land to a winter (seasonal) wetland habitat for waterfowl (see attached wetland feasibility assessment). Construction of the wetland would require grading of the site, construction of low levees and habitat islands, conveyance facilities to deliver low-selenium saline agricultural drainage water to the wetland, internal water level and delivery facilities, and drainage of the wetland to an existing drainage water canal. Construction activity would be temporary and similar to agricultural practices at the current site and surrounding areas. The wetland would be watered in the fall, winter, and early spring. The wetland will be dewatered during the late spring, summer, and early fall to control and manage vegetation.

   No sensitive species or habitat has been reported within 4-5 miles of the site. Results of a wildlife survey of the site did not identify sensitive species or habitats that would be adversely affected by the construction and operation of the proposed wetland. The seasonal wetland would be designed and managed to provide an environmental benefit and seasonal habitat and foraging area for waterfowl and other local wildlife.

   Armona loam, Vanguard sandy loam, and Pitco clay are components of the saline-alkali soil at the site. High clay content of the soil results in poor drainage and low permeability. Low-selenium saline subsurface drainage water is available for use at the site during the winter months. The constituents of the drainage water are within the limits set by the EPA National Recommended Water Quality Criteria (1999), except for chloride.

   Creation of the wetland would provide habitat, cover, loafing, and foraging areas for target species (dabbling and diving ducks) as well as provide incidental benefits to other migratory waterfowl and wildlife. Secondary benefits include possible removal of selenium by bacterial methylization. The project proposal incorporates management techniques for creation and maintenance of a functional wetland.

   Target Species: Dabbling and diving ducks are the target species for the proposed wetland. This determination was based on observations of the waterfowl species seasonally inhabiting similar successful wetland sites such as Kern National Wildlife Refuge located within the San Joaquin Valley. Specific species expected to utilize the site are green-winged teal, mallard, northern pintail, northern shoveler, gadwall, American widgeon, cinnamon teal, ring-necked duck, and ruddy duck. The habitat will also be suitable for visits by geese, bitterns, herons, egrets, cranes, killdeer, American avocet, and black-necked stilts. The wetland habitat design incorporates various water depths, ranging from approximately 0 to 12 inches, utilized by different waterfowl species for foraging.

   Water: Low-selenium saline subsurface drainage water supplies are available at the site during the period when winter waterfowl would be present. The concentration of selenium in water supplies that would be used in the seasonal wetland range from 0.9 µg/l to 2.0 µg/l; concentrations well below the EPA water quality criterion of 5 µg/l for protection of wildlife (chronic exposure criterion). Adverse selenium effects are further reduced in flowing saline waters. A flow-through rate of 1.8 to 4.5 cubic feet per second (cfs) will reduce the potential for selenium and salt to concentrate as a result of evaporation. Once the wetland is constructed a hydraulic analysis will confirm the estimated flow-through rate. Routine monitoring of flow-through rates, selenium concentrations, and TDS/electrical conductivity, will occur as part of wetland operations and management.

   Vegetation: The proposed area is currently devoid of trees and shrubs. The California Waterfowl Association (CWA) recommends that the wetland be managed for a diverse plant community to provide cover, food and protection. Key seasonal wetland plants included in the wetland management plan are fat hen, alkali bulrush, watergrass, smartweed, swamp timothy, cattail, tules, sago pondweed, and widgeon grass. Target plant species seeds may be readily available in the soil or transported to the wetland from other sites. The purchasing or harvesting of seeds with supplemental planting will be done if the desired species are not available in the soil. Seedling germination requires lower salinity levels, which can be accomplished by leaching prior to planting. Vegetation will be managed through discing of dense stands of tules and cattails, burning of very dense vegetation, and possible mowing of alkali bulrush. Exotic invasive plant species will be monitored and removed immediately following each spring drainage event.

No permanent shrubs or trees will be planted because of the potential for their roots to extend through clay layers of aWaterfowl will be protected from predation within the wetland. A fence surrounding the wetland perimeter will prevent possible predation by coyotes, raccoons, and other large mammals. Hunting will not be permitted.

Disease: Avian botulism and influenza are known to affect numerous waterfowl species but are avoidable given the implementation and practice of proper management strategies. Botulism is caused by ingestion of a toxin produced by bacteria that grow on animal protein in anaerobic conditions in warm shallow water and marsh soils. Preventative measures include immediate clean up of carcasses, and use of flowing saline water supplies. Discing areas of dense vegetation will expedite the location of carcasses. The viral disease, avian influenza, is transmitted via direct contact or inhalation, primarily affecting young birds in the summer and early fall. The USFWS recommends a buffer zone of 600 feet between wetlands and commercial poultry operations. The proposed site well exceeds the recommended distance at 4,000 feet from the nearest poultry operation—a turkey ranch. There is little potential for the spread of disease between waterfowl and poultry. The local poultry producer currently practices biosecurity measures to reduce the possibility of disease transmission.

Potential transmission of disease through fecal matter from the turkey ranch during seasonal heavy rains –- a key area of concern –- is infeasible taking into account: (1) the down slope location of the turkey ranch with levees located in between turkey ranch and the constructed wetland; and (2) management policies at the turkey ranch which prohibit the storage of manure onsite; fecal matter is moved immediately off-site and transported to the fields where it has intended use as manure.

Pests: Invertebrate consumption can account for up to 30% of the total food intake for certain waterfowl. Production of the desired aquatic invertebrates such as earthworms, gastropods, midges, and beetles can be accomplished while avoiding production of mosquitoes. Water management is a strategy commonly employed in many wetlands for mosquito control and prevention. Mosquitoes require wet mud in spring and summer to lay eggs. As part of wetland operations, the wetland will be dewatered and the soil will naturally dry, thereby avoiding potential spring and summer mosquito production. The wetland will not have permanently ponded water throughout the year.

Wetland Design: The proposed wetland would be approximately 1 mile wide by 1 mile long, and would remain wetted from late September through May with water flowing in from the Northwest corner of the wetland and flowing out from the southwest corner of the wetland. The seasonally ponded area will be approximately 281 acres, following a typical pond-island configuration of a series of swales separated by islands, divided into blocks of habitat—habitat units—with water control structures so that individual portions of the wetland complex can be flooded and drained at different times and rates appropriate for three primary forage plant groups: fat-hen, smartweed and swamp timothy, and alkali bulrush and watergrass. Individual wetland cells will be managed (e.g., water depths, seasonal period of flooding and draining, etc.) based on the forage plants being produced.

The proposed three habitat units included in the wetland design may also be sub-divided into cells, which can be hydraulically isolated and managed independently to reflect water availability and target species behavior. Individual cells may be flooded to different depths to reflect the relative abundance of various target species during the overall winter migration period. It may be feasible to excavate the required main water delivery canal to a depth of 3.5 feet and ponds to a depth of 1 to 1.5 feet. Spoil from these excavations will be used within the wetland to create narrow islands and the required perimeter levees and uplands. Assuming that ponds are on average 800 feet wide, excavation of each 30 linear foot of swale will create enough spoil to construct an island 12 feet wide, 1.5 feet high, having 10:1 levee slopes. Remaining swale excavations will be used for levee building. No soil will be imported or exported from the existing site.

9. **Surrounding land uses and setting; briefly describe the project's surroundings:**

The proposed wetland would encompass a 305-acre site northwest of Corcoran, California in the Tulare Basin. The wetland site is near the southwest juncture of Nevada and 12th Avenue (two lane paved local access roads). Currently, the site is agricultural land used for planting cotton and safflower (the site has been cultivated for several decades). Surrounding lands are also agricultural with cotton and safflower as the primary annual crops. Areas of wheat crop and rangeland are found some distance from the site. A poultry operation (turkey ranch) is located approximately 4,000 feet from the site. There are no residences or businesses within 0.5 miles of the site.

No cultural resources have been identified within the project area, pursuant to California PRC § 21084.1.

10. **Other public agencies whose approval is required (e.g., permits, financing approval, or participation agreement.)**

Central Valley Regional Quality Control Board – The Regional Board will review the proposed project to determine whether a Waste Discharge Requirement (WDR) or other water quality permit is required for operation of the wetland.

Kings County, Land Use Approval – Required for any proposal to alter land use.

California State Clearinghouse – CEQA environmental review.

Cooperation with U.S. Fish and Wildlife Service, California Department of Fish and Game, and the California Waterfowl Association is required for the success of the project. These parties have participated in the project design and review.

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED:

The environmental factors checked below would be potentially affected by this project, involving at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

❒ Aesthetics	❒ Agriculture Resources	❒ Air Quality
❒ Biological Resources	❒ Cultural Resources	❒ Geology/Soils
❒ Hazards & Hazardous Materials	❒ Hydrology/Water Quality	❒ Land Use/Planning
❒ Mineral Resources	❒ Noise	❒ Population/Housing
❒ Public Services	❒ Recreation	❒ Transportation/Traffic
❒ Utilities/Service Systems	❒ Mandatory Findings of Significance	

DETERMINATION

On the basis of this initial evaluation:

☒ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☐ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions in the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a "potentially significant impact" or "potentially significant unless mitigated" impact on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier EIR or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the proposed project, nothing further is required.

Signature _____ Date _____

Douglas E. Davis
Printed Name

EVALUATION OF ENVIRONMENTAL IMPACTS

Issues:

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
I. AESTHETICS – Would the project:				
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☐	☒
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☐	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
d) Create a new source of substantial light or glare that would adversely affect day or nighttime views in the area?	☐	☐	☐	☒
II. AGRICULTURE RESOURCES: In determining whether impacts to agricultural resources are significant environmental effects, lead agencies may refer to the California Agricultural Land Evaluation and Site Assessment Model (1997) prepared by the California Dept. of Conservation as an optional model to use in assessing impacts on agriculture and farmland. Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☒	☐
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒
c) Involve other changes in the existing environment, which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use?	☐	☐	☒	☐
III. AIR QUALITY – Where available, the significance criteria established by the applicable air quality management or air pollution control district may be relied upon to make the following determinations. Would the project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	☐	☐	☐	☒
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☐	☐	☐	☒
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions, which exceed quantitative thresholds for ozone precursors)?	☐	☐	☐	☒
d) Expose sensitive receptors to substantial pollutant concentrations?	☐	☐	☐	☒
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☐	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
IV. BIOLOGICAL RESOURCES – Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	❒	❒	❒	☒
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Game or US Fish and Wildlife Service?	❒	❒	❒	☒
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	❒	❒	❒	☒
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?	❒	❒	❒	☒
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	❒	❒	❒	☒
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	❒	❒	❒	☒
V. CULTURAL RESOURCES – Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in § 15064.5?	❒	❒	❒	☒
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to § 15064.5?	❒	❒	❒	☒
c) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?	❒	❒	❒	☒
d) Disturb any human remains, including those interred outside of formal cemeteries?	❒	❒	❒	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
VI. GEOLOGY AND SOILS – Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:	☐	☐	☐	☒
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☐	☒
ii) Strong seismic ground shaking?	☐	☐	☐	☒
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☐	☒
iv) Landslides?	☐	☐	☐	☒
b) Result in substantial soil erosion or the loss of topsoil?	☐	☐	☐	☒
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse?	☐	☐	☐	☒
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☐	☒
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?	☐	☐	☐	☒
VII. HAZARDS AND HAZARDOUS MATERIALS – Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☐	☒
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☐	☐	☐	☒
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?	☐	☐	☐	☒
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☐	☐	☐	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in the project area?	❒	❒	❒	☒
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	❒	❒	❒	☒
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	❒	❒	❒	☒
h) Expose people or structures to a significant risk of loss, injury or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	❒	❒	❒	☒
VIII. HYDROLOGY AND WATER QUALITY – Would the project:				
a) Violate any water quality standards or waste discharge requirements?	❒	❒	❒	☒
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?	❒	❒	❒	☒
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on- or off-site?	❒	❒	☒	❒
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site?	❒	❒	☒	❒
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?	❒	❒	❒	☒
f) Otherwise substantially degrade water quality?	❒	❒	❒	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☒
h) Place within a 100-year flood hazard area structures that would impede or redirect flood flows?	☐	☐	☐	☒
i) Expose people or structures to a significant risk of loss, injury or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☐	☒
j) Inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☒
IX. LAND USE AND PLANNING – Would the project:				
a) Physically divide an established community?	☐	☐	☐	☒
b) Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☐	☐	☐	☒
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☒
X. MINERAL RESOURCES – Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan or other land use plan?	☐	☐	☐	☒
XI. NOISE -- Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☐	☒
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☐	☒
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☒	☐
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☒	☐

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	❒	❒	❒	☒
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	❒	❒	❒	☒
XII. POPULATION AND HOUSING – Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?	❒	❒	❒	☒
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	❒	❒	❒	☒
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	❒	❒	❒	☒
XIII. PUBLIC SERVICES				
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:				
Fire protection?	❒	❒	❒	☒
Police protection?	❒	❒	❒	☒
Schools?	❒	❒	❒	☒
Parks?	❒	❒	❒	☒
Other public facilities?	❒	❒	❒	☒
XIV. RECREATION				
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	❒	❒	❒	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities, which might have an adverse physical effect on the environment?	❒	❒	❒	☒
XV. TRANSPORTATION/TRAFFIC – Would the project:				
a) Cause an increase in traffic, which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections)?	❒	❒	❒	☒
b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?	❒	❒	❒	☒
c) Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risks?	❒	❒	❒	☒
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	❒	❒	❒	☒
e) Result in inadequate emergency access?	❒	❒	❒	☒
f) Result in inadequate parking capacity?	❒	❒	❒	☒
g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	❒	❒	❒	☒
XVI. UTILITIES AND SERVICE SYSTEMS – Would the project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	❒	❒	❒	☒
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	❒	❒	❒	☒
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	❒	❒	❒	☒

	Potentially Significant Impact	Less Than Significant with Mitigation Incorporated	Less Than Significant Impact	No Impact
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	❒	❒	❒	☒
e) Result in a determination by the wastewater treatment provider, which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	❒	❒	❒	☒
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?	❒	❒	❒	☒
g) Comply with federal, state, and local statutes and regulations related to solid waste?	❒	❒	❒	☒
XVII. MANDATORY FINDINGS OF SIGNIFICANCE				
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	❒	❒	❒	☒
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	❒	❒	❒	☒
c) Does the project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?	❒	❒	❒	☒

Form A

Notice of Completion & Environmental Document Transmittal

SCH # _____

Mail to: State Clearinghouse, PO Box 3044, Sacramento, CA 95812-3044 916/445-0613

Project Title: Winter Waterfowl Wetland Habitat Project Using Agricultural Drainage Water

Lead Agency: Tulare Lake Drainage District | Contact Person: Douglas E. Davis

Mailing Address: P.O. Box 985 | Phone:(559) 992-3145; email: tldd@lightspeed.net

City: Corcoran | Zip: 93212 | County: Kings County

Project Location:

County: Kings County | City/Nearest Community: (northwest of) Corcoran

Cross Streets: South of Nevada Avenue, and West of 12th Avenue | Zip Code: 93212 | Total Acres: 305

Assessor's Parcel No. T21S R21E | Section: 3 | Twp. | Range: | Base:

Within 2 Miles: State Hwy #: | Waterways:

Airports: | Railways: | Schools:

Document Type:

CEQA: ☐ NOP ☐ Early Cons ☒ Neg Dec ☐ Draft EIR ☐ Supplement/Subsequent EIR (Prior SCH No.)_____ ☐ Other _____

NEPA: ☐ NOI ☐ EA ☐ Draft EIS ☐ FONSI

Other: ☐ Joint Document ☐ Final Document ☐ Other_____

Local Action Type:

☐ General Plan Update ☐ General Plan Amendment ☐ General Plan Element ☐ Community Plan

☐ Specific Plan ☐ Master Plan ☐ Planned Unit Development ☐ Site Plan

☐ Rezone ☐ Prezone ☐ Use Permit ☐ Land Division (Subdivision, etc.)

☐ Annexation ☒ Redevelopment ☐ Coastal Permit ☐ Other_____

Development Type:

☐ Residential: *Units*_____ *Acres*_____
☐ Office: *Sq.ft.*_____ *Acres*_____ *Employees*_____
☐ Commercial: *Sq.ft.* _____ *Acres*_____ *Employees*_____
☐ Industrial: *Sq.ft.* _____ *Acres*_____ *Employees*_____
☐ Educational _____
☐ Recreational _____

☐ Water Facilities: *Type*_____ *MGD*_____
☐ Transportation: *Type*_____
☐ Mining: *Mineral*_____
☐ Power: *Type*_____ *Watts*_____
☐ Waste Treatment: *Type*_____
☐ Hazardous Waste: *Type*_____
☒ Other: Agricultural; 305 acres

Funding (approx.): Federal $_____ State $_____ Total $_____

Project Issues Discussed in Document:

☐ Aesthetic/Visual
☒ Agricultural Land
☐ Air Quality
☒ Archeological/Historical
☐ Coastal Zone
☒ Drainage/Absorption
☐ Economic/Jobs
☐ Fiscal
☒ Flood Plain/Flooding
☐ Forest Land/Fire Hazard
☐ Geologic/Seismic
☒ Minerals
☐ Noise
☐ Population/Housing Balance
☐ Public Services/Facilities
☐ Recreation/Parks
☐ Schools/Universities
☐ Septic Systems
☐ Sewer Capacity
☒ Soil Erosion/Compaction/Grading
☐ Solid Waste
☐ Toxic/Hazardous
☐ Traffic/Circulation
☒ Vegetation
☒ Water Quality
☒ Water Supply/Groundwater
☐ Wetland/Riparian
☒ Wildlife
☐ Growth Inducing
☒ Landuse
☐ Cumulative Effects
☐ Other _____

Present Land Use/Zoning/General Plan Designation: Agricultural

Project Description: See attached summary

Reviewing Agencies Checklist

Form A, continued

KEY
S = Document sent by lead agency
X = Document sent by SCH
✓ = Suggested distribution

_____**Resources Agency**
_____Boating & Waterways
_____Coastal Commission
_____Coastal Conservancy
_____Colorado River Board
_____Conservation
_X___Fish & Game
_____Forestry & Fire Protection
_____Office of Historic Preservation
_____Parks & Recreation
_____Reclamation Board
_____S.F. Bay Conservation & Development Commission
_X___Water Resources (DWR)

Business, Transportation & Housing
_____Aeronautics
_____California Highway Patrol
_____CALTRANS District #_____
_____Department of Transportation Planning (headquarters)
_____Housing & Community Development

_____**Food & Agriculture**

Health & Welfare
_____Health Services _____

State & Consumer Services
_____General Services
_____OLA (Schools)

Environmental Protection Agency
__X__Air Resources Board
_____California Waste Management Board
_____SWRCB: Clean Water Grants
_____SWRCB: Delta Unit
_X___SWRCB: Water Quality
_____SWRCB: Water Rights
_X_ Regional WQCB #_5_ (Central Valley, CVRQCB)

Youth & Adult Corrections
_____Corrections

Independent Commissions & Offices
_____Energy Commission
_____Native American Heritage Commission
_____Public Utilities Commission
_____Santa Monica Mountains Conservancy
_____State Lands Commission
_____Tahoe Regional Planning Agency

_X_ Other: Kings County Planning; U.S. Fish & Wildlife Service

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Public Review Period (to be filled in by lead agency)

Starting Date May 19, 2005 Ending Date June 16, 2005

Signature _____ Date _____

Lead Agency (Complete if applicable):
Consulting Firm: Tulare Lake Drainage District
Address: P.O. Bx 985 (1107 Norboe Avenue)
City/State/Zip: Corcoran, CA 93212
Contact: Douglas E. Davis
Phone: (559) 992-3145

Applicant: Tulare Lake Drainage District
Address: P.O. Bx 985 (1107 Norboe Avenue)
City/State/Zip: Corcoran, CA 93212
Phone: (559) 992-3145

For SCH Use Only:
Date Received at SCH _____
Date Review Starts _____
Date to Agencies _____
Date to SCH _____
Clearance Date _____
Notes:

STATE OF CALIFORNIA

Governor's Office of Planning and Research

State Clearinghouse and Planning Unit

Arnold Schwarzenegger
Governor

Sean Walsh
Director

June 17, 2005

Douglas E. Davis
Tulare Lake Drainage District
P.O. Box 985
Corcoran, CA 93232

Subject: Winter Waterfowl Wetland Habitat Project Using Agricultural Drainage Water
SCH#: 2005051105

Dear Douglas E. Davis:

The State Clearinghouse submitted the above named Negative Declaration to selected state agencies for review. On the enclosed Document Details Report please note that the Clearinghouse has listed the state agencies that reviewed your document. The review period closed on June 16, 2005, and the comments from the responding agency (ies) is (are) enclosed. If this comment package is not in order, please notify the State Clearinghouse immediately. Please refer to the project's ten-digit State Clearinghouse number in future correspondence so that we may respond promptly.

Please note that Section 21104(c) of the California Public Resources Code states that:

> "A responsible or other public agency shall only make substantive comments regarding those activities involved in a project which are within an area of expertise of the agency or which are required to be carried out or approved by the agency. Those comments shall be supported by specific documentation."

These comments are forwarded for use in preparing your final environmental document. Should you need more information or clarification of the enclosed comments, we recommend that you contact the commenting agency directly.

This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act. Please contact the State Clearinghouse at (916) 445-0613 if you have any questions regarding the environmental review process.

Sincerely,

Terry Roberts

Terry Roberts
Director, State Clearinghouse

Enclosures
cc: Resources Agency

Document Details Report
State Clearinghouse Data Base

SCH# 2005051105
Project Title Winter Waterfowl Wetland Habitat Project Using Agricultural Drainage Water
Lead Agency Tulare Lake Drainage District

Type Neg Negative Declaration

Description Develop a 305 acre winter waterfowl habitat using low-selenium saline subsurface agricultural drainage water.

Lead Agency Contact

Name Douglas E. Davis
Agency Tulare Lake Drainage District
Phone (559) 992-3145 **Fax**
email
Address P.O. Box 985
City Corcoran **State** CA **Zip** 93232

Project Location

County Kings
City Corcoran
Region
Cross Streets Southwest corner of Nevada and 12th Avenue
Parcel No. 044-020-031
Township 21S **Range** 21E **Section** 3 **Base**

Proximity to:

Highways
Airports
Railways
Waterways
Schools
Land Use Agricultural

Project Issues Aesthetic/Visual; Agricultural Land; Air Quality; Archaeologic-Historic; Drainage/Absorption; Landuse; Noise; Population/Housing Balance; Soil Erosion/Compaction/Grading; Vegetation; Water Quality; Water Supply; Wetland/Riparian; Wildlife

Reviewing Agencies Resources Agency; Regional Water Quality Control Bd., Region 5 (Fresno); Department of Parks and Recreation; Native American Heritage Commission; Department of Health Services; Department of Fish and Game, Region 4; Department of Water Resources; Department of Conservation; Caltrans, District 6; Department of Toxic Substances Control; State Water Resources Control Board, Division of Water Rights; State Water Resources Control Board, Clean Water Program

Date Received 05/18/2005 **Start of Review** 05/18/2005 **End of Review** 06/16/2005

PUBLIC NOTICE
INTENT TO ADOPT A MITIGATED NEGATIVE DECLARATION
Tulare Lake Drainage District, Corcoran CA

Project Title, Description, and Location

The Tulare Lake Drainage District (TLDD) proposes to adopt a Negative Declaration for the construction and operation of a seasonal winter wetland (Proposed Project). The proposed project would convert 305 acres of agricultural land to a winter (seasonal) wetland habitat for waterfowl. The proposed wetland would encompass a 305-acre site northwest of Corcoran, California in the Tulare Basin. The wetland site is near the southwest juncture of Nevada and 12th Avenue. Currently, the site is agricultural land used for planting cotton and safflower (the site has been cultivated for several decades). Surrounding lands are also agricultural with cotton and safflower as the primary annual crops. A poultry operation (turkey ranch) is located approximately 4,000 feet from the site. There are no residences or businesses within 0.5 miles of the site.

Construction of the wetland would require grading of the site, construction of low levees and habitat islands, conveyance facilities to deliver low-selenium saline agricultural drainage water to the wetland, internal water level and delivery facilities, and drainage of the wetland to an existing drainage water canal. Construction activity would be temporary and similar to agricultural practices at the current site and surrounding areas. The wetland would be watered in the fall, winter, and early spring. The wetland will be dewatered during the late spring, summer, and early fall to control and manage vegetation. A fence surrounding the wetland perimeter will prevent possible predation by coyotes, raccoons, and other large mammals. Hunting will not be permitted.

No sensitive species or habitat has been reported within 4-5 miles of the site. Results of a wildlife survey of the site did not identify sensitive species or habitats that would be adversely affected by the construction and operation of the proposed wetland. The seasonal wetland would be designed and managed to provide an environmental benefit and seasonal habitat and foraging area for waterfowl and other local wildlife.

Creation of the wetland would provide habitat, cover, loafing, and foraging areas for target species (dabbling and diving ducks including are green-winged teal, mallard, northern pintail, northern shoveler, gadwall, American widgeon, cinnamon teal, ring-necked duck, and ruddy duck). The habitat will also be suitable for visits by geese, bitterns, herons, egrets, cranes, killdeer, American avocet, and black-necked stilts. The wetland habitat design incorporates various water depths, ranging from approximately 0 to 12 inches, utilized by different waterfowl species for foraging.

Low-selenium saline subsurface drainage water supplies are available at the site. The concentration of selenium in water supplies that would be used range from 0.9 µg/l to 2.0 µg/l; concentrations well below the EPA water quality criterion of 5 µg/l for protection of wildlife (chronic exposure criterion). Adverse selenium effects are further reduced in flowing saline waters.

The proposed area is currently devoid of trees and shrubs. The California Waterfowl Association (CWA) recommends that the wetland be managed for a diverse plant community to provide cover, food and protection. Key seasonal wetland plants included in the wetland management plan are fat hen, alkali bulrush, watergrass, smartweed, swamp timothy, cattail, tules, sago pondweed, and widgeon grass. Vegetation will be managed through discing of dense stands of tules and cattails, burning of very dense vegetation, and possible mowing of alkali bulrush. Exotic invasive plant species will be monitored and removed immediately following each spring

drainage event. No permanent shrubs or trees will be planted because of the potential for their roots to extend through clay layers of the wetland and adversely affect drainage.

Avian botulism and influenza are known to affect numerous waterfowl species but are avoidable given the implementation and practice of proper management strategies. The USFWS recommends a buffer zone of 600 feet between wetlands and commercial poultry operations. The proposed site well exceeds the recommended distance at 4,000 feet from the nearest poultry operation—a turkey ranch. There is little potential for the spread of disease between waterfowl and poultry. The local poultry producer currently practices biosecurity measures to reduce the possibility of disease transmission. Potential transmission of disease through fecal matter from the turkey ranch during seasonal heavy rains is infeasible taking into account: (1) the down slope location of the turkey ranch with levees located in between turkey ranch and the constructed wetland; and (2) management policies at the turkey ranch which prohibit the storage of manure onsite; fecal matter is moved immediately off-site and transported to the fields where it has intended use as manure.

Water management is a strategy commonly employed in many wetlands for mosquito control and prevention. As part of wetland operations, the wetland will be dewatered and the soil will naturally dry, thereby avoiding potential spring and summer mosquito production. The wetland will not have permanently ponded water throughout the year.

California State Law requires TLDD to conduct environmental review for all pending projects that require a public hearing. Environmental review examines the nature and extent of any potentially significant adverse impacts on the environment that could occur if a project is approved and implemented. The General Manager of TLDD would require the preparation of an Environmental Impact Statement if the review concluded that the proposed project could have significant unavoidable effects on the environment. The California Environmental Quality Act (CEQA) requires this notice to disclose whether any listed toxic sites are present; the project does **not** contain a listed toxic site.

Based on initial study, the General Manager has concluded that the project will not have significant adverse effects on the environment. TLDD has sent this intent to adopt a Negative Declaration for the proposed project to responsible agencies, trustee agencies, and the Kings County clerk and published a Notice of Intent in the Corcoran Journal for general circulation in the project area. The draft Negative Declaration, initial study, and the reference documents are available for review from 9:00 a.m. to 4:30 p.m., Monday through Friday at TLDD located at 1107 Norboe Avenue, Corcoran, California, 93212. Written comments on the Proposed Project should be sent to TLDD ATTN: Mr. Doug Davis, General Manager on or before 5:00 PM, June 16, 2005.

Adoption of a Negative Declaration does not constitute approval of the proposed project. The decision to approve or deny the project described will be made separately as required by County Ordinance. For additional information or to obtain a copy of the draft Negative Declaration, please call TLDD at 559-992-3145.

Douglas E. Davis
General Manager
Tulare Lake Drainage District

Circulated on:_____ _____

DEPARTMENT OF CONSERVATION

DIVISION OF LAND RESOURCE PROTECTION

801 K STREET • MS 18-01 • SACRAMENTO, CALIFORNIA 95814

PHONE 916 / 324-0850 • FAX 916 / 327-3430 • TDD 916 / 324-2555 • WEB SITE conservation.ca.gov

Clear 6.16.05 e

June 15, 2005

Mr. Doug Davis, General Manager
Tulare Lake Drainage District
P.O. Box 985
Corcoran, CA 93212

Subject: Winter Waterfowl Wetland Habitat Project Negative Declaration (ND) – SCH# 2005051105, Kings County

Dear Mr. Davis:

The Department of Conservation's (Department) Division of Land Resource Protection (Division) has reviewed the ND for the referenced project. The Division monitors farmland conversion on a statewide basis and administers the California Land Conservation (Williamson) Act and other agricultural land conservation programs. We offer the following comments and recommendations with respect to the project's impacts on agricultural land resources.

Project Description

The proposed project is the conversion by the Tulare Lake Drainage District (District) of 305 acres of prime agricultural land to a winter wetland habitat for waterfowl. The project site is currently planted in cotton and safflower and has been cultivated for several decades. Surrounding lands are agricultural with cotton and safflower the primary crops. The project site is located near the southwest juncture of Nevada and 12th Avenues northwest of Corcoran, Kings County (County). The project will involve grading, construction of low levees and habitat islands, conveyance facilities and internal water level and delivery facilities. The wetland will be watered in the fall, winter and early spring with low-selenium saline agricultural drainage water and dewatered during late spring, summer and early fall. No sensitive species or habitat has been reported within 4-5 miles of the site.

Public Acquisition of Williamson Act Land

According to the County Assessor's Office, the subject site (APN 044-020-031, currently 044-020-038 and 039) was formerly enforceably restricted by a Farmland Security Zone contract. On March 19, 2002, the property was taken out of contract with its transfer to the District. However, the Department has no record that the District provided notice of the proposed acquisition of contracted land as required by Government Code section

51291(b). Without notice, the Department is unable to exercise is statutory responsibility to provide comments as to the agricultural impacts of the acquisition and whether it can achieve statutory compliance. The District is deprived of fulfilling its statutory duty to consider the Department's comments prior to making a decision on whether to acquire the property. Further, to date, it appears that the District has not notified the Department that it acquired the property as required by section 51291(c). In order to acquire Williamson Act land, a public agency must make required findings under section 51292 and must comply with eminent domain law to acquire the land by eminent domain or in lieu of eminent domain in order to void the contract pursuant to section 51295. Otherwise, contract restrictions will remain in force, and the agency's use of the property will be limited by those restrictions. The Department requests that the District provide the Department with the required notification (Please find enclosed Notification Provisions).

Compatibility on Williamson Act Land

It is the Department's position that a wetland habitat converting 305 acres of prime agricultural land is not a compatible use on FSZ contracted land. The conversion would significantly compromise the land's agricultural capability, displace agricultural operations and conflict with the principles of compatibility in Government Code section 51238.1. In addition, such a conversion would make the land ineligible for enrollment in a FSZ contract. If the contract has not been properly voided and the District and County desire to proceed with the project, the Department recommends that a notice of nonrenewal should be filed for the FSZ contract for the site and that development be postponed until expiration of the nonrenewal period. The parties may also have an option to rescind the FSZ contract 10 years after the inception of the nonrenewal period and enter into a new contract (pursuant to section 51254) that specifies the primacy of open space use according to the definition of open space in Government Code section 51201(o), after consultation with the Department of Fish and Game. In this case, the County would have to find that the wetland habitat and associated facilities are compatible with the open space use. The option of rescission and re-entry, however, is uncertain since the statute requires the new contract to be at least as restrictive as the former contract. FSZ contract provisions apply to specifically designated agricultural land, not land converted to open space use.

Thank you for the opportunity to comment on this ND. If you have questions on our comments or require technical assistance or information on agricultural land conservation, please contact Bob Blanford at 801 K Street, MS 18-01, Sacramento, California 95814; or, phone (916) 327-2145.

Sincerely,

Dennis J. O'Bryant
Acting Assistant Director

Enclosure

ACQUISITION NOTIFICATION PROVISIONS OF THE WILLIAMSON ACT

Notification provisions of the Williamson Act (Government Code Section 51291) require an agency to notify the Director of the Department of Conservation of the possible acquisition of Williamson Act contracted land for a public improvement. Such notification must occur when it **appears** that land enrolled in a Williamson Act contract may be required for a public use, is **acquired**, the original public improvement for the acquisition is **changed**, or the land acquired is **not used** for the public improvement. The local governing body responsible for the administration of the agricultural preserve must also be notified.

NOTIFICATION (Government Code Section 51291 (b))

The following information must be included in the notification correspondence.

1. The total number of acres of Williamson Act contracted land to be acquired and whether the land is considered prime agricultural land according to Government Code Section 51201.
2. The purpose for the acquisition and why the land was identified for acquisition. (If available, include documentation of eminent domain proceedings or a property appraisal and written offer in lieu of eminent domain per GC §§7267.1 and 7267.2 to void the contract per GC §51295; include a chronology of steps taken or planned to effect acquisition by eminent domain or in lieu of eminent domain.)
3. A description of where the parcel(s) is located.
4. Characteristics of adjacent land (urban development, Williamson Act, noncontract agricultural, etc.)
5. A vicinity map and a location map (may be the same as #8).
6. A copy of the contract(s) covering the land.
7. CEQA documents for the project.
8. **The findings required under GC §51292 , documentation to support the findings and an explanation of the preliminary consideration of §51292.** (Include a map of the proposed site and an area of surrounding land identified by characteristics and large enough to help clarify that no other, noncontract land is reasonably feasible for the public improvement.)

ACQUISITION (Government Code Section 51291 (c))

The following information must be included in the notification when land within an agricultural preserve has been **acquired**. The notice must be forwarded to the Director within **10 working days** of the acquisition of the land. The notice must also include the following:

1. A general explanation of the decision to acquire the land, and why noncontracted land is not available for the public improvement.
2. Findings made pursuant to Government Code Section 51292, as amended.
3. If the information is different from that provided in the previous notice sent upon consideration of the land, a general description of the land, and a copy of the contract covering the land shall be included in the notice.

SIGNIFICANT CHANGE IN PUBLIC IMPROVEMENT (Government Code Section 51291 (d))

Once notice is given as required, if the public agency proposed any significant change in the public improvement, the Director must be notified of the **changes** before the project is completed.

LAND ACQUIRED IS NOT USED FOR PUBLIC IMPROVEMENT (Government Code Section 51295)

If the acquiring public agency does not use the land for the stated public improvement and plans to return it to private ownership, **before** returning the land to private ownership the Director must be notified of the action. **Additional requirements apply.** The mailing address for the Director is: **Debbie Sareeram, Interim Director, Department of Conservation, 801 K Street, MS 13-71, Sacramento, CA 95814; phone (916) 324-0850.**

(April 2002)

STATE OF CALIFORNIA—BUSINESS, TRANSPORTATION AND HOUSING AGENCY ARNOLD SCHWARZENEGGER, Governor

DEPARTMENT OF TRANSPORTATION
1352 WEST OLIVE AVENUE
P.O. BOX 12616
FRESNO, CA 93778-2616
PHONE (559) 445-5867
FAX (559) 488-4088
TTY (559) 488-4066

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May 27, 2005

2133 IGR/CEQA
6-KIN-43-5.09+/-
DRAFT NEGATIVE DECLARATION
TULARE LAKE WINTER WATERFOWL
WETLAND HABITAT PROJECT
SCH: 2005051105

Mr. Douglas E. Davis
General Manager
Tulare Lake Drainage District
P.O. Box 985
Corcoran, CA 93232

Dear Mr. Davis:

Thank you for the opportunity review of the Draft Negative Declaration for a proposal to develop a 305-acre winter waterfowl habitat area using low-selenium saline subsurface agricultural drainage water. The project site is located approximately five miles west of the State Route 43 and Nevada Avenue intersection and seven miles northwest of the City of Corcoran. Caltrans has the following comment:

It is not anticipated that the proposed project would have any impact on the State facilities.

If you have any questions, please contact me at (559) 445-5867.

Sincerely,

PAUL-ALBERT MARQUEZ
Office of Transportation Planning
District 6

C: State Clearinghouse

USFWS COMMENTS

Subject: Re: Feasibility of a Winter Waterfowl Wetland Habitat Using Agricultural Drainage Water
Date: 6/21/2005 12:20:19 PM Pacific Standard Time
From: Thomas_Maurer@fws.gov
To: tldd@lightspeed.net
Sent from the Internet (Details)

Dear Doug,

I sincerely apologize for not responding sooner. After my initial review I did not have any specific comments that would significantly alter the nature of your wetland habitat proposal or my earlier comments to you that the endeavor is worth striving for in the Tulare Basin, thus it was placed on my back burner. Most of my comments will be useful in the detailed design, planning, and implementation phases of the project. The comments I have are:

p. 15, 1st column, 3rd paragraph--Although the national selenium criteria and general selenium criteria for California is 5 ppb it should be noted that there is a site-specific standard of 2 ppb for wetland supply channels in the Grassland area of the lower San Joaquin River system. For the most part selenium concentrations in the Grassland wetland supply channels are at or below 2 ppb but pulses can reach the double digit level in the winter during extreme runoff events in the Panoche Creek watershed. When these storm events occur wetland managers generally have sufficient time to close intake structures so they do not bring in selenium contaminated water. Based on the selenium monitoring at your summer shorebird wetland the supply water for the proposed winter waterfowl wetland is expected to average around 2 ppb with a maximum no higher than 4 ppb thus selenium risks should be low.

p. 15, 1st column, 3rd paragraph--". . . operated as a flow through facility (lotic) . . ." I would not consider the proposed wetlands lotic just because the system is flow through as most lentic systems are flow through. However, even as a lentic system the winter waterfowl wetland is expected to be a low risk for selenium problems as stated above.

p.29, 1st column, 2nd paragraph--The frequency of selenium monitoring should be often enough to truly provide a quick response time for management changes needed to safely control pulses of selenium into the wetlands. Just a week of elevated selenium concentrations could be enough to send a selenium pulse through the food chain. If the water supply is consistent, a selenium to conductivity relationship might be developed that could provide a very quick assessment of selenium input. If you have several drain sumps supplying the source water, knowing if a particular drain sump has higher selenium that others could allow you to always be sure that drainage water from that sump is being diluted by cleaner sumps or temporarily divert the wetland input to the evaporation ponds.

p.31, Table 8--Avian cholera is a common waterfowl disease in the Central Valley that should be labeled "numerous" in the waterfowl affected column in Table 8. Many of the management recommendations discussed for other diseases should apply as well to avian cholera. In general, for all the waterfowl diseases, a contingency plan should be developed early in the process as it could direct some of the design (good winter access to wetlands for observation and carcass removal), implementation efforts, and long-term coordination with other wetland managers in the San Joaquin Valley. An excellent guide to wildlife diseases (primarily avian) can be found at http://www.nwhc.usgs.gov/pub_metadata/field_manual/field_manual.html

Again, I apologize for the delay in providing comments on your winter waterfowl wetland project. Based on the information provided and the egg data from your shorebird wetland I expect the risks to waterfowl from selenium in your source water to be low. With assistance from the California Waterfowl Association and other local wetland managers you should be able to create a highly productive wetland.

Good luck on this exciting challenge!
Tom

Thomas C. Maurer
Chief, Investigations and Prevention Branch
Sacramento Fish and Wildlife Office
U.S. Fish and Wildlife Service
2800 Cottage Way, Room W-2605
Sacramento, California 95825
(916) 414-6594
fax 414-6713
thomas_maurer@fws.gov

CALIFORNIA HISTORICAL RESOURCES INFORMATION SYSTEM

FRESNO
KERN
KINGS
MADERA
TULARE

Southern San Joaquin Valley Information Center
California State University, Bakersfield
9001 Stockdale Highway
Bakersfield, California 93311-1099
661/664-2289 FAX 661/664-2415
Email: abaldwin@csub.edu

TO: Charles H. Hanson, Ph. D.
Hanson Environmental, Inc.
132 Cottage Lane
Walnut Creek, CA 94595

(RS# 05-265)

DATE: July 8, 2005

RE: Tulare Lake Drainage District Proposed Winter Wetland Habitat Area

County: Tulare

Map(s): El Rico Ranch and Guernsey 7.5's

The Southern San Joaquin Valley Information Center is under contract to the State Office of Historic Preservation and is responsible for the local management of the California Historical Resources Inventories for Fresno, Kern, Kings, Madera & Tulare Counties. The Center is funded by research fees and a grant from the State Office of Historic Preservation. The Information Center does not conduct fieldwork and is not affiliated with any archaeological consultants who conduct fieldwork.

CULTURAL RESOURCES RECORDS SEARCH

The following are the results of a search of the cultural resources files at the Southern San Joaquin Valley Information Center. These files include known and recorded archaeological and historic sites, inventory and excavation reports filed with this office, and properties listed on the National Register of Historic Places, the Historic Property Data File, (5/2/05), the California Historical Landmarks, the California Register, the California Inventory of Historic Resources, and the California Points of Historical Interest.

PRIOR CULTURAL RESOURCE INVENTORIES WITHIN THE PROJECT AREA AND A ½ MILE RADIUS

According to the information in our files, there have been no previous cultural resource inventories conducted within the project area or a ½ mile radius.

KNOWN/RECORDED CULTURAL RESOURCES WITHIN THE PROJECT AREA AND A ½ MILE RADIUS

There are no recorded cultural resources within the project area or within a ½ mile radius. ***Please note that a lack of data does not indicate negative data!!***

(RS# 05-265)

There are no known additional cultural resources within the project boundaries that are listed in the California Register, California Inventory of Historic Resources, California Points of Historical Interest, or the California State Historic Landmarks.

COMMENTS

We recommend that a qualified professional archaeologist conduct a field survey of the entire project area prior to ground disturbance activities in order to determine if cultural resources exist there. A referral list of qualified professionals is enclosed. If you have any questions or need additional information, please don't hesitate to contact me at (661) 664-2289.

By

Adele Baldwin
Assistant Coordinator

Date: July 8, 2005

Fee: $120.00/hr.

Invoice # A3239

RESPONSE TO COMMENTS

Department of Transportation:

Comment noted.

Department of Conservation:

Tulare Lake Drainage District plans to file a notice under the Williamson Act with the Department of Conservation acknowledging the transfer of ownership to TLDD voiding the Farmland Security Zone (FSZ) contract issued to the previous owner.

U.S. Fish and Wildlife Service:

Comments noted. The final report has been modified to address the comments.

Southern San Joaquin Valley Information Center / C.H.R.I.S. Records Search

J & R Environmental Services was contracted to conduct an (Phase I) archaeological survey of the proposed project area.The archaeological survey of the project study area was completed by Jon L. Brady, R. Kristina Brady, and Justin M. Brady on July 30, 2005.

In the Archaeological Survey Report, dated August 15, 2005, J & R Environmental reports:

> *The ground visibility was excellent, thus, all areas of the project were intensively surveyed. The results of the archaeological survey were negative. No prehistoric or cultural resources were identified.*
>
> *The results of the archaeological survey were negative. In light of these research results, no cultural resources were identified within the project area pursuant to California PRC § 21084.1. No further cultural resources investigation is recommended for the undertaking unless project plans undergo such changes as to include areas not covered by this study.*
>
> *Finally, during the course of future development within the new study area, should aboriginal or historic materials be unearthed, that have no otherwise been considered in this report, the Kings County Planning Department and the author of this report should be notified immediately. If bone is identified which may be human, state law requires notification of the County Coroner and the Native American Heritage Commission.*

NEGATIVE DECLARATION

Tulare Lake Drainage District
Winter Waterfowl Wetland Habitat Project
Using Agricultural Drainage Water

The Tulare Lake Drainage District (TLDD) has reviewed the proposed project described below to determine whether it could have significant effects on the environment as a result of project implementation. "Significant effects on the environment" means a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project, including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance. See the Attached Initial Study and feasibility report for details related to the Proposed Project, and the Proposed Project's potential effects on the environment.

Project Name: Winter Waterfowl Wetland Habitat Project Using Agricultural Drainage Water

Project File Number: NA

Project Location: The proposed wetland would encompass a 305-acre site northwest of Corcoran, California in the Tulare Basin. The wetland site is near the southwest juncture of Nevada and 12th Avenue.

County Supervisorial Districts: Kings County District 1

Mailing Address and Phone Number of Applicant Contact Person for this Project: Tulare Lake Drainage District ATTN: Mr. Doug Davis, General Manager, 1107 Norboe Avenue, Corcoran, California, 93212. (559) 992-3145

Project Description:

The Tulare Lake Drainage District (TLDD) proposes to convert 305 acres of agricultural land to a winter (seasonal) wetland habitat for waterfowl. The wetland site is near the southwest juncture of Nevada and 12th Avenue. Currently, the site is agricultural land used for planting cotton and safflower (the site has been cultivated for several decades). Surrounding lands are also agricultural with cotton and safflower as the primary annual crops. A poultry operation (turkey ranch) is located approximately 4,000 feet from the site. There are no residences or businesses within 0.5 miles of the site.

Construction of the wetland would require grading of the site, construction of low levees and habitat islands, conveyance facilities to deliver low-selenium saline agricultural drainage water to the wetland, internal water level and delivery facilities, and drainage of the wetland to an existing drainage water canal. Construction activity would be temporary and similar to agricultural practices at the current site and surrounding areas. The wetland would be watered in the fall, winter, and early spring. The wetland will be dewatered during the late spring, summer, and early fall to control and manage vegetation. A fence surrounding the wetland perimeter will prevent possible predation by coyotes, raccoons, and other large mammals. Hunting will not be permitted.

Creation of the wetland would provide habitat, cover, loafing, and foraging areas for target species (dabbling and diving ducks including are green-winged teal, mallard, northern pintail, northern shoveler, gadwall, American widgeon, cinnamon teal, ring-necked duck, and ruddy duck). The habitat will also be suitable for visits by geese, bitterns, herons, egrets, cranes, killdeer, American avocet, and black-necked stilts. The wetland habitat design incorporates various water depths, ranging from approximately 0 to 12 inches, utilized by different waterfowl species for foraging.

Low-selenium saline subsurface drainage water supplies are available at the site. The concentration of selenium in water supplies that would be used range from 0.9 µg/l to 2.0 µg/l; concentrations well below the EPA water quality criterion of 5 µg/l for protection of wildlife (chronic exposure criterion). Adverse selenium effects are further reduced in flowing saline waters.

The proposed area is currently devoid of trees and shrubs. The California Waterfowl Association (CWA) recommends that the wetland be managed for a diverse plant community to provide cover, food and protection. Key seasonal wetland plants included in the wetland management plan are fat hen, alkali bulrush, watergrass, smartweed, swamp timothy, cattail, tules, sago pondweed, and widgeon grass. Vegetation will be managed through discing of dense stands of tules and cattails, burning of very dense vegetation, and possible mowing of alkali bulrush. Exotic invasive plant species will be monitored and removed immediately following each spring drainage event. No permanent shrubs or trees will be planted because of the potential for their roots to extend through clay layers of the wetland and adversely affect drainage.

Finding:

Based on the attached Initial Study, the Board of Directors of the Tulare Lake Drainage District finds that the Winter Waterfowl Wetland Habitat Project will not have significant effects on the environment.

PUBLIC REVIEW PERIOD

Before 5:00 PM on June 16, 2005, any person may:

(1) Review the Draft Negative Declaration (ND)

(2) Submit written comments regarding the information, analysis, and mitigation measures in the Draft ND. Before the ND is adopted, Tulare Lake Drainage District staff will prepare written responses to any comments, and revise the Draft ND, if necessary, to reflect any concerns raised during the public review period. All written comments will be included as part of the Final ND, and/or

(3) File a formal written protest of the determination that the project would not have a significant effect on the environment. This formal protest must be filed at the Tulare Lake Drainage District ATTN: Mr. Doug Davis, General Manager, 1107 Norboe Avenue, Corcoran, California, 93212. (559) 992-3145.. The written protest should make "fair argument" based on substantial evidence that the project will have one or more significant effects on the environment. If a valid written protest is filed with the Board of Directors of the Tulare Lake Drainage District within the noticed review period, the Board of Directors may (1) adopt the ND and set a noticed public hearing on the protest before the Board of Directors, (2) require the preparation of a mitigated negative declaration incorporating avoidance and mitigation measures or an environmental impact report, or (3) require the draft ND to be revised and undergo additional noticed public review.

Douglas E. Davis, General Manager
For, Tulare Lake Drainage District

Circulated on _____, 2005

Notice of Determination

Form C

To: ☑ Office of Planning and Research
PO Box 3044, 1400 Tenth Street, Room 212
Sacramento, CA 95812-3044

☑ County Clerk
County of Kings County

From: (Public Agency) Tulare Lake Drainage District
P.O. Box 905 Corcoran, CA 93212
(Address)

Subject:
Filing of Notice of Determination in compliance with Section 21108 or 21152 of the Public Resources Code.

Winter Waterfowl Wetland Habitat Project Using Agricultural Drainage Water
Project Title

2005 051105	Douglas E. Davis	(559) 992-3145
State Clearinghouse Number (If submitted to Clearinghouse)	Lead Agency Contact Person	Area Code/Telephone/Extension

Corcoran, California; South of Nevada Avenue, and West of 12th Avenue, Kings County.
Project Location (include county)

Project Description:

Construction and operation of a seasonal winter waterfowl wetland habitat at a 305-acre site located northwest of Corcoran, California. The water supply for the wetland would be low-selenium saline subsurface drainage water.

This is to advise that the Tulare Lake Drainage District ☑ Lead Agency ☐ Responsible Agency has approved the above described project on June 24, 2005 (Date) and has made the following determinations regarding the above described project:

1. The project [☐will ☑will not] have a significant effect on the environment.
2. ☐ An Environmental Impact Report was prepared for this project pursuant to the provisions of CEQA.
   ☑ A Negative Declaration was prepared for this project pursuant to the provisions of CEQA.
3. Mitigation measures [☐were ☑were not] made a condition of the approval of the project.
4. A statement of Overriding Considerations [☐was ☑was not] adopted for this project.
5. Findings [☑were ☐were not] made pursuant to the provisions of CEQA.

This is to certify that the final EIR with comments and responses and record of project approval is available to the General Public at:
Tulare Lake Drainage District 1107 Norboe Avenue Corcoran, CA 93212

Douglas E. Davis — June 24, 2005 — District Manager
Signature (Public Agency) *Date* *Title*

Date received for filing at OPR:

APPENDIX C

Background Information and Investigations

FIGURE C-1. Suisun Marsh during early flooding stage of wetland management. Pictures taken 9-23-03.

FIGURE C-2. Suisun Marsh during late flooding stage of wetland management. Pictures taken 11-11-03.

FIGURE C-3. Dry land vegetated habitat adjacent to flooded areas. Maintained year round. Pictures taken 9-23-03 and 11-11-03.

FIGURE C-4. Examples of wetland management techniques.

Note: Discing destroys both the erect stems as well as breakup the extensive rhizome system that keeps plants alive during dry conditions. Two types of discs are used. A standard agricultural disc works in light stands of vegetation or in areas where the intent is to only knock down the vegetation. On dense stands of river bulrush and cattail, an industrial 12-foot disk is used. It is able to penetrate deeper into the root zone. Prescribed burning is used to remove old vegetative growth, release nutrients back to the soil, decrease woody species, increase other plant species, and reduce the amount of organic matter on the soil surface. Shredding of dense stands of river bulrush and cattail are done to create small open water areas in wetlands. On Waterfowl Production Areas, trees are removed to restore the more natural grassland ecosystem.

TABLE C-1. Birds of the Kern Wildlife Refuge, Delano, California, 2001

WATERFOWL	Sp	S	F	W
___ Greater White-Fronted Goose	o	-	o	o
___ Snow Goose	o	-	o	o
___ Canada Goose	u	r	u	u
___ Wood Duck	u	-	u	u
___ Green-winged Teal*	c	c	a	a
___ Mallard*	c	c	a	a
___ Northern Pintail*	a	c	a	a
___ Blue-winged Teal*	o	o	o	o
___ Cinnamon Teal*	a	c	o	c
___ Northern Shoveler*	a	u	a	a
___ Gadwall*	a	c	a	a
___ American Wigeon*	a	o	a	a
___ Canvasback*	o	r	o	o
___ Redhead*	u	o	u	u
___ Ring-necked Duck*	u	r	u	c
___ Lesser Scaup	-	o	o	o
___ Bufflehead	u	-	u	u
___ Common Merganser	o	-	o	o
___ Ruddy Duck*	c	c	c	c
GALLINACEOUS BIRDS	Sp	S	F	W
___ Ring-necked Pheasant (I) *	a	a	a	a
GREBES	Sp	S	F	W
___ Pied-billed Grebe*	c	c	c	c
___ Eared Grebe*	c	o	c	c
___ Western Grebe*	o	o	o	u
___ Clark's Grebe*	o	o	o	u
PELICANS AND CORMORANTS	Sp	S	F	W
___ American White Pelican	o	r	o	o
___ Double-crested Cormorant	u	o	u	u
BITTERNS, HERONS AND EGRETS	Sp	S	F	W
___ American Bittern*	u	r	u	o
___ Least Bittern	o	r	r	o
___ Great Blue Heron*	c	c	c	c
___ Great Egret	c	u	c	u
___ Little Blue Heron	-	-	-	-
___ Snowy Egret*	c	c	u	u
___ Cattle Egret*	u	u	u	u
___ Green Heron	u	u	u	u
___ Black-crowned Night-Heron*	c	c	c	c
VULTURES	Sp	S	F	W
___ Turkey Vulture	o	o	o	r

The seasons and status of the 216 species listed are coded as follows:

Season Designations

Sp - Spring, March to May

S - Summer, June to August

F - Fall, September to November

W - Winter, December to February

Abundance Symbols

a - abundant species

c - common, certain to be seen in proper habitat

u - uncommon, present but not certain to be seen

o - occasionally seen

Note: Species categorized as rarely seen (r) or outside of normal species range (x) year-round have been omitted from this study (these species include the Fulvous Whistling-Duck, Hooded Merganser, Ross' Goose, Red-breasted Merganser, Tundra Swan, Common Goldeneye, Barrow's Goldeneye, California Quail, Scaled Quail), Osprey, Bald Eagle, Swainson's Hawk, Red-shouldered Hawk, Merlin, Sandhill Crane, Wandering Tattler, Red Knot, Semipalmated Sandpiper)

(Source: Kern National Wildlife Refuge Complex website. 2004. http://natureali.org/knwr_bird_list.htm)

IBIS AND SPOONBILLS	Sp	S	F	W
___ White-faced Ibis*	c	c	u	o
OSPREY, KITES, EAGLES AND HAWKS	Sp	S	F	W
___ White-tailed Kite*	c	c	c	o
___ Northern Harrier*	a	c	a	a
___ Sharp-shinned Hawk	c	c	c	c
___ Cooper's Hawk	u	u	u	u
___ Red-tailed Hawk*	c	u	a	a
___ Ferruginous Hawk	o	-	o	o
___ Golden Eagle	o	r	o	o
FALCONS	Sp	S	F	W
___ American Kestrel*	c	c	c	c
___ Peregrine Falcon	o	o	o	o
___ Prairie Falcon	o	o	o	o
RAILS	Sp	S	F	W
___ Virginia Rail*	u	u	u	u
___ Sora*	o	u	c	c
___ Common Moorhen*	u	r	c	c
___ American Coot*	a	o	a	a
PLOVERS	Sp	S	F	W
___ Black-bellied Plover	u	-	u	o
___ Snowy Plover	o	-	-	-
___ Semipalmated Plover	o	-	o	o
___ Killdeer*	a	a	a	a
___ Mountain Plover	o	-	u	u
STILTS AND AVOCETS	Sp	S	F	W
___ Black-necked Stilt*	a	a	c	c
___ American Avocet*	a	a	a	r
SHOREBIRDS	Sp	S	F	W
___ Greater Yellowlegs	c	-	c	c
___ Lesser Yellowlegs	o	-	o	o
___ Willet	o	-	o	o
___ Spotted Sandpiper	u	-	o	o
___ Whimbrel	o	-	o	-
___ Long-billed Curlew	u	o	u	c
___ Marbled Godwit	o	-	o	-
___ Western Sandpiper	a	o	a	o
___ Least Sandpiper	c	o	a	c
___ Baird's Sandpiper	-	-	u	-
___ Pectoral Sandpiper	-	-	o	-
___ Dunlin	c	-	u	o
___ Short-billed Dowitcher	u	o	u	o
___ Long-billed Dowitcher	a	c	a	a
SNIPE	Sp	S	F	W
___ Common Snipe	c	o	c	c
PHALAROPES	Sp	S	F	W
___ Wilson's Phalarope	u	o	u	-
___ Red-necked Phalarope	u	-	u	-
GULLS AND TERNS	Sp	S	F	W
___ Bonaparte's Gull	o	o	-	-
___ Ring-billed Gull	o	c	c	c
___ California Gull	c	o	o	c
___ Caspian Tern*	o	o	o	o
___ Forster's Tern	c	c	u	u
DOVES	Sp	S	F	W
___ Rock Pigeon (I)	o	o	o	o
___ Mourning Dove*	c	a	a	a
CUCKOOS	Sp	S	F	W
___ Greater Roadrunner	c	c	c	c
OWLS	Sp	S	F	W
___ Barn Owl*	c	c	c	c
___ Western Screech-Owl	o	o	o	o
___ Great Horned Owl*	u	u	u	u
___ Burrowing Owl*	c	c	c	c
___ Short-eared Owl*	u	u	o	o
___ Long-eared Owl*	-	o	-	-
GOATSUCKERS	Sp	S	F	W
___ Lesser Nighthawk	c	c	o	-
___ Common Poorwill	-	u	-	-
SWIFTS	Sp	S	F	W
___ Vaux's Swift	o	-	o	-
HUMMINGBIRDS	Sp	S	F	W
___ Black-chinned Hummingbird	u	c	u	-
___ Anna's Hummingbird*	c	c	c	c
___ Rufous Hummingbird	o	-	o	-
KINGFISHERS	Sp	S	F	W
___ Belted Kingfisher	u	-	u	u
WOODPECKERS	Sp	S	F	W
___ Acorn Woodpecker	o	o	o	-
___ Nuttall's Woodpecker	o	-	o	o
___ Downy Woodpecker	-	-	u	u
___ Northern Flicker	c	o	c	c
FLYCATCHERS	Sp	S	F	W
___ Olive-sided Flycatcher	o	o	-	-
___ Western Wood-Pewee	c	-	u	-
___ Willow Flycatcher	-	o	-	-
___ Hammond's Flycatcher	u	-	o	-
___ Dusky Flycatcher	o	-	-	-
___ Pacific Slope Flycatcher	u	-	u	-
___ Black Phoebe	u	u	c	c
___ Say's Phoebe	u	o	u	u

___ Willow Flycatcher	-	o	-	-
___ Hammond's Flycatcher	u	-	o	-
___ Dusky Flycatcher	o	-	-	-
___ Pacific Slope Flycatcher	u	-	u	-
___ Black Phoebe	u	u	c	c
___ Say's Phoebe	u	o	u	u
___ Ash-throated Flycatcher	u	-	u	-
___ Western Kingbird*	c	c	o	-
LARKS	Sp	S	F	W
___ Horned Lark*	c	c	c	c
SWALLOWS	Sp	S	F	W
___ Tree Swallow	c	u	a	o
___ Violet-green Swallow	u	-	u	-
___ Northern Rough-winged Swallow	u	-	u	-
___ Bank Swallow	o	o	-	-
___ Cliff Swallow*	a	a	o	-
___ Barn Swallow*	c	c	u	-
JAYS, MAGPIES AND CROWS	Sp	S	F	W
___ American Crow	o	o	o	o
___ Common Raven *	c	c	c	c
WRENS	Sp	S	F	W
___ Bewick's Wren	-	-	o	o
___ House Wren	o	-	o	o
___ Marsh Wren*	a	a	a	a
KINGLETS, BLUEBIRDS & THRUSHES	Sp	S	F	W
___ Golden-crowned Kinglet	-	-	o	o
___ Ruby-crowned Kinglet	u	-	u	u
___ Blue-gray Gnatcatcher	-	-	o	-
___ Western Bluebird	-	-	o	o
___ Swainson's Thrush	o	-	-	-
___ Hermit Thrush	u	-	u	u
___ American Robin	u	-	u	u
___ Varied Thrush	o	-	o	o
MOCKINGBIRDS AND THRASHERS	Sp	S	F	W
___ Northern Mockingbird*	u	u	u	u
___ Sage Thrasher	o	-	o	o
___ California Thrasher	o	o	o	o
WAGTAILS AND PIPITS	Sp	S	F	W
___ American Pipit	u	-	c	c
WAXWINGS	Sp	S	F	W
___ Cedar Waxwing	u	-	u	o
SHRIKES	Sp	S	F	W
___ Loggerhead Shrike*	a	a	c	c
VIREOS	Sp	S	F	W
___ Cassin's Vireo	u	-	u	-
___ Warbling Vireo	u	-	u	-

WARBLERS	Sp	S	F	W
___ Orange-crowned Warbler	u	-	u	-
___ Nashville Warbler	o	-	o	-
___ Yellow Warbler	c	-	c	c
___ Yellow-rumped Warbler	c	-	c	-
___ Black-throated Gray Warbler	u	-	u	-
___ Townsend's Warbler	o	-	-	-
___ Hermit Warbler	o	-	-	-
___ MacGillivray's Warbler	u	-	u	-
___ Common Yellowthroat	c	u	u	u
___ Wilson's Warbler	c	-	u	-
TANAGERS	Sp	S	F	W
___ Western Tanager	u	u	u	-
GROSBEAKS AND BUNTINGS	Sp	S	F	W
___ Black-headed Grosbeak	c	u	u	-
___ Blue Grosbeak	u	u	o	-
TOWHEES AND SPARROWS	Sp	S	F	W
___ Spotted Towhee	u	-	u	u
___ Chipping Sparrow	u	-	u	-
___ Vesper Sparrow	u	-	u	u
___ Lark Sparrow	u	-	u	u
___ Sage Sparrow*	u	u	u	u
___ Savannah Sparrow	c	-	c	a
___ Fox Sparrow	u	-	u	u
___ Song Sparrow	c	c	c	c
___ Lincoln's Sparrow	u	-	c	c
___ Golden-crowned Sparrow	u	-	u	r
___ White-crowned Sparrow	c	-	a	a
___ Dark-eyed Junco	o	-	c	c
BLACKBIRDS, MEADOWLARKS & ORIOLES	Sp	S	F	W
___ Red-winged Blackbird*	a	a	a	a
___ Tricolored Blackbird*	a	a	a	a
___ Western Meadowlark*	a	a	a	a
___ Yellow-headed Blackbird*	a	a	c	o
___ Brewer's Blackbird*	a	a	a	a
___ Great-tailed Grackle*	c	c	c	c
___ Brown-headed Cowbird*	c	c	u	u
___ Hooded Oriole	o	-	-	-
___ Bullock's Oriole*	c	c	r	-
FINCHES	Sp	S	F	W
___ House Finch	c	c	c	c
___ Pine Siskin	r	-	r	o
___ Lesser Goldfinch	u	-	u	u
___ American Goldfinch	u	-	u	u
WEAVER FINCHES	Sp	S	F	W
___ House Sparrow (I)*	c	c	c	c
___ House Sparrow (I)*	c	c	c	c

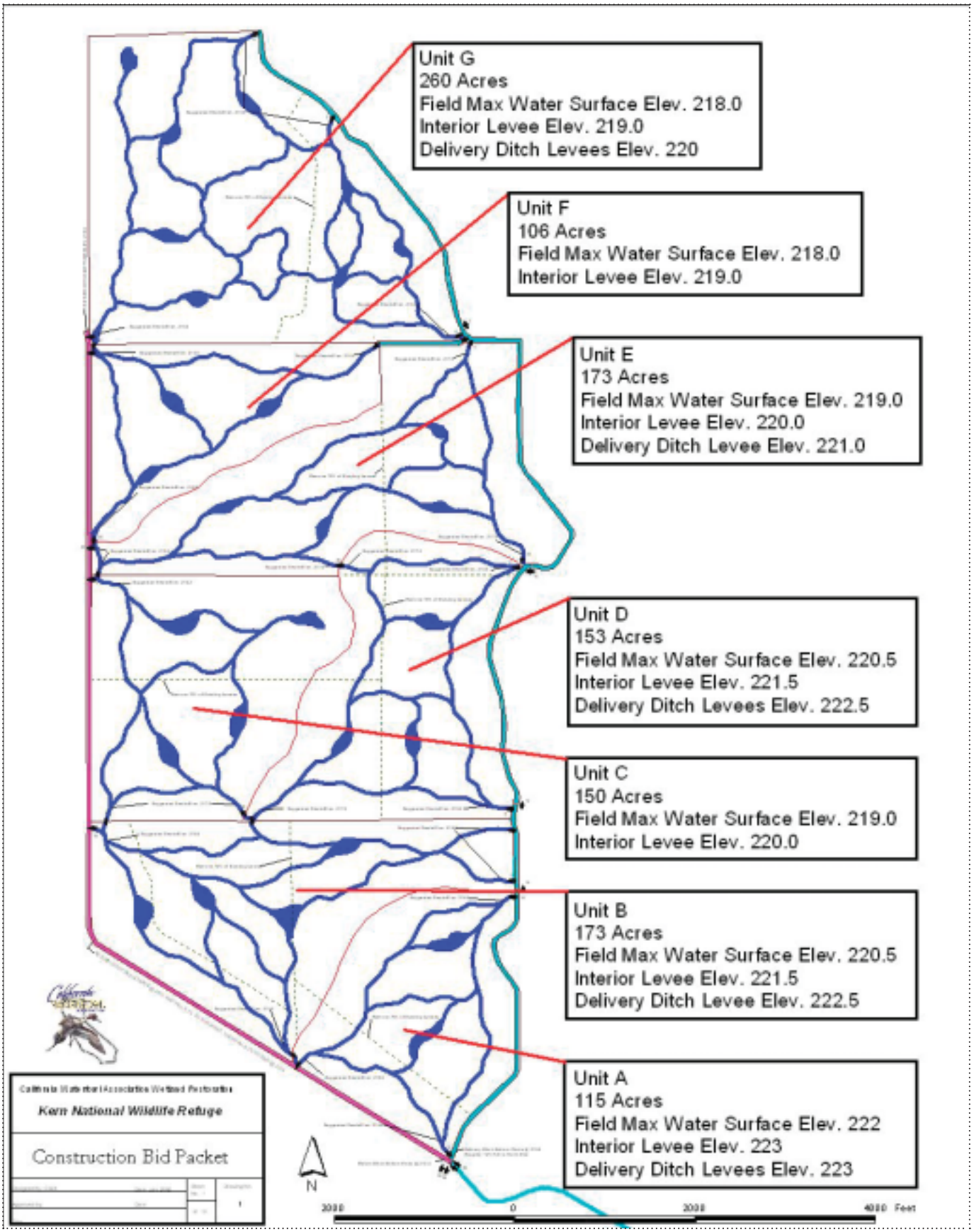

FIGURE C-5. Kern National Wildlife Refuge design (source: CWA 2004).

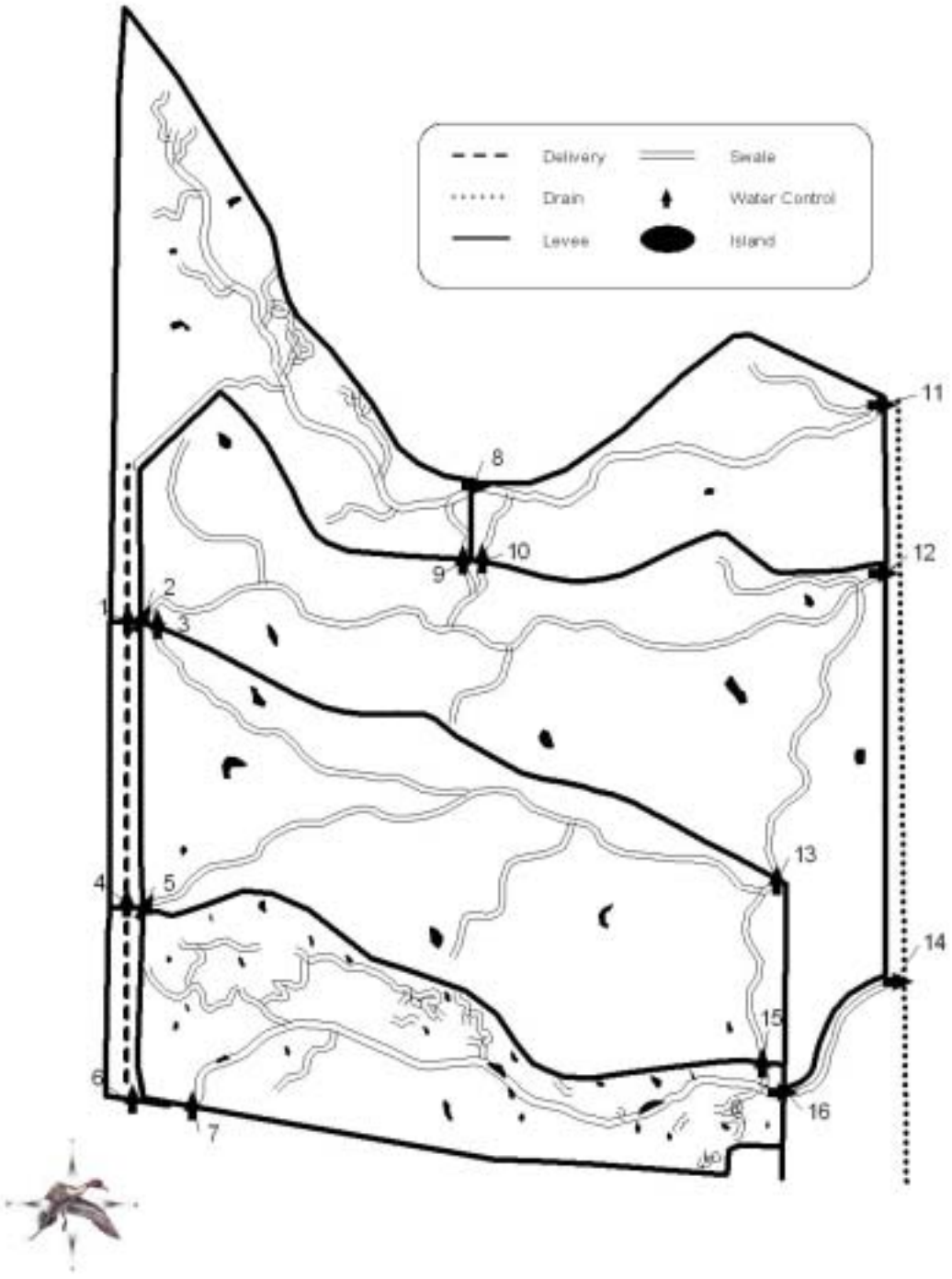

FIGURE C-6. Typical wetland design — San Joaquin Valley (source: CWA 2004).

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