Los Banos Wildlife Area

Water Management Plan

First draft submitted December 30, 2010
Final plan submitted June 17, 2011

Data, including estimated habitat acreages and water requirements for optimal production and maintenance, included in this document and associated tables are referenced from the San Joaquin Basin Action Plan/Kesterson Mitigation Plan Report (1989) and Report on Refuge Water Supply Investigations (1989), developed by the Bureau of Reclamation, Fish and Wildlife Service, and the Department of Fish and Game. Precipitation data was drawn from local weather stations and may be unrepresentative given the expansive distribution of the CVPIA wetlands. Evaporation and seepage data were derived from gross estimates and are unrepresentative of actual conditions given the high variability in vegetation and soil type. Furthermore, estimated applied acre feet per wetland acre data was calculated based on the aforementioned assumptions and water delivery estimates. Given the inherent numerous assumptions utilized to generate the data included in this document and associated tables, this information is not intended for any other purpose and should not be used without the written consent of the author agencies.

Section A - Background

1. *Identify the staff member responsible for developing and implementing the Plan. Provide their contact information*

Name William Cook Title Wildlife Habitat Supervisor II

Address 18110 Henry Miller Road

Telephone 209-826-0463 Fax 209-826-1761

E-mail wcook@dfg.ca.gov

2. *Year refuge established* 1929

Define year-type used consistently throughout plan *March 1 through February 28*

3. *Water supplies*

List each annual entitlement of surface water under each water right and/or contract

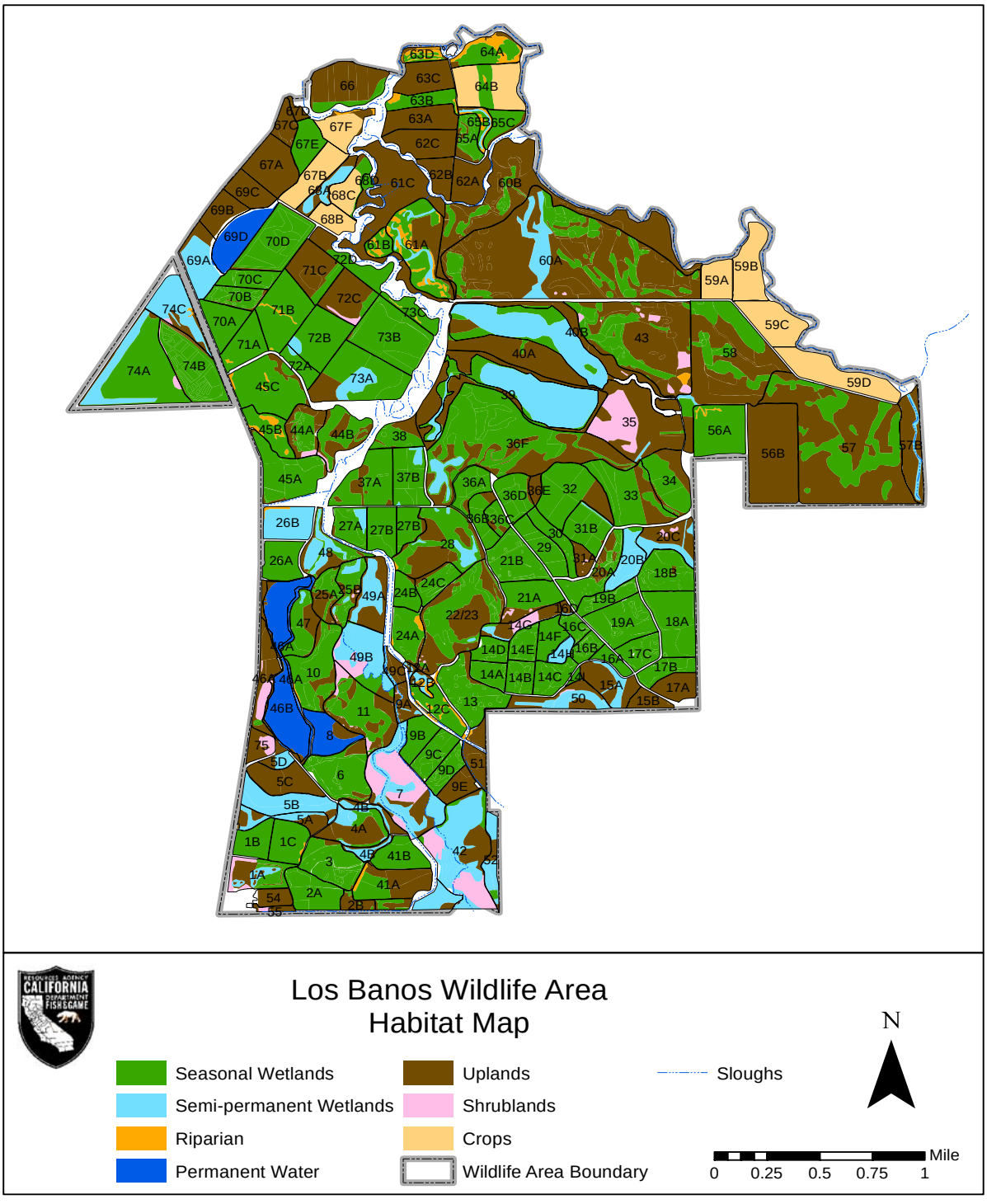
Supplier	*Water source*	*Contract #*	*Contract restrictions*	*Acre-feet/year*
Federal level 2	*Grasslands/SLCC*	*01-WC-20-1756*		16,670
Federal level 4	*Grasslands/SLCC*	*01-WC-20-1756*		8,330
State				
Appropriative				
Other, riparian	SLCC	*Pre-1914 right*		320

4. *Provide a narrative on pre-CVPIA refuge water supplies and water management*

The original 3,000 acre purchase had a 9,000 acre foot water right. This was altered in 1958 when a new water contract was agreed to by Miller and Lux, the San Luis Canal Company, and the State of California to deliver a lesser amount of water (4,000 acre/foot a year in non-critical year, 2,365 acre/foot in a critical year), but did include minimum definite qualities of water to be delivered. Portions of the wildlife area were also placed in the Grassland Water District. There was also a right to pump or divert water out of the Boundary Drain and typical pre-CVPIA use was as much as 6,000 acre feet annually. There was also a contract in 1981 to transfer 1,000 acre-feet of water from San Luis Canal to Boundary Drain during the autumn to augment the flow in Boundary Drain. In addition, there was a riparian water right to 5 cubic second feet out of Mud Slough.

5. *Land use history--Identify habitat types specific to this refuge.*

Attach a refuge map showing habitat location and size



List refuge habitat-types with 5% or more of total acreage

Habitat type	*Original size*	*1992 acres*	*1997 acres*	*2010 acres*
Seasonal wetland – timothy (not irrig)	NA	NA	NA	120
Seasonal wetland – timothy (irrigated)	NA	NA	220	355
Seasonal wetland – smartweed	NA	NA	1,350	1,250
Seasonal wetland - watergrass	NA	NA	220	395
Permanent wetland	NA	NA	359	370
Semi-permanent wetland/brood pond	NA	NA	489	450
Reverse cycle wetlands	NA	NA	NA	90
Riparian	NA	NA	50	110
Irrigated pasture	NA	NA	123	165
Upland	NA	NA	1,948	1,719
Upland (not irrigated)	NA	NA	644	464
Upland (managed)	NA	NA	884	835
Upland (grains)	NA	NA	420	420
Other (>5%)	NA	NA	0	0
Misc. habitat (<5%)	NA	NA	44	44
Sub-total – habitat acres	NA	NA	4,853	5,068
Roads, buildings, etc.	NA	NA	516	518
Total (size of refuge)	NA	NA	5,369	5,586

Describe refuge habitat-type water use characteristics

Habitat type	*AF/ac*	*# of irrigations*	*Floodup date*	*Draw down date*
Seasonal wetland	6.0	1	8/1	3/1-4/1
Seasonal wetland - timothy	5.0	1	8/1	3/1-4/1
Seasonal wetland - watergrass	8.0	2	8/1	4/1-5/1
Permanent wetland	12.0			
Semi-permanent wetland/brood pond	10.0		February	10/15
Riparian	4.0			
Irrigated pasture	5.0		Feb-Nov	
Upland (not irrigated)				
Upland (managed)				
Upland (grains)	2.0	1-5		
Other (>5%)				
Misc. habitat (<5%)				

Section B - Water Management Related Goals and Objectives

1. *Describe the refuge mission relative to water management. (i.e. crop depredation, legislative mandates, service to landowners)*

The first purchase of the Los Banos Wildlife Area was in 1929 to provide wetland and waterfowl protection via a sanctuary (non-hunted). In addition, there are many legislative acts that affect the wildlife area mission. In the 1940's, the Leah Act was passed to fund the purchase and

management of public lands to decrease crop depredation in the surrounding landscape. In 1953, the Wildlife Area opened to public use and became part of the PR (Pittman-Robertson) program; providing habitat for wintering waterfowl, minimizing crop depredation and providing public hunting opportunities became main objectives.

Los Banos was included in the San Joaquin Basin Action Plan / Kesterson Mitigation Plan. The San Joaquin Basin Action Plan (SJBAP) provides a framework within which 23,500 acres of contiguous State and Federal wildlife areas can be developed and managed in a coordinated manner. This Plan describes the acquisition of additional land and installation of water delivery features primarily to protect and enhance existing wetlands and to restore and develop new wetlands for migratory bird habitat in the North Grasslands area in Merced County, California.

The SJBAP meets the requirements for long-term mitigation for Kesterson Reservoir and contributes toward achieving the objectives for the San Joaquin Basin adopted by the Central Valley Habitat Joint Venture in support of the North American Waterfowl Management Plan. The SJBAP was initiated on October 9, 1990, by a cooperative agreement among the Bureau of Reclamation (Reclamation), the U.S. Fish and Wildlife Service (Service), and the California Department of Fish and Game (DFG) to implement the concepts in the report San Joaquin Basin Action Plan / Kesterson Mitigation Plan, published in 1989.

In 1972, the Federal Endangered Species Act was passed to conserve fish and wildlife which are listed as endangered species or threatened species. In 1977, the California Endangered Species Act was passed with a similar purpose to the federal law. The San Joaquin Basin Action Plan lands are owned by separate agencies but managed in a cooperative manner to form a large block of diverse wildlife habitat. This increase of wetlands and other habitats will fulfill the requirements of mitigation for Kesterson Reservoir and will contribute to meeting objectives of the Central Valley Habitat Joint Venture and the North American Waterfowl Management Plan.

2. *Describe specific habitat management objectives. Include pertinent information from refuge management plans*

The wildlife area prepares annual Work Plans which identify habitat management efforts for the coming year. The Work Plans follow the Wildlife Area Habitat Committee guidelines for specific habitat management. In addition, the wildlife area is also guided by the San Joaquin Basin Action Plan. The current Wildlife Area Habitat Committee objectives are as follows:

<u>Permanent Wetlands:</u>

Permanent wetlands are wetlands which remain flooded year-round. Typical permanent wetland habitat includes ditches, deep ponds, and sloughs. Area management plans must identify permanent wetland habitat, ideally ranging in size from two to 20 acres and no less than three percent of total wetland acreage. Permanent wetlands should be spaced at a maximum of one-mile intervals.

<u>Semi-permanent Wetlands (Spring/Summer Wetlands):</u>

Habitat must be flooded from February 1 to September 15 annually, but may be drained as early as August 15 when habitat management is needed. Semi-permanent wetlands typically provide key brood habitat for waterfowl and shorebird populations as well as summer water essential to resident wildlife. The management goal is to provide no less than three percent of the total wetland acreage in this habitat type. Semi-permanent wetlands should range in size from two to 20 acres, have shallow edges, and be scattered at approximately ½ -mile intervals throughout the wildlife area.

Diverse Moist Soil Vegetation:

This habitat is managed primarily for production of plant species which produce desirable seed and sustain invertebrates important to waterfowl and other wetland wildlife species. At least three major vegetation species, which may include but are not restricted to swamp timothy, watergrass, and smartweed, must be provided for in the area plan. Each of the three species should account for a minimum of 25 percent of the total seasonal wetland acreage and, ideally, the three species should cumulatively provide a high level of nutrition and forage availability. The species should compliment one another in such a way as to provide for a balance of nutritional and cover qualities. The selection moist soil vegetation should also take into account the abundance and availability of other moist soil habitats within the surrounding geographic area.

Fall flooding and moist soil habitat which creates what is known as "seasonal wetlands" and provides an important resting and food source for wildlife should be timed to meet the needs of wildlife. Staged flooding should begin in early August as migratory shorebirds and waterfowl begin to move into California and continue through early December. Up to 25 percent of managed moist soil habitat should be flooded by September 15. Drawdown should occur during late-winter to late-spring, depending on target species' germination requirements.

Special Ecological Communities:

These include communities identified by area managers or recognized by the Natural Diversity Data Base (NDDB) as occurring on or within the vicinity of a wildlife area. The objective is to protect existing habitat types with no net loss of acreage and to enhance, where possible, their quality.

Riparian Habitat:

Riparian habitat on wildlife areas has been most commonly associated with the water management system of the area (e.g., delivery ditches, natural sloughs, creek banks). The standard is to maintain existing habitat and to expand its acreage by 50 percent over the next 10 years.

Managed Nesting Habitat:

The goal for management of upland nesting cover is to optimize such habitat for resident breeding birds such as short-eared owls, northern harriers, ducks, and pheasants. The objective is to manage the structure of the habitat (height, density, species composition, and soil moisture) to optimize nesting density and

success. The standard is to maintain a minimum of 25 percent of the total upland habitat managed as dense nesting habitat with a minimum plot size of five acres.

Upland Foraging Areas:

These areas are managed primarily for grazing and upland foraging wildlife species such as raptors, greater and lesser sandhill cranes, and geese. Where appropriate, the standard is to manage a total 25 percent of the total upland habitat as upland foraging areas with a minimum plot size of 50 acres.

Cereal Grain Plantings:

The standard for cereal grain plantings is a minimum of 10 percent of the total upland habitat. Ideally, plots of five to 20 acres will be managed for pheasants and other species (raptors), and 50-acre minimum size plots will be managed for geese and Sandhill cranes. Cereal grains planted early in the fall (prior to December 1) can be considered as both managed nesting habitat and upland forage areas.

3. Describe the strategies used to attain objectives listed above

On an annual basis, the wildlife area staffs review/assess the current habitat management plan and make changes as necessary to meet the habitat objectives.

4. Describe constraints that prevent attainment of objectives and explain the effect on operations

Every year, we seek in our annual Work Plans to accomplish more than can be currently implemented given current budgetary and personnel levels. In addition, Level 4 water comprises 1/3 of our water needs; however, the water is not yet delivered at proposed levels or at the needed times in most years. Water delivery agencies are not always able to deliver Level 2 or 4 water due to maintenance or other issues during some portions of some years (this includes both Level 2 and Level 4 water). Further constraints result from the mosquito abatement best management practices and include: control of emergent vegetation, the ability to flood certain portions of the wildlife area during summer and fall months, and significant expense to implement these measures.

5. Describe the strategies used to remedy the constraints listed above

Additional funding and personnel would help meet the first two constraints. Continue to work with the Bureau to address the Level 4 situation. Continue to seek solutions with water delivery agencies to deliver water in a more consistent fashion. Continue to work with the Vector Control agencies to improve implementation of their BMPs on a regional basis.

Section C - Policies and Procedures

1. Describe the refuge policies/procedures on accepting agricultural drainage water as supply

The Los Banos Wildlife Area water delivery contract states that we will not accept water which contains "dissolved oxygen levels below 5.0 mg/l; a pH level below 6.5 or greater than 8.5; or chemical constituents, pesticides, or salinity levels; that adversely affect beneficial uses of the refuge water" (from wheeling agreement with San Luis Canal Company). In addition, we currently accept agricultural drainage water as long as the selenium level is less than 2 ppm (Federal EPA standard), the boron level is less than 6 ppm (based on Grassland Water District standards), and the salinity level is less than 1,500 ECs (standard based

on local historical knowledge).

2. Describe the refuge policies/procedures on water pooling, transfers, reallocations or exchanges
The January 2001 USBR/DFG refuge water supply contract addresses pooling in Article 6, and transfers, reallocations, and exchanges of water in Article 7. The Los Banos Wildlife Area has no additional policies or procedures on pooling, transfers, reallocations, or exchanges.

3. Describe the refuge water accounting policies/procedures for inflow, internal flow and outflow
Inflows are measured by the agencies wheeling the water. Internal flows are monitored daily for purposes of tracking movement through the system to the proper place of use on the wildlife area. Outflow at some points is monitored by area staff as time permits.

4 Attach a copy of the refuge's shortage policies, drought plan, or any similar document.
Based on established refuge purposes (see B1) and the projected water supply, we will determine critical habitat needs and analyze existing water use records by both refuge unit and habitat type to determine the amount, distribution and timing of each habitat to be flooded during water shortages.

5. (GRCD only) ~~Describe water policies as they pertain to:~~
~~a. water allocation policy to customers (attach),~~
~~b. lead time for water orders (attach sample water order form),~~
~~c. policies for wasteful use of water (attach policy), and~~
~~d. pricing and billing policies (attach sample bills)~~

~~Fixed Charges~~			
~~Charges ($ unit)~~	~~Charge units ($/acre), ($/customer) etc.~~	~~Units billed during year (acres, customer) etc.~~	~~$ collected ($ times units)~~

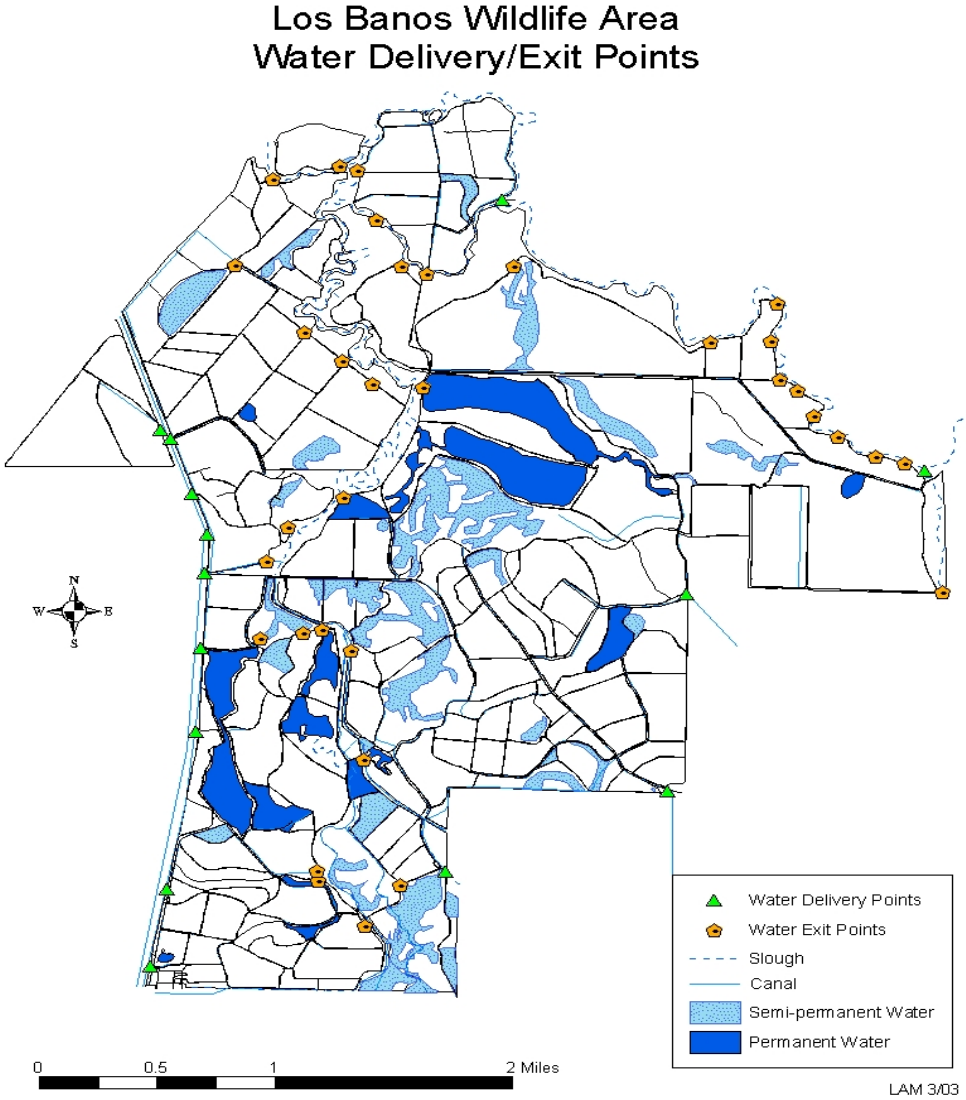
~~Volumetric charges~~			
~~Charges ($ unit)~~	~~Charge units ($/AF), ($/HCF), etc.~~	~~Units billed during year (AF, HCF) etc.~~	~~$ collected ($ times units)~~

Section D - Inventory of Existing Facilities

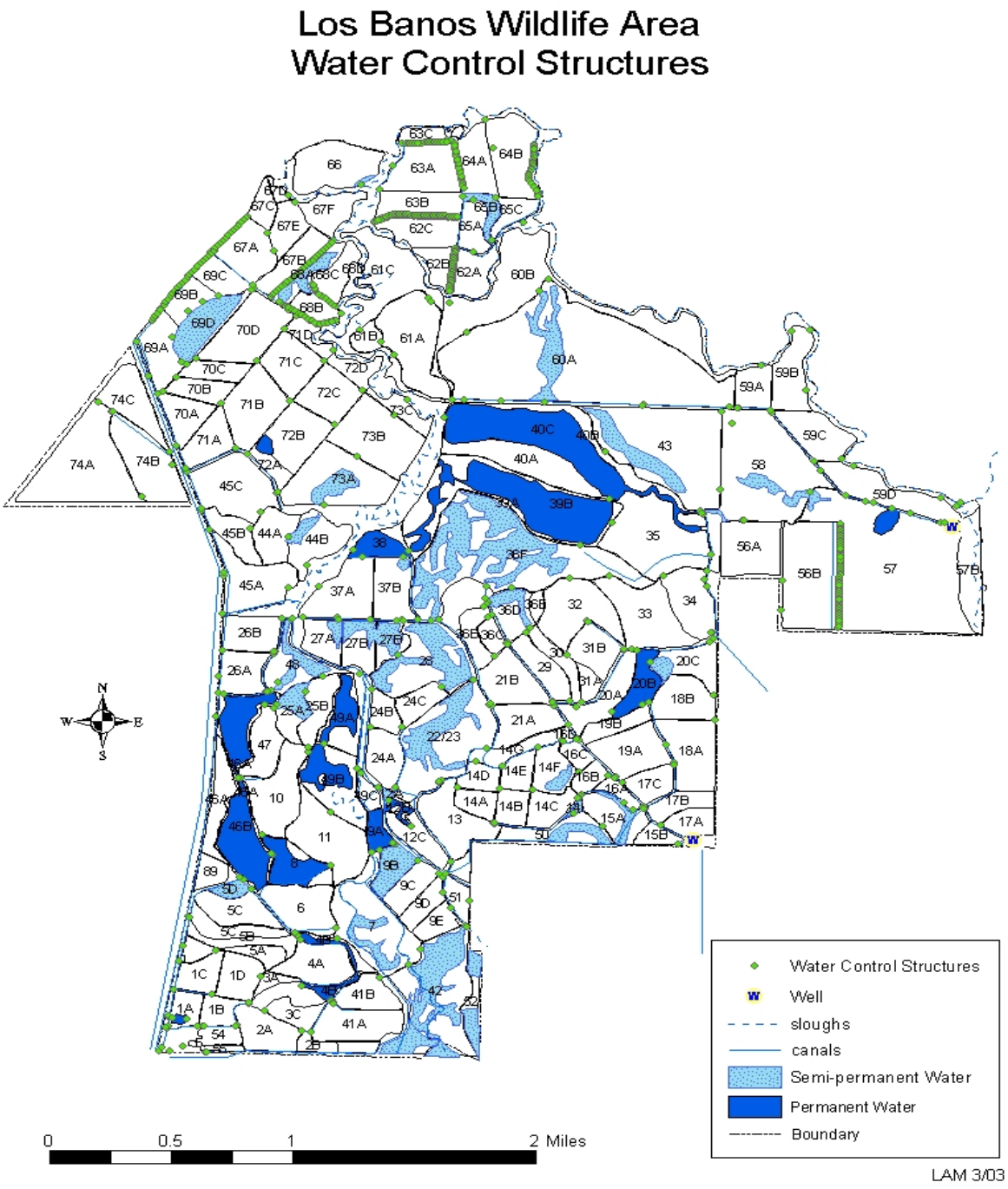
1. Mapping

Attach existing facilities map(s) that show points of delivery, turnouts (internal flow), and outflow (spill) points, measurement locations, conveyance system, storage facilities, operational loss recovery system, wells, and water quality monitoring locations. Describe in the body of the plan the information contained in each attached map.

The following map(s) show points of delivery, turnouts (internal flow), and outflow (spill) points, measurement locations, conveyance system, storage facilities, operational loss recovery system, wells, and water quality monitoring locations.



Water delivery and exit points on the Los Banos Wildlife Area. See items 2 and 3 below for more information.



Internal turn-outs and wells on the Los Banos Wildlife Area. See item 2 for details.

2. *Water measurement*
   a. *Inflow/deliveries*

Total # of inflow locations/points of delivery 12

Total # of measured points of delivery 5

Percentage of total inflow (volume) measured during report year *63% of the total delivered amount is currently measured.*

Delivering agency	*Conveyance facility*	*Measuring point*	*Refuge distribution facility*	*% of total inflow*	*Type of measurement*	*Measuring agency*
SLCC	San Pedro Canal	On canal at boundary	San Pedro Canal	9% / 2300 AF/year	Flow meter	SLCC
SLCC	Boundary Drain	San Pedro Spillway	PR Canal	22% / 5300 AF/year	Weir	SLCC
SLCC	West Delta #2	Boundary	West Delta	11% / 2600 AF/year	Flow meter	SLCC
SLCC	Salt Slough	Delta Flume	Sand Dam Ditch	21% / 5100 AF/year	Run time	LBWA
GWD	San Luis Canal	SL1	Various	37% / 9000 AF/year	Weir	GWD

b. Internal flow at turnouts

Total # of refuge water management units (units) 171

Total # of refuge water management unit turnouts 782

Total # of measured turnouts 0 (monitored daily, but not measured)

Estimated % of total internal flow (volume) during report year that was measured at a turnout 0

Number of turnouts supplying more than one unit or not directly off delivery system 25

Measurement type	*Number of devices*	*Acres served*	*Accuracy (avg or range)*	*Reading frequency*	*Calibration frequency (months)*	*Maintenance frequency (months/days)*
Orifices						
Propeller						
Weirs						
Flumes						
Venturi						
Alfalfa valves	458	680	NA	Daily (but not measured) when in use	NA	NA
Metered gates						
Other, stop-log and screwgates			NA	Daily (but not measured) when in use	NA	NA

c. Outflow

Outflow (AF/yr) Estimated to be 7,800 AF/year, estimate based on current monitoring data.

Total # of outflow locations/points of spill 34

Total # of measured outflow points 4

Percentage of total outflow (volume) measured during report year *Estimated at 80%, the 4 measured outflow points are responsible for an approximate 80% of the outflow.*

Outflow point	*Measuring point*	*Type of measurement*	*Percent of total outflow (estimated)*	*Measuring agency*	*Acres drained*
Buttonwillow Lakes	Little Buttonwillow drain	Sontek Monitoring Device	48%	GWD	1,606
Field 38	NW corner Field 38	Clausen Weir Rule	20%	DFG	142
Field 70 drain	North end of Field 70	Clausen Weir Rule	8%	DFG	96
Field 73 drain	North end of Field 73	Clausen Weir Rule	4%	DFG	115
Miscellaneous outflows (each less than 1% of total outflow)	No measuring point	NA	20%	NA	3,627

3. Identify the type and length of the refuge internal distribution system

Miles unlined canal	*Miles lined canal*	*Miles piped*	*Miles – other*
20.22	0	4.33	18.57

Describe the location and types of identified leaks and areas of higher than average canal seepage, and any relation to soil type. There are no known high seepage or leaks in these facilities.

4. Describe the refuge operational loss recovery system

Pump #	Location	HP
12	Boundary Drain	15
14	Buttonwillow Lake	10

5. Groundwater

Describe groundwater availability, quality and potential for use

Groundwater availability is fair, the quality of the water is fair to poor (EC levels at around 2,200-2,500), the potential for use is limited unless this water can be blended with higher quality water as well as the high cost of pumping. Groundwater could be used to augment other water supplies, but can't be used on its own. See USBR July 2004 "Evaluation of Groundwater Potential for Incremental Level 4 Refuge Water Supply" for more details.

Groundwater plan *No* ___X___ *Yes* _____ *(please attach or provide web link).*

Groundwater basin(s) that underlie the refuge

Name of basin underlying refuge	*Size (sq. mi.)*	*Usable capacity (AF)*	*Safe yield (AF/Y)*	*Management agency*	*Relevant reports*
San Joaquin Basin	13,500	80,000,000	Unknown	NONE	CH2M Hill

Identify refuge-operated ground water wells

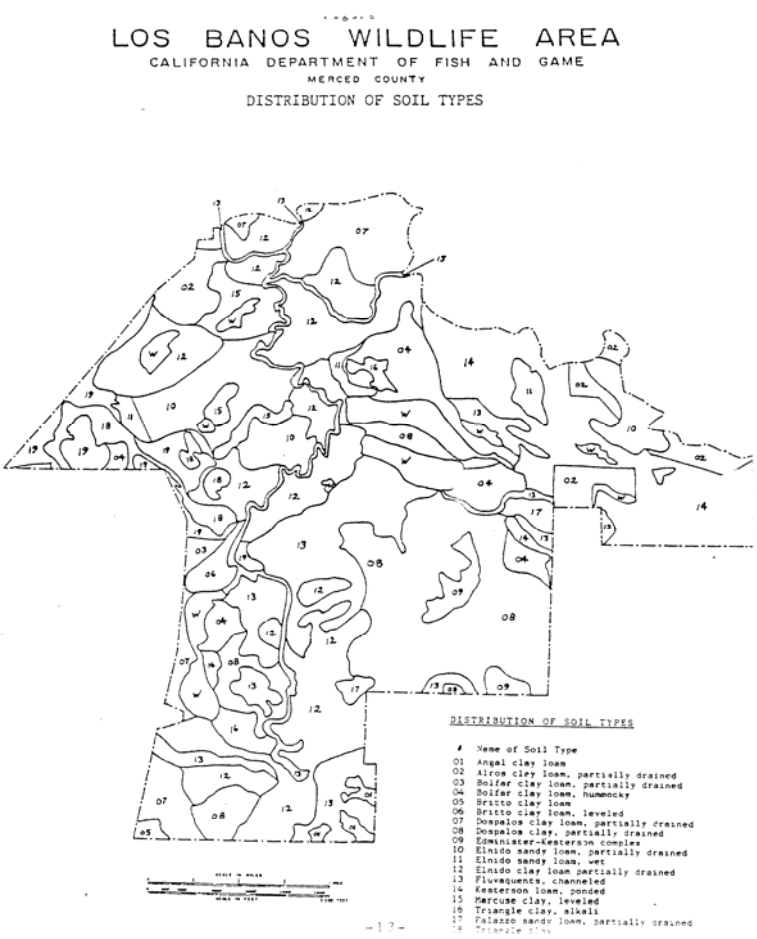
#	*Location*	*Status*	*HP*	*2003 (AFY)*	*Future plans*
Field 15	Active	250 AF/Y	Continue pumping as funding allows	250 AF/Y	Continue pumping as funding allows
Field 57	Inactive	0 AF/Y	Continue pumping as funding allows	0 AF/Y	No plans to reactivate
Field 1A	Active	250 AF/Y	No plans to reactivate	250 AF/Y	Continue pumping as funding allows

Section E Environmental Characteristics

1. Topography - describe and discuss impact on water management
The topography is mostly flat, with the general fall going from south to north and more localized fall towards either Mud or Salt Slough. Most levees are built on a one foot or less contour. This enables a fairly high level of control of water depths which enables us to manage wetlands for a diversity of water-dependent species with different water depth needs.

2. Soils - describe and discuss impact on water management (see attached map)
Most soils on the wildlife area are suitable for wetlands and are clay-based. There are some areas where more sandy soils dominate- these areas are generally reserved for upland or riparian habitat. Both black and white alkali soils are common on the wildlife area and create a different plant community than on less alkali soils. In many instances, we make no attempt to flush salts from the area as these areas support native and

increasingly rare plant communities. In some instances, however, there is a need to manage for the flushing of salts via water management. Soils are always taken into account with habitat planning and restoration efforts.



3. Climate

National Weather Service – Merced (KMCE) 1998-2008 (weather station - years)

	Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Annual*
avg precip	2.8	2.28	1.35	1.08	0.48	.02	0.0	0.0	0.8	0.81	0.83	1.69	10.7
avg. temp	44.9	49.4	54.2	58.5	67.7	74.3	78.8	77.0	72.3	63.3	52.8	45.6	61.6
max temp	53.3	60.1	66.9	72.2	83.2	90.8	95.6	94.1	88.9	78.1	64.2	55.0	75.2
min temp	36.5	38.7	41.5	44.7	52.1	57.7	61.9	60.0	55.8	48.5	41.3	36.3	47.9
ETo	1.24	2.24	3.72	5.70	7.44	8.10	8.68	7.75	5.70	4.03	2.10	1.24	57.9

Discuss the impact of climate, and any microclimates, on water management

The high ETo in the summer and early fall months means that any wetlands in the summer and early fall are going to require a much higher rate of water application than areas flooded in the winter. Summer water ponds must generally be fairly deep to prohibit vegetation from quickly dominating the wetlands. Ponds can also be flooded less deeply, but then must be disced on an annual basis and kept dry every other year. In addition, high winds out of Pacheco Pass raise ETo during the spring months.

There are no known microclimates that affect water management on the area.

4. Water quality monitoring (attach water quality test result forms)

If the refuge has a water quality monitoring program complete this table

Analyses performed	*Frequency range*	*Concentration range*	*Average*
EC readings	Once weekly	800-3500	1200
Flow and EC	Continuous	900-2500	1200

These reading are taken from 12 inputs and 5 outputs on the wildlife area by DFG staff. In Addition Grassland Water District monitors a major outlet at Buttonwillow Lake with automated equipment.

Discuss the impact of water quality on water management

When water with high EC levels is known to be coming through delivery areas, we greatly reduce or eliminate our take of this poor quality water. Due to high salinity in groundwater, we also avoid groundwater pumping unless we can dilute it with higher quality water.

Section F Transfers, Exchanges and Trades

Provide information on any transfers, exchanges and/or trades into or out of the refuge

From whom	To whom	Report year (AF)	Use
NONE			
	TOTAL		

Section G Water Inventory

See Tables

Section H Critical Best Management Practices

Describe the 5-year implementation plan and the proposed 3-year funding budget.

1. *Management programs*
   a. *Education*

Program	*Estimated cost (in $1,000s)*		
	2011	*2012*	*2013*
Public outreach- Environmental Education Coordinator (1/4 time on water issues)	$15K	$15K	15K
Annual Refuge Management Workshop	$1.5K	$1.5K	$1.5 K

Describe the specifics of each program (number of participants, topics, purpose, etc.) and attach program materials, if available.

The **Environmental Education Coordinator** conducts field trips on the wildlife area and surrounding wetlands as well as visiting classrooms for over 5,500 children and adults in the past two years. A portion of the curriculum focuses on the importance of wetlands to water quality and flood control as well as the importance of clean water to the wetlands themselves.

Annual Refuge Management Workshop We attend annual wetland workshop training, when feasible, to train staff in water and wetland management techniques.

The Grasslands Environmental Education Center is located at Los Banos Wildlife Area and is operated though partnerships with Grassland Water District, Central Valley Joint Venture, Ducks Unlimited and California Waterfowl Association.

Annual wetland management workshops are coordinated efforts of CDFG, USFWS and NRCS.

   b. *Water quality monitoring*

Type of water	*Existing Estimated cost (in $1,000s)*		
	2011	*2012*	*2013*
Surface – USBR and riparian	$2.5K	$2.5K	$2.5K
Upslope drain			
Groundwater			
Outflow	$2.5K	$2.5K	$2.5K

Short description of existing or planned program – i.e., required by which agency, coordinated with whom, constituents monitored and frequency

Wildlife area staff currently monitor salinity and water flow rates at 10 points weekly on the wildlife area- 5 inflow points and 5 outflow points (cost: $5,000/year, see above table). We would like to expand the program, but are waiting to determine the factors that will need to be monitored to meet our requirements under the Central Valley Regional Water Quality Control Board conditional waiver to waste discharge requirements.

   c. *Cooperative efforts*

We are currently a partner (along with Grassland Water District and Lawrence-Livermore Laboratories) on a CALFED-funded project that examines real-time changes in water quality at points throughout the Grasslands. We provide access for real time water quality monitoring stations on several wildlife areas in the Grasslands.

d. Pump evaluations (mobile labs)

Total number of groundwater pumps on refuge 2

Total number of surface water (low-lift) pumps on refuge 13

Groundwater pumps	*Estimated cost (in $1,000s)*		
	2011	*2012*	*2013*
# of groundwater pumps tested		2 @ $1K each	
# of pumps to be fixed or replaced			
# of low-lift pumps to be tested	5 @ $1K each	5 @ $1K each	5 @ $1K each
# of pumps to be fixed or replaced	2 @ $12K each	2 @ $12K each	2 @ $12K each

e. Policy evaluation

If CVP power could be obtained, it would greatly enhance our ability to both pump and distribute water onto the wildlife area.

The ability to change scheduled monthly quantities so that the refuge can use available supply in response to unpredictable weather conditions and changing habitat needs is critical to overall operation and water conservation.

f. (GRCD only) ~~*Provide Customer Services - Facilitate physical/structural improvements for member units; provide management services and technical advice to raise funds for BMP Implementation and provide customers with water efficiency education programs.*~~

2. (GRCD only) ~~*Pricing structure*~~

3. (GRCD only) ~~*Plan to measure deliveries*~~

4. Water management coordinator

Name: William W. Cook Jr. *Title:* Wildlife Habitat Supervisor II

Address: *18110 W. Henry Miller Ave. Los Banos CA 93635*

Telephone: 209-826-0463 *E-mail:* wcook@dfg.ca.gov

Section I Exemptible Best Management Practices

Describe the 5-year implementation plan and the proposed 3-year funding budget.

1. Improve management unit configuration

Unit name	*Current acres*	*Reason for change*	*Proposed acres*	*Estimated cost (in $1,000s)*		
				2011	*2012*	*2013*
Fields 70, 73, 45C and 44	290	Levee and water conveyance improvement	290	$150K		
Fields 59a&b, 67,68,69	134	Re-level fields to optimize irrigation/water conservation	134	$40K		
Fields 59c&d	70	Re-level fields to optimize irrigation/water conservation	70		$60K	

(GRCD only) ~~*Assist customers to improve management unit configurations.*~~

2. Improve internal distribution system

a. New control structures within distribution system

Proposed location	*Type of structure*	*Reason for new structure*	*Estimated cost (in $1,000s)*		
			2011	*2012*	*2013*
5-10 Annually	Concrete	Replace damaged or leaking structures	$10K	$10K	$10K

b. Line/pipe sections of distribution system

Proposed reach/sect.	*Reason for new structure*	*Estimated cost (in $1,000s)*		
		2011	*2012*	*2013*
	None anticipated see note below			

All known feasible locations for pipelines construction have been accomplished; new pipeline possibilities will be discussed during development of annual work plans. Interior canals provide additional wildlife habitat and lining them would not be conducive to primary function of the wildlife area.

c. Independent water control for each unit

Proposed control point	*Reason for new control point*	*Estimated cost (in $1,000s)*		
		2011	*2012*	*2013*
	See note below			

Water control configurations are determined/altered each year in the annual planning process. Independent water control structures are not planned for 2010 due to the existing flow-through design which maximizes water distribution across the largest area of targeted wetland acreages possible and the fact that much of the area has already been modified to install independent control where advantageous.

d. New internal distribution sections (pipe, canal) to provide water to existing and new habitat units

Proposed new section	*Units served*	*Reason for new section*	*Estimated cost (in $1,000s)*		
			2011	*2012*	*2013*
		See detail below		$15K	

Any changes to internal distribution sections are determined each year in the annual planning process. We are currently conceptually planning to augment the Boundary Drain pumps (responsible for about 22% of current water supply) by restoring an old gravity flow system. Such a system would reduce our pumping costs dramatically. The current cost of the project is currently unknown. Costs for 2012 are for planning and meetings, the cost for 2012 includes planning and surveying. Implementation of the project past 2012 will be dependent on the outcome of the meetings and survey results.

(GRCD only) ~~*Provide assistance to member units to improve internal distribution*~~

3. Develop a Water Use Schedule

Plan element	*Completion date*	*Estimated development/update cost (in $1,000s)*		
		2011	*2012*	*2013*
Floodup dates by unit	Completed Annually	$1K	$1K	$1K
Drawdown dates by unit	Completed Annually	$1K	$1K	$1K
Irrigation dates by unit	Completed Annually	$1K	$1K	$1K

4. Plan to measure outflow

Identify locations, prioritize, determine best measurement method/cost, submit funding proposal

	Estimated cost (in $1,000s)		
	2011	*2012*	*2013*
Identify locations	Done		
Estimate outflow quantity/rank	Done		
Develop plan	Done		
Estimate construction start date		TBD	
Estimate construction completion date		TBD	

5. (GRCD only) ~~*Incentive pricing*~~

6. Construct and operate operational loss recovery systems

Proposed location	*Reason for improvement*	*Estimated cost (in $1,000s)*		
		2011	*2012*	*2013*
Pump 12 boundary drain	Accomplished all these pump installations in Summer of 2010 @ $200 K.			
Pump 13 Ruth Lake				
Pump 14 Buttonwillow Lake				

7. Optimize conjunctive use of surface and groundwater

Proposed production/injection well	*Anticipated yield*	*Estimated cost (in $1,000s)*		
		2011	*2012*	*2013*
See Detail Below				

Four groundwater wells were used into the early 1970s and then abandoned due to poor water quality, well cave-ins, and power rate increases. Three additional wells have since been established – the PR Well which continues to function at 1,500 – 2,100 EC, the San Dam Well which was rehabilitated in 2002, has failed, the Headquarters Well which is now functional. These three wells are used occasionally to augment surface supplies. See USBR July 2004 "Evaluation of Groundwater Potential for Incremental Level 4 Refuge Water Supply" for more details.

8. Facilitate use of available recycled urban wastewater that otherwise would not be used beneficially, meets all health and safety criteria, and does not cause harm to wildlife management goals.

NA – No recycled urban wastewater is available in this area.

9. Mapping

GIS map layers	*Estimated cost (in $1,000s)*		
	2011	*2012*	*2013*
Completed in 2005, need some updating		$25K	

10. CALFED Quantifiable Objectives

Describe any past, present, or future plans that address the goals identified for this refuge

If reducing nonproductive ET involves removing invasive plants, complete the following:

Invasive unwanted species name	Estimated acres			*Estimated cost (in $1,000s)*		
	2011	*2012*	*2013*	*2011*	*2012*	*2013*
Perennial Pepper Weed	150	150	125	$30K	$30K	$20K
Hyacinth	30	30	30	$6K	$6K	$6K
Parrots Feather	10	10	10	$3K	$3K	$3K

Sacramento and Delevan National Wildlife Refuges (NWRs)

1. Describe actions that reduce the salinity of surface return water. (Targeted Benefit (TB) 24)
2. Describe actions that reduce nonproductive ET. (TB 25)

Colusa and Sutter NWR's

1. Describe actions that reduce nonproductive ET. (TB 33)

Gray Lodge Wildlife Area (WA)

1. Describe actions that reduce nonproductive ET. (TB 46)

North Grassland, Volta, and Los Banos WA's

1. Describe actions that reduce selenium concentration in the Grassland Marshes. Reduce selenium concentration to 5 ug/L in the Grassland Marshes. (TB 95) **We currently accept only water with a selenium level of less than 2 ppm (Federal EPA standard).**

2. Describe actions that reduce San Joaquin River selenium and boron concentrations. Reduce San Joaquin River selenium concentration to 5 ug/L and boron concentration to 2 mg/L from March 15 to September 15 and to 2.6 mg/L September 16 to March 14. (TB 98) **We currently accept only water with a selenium level of less than 2 ppm (Federal EPA standard) and less than 6 ppm boron (based on Grassland Water District standards).**

3. Describe actions that reduce salinity in the Grassland Marshes and Mud and Salt Sloughs. Reduce salinity in the Grassland Marshes and Mud and Salt Sloughs. (TB 102, 103) **We currently accept water with a salinity level of less than 1,500 ECs (standard based on local historical knowledge).**

4. Describe actions that reduce nonproductive ET. Reduce unwanted ET. (TB 107) **We control invasive weeds from canal banks and wetland units. In addition, we mow the sides of canals.**

San Luis NWR, Grassland Resource Conservation District

1. Describe actions that reduce salinity in the San Joaquin River, Grassland Marshes and Mud and Salt Sloughs. (TB 95, 96, 98)
2. Describe actions that reduce salinity in the Grassland Marshes and Mud and Salt Sloughs. (TB 102, 103, 104) (All of these six contaminant TBs could be incorporated into one Refuge manager response, e.g. addressed through the Grassland Drainage Program.
3. Describe actions that reduce nonproductive ET. (TB 107)

Merced NWR

1. Describe actions that provide additional flow to San Joaquin River. (TB 148)
2. Describe actions that reduce salinity at Vernalis. (TB 154)
3. Describe actions that reduce nonproductive ET. (TB 157)

Mendota WA

1. Describe actions that reduce flows to salt sink. (TB 167)
2. Describe actions that reduce nonproductive ET. Reduce unwanted ET. (TB 168)

Kern and Pixley NWR

1. Describe actions that reduce nonproductive ET. (TB 189)

Section J BMP Exemption Requests

For each BMP for which the refuge is seeking an exemption, provide a detailed narrative and complete the summary table

Summary of BMP exemptions

BMP	*Constraint*[1]	*Outstanding Need*[2]
		N/A

1. *Constraint – list existing constraint. Use additional rows for multiple BMPs or constraints. Identify Legal (L), Environmental (EN), or Economic (EC) issues using code. If the BMP is not seen as beneficial, provide detailed information*
2. *Outstanding need – identify assistance required to implement the BMP. State specific funding or other assistance required*

Provide a detailed exemption request below for each BMP listed in the summary table

Non-Applicability (N/A) of Exemptible BMPs

To establish that a BMP is not applicable to the Refuge, the Plan should explain the reasons why the BMP does not apply to the Refuge. This justification must be consistent with Section A of the Criteria titled, "Background." Examples of non-applicability for each exemptible BMP are listed below. This list is not all-inclusive.

Section I, B. Exemptible Best Management Practices

2. Improve the Distribution System

b. Line/pipe sections of distribution system

NA if the Current system can distribute water effectively with regular maintenance and on-going improvements to open channels – thus maximizing habitat.

6. Construct and operate operational loss recovery systems

NA if system is completely piped and there are no spill points.

7. Optimize conjunctive use of surface and groundwater NA

NA is there is no usable groundwater

8. Facilitate use of available recycled urban wastewater that otherwise would not be used beneficially, meets all health and safety criteria, and does not cause harm to wildlife management goals.

NA is no recycled urban wastewater is available

Table 1

Water Supply

2010	Federal Wtr Level 2 (acre-feet)	Federal Wtr Level 4 (acre-feet)	Local Water Supply (acre-feet)	Refuge Groundwtr (acre-feet)	Up Slope Drain Wtr (acre-feet)	other (riparian) (acre-feet)	Total (acre-feet)
Method							
Jan-2010	1,366	0	0	0	0	0	**1,366**
February	1,087	0	0	0	0	120	**1,207**
Mar-2009	292	0	0	0	0	60	**352**
April	150	466	0	0	0	140	**756**
May	344	13	0	0	0	140	**497**
June	287	522	0	0	0	120	**929**
July	668	200	0	0	0	140	**1,008**
August	1,358	400	0	0	0	120	**1,878**
September	3,068	399	0	0	0	120	**3,587**
October	4,226	0	0	0	0	120	**4,346**
November	2,999	0	0	0	0	60	**3,059**
December	490	0	0	0	0	60	**550**
TOTAL	**16,335**	**2,000**	**0**	**0**	**0**	**1,200**	**19,535**

***March 1, 2009 - February 28, 2010**

Measurement Method Definiti	
M1	Measured sum
M2	Measured sum
M3	Measured sum
C1	Calculated (mc
C2	Calculated usi
C3	Calculated usi
E1	Estimated usin
E2	Estimated usin
E3	Estimated usin
O1	Other (attach a

Table 2

Internal Distribution System

Year	2010								
Canal, lateral	**Length (feet)**	**Width (feet)**	**Surface Area (square feet)**	**Precip. (acre-feet)**	**Evaporation (acre-feet)**	**Seepage (acre-feet)**	**Operational losses (acre-feet)**	**Measure method see Cell K5**	**Total (acre-feet)**
Unlined Canal	106,762	8	854,096	16.26	93.20	825	275	E3	**(1,177)**
Pipeline	22,862	2	45,724	0.87	4.99	75	75	E3	**(154)**
Natural Sloughs	98,050	30	2,941,500	55.99	320.98	825	275	E3	**(1,365)**
			0	0.00	0.00				**0**
			0	0.00	0.00				**0**
			0	0.00	0.00				**0**
			0	0.00	0.00				**0**
			0	0.00	0.00				**0**
			0	0.00	0.00				**0**
			0	0.00	0.00				**0**
			0	0.00	0.00				**0**
			0	0.00	0.00				**0**
			0	0.00	0.00				**0**
TOTAL	**227,674**		**3,841,320**	**73**	**419**	**1,725**	**625**		**(2,696)**
			88	**acres**					

Table 3

Managed Lands Water Needs

Year	2010									
Habitat Type	Area habitat acres	Habitat Water Needs (AF/ac)	AF/ac water (AF/ac)	Delivered Water (Total AF)	Precip (AF/Ac)	Shallow Groundwtr (AF/Ac)	Evap (AF/Ac)	Cultural Practices (AF/Ac)	Seepage (AF/Ac)
Seasonal wetlands: timothy	475	5.00	2.50	1,188	0.73	0.00	1.63	1.50	1.25
Seasonal wetlands: smartweed	1,250	6.00	3.60	4,500	0.73	0.00	1.63	1.50	1.50
Seasonal wetlands: watergrass	395	8.00	5.75	2,271	0.73	0.00	1.63	1.50	2.00
Permanent wetlands	370	12.00	8.00	2,960	0.83	0.00	4.75	3.00	3.00
Semi-perm wetlands/brood pond	450	10.00	8.00	3,600	0.83	0.00	1.63	2.00	2.50
Riparian	110	12.00	4.00	440	0.83	0.00	4.75	1.50	1.00
Irrigated pasture	165	5.00	4.79	790	0.31	0.00	3.93	1.50	1.25
Upland (Irrigated)	125	5.00	2.00	250	0.31	0.00	3.93	0.50	1.00
Grain Crops	420	2.00	2.00	840	0.00	0.00	0.00	0.50	1.00
(define)				0	0.00	0.00	0.00	0.00	0.00
Total Habitat Acres	**3,760**	**6.80**	**4.48**	**16,839**					

Table 4

Refuge Water Inventory

Year	2010	Reference		
Total Water Supply		**Table 1**		19,535
Precipitation		**Table 2**	**plus**	73
Evaporation		**Table 2**	**minus**	419
Seepage		**Table 2**	**minus**	1,725
Operational Losses		**Table 2**	**minus**	625
		Deliveries to Managed Lands		16,839
Managed Land needs		**Table 3**	**minus**	25,585
Difference		**(calculated)**		(8,746)
		Balance (outflow?) (Table 3)		(590)
		Water Inventory Balance		(9,336)

Table 5

Annual Water Quantities Delivered Under Each Right or Contract

Year	Federal Wtr Level 2 (acre-feet)	Federal Wtr Level 4 (acre-feet)	Local Water Supply (acre-feet)	Refuge Groundwtr (acre-feet)	Up Slope Drain Wtr (acre-feet)	Riparian (acre-feet)	Total (acre-feet)
2001	15,338	7,070	0	150	0	1,200	**23,758**
2002	16,433	7,286	0	0	0	1,200	**24,919**
2003	16,784	7,074	0	0	0	280	**24,138**
2004	16,670	4,723	0	100	0	1,200	**22,693**
2005	17,731	3,691	0	100	0	1,200	**22,722**
2006	15,090	5,805	0	0	0	1,200	**22,095**
2007	17,520	2,453	0	100	0	1,200	**21,273**
2008	15,836	1,820	0	100	0	1,200	**18,956**
2009	16,335	2,000	0	50	0	1,200	**19,585**
2010	16,335	2,000	0	0	0	1,200	**19,535**
Total	**164,072**	**43,922**	**0**	**600**	**0**	**11,080**	**219,674**
Average	**16,407**	**4,392**	**0**	**60**	**0**	**1,108**	**21,967**