# Mendota Wildlife Area

# Refuge Water Management Plan

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## Section A - Background

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


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2. *Year refuge established* 1954

*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* | Mendota Pool | 14-06-200-8033A | NA | 3,000 |
| *Federal level 2* | Mendota Pool | 14-06-200-4359A Sect. 2 | Note 1 | 7,000 |
| *Federal level 2* | Mendota Pool | 14-06-200-4359A Sch. 2 | Note 2 | 1,142 |
| *Federal level 2* | Mendota Pool | 14-06-200-4359A Sect. 6 | NA | 12,000 |
| *Federal level 2* | Mendota Pool | 14-06-200-7859Z Sch. 2 | Note 3 | 1,321 |
| *Federal level 2* | Mendota Pool | 14-06-200-7859Z Sup. | NA | 3,120 |
| *Federal level 2* | Westlands W. D. | 14-06-200-8033A M&I | | 10 |
| *Federal level 4* | Mendota Pool | 01-WC-20-1756 | | 0-2,057 |
| *State* | NA | NA | NA | NA |
| | | | TOTAL | ~29,650 |
| | Mendota Pool | 14-06-200-4359A | Note 4 | (~5,000) |

Note 1: Not more than 5,800 AF of the 7,000 AF-section 2 water can be delivered after June 30th.

Note 2: Water is not available July through December.

Note 3: July and August deliveries under Schedule 2 are firm at 231 and 35 AF. Water is not available September through January.

Note 4: From October 1 through the end of February approximately 1,500 acres of wetlands on the eastside of the Mendota Pool: Fields 35 through 43; and fields 18 and 45, by contract, become part of the Mendota Pool. Approximately 5,000 acre feet of water per year are used, but no charge is attributed to MWA's water allocation. This water is typically referred to as "Area of Fluctuating Water." (see Figure 2)

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

Pre-CVPIA water supplies and management were similar to current supply and management. Pre-1992 contracts between USBR and CA DFG provided the water needed to operate the refuge. CVPIA provided more certainty during water short years. Level 4 amounts of an additional 2,057 AFY to optimally manage

the wildlife area has not been realized at MWA with only small quantities of level 4 water use occurring in the last 10 years.

From the 1980's to the early 1990's Mendota Dam was inspected by the Division of Dam Safety every 3 to 4 years. During inspection the Mendota Pool is de-watered from late November through January (possibly mid- February) effectively shutting off all water supply to MWA. During years when the Mendota Pool is dewatered many wetland cells are flooded deeper than optimal prior to loss of water supply. Also, proportionally more wetland acres are not flooded until water is returned to the Mendota Pool, especially habitat of high carbohydrate value such as watergrass. Since the mid 1990's the frequency of de-watering has increased to every other year and concern over the existing condition of the dam may cause the Division of Dam Safety to inspect the dam annually. Also, the Mendota Pool operating elevation has been lowered which has had a major negative impact during fall flooding. , also according to CCID ordered by the Division of Dam safety

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* | *2009 acres* |
|---|---|---|---|---|
| *Seasonal wetland – timothy* | NA | 3,331 | 3,988 | 4,458 |
| *Seasonal wetland – smartweed* | NA | 1,548 | 1,397 | 1,020 |
| *Seasonal wetland - watergrass* | 1,980 | 894 | 1,564 | 1,169 |
| *Permanent wetland* | 2,000 | 1035 | 1,194 | 1,047 |
| *Semi-permanent wetland/brood pond* | NA | 512 | 500 | 346 |
| *Seasonal wetland-trees (included in Misc)* | | | | 0 |
| *Irrigated pasture* | NA | 728 | 1,396 | 1,465 |
| *Upland* | 3,950 | 0 | 0 | 0 |
| *Upland (not irrigated)* | NA | 1,342 | 922 | 933 |
| *Upland (managed)* | NA | NA | NA | NA |
| *Upland (grains)* | NA | 678 | 349 | 861 |
| *Other (>5%) development* | NA | 1,281 | 39 | 0 |
| *Misc. habitat (<5%)Alk. Sink Scrub* | NA | 276 | 276 | 276 |
| *Flood Plain* | NA | 0 | 0 | 50 |
| *Sub-total – habitat acres* | 7,932 | 11,625 | 11,625 | 11,625 |
| *Roads, buildings, etc.* | 450 | 800 | 800 | 800 |
| *Total (size of refuge)* | 8,380 | 12,425 | 12,425 | 12,425 |

*1,800 acres of the 4,164 acres of Timothy are in the Mendota Pool and while considered wildlife habitat are not irrigated with CVP water. (See Table 3)

*Describe refuge habitat-type water use characteristics*

| *Habitat type* | *AF/ac* | *# of irrigations* | *Flood date* | *Draw down date* |
|---|---|---|---|---|
| *Seasonal wetland – timothy* | 2.5 | 0 | 8/1-1/15 | 3/1-4/1 |
| *Seasonal wetland – smartweed** | 4.0 | 2 to 3 | 8/1-1/15 | 2/15-3/1 |
| *Seasonal wetland - watergrass* | 3.5 | 2 to 3 | 9/15-1/15 | 4/1-5/1 |
| *Permanent wetland* | 6.0 | | | |
| *Semi-permanent wetland/brood pond* | 4.5 | | Feb-Mar | 8/15 |
| *Seasonal wetland/trees* | 5.0 | | | |
| *Irrigated pasture* | 2.5 | 2 | Mar-Aug | |
| *Upland (not irrigated)* | 0 | | | |

| | | | | |
|---|---|---|---|---|
| *Upland (managed)* | 2.0 | 1-2 | variable | |
| *Upland (grains)* | 0-4.0 | 0-5 | | |
| *Other (>5%)* | | | | |
| *Misc. habitat (<5%)* | | | | |

*referred to as 'combination' on Figure 1A

## 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 12,425 acre wildlife area is managed to provide habitat for waterfowl and other wetland/upland associated flora and fauna; to provide habitat for threatened, endangered, or sensitive species; to protect, enhance, or restore wetlands/uplands; and to provide for appropriate wildlife oriented public uses.

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

Overall habitat management objectives are described in the January 1994 Mendota Wildlife Area Management Plan, which functions as a general guidance manual for managing the area's habitats and species, describing resources and public uses, operation and maintenance tasks, and potential environmental impacts. An Annual Management Work plan is prepared each year to implement the overall management goals and objectives in the Wildlife Area Management Plan. The Work Plans follow the former Wildlife Area Habitat Committee guidelines for specific habitat management. Annual Work Plans identify habitat management efforts for the coming year.

Permanent Wetlands:

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.

Semi-permanent Wetlands (Spring/Summer Wetlands):

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*
MWA staff develop and implement the annual work plan with precision and efficiency integrating the wide variety of tasks such as water management, wildlife and vegetation surveys, vegetation manipulation, managing public use, maintaining roadways and water delivery systems, and invasive weed suppression to create wetland and upland habitat that supports a diversity of wildlife.

On an annual basis, the wildlife area staff in conjugation with statewide representatives from the Wildlife Area Habitat Committee conduct site visits and review/assess the current habitat management plan and make changes as necessary to meet the habitat objectives.

An Annual Management Work plan is prepared each year to implement the overall management goals and objectives in the Wildlife Area Management Plan.

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

A legal constraint affecting management of the area pertains to the abatement of mosquitoes. This practice is required by the State's Public Health Code. Fresno County Mosquito Abatement District bears the responsibility of chemically treating ponds on the wildlife area on an "as needed" basis, and then billing the DFG for that service. MWA must expend a significant amount of its annual budget on mosquito abatement. A contract for $48,000 per year from 2005 through 2007 is in place with Fresno County Mosquito Abatement District. Another constraint involves the "Take Avoidance Measures for Listed Species" regarding Giant garter snakes (*Thamnophis gigas*) which states that, "Construction activity within habitat should be conducted between May 1 and October1." Therefore, water conveyance system repairs cannot be conducted between October 2nd and April 30th.

Title easements which may constrain DFG management activities include subsurface mineral rights reservations over most of the property. In the event that a holder of subsurface mineral rights should wish to exercise those rights, the DFG is legally obligated to accommodate reasonable surface access. This legal obligation in no way releases the subsurface mineral rights holder from complying with the California Endangered Species Act (CESA) or other laws and regulations pertaining to negative environmental impacts. Any negative impacts which might occur as a result of action taken by the holder of subsurface mineral rights would have to be mitigated. DFG Environmental Services staff would stipulate at that time what mitigation measures would be required before any party could be granted a permit for extraction of subsurface minerals. Given these circumstances it is questionable whether subsurface mineral rights reservations constitute a significant constraint upon Departmental management activities at MWA.

At the present time DFG cannot spray herbicides on any waters of the state. Explosive populations of water primrose (*Ludwigia spp*.) have severely impacted many delivery systems on the wildlife area. Water primrose slows water movement by forming dense mats of vegetation and also increases siltation causing further impairment of delivery systems. Water primrose can also create optimal breeding habitat for mosquitoes and excessive decomposition of plant material can degrade water quality and cause depletion of dissolved oxygen in the water.

The primary factor which has limited the DFG's management activities at MWA is an inadequate budget. At the present time the area is funded for a total of only seven (7.0) staff positions, plus a minor amount of seasonal aide time. That number of positions is insufficient to maintain the habitat in a *status quo* condition (Management Plan for Mendota Wildlife Area 1994). Currently the wildlife area has 7.5 permanent positions.

Also, see A4 for Mendota Dam operation.

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

MWA takes various management actions to minimize mosquito production on the area when such management actions are determined to not significantly impact the wetlands capacity to support wildlife. These include increasing the speed of irrigation, maintaining constant water levels, and decreasing duration

of irrigations. DFG is working with the statewide Mosquito Abatement Association to implement Best Management Practices that satisfies both entities objectives.

MWA in cooperation with DFG's Pesticide Use Coordinator has sprayed primrose in ditches which have been allowed to dry and has seen improvement for up to two years. Mechanical removal of primrose has also shown some short term benefits.

Central California Irrigation District along with DFG are, at present, seeking to replace the Mendota Dam which is the preferred alternative for updating the wildlife area delivery system to accommodate Level 4 water supplies. This project has been overshadowed in the last few years by the San Joaquin River Restoration Project which is the lead in determining how water flows for salmon restoration will affect the Mendota Dam and Mendota Pool operation.

DFG is working with the statewide Mosquito Abatement Association to implement Best Management Practices that satisfies both entities objectives.

## Section C - Policies and Procedures

*1. Describe the refuge policies/procedures on accepting agricultural drainage water as supply*
Until the mid-1980s MWA used agricultural drain-water on the northwest portion of the wildlife area. Following the Kesterson Refuge selenium debacle agricultural drain-water is no longer used at MWA. Three agricultural drain-water diversion structures are still in place along the west boundary of MWA but are only opened in flood events when the waters are routed across MWA and pumped into the Fresno Slough.

*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.

POOLING OF WATER SUPPLIES

6. (a) Whenever the maximum quantities of Level 2 Water Supplies and/or the Incremental Level 4 Water Supplies depicted in Exhibit AB@ are reduced pursuant to Article 9 of this Contract, the remaining Level 2 Water Supplies and/or the Incremental Level 4 Water Supplies may be pooled for use on other Refuge(s); Provided, that no individual Refuge shall receive more Level 2 Water Supplies than would have been made available to it absent a reduction pursuant to Article 9 of this Contract; or be reduced by more than twenty-five (25) percent; Provided further, that the Contracting Officer makes a written determination that pooling of water for use on other Refuge(s) would not have an adverse impact, that cannot be reasonably mitigated, on Project operations, other Project Contractors, or other Project purposes; Provided further, that the Contracting Officer determines that such reallocation is permitted under the terms and conditions of the applicable underlying water right permit and/or license; and Provided still further, that water made available under this contract may not be scheduled for delivery outside the Contractor=s Boundary without prior written approval of the Contracting Officer.

(b) An Interagency Refuge Water Management Team, to be chaired by the Contracting Officer and to be established upon execution of this Contract, shall be entitled to collaboratively allocate the pooled water supplies and provide a schedule for delivery of the pooled supplies to meet the highest priority needs of the Refuge(s) as depicted in Exhibit AB@; Provided, however, nothing in this Article is intended to require the Contractor to pool the water supply provided for

in this Contract. The Interagency Refuge Water Management Team shall be composed of designees of the Bureau of Reclamation, the United States Fish and Wildlife Service, the California Department of Fish and Game, and the Grassland Water District.

TRANSFERS, REALLOCATIONS OR EXCHANGES OF WATER

7. Subject to the prior written approval of the Contracting Officer, the Project Water made available under this Contract may be transferred, reallocated or exchanged in that Year to other Refuge(s) or Project contractors if such transfer, reallocation or exchange is requested by the Contractor and is authorized by applicable Federal and California State laws, and then-current applicable guidelines or regulations.

The Mendota Wildlife Area has no additional policies or procedures on pooling, transfers, reallocations, or exchanges.

A significant portion of the water delivered to MWA is delivered to the Mendota Pool from Mendota Pool Group (exchange contactors) shallow wells. This marginal quality well water mixes with Delta Mendota Canal, and San Joaquin River water in the Mendota Pool.

Level 4 water has been used at MWA in only 2002 and 2004 water years. In previous years Level 4 water south of the Delta that was available to MWA was added to pool and made available to other refuges that are more dependant on Level 4 supplies.

*3. Describe the refuge water accounting policies/procedures for inflow, internal flow and outflow*

Inflows are measured daily at 9 low-lift pumps by the DFG and bi-monthly San Luis Delta Mendota Water Authority (SLDMWA). Unmetered water is reported to SLDMWA and USBR. Unmetered water is estimated at 1 AF/ acre flooded, or ~.5 AF/ acre irrigated. DFG reports monthly water use, broken down by water contract, to USBR using both DFG and SLDMWA use figures.

Internal flows are monitored daily by DFG for purposes of maintaining optimal habitat conditions. Weekly water maps are generated for evaluating habitat response, and for use by the local mosquito abatement district.

Outflow is measured by DFG at two of three low lift pumps. Pump#6 returns water directly into the main intake ditch for Pump #1 and is credited as a recirculation pump. Pump # 8 returns water directly to the Fresno Slough and is equipped with an hour meter.

Outflow which is not measured is returned to the Fresno Slough through Pump #11 and two Gravity flow structures in field 50.

*4. Describe the refuge water shortage policies/procedures*

Based on established refuge purposes (see B1) and the projected water supply, management is determined by critical habitat needs and analysis of existing water use records by habitat type to determine the amount, distribution and timing of each habitat type to be flooded during water shortages. See Section H 2, water shortage contingency plan.

## 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 facilitie~~s, operational loss recovery system, wells, and water quality monitoring locations. Describe in the body of the plan the information contained in each attached map*

Figure 1a, Habitat, shows field numbers and areas of swamp timothy, watergrass, and smart weed. Page 19
Figure 1b, Habitat, shows field numbers and areas of upland habitat. Page 21
Figure 1c, Habitat, shows field numbers and areas of permanent and semi-permanent water. Page 20

Figure 2, Internal Flow – Points of Measurement / Pump Sites, shows internal flow control devices, pump locations and areas served by each pump, gravity and fluctuating water. Page 22

Figure 3, Internal Flow – Drainage, shows cell numbers (sub-divisions of fields), the areas drained (all to Fresno Slough) by each of the five drainage points. Page 23

Figure 4, Internal Flow – Gravity Intake Structures and Ditches, shows the gravity flow intake ditches and the gravity flow intake structures. Page 24

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

*Total # of inflow locations/points of delivery* 24 (9 pumps and 15 gravity flow)
*Total # of measured points of delivery* 10
*Percentage of total inflow (volume) measured during report year* 90

| *Delivering agency* | *Conveyance facility* | *Measuring point* | *Refuge distribution facility* | *% of total inflow* | *Type of measurement* | *Measuring agency* |
|---|---|---|---|---|---|---|
| SLDMWA | DMC to Mendota Pool | Pump 1 | Reservoir 1 | 34 | Hour meter / pump factor | SLDMWA |
| SLDMWA | same | Pump 2 | Reservoir 2 | 11 | same | SLDMWA |
| SLDMWA | same | Pump 3 | Reservoir 3 | 12 | same | SLDMWA |
| SLDMWA | same | Pump 4 | Reservoir 4 | 9 | same | SLDMWA |
| SLDMWA | same | Pump 5 | Reservoir 5 | 8 | same | SLDMWA |
| SLDMWA | same | Pump 7 | Reservoir 7 | 5 | same | SLDMWA |
| SLDMWA | same | Pump 9a | Field 51.1 | .5 | same | SLDMWA |
| SLDMWA | same | Pump 9b | Reservoir 9 | .5 | same | SLDMWA |
| SLDMWA | same | Pump 10 | Reservoir 10 | 8 | same | SLDMWA |
| SLDMWA | same | Pump 12 | Reservoir 12 | 2 | | |
| SLDMWA | same | None - | varies | 10 | same | SLDMWA |

   b. *Internal flow at turnouts*

*Total # of refuge water management units (units)* 252
*Total # of refuge water management unit turnouts* 600+
*Total # of measured turnouts* 0 (monitored but not measured)
*Estimated percentage of total internal flow (volume) during report year that was measured at a turnout* 0

| *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* | | | | | | |
| *Metered gates* | | | | | | |
| *stop-log/ screwgates* | 700+ | 12,425 | NA | daily | NA | NA |

*c. Outflow*

*Outflow (AF/yr)* 2,400
*Total # of outflow locations/points of spill* 6
*Total # of measured outflow points* 2
*Percentage of total outflow (volume) measured during report year* 70%

| *Outflow point* | *Measuring point* | *Type of measurement* | *Percent of total outflow (estimated)* | *Measuring agency* | *Acres drained* |
|---|---|---|---|---|---|
| Pump #6 | At pump | Hour meter | 55 | SLDMWA | 5,600 |
| Pump #8 | At pump | Hour meter | 15 | DFG | 1,500 |
| Pump #11 | NA | NA | 25 | NA | 1,000 |
| Pump #13 | NA | NA | 0 | NA | 300 |
| Field 50-3A (gravity) | NA | NA | 2 | NA | 40 |
| Field 50-3D (gravity) | NA | NA | 3 | NA | 40 |

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

| *Miles unlined canal* | *Miles lined canal* | *Miles piped* | *Miles – other (natural)* |
|---|---|---|---|
| 35 | 0 | 0 | 0 |

*Describe the location and types of identified leaks and areas of higher than average canal seepage, and any relation to soil type.*

Well developed levees and ditches composed of low permeable clay soil reduce seepage and leaks to minimal levels. Structural failure is a more relevant source of leakage. Identification and replacement of failed structures are given high priority when assigning daily tasks.

*4. Describe the refuge operational loss recovery system*

MWA has one 25 hp return pump (#6) on the west side of the wildlife area which returns water directly to the main intake ditch (E ditch) for a 100 hp pump (#1) which delivers water to approximately 3,600 acres. (see Figure 4.) A second recirculation pump (pump 13) was installed in 2009, it drains fields 30 and 24 directly into Reservoir 1.

*5. Groundwater*

*Describe groundwater availability, quality and potential for use*

There are no production, monitoring, or domestic wells in use, with the exception of four or five monitoring wells on the west side of the Mendota Pool that Westlands Water District tests. Three wells were abandoned within the MWA in the 1950's due to high boron concentrations. Another three wells were acquired with the Traction Ranch property and were capped in 1992 due to boron concentrations of 2.0 mg/L, EC of 7,800µmhos/cm and eroded casings. Wells were non-functional and abandoned by former property owner. Two test wells were drilled in April 1992, one located at parking lot #16, drilled to 580 feet, tested boron at 5.0 mg/L and an EC of 9,640 µmhos/cm. The second test well located at parking lot #22, Traction Ranch, drilled 570 feet, tested boron at 2.2 mg/L and EC of 5,601 µmhos/cm. These wells did not go below the Corcoran clay (600 ft).

Additional concerns of salinity, manganese, and selenium detected in wells within the Kings Subbasin as well as aquifer depletion and soil subsidence will need to be addressed before groundwater use can be considered. See CH2MHILL groundwater report (in preparation) prepared for USBR for more details.

*Groundwater Plan* *No* X *Yes* _____

*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* |
|---|---|---|---|---|---|
| Kings Subbasin | | | | | Mendota Pool Group Pumping and Monitoring Annual Reports – Ludorff and Scalmanini<br><br>Refuge Groundwater Report in prep-CMH2Hill |

*Identify refuge-operated deep wells*

None.

## Section E Environmental Characteristics

*1. Topography - describe and discuss impact on water management*

Topography is typical of the San Joaquin Valley, with elevations between 160 and 165 feet above sea level. Generally elevations rise gradually from the Fresno Slough both to the west and east. Rather large levees

have been built to control water within areas of similar elevation (cells). Levees average 6 feet in height with 10 feet wide crowns and a 2:1 side slope. Levees were pushed from the immediate vicinity creating low elevation borrows surrounding most cells.

*2. Soils - describe and discuss impact on water management*

The MWA is covered with an alluvium to a depth of 550 feet. Within the alluvium are four clay layers, composed of basin, flood plain, lacustrine, and marsh deposits. The fourth clay layer contains the Corcoran Clay, mapped at a depth of about 400 feet at the southern boundary (Croft, 1972), but can be as deep as 600 feet in the northeastern portion of the wildlife area.

Soil in the northeastern part of the refuge can be classified into three associations: a relatively small area of Traver-Calhi along the northern boundary, followed by Rossi-Waukena, progressing to the Merced-Temple association near Fresno Slough. Waukena Loam is found on the northern side of the refuge and Merced Clay is found in a large area bordering the Fresno Slough. The Merced-Temple soils are poorly drained, having low to very low surface permeability, and in localized areas having alkali and saline content in ranges detrimental to agricultural production. The available water-holding capacity is high. Soils on the northern side of the refuge consist of sandy loam or loamy coarse sand at depths of 2 feet, these areas are managed as uplands. (USDA 1956 and 1971).The Corcoran Clay lies beneath this refuge at approximately 600 feet bgs (DWR 1981).
Severe subsidence has occurred in areas southwest of Mendota. Future subsidence is possible in the upper aquifer where it is confined (Central California ID 1997).

*3. Climate*

The climate at MWA consists of hot, dry summers and mild, cool winters, with an annual temperature range of from 20 to 110 degrees Fahrenheit. Precipitation averages less than six inches per annum and comes in the form of winter rains. Infrequent winter rainfall events are interspersed with periods of mild, sunny weather and/or densely foggy conditions. Summertime is generally extremely dry and hot.

*National Weather Service –(Los Banos - 1961-1990)*

| | *Jan* | *Feb* | *Mar* | *Apr* | *May* | *Jun* | *Jul* | *Aug* | *Sep* | *Oct* | *Nov* | *Dec* | *Annual* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *avg precip* | 1.6 | 1.6 | 1.4 | 0.8 | 0.3 | 0.0 | 0.0 | 0.0 | 0.2 | 0.5 | 1.0 | 1.5 | 9.0 |
| *max temp* | 54.5 | 62.6 | 67.6 | 74.3 | 82.0 | 89.6 | 95.5 | 93.9 | 88.7 | 79.7 | 64.9 | 54.5 | 75.6 |
| *min temp* | 36.0 | 39.7 | 42.8 | 46.0 | 51.4 | 56.8 | 60.3 | 59.5 | 56.1 | 49.8 | 41.9 | 36.0 | 48.0 |
| *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.

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

*4. Water quality monitoring*

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

| *Analyses performed* | *Frequency range* | *Concentration range* | | *Average* | |
|---|---|---|---|---|---|
| | | *Inflow* | *Outflow* | *Inflow* | *Outflow* |
| EC µS/cm | Bi-monthly | 227-1468 | 432-1470 | 591 | 725 |
| TDS mg/L | Bi-monthly | 105-700 | 179-716 | 330 | 414 |
| Salinity | Bi-monthly | 0.1-0.5 | 0.2-0.7 | 0 .32 | 0.42 |

Inflow readings are taken from the DMC and 4 locations along the Fresno Slough. Outflow readings are taken at the 3 return pumps (pumps 6, 8 & 11).

Existing monitoring may change depending on future requirements of regulatory programs such as the State Water Resources Control Board's Basin Plan Amendment for Salt/Boron discharge into the San Joaquin River, the Regional Water Quality Control Board's Irrigated Lands Waiver, and funding availability.

*Discuss the impact of water quality on water management*

To date surface water quality has been maintained at acceptable levels for use on the wildlife area. Agricultural drain water and internal DFG well water use has been discontinued due to concerns over water quality.

**Delivered water** - Section C1 above identifies acceptable water quality criteria for contract water delivered by SLDMWA.

## 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 |
|---|---|---|---|
| Mendota | Grasslands Water District | 09-10 | 500 AF |
| | *TOTAL* | | 500 AF |

## Section G Water Inventory

1. Refuge Water Supplies Quantified
   Surface water supplies, imported and originating within the District, by month. Table 1
   Ground water extracted by the Refuge, by month. Table 1
   Precipitation by Habitat Type. Table 3
   Upslope Drain Water, by month. Table 1
   Other supplies, by month. Table 1
   Refuge water inventory. Table 4
   Ten-year history of Refuge water supplies. Table 5

2. Water Used Quantified
   Conveyance losses, including seepage, evaporation, and operational losses. Table 2
   Applied Habitat water, evapotranspiration, water for cultural practices (e.g., disease control). Table 3
   Estimated deep percolation (seepage) within Habitat areas. Table 3
   Habitat spills or drain water leaving the Refuge. Table 4

## Section H Critical Best Management Practices

*1. Management programs*

*a. Education*

| *Program* | *Estimated cost (in $1,000s)* | | |
|---|---|---|---|
| | *2011* | *2012* | *2013* |
| Current public tours – 7 groups | .5 | .5 | .5 |
| Annual Refuge Management Workshop | .5 | .5 | .5 |

*Describe the specifics of each program (number of participants, topics, purpose, etc.)*
The Annual Refuge Management Workshop is a collaborative session with USFWS and CDFG in which relevant wetland management or pertinent wildlife topics are addressed.

*b. Water quality monitoring*

| *Type of water* | *Existing Estimated cost (in $1,000s)* | | |
|---|---|---|---|
| | *2011* | *2012* | *2013* |
| *Surface – USBR and riparian* | 2 | 2 | 2 |
| *Upslope drain* | | | |
| *Groundwater** | | | |
| *Outflow* | 1 | 1 | 1 |

Surface waters which exit Mendota Wildlife Area to waters of the state are subject to the Central Valley Regional Water Quality Control Board July 2003 *Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands within the Central Valley Region.* The waiver includes "managed wetlands" in the definition of irrigated lands. A Monitoring and Reporting Program Plan has been prepared by the Westside San Joaquin River Watershed Group (Coalition) which includes all lands comprising the Mendota Wildlife Area. The plan was submitted by the Coalition to the Board April 1, 2004, with monitoring to begin July, 2004. The goal of the MRPP and the Coalition is to identify if dischargers are in compliance with the Sacramento/San Joaquin River Basin Plan, and to facilitate appropriate action where required. The Department of Fish and Game continues to work with the Coalition and other wetland managers to identify any required actions.

*c. Cooperative efforts*
DFG coordinates water use with the USBR, SLDMWA, and CCID.

*d. Pump evaluations* (mobile labs)
*Total number of groundwater pumps on refuge* 0
*Total number of surface water (low-lift) pumps on refuge* 12

| *Groundwater pumps* | *Estimated cost (in $1,000s)* | | |
|---|---|---|---|
| | *2011* | *2012* | *2013* |
| *# of groundwater pumps tested* | | | |
| *# of pumps to be fixed or replaced* | | | |
| *# of low-lift pumps to be tested* | 5 | 5 | 2 |
| *# of pumps to be fixed or replaced* | | 25 | 60 |

The above estimated costs would fund an annual program to test, maintain, and replace when necessary, low-lift pumps. This program would increase efficiency, lower costs, and increase overall cost effectiveness.

*e. Policy evaluation*

At the present time, due to the Headwaters, Inc. v. Talent Irrigation District decision, DFG cannot spray herbicides on any waters of the state. Explosive populations of water primrose (*Ludwigia spp*.) have severely impacted many delivery systems on the wildlife area. Water primrose slows water movement by forming dense mats of vegetation and also increases siltation causing further impairment of delivery systems. Water primrose can also create optimal breeding habitat for mosquitoes and excessive decomposition of plant material can degrade water quality and cause depletion of dissolved oxygen in the water. DFG continues to investigate opportunities to obtain an NPDES permit from the SWRCB to apply aquatic herbicides; the permit process is currently constrained by budgetary limitations.

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

Dewatering of the Mendota Pool has a major impact on the quantity and quality of wetlands maintained during the peak season of waterfowl and shorebird use.

Lowered operating elevation of the Mendota Pool has made flooding of "Area of Fluctuating Water" difficult and in some cases not possible. Alternating operational hours of some pumps has also been required. In both cases flooding rates have been reduced which is not consistent with mosquito abatement BMP's or advantageous to maintaining quality moist soil habitat.

Escalating mosquito abatement costs are impacting operating dollars needed to fund operation and maintenance of the water system and wetland habitat. Best management practices being developed to reduce mosquito production are often times not in the best interest of the wetland habitat and associated wildlife that are part of our mission to protect and enhance.

*2. Water Shortage Contingency Plan*

*Existing plan Yes* X *Please attach No* _ *Projected completion date* 2007

## Section I Exemptible Best Management Practices

*1. Improve management unit configuration*

| *Unit name* | *Current acres* | *Reason for change* | *Proposed acres* | *Estimated cost (in $1,000s)* | | |
|---|---|---|---|---|---|---|
| | | | | *2011* | *2012* | *2013* |
| Field 29 | 380 | Improve water distribution system | 380 | 60 | | |
| Field 18 | 95 | Change flooding regime from gravity to pumped | 95 | | 50 | |
| Field 9 | 220 | Improve water distribution system | 220 | | | 45 |

*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* |
| Res #1 | Diversion structures– screw gates | Replace dilapidated structures with long lasting HDPE pipe | 65 | | |
| Res #2 | Diversion structures– screw gates | Replace dilapidated structures with long lasting HDPE pipe | | 60 | |

*b. Line/pipe sections of distribution system*

| *Proposed reach/sect.* | *Reason for new structure* | *Estimated cost (in $1,000s)* | | |
|---|---|---|---|---|
| | | *2011* | *2012* | *2013* |
| | | | | |

*c. Independent water control for each unit*

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

Current internal water control configurations maximize water distribution efficiency. MWA will continue to evaluate water distribution configurations to identify possible future improvements to water control operation.

*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. | | | |

Any changes to internal distribution sections are determined each year in the annual planning process. Current internal water control configurations maximize water distribution efficiency. MWA will continue to evaluate water distribution configurations to identify possible future improvements to water control operation.

*3. Automate water distribution system*

| *Proposed automation location* | *Type of improvement* | *Reason for improvement* | *Estimated cost (in $1,000s)* | | |
|---|---|---|---|---|---|
| | | | *2011* | *2012* | *2013* |
| | | | | | |

MWA pumps are currently operated by electrode or mercury switch floats as well as timers which automatically turn pumps on and off. Further automation would be cost prohibitive and ineffective due to frequent plugging of water control structures by beaver and loose debris.

*4. Measurement*

*a. Plan to measure outflow*

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

| *Name of Location* | *Estimated cost (in $1,000s)* | | |
|---|---|---|---|
| | *2011* | *2012* | *2013* |
| To be studied | | | |
| | | | |

*See narrative under H1b. above for a description of future monitoring needs under the Central Valley Regional Water Quality Control Board July 2003 *Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands within the Central Valley Region.*

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

*6. Construct and operate operational loss recovery systems*

| *Proposed location* | *Reason for improvement* | *Estimated cost (in $1,000s)* | | |
|---|---|---|---|---|
| | | *2011* | *2012* | *2013* |
| | | | | |
| | | | | |

The MWA (Pump #6 to Pump #1)operational loss recovery system currently captures for reuse all but ~ 1000 AFY. The new loss recovery system (Pump #13) captures an estimated 200 additional AFY for reuse.

*7. Optimize conjunctive use of surface and groundwater*

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

No groundwater of acceptable quality has been found. CH2MHill prepared a groundwater study that predicts some acceptable quality groundwater may be found, however no luck yet.

*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 maps* | *Estimated cost (in $1,000s)* | | |
|---|---|---|---|
| | *2011* | *2012* | *2013* |
| *Map 1 – Distribution system* | Complete* | | |
| *Map 2 – Drainage system* | Complete* | | |

* See attached (6) maps

*10. CAL-Fed Quantifiable Objectives*

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

There are two "targeted benefits" which apply to Mendota WA. We need to very briefly describe any past, present, or known future wildlife area actions that may contribute to these targets:

1. Describe actions that reduce flows to salt sinks. (TB 167)
All water that exits the wildlife area enters Mendota Pool, which is not a salt sink.

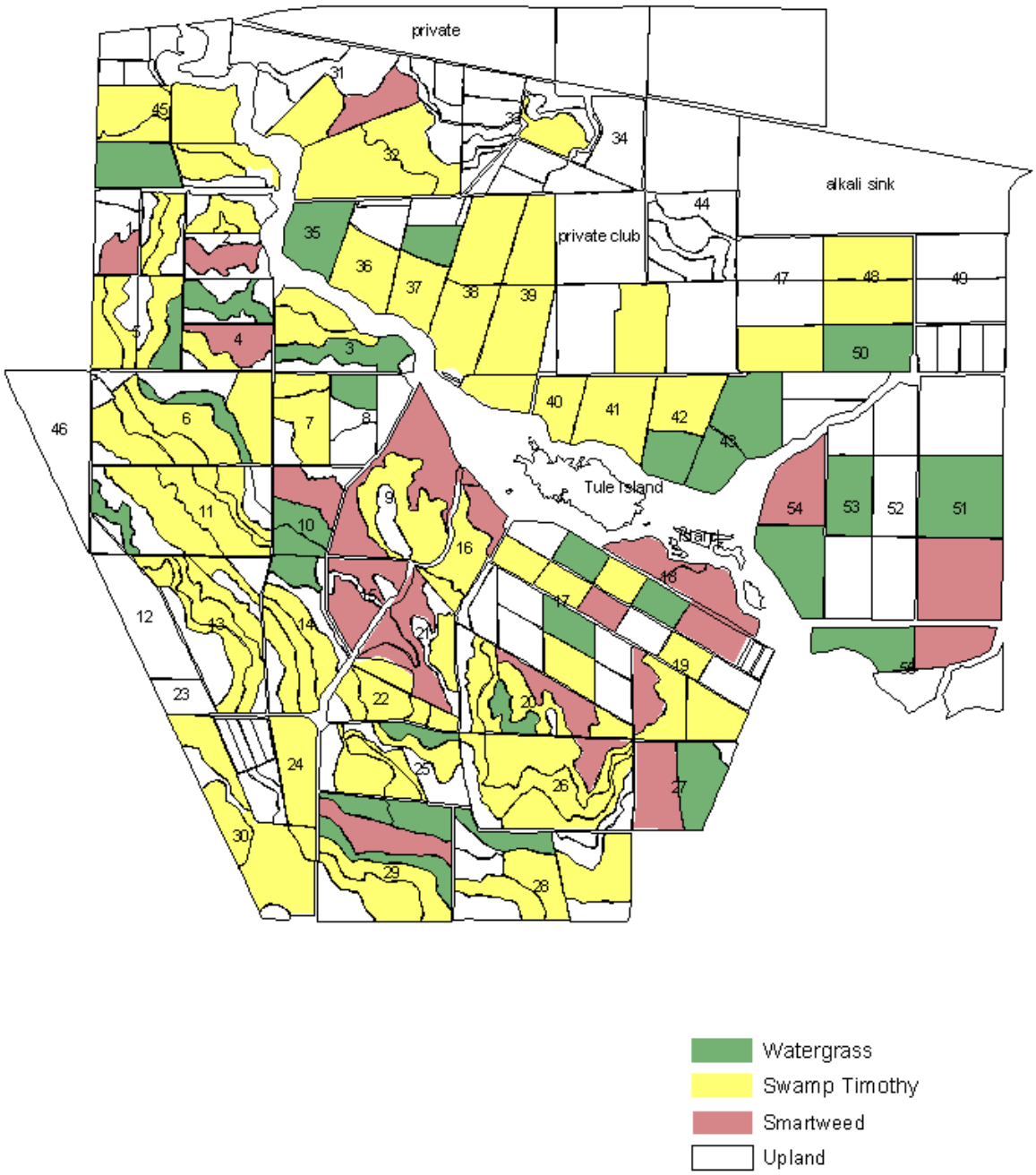
2. Describe actions that reduce nonproductive ET. Reduce unwanted ET. (TB 168)
Planting of barley in wetland fields that have become late successional, poor production areas decreases unwanted vegetation and improves production of target plant species. Annual spot discing, and mowing of unwanted vegetation also reduces evapotranspiration. Burning late successional areas also reduces unwanted vegetation. Burning was once practiced on more acres than is currently possible under San Joaquin Valley Air Pollution Control District guidelines. However limited areas (~30 acres) are burned annually.

## Section J BMP Exemption Requests

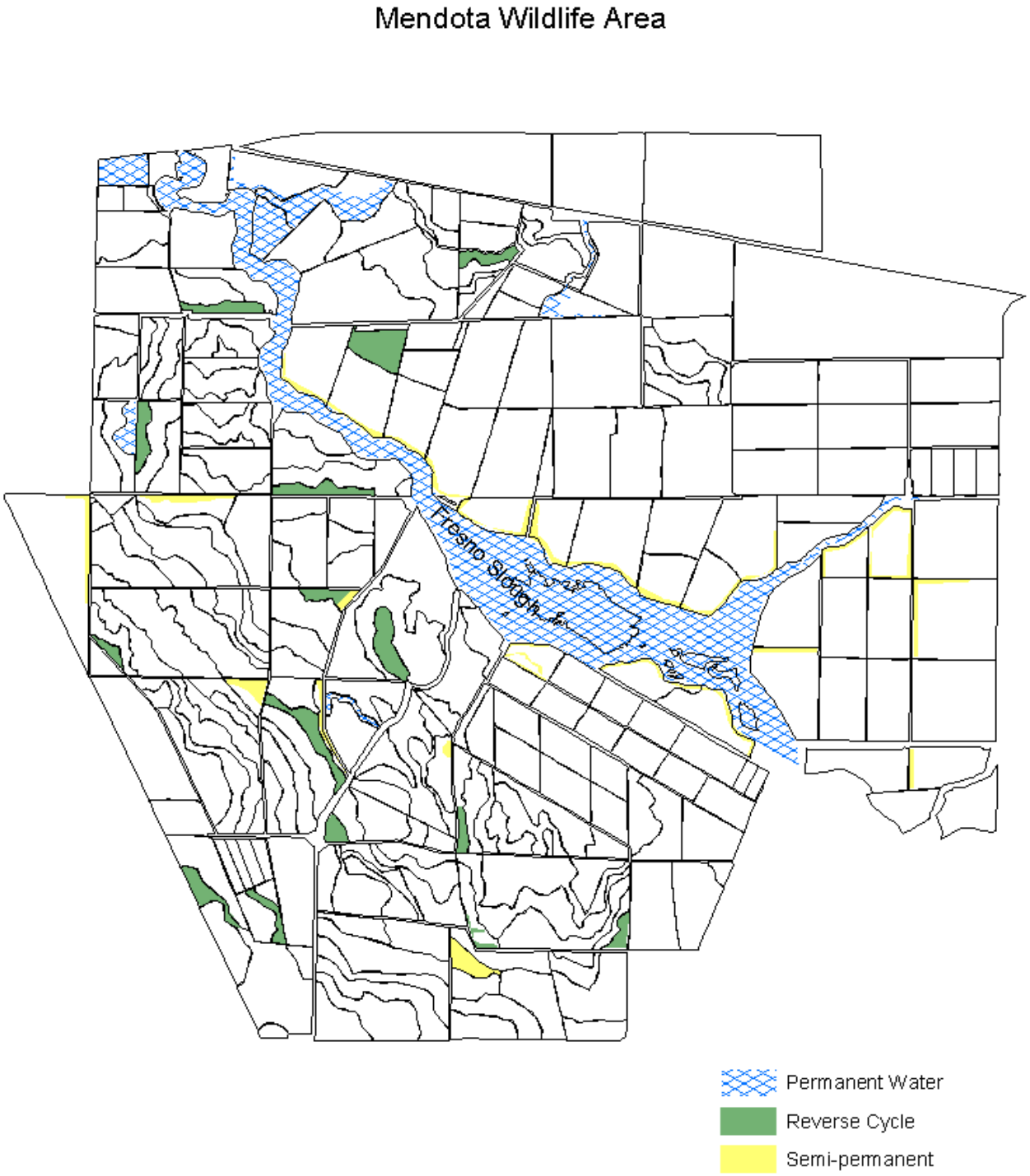
No exemption requests

Section A-5 Figure 1a. Moist soil wetlands.

## MENDOTA WILDLIFE AREA

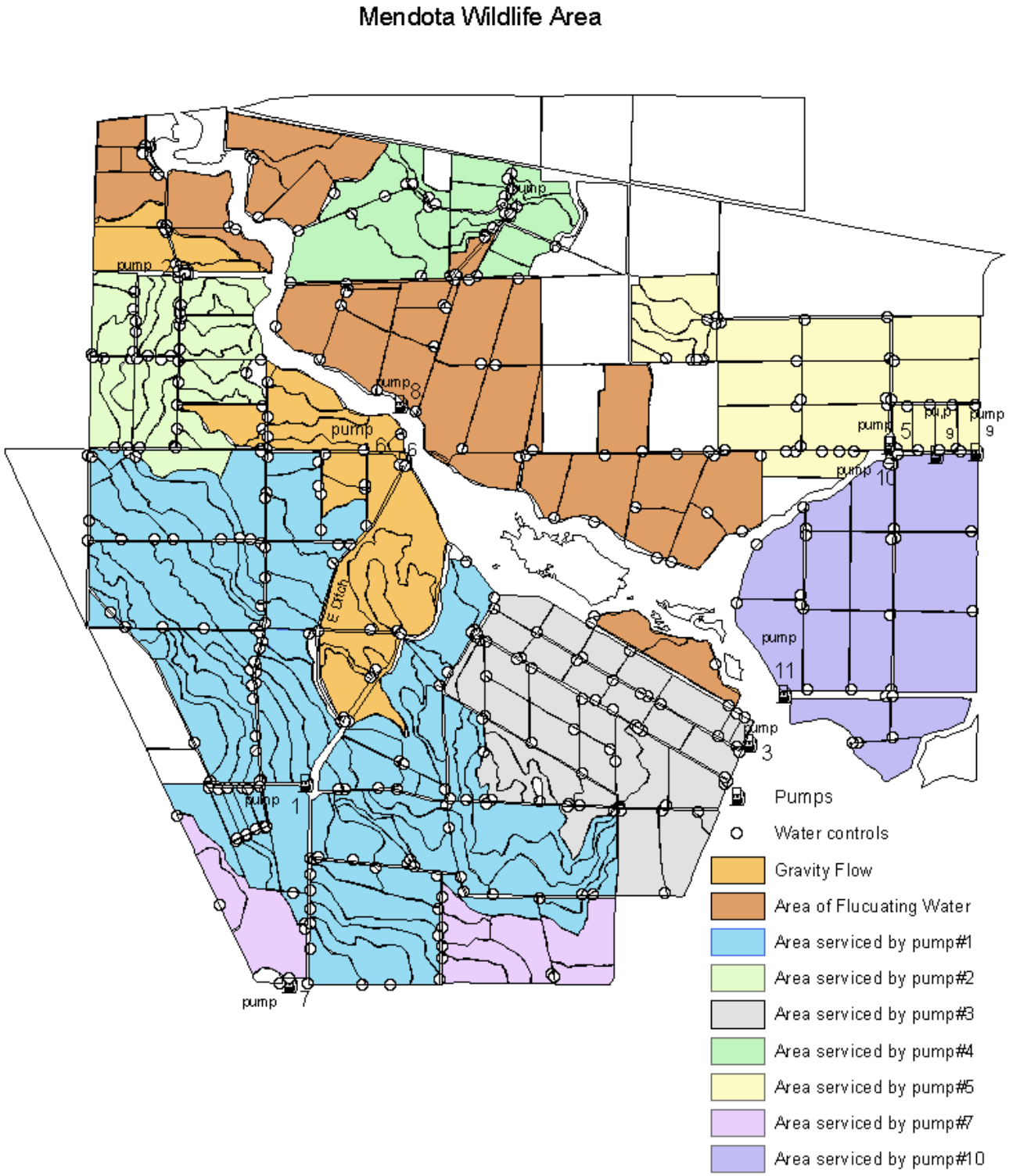


Section A 5. Figure 1C. Summer Wetlands and Permanent Water.

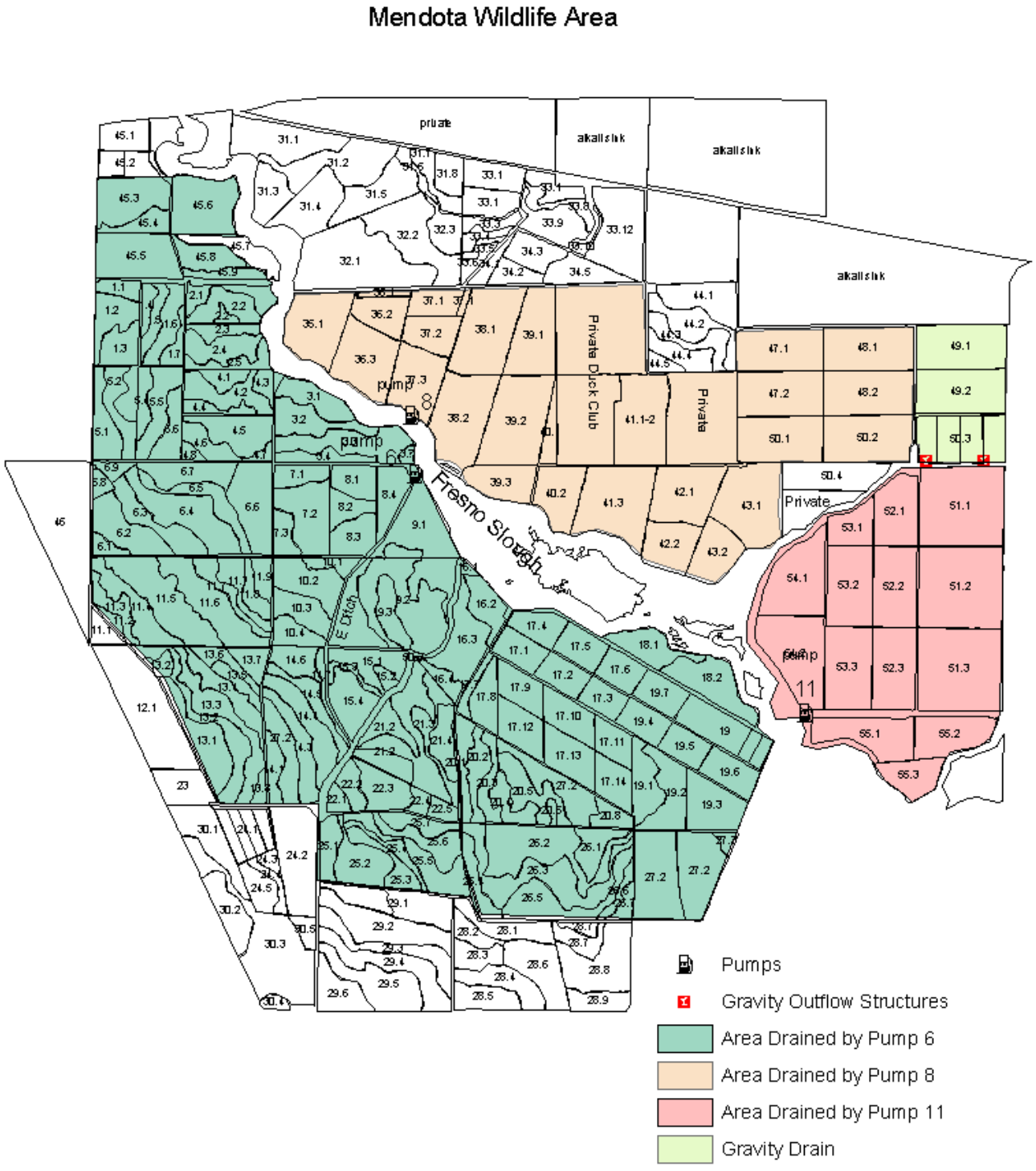


Section A 5. Figure 1b. Upland habitat.

D 1. Figure 2. Conveyance System. Inflow Points - Pump sites are points of measurement.

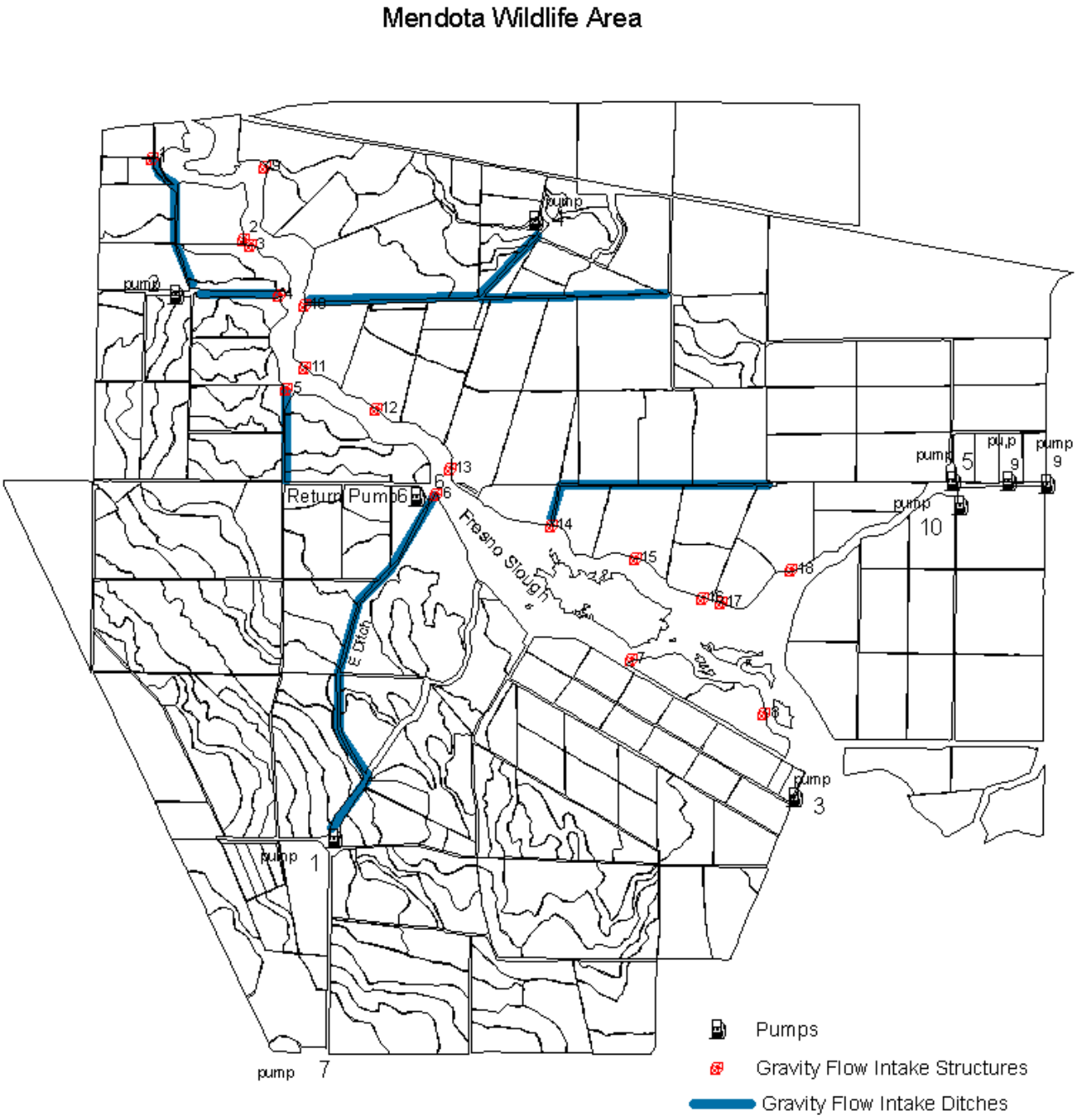


D 1. Figure 3. Drainage System. Outflow Points

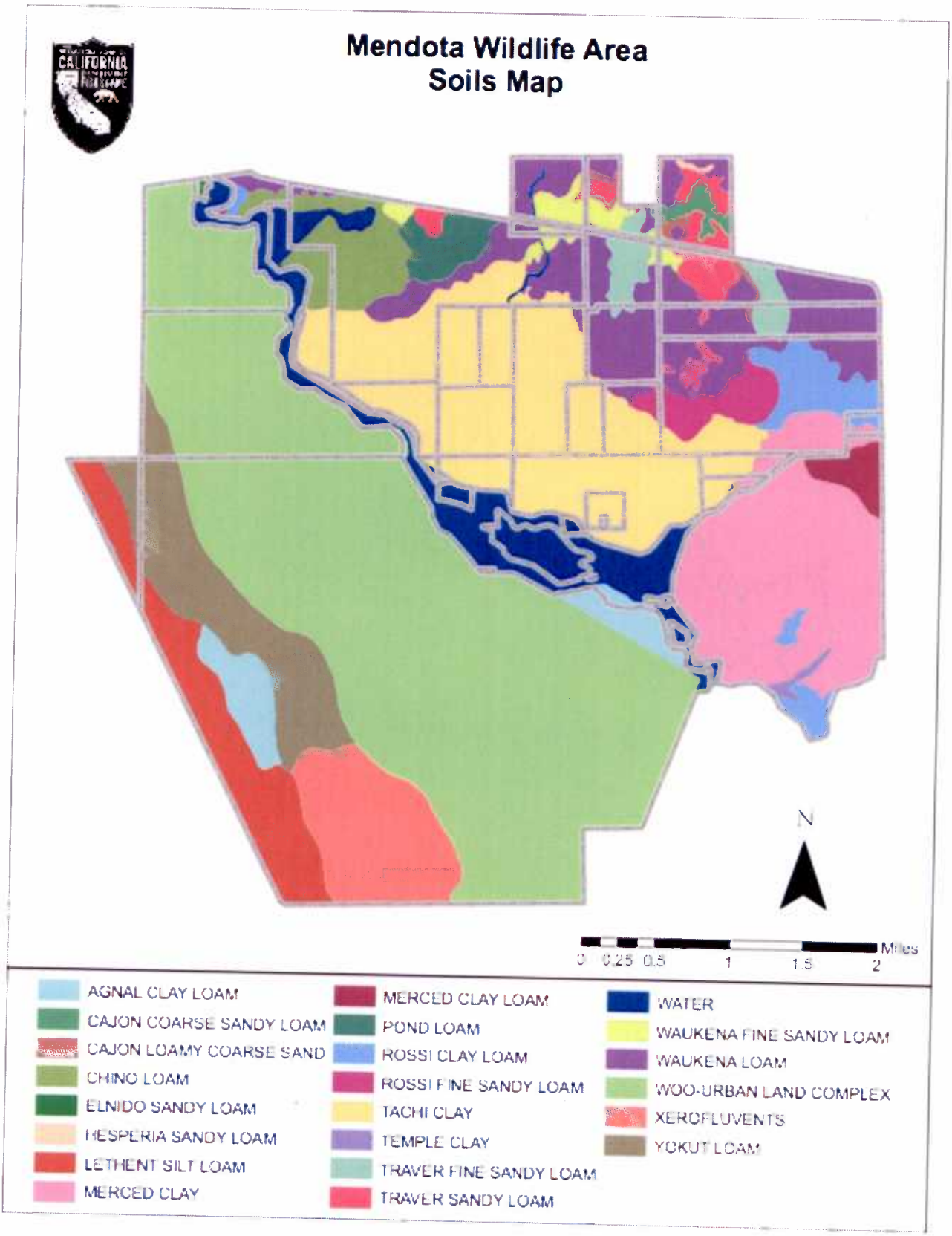



All outflow is returned to Fresno Slough except Pump #6 which returns to E ditch.

D 1. Figure 4. Delivery Points.

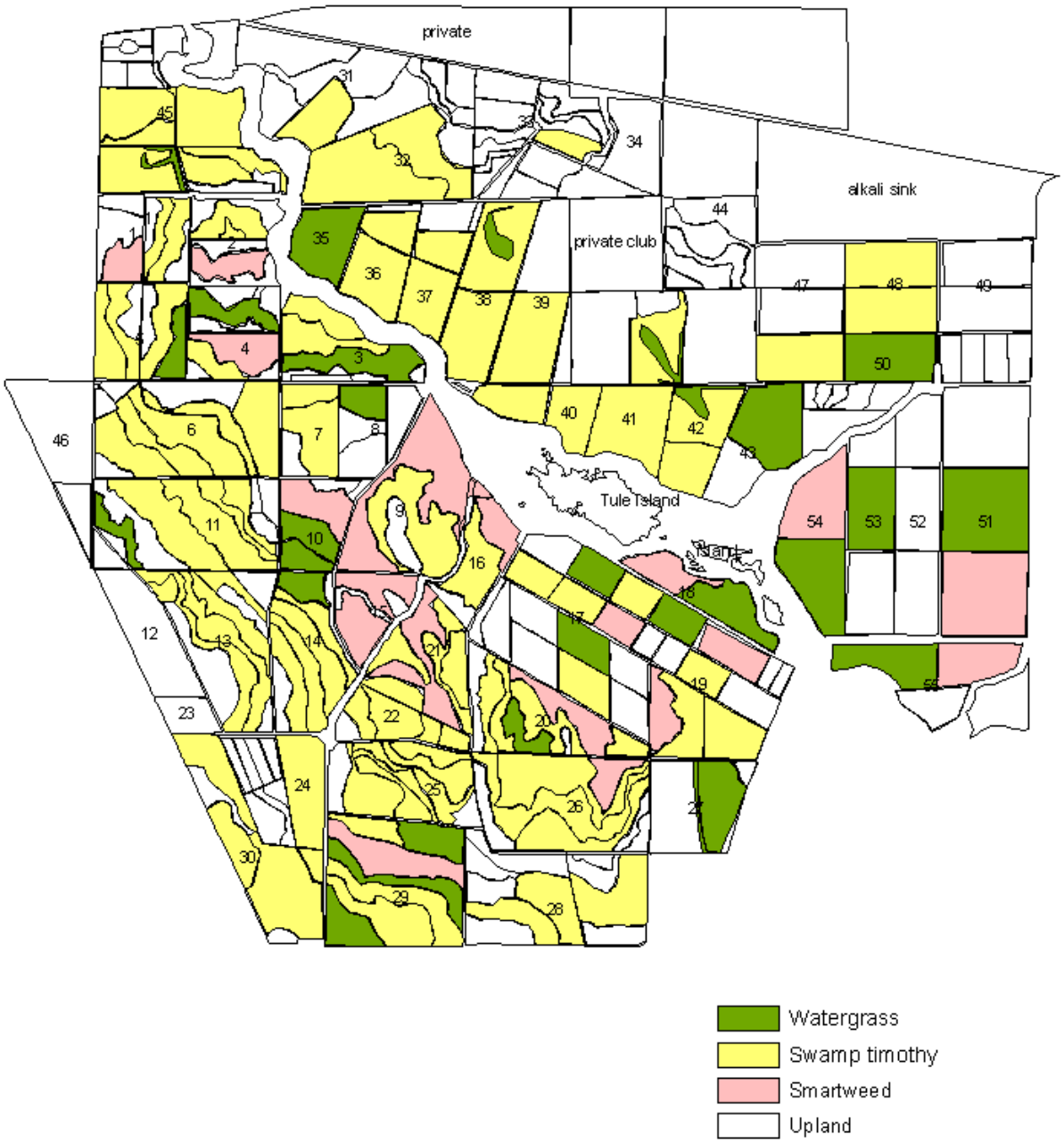



Operational loss recovery system consists of return pump #6, E-Ditch, and pump #1.

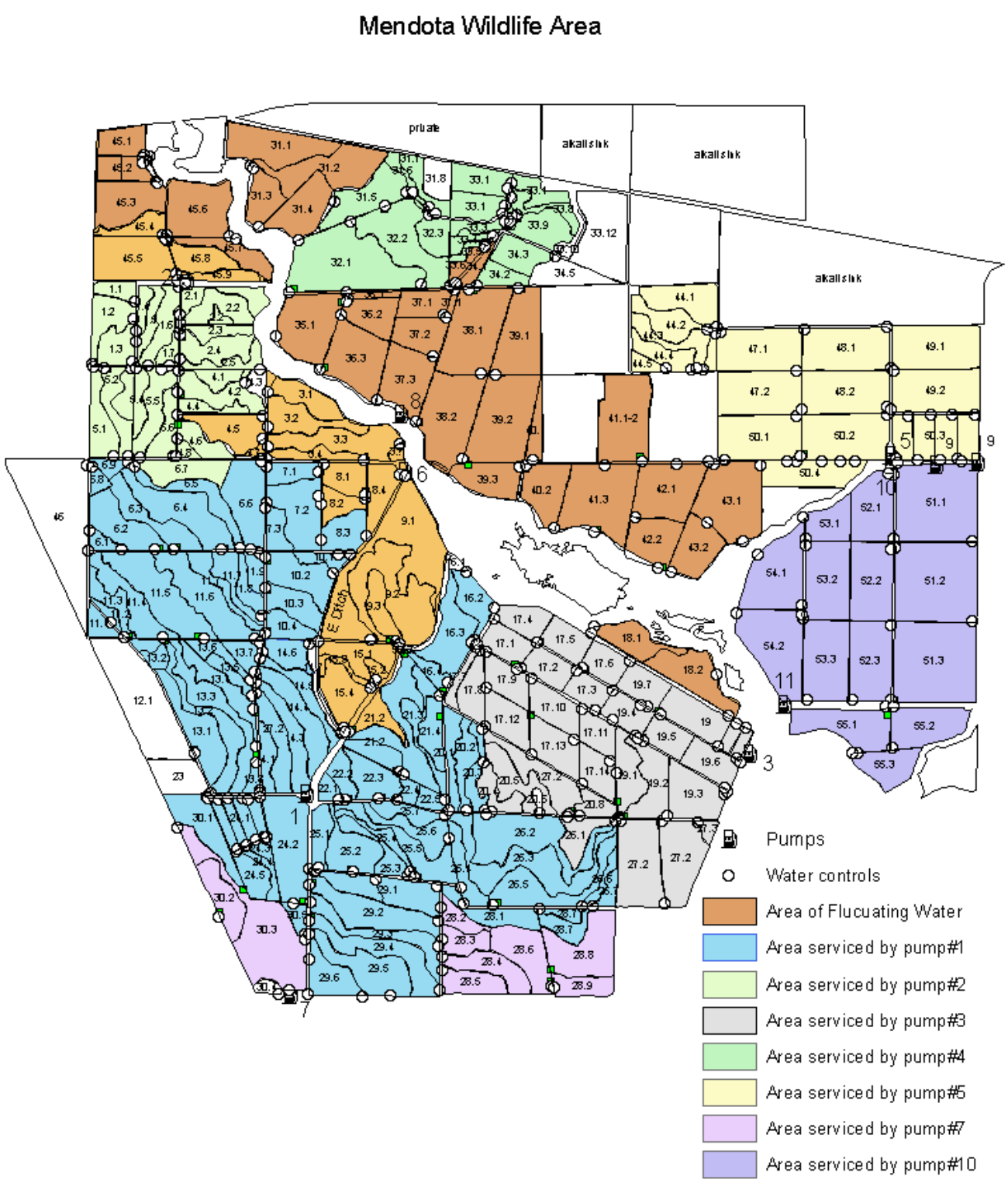

Mendota Wildlife Area
Soils Map
N
0 0.25 0.5 1 1.5 2
Miles
AGNAL CLAY LOAM
CAJON COARSE SANDY LOAM
CAJON LOAMY COARSE SAND
CHINO LOAM
ELNIDO SANDY LOAM
HESPERIA SANDY LOAM
LETHENT SILT LOAM
MERCED CLAY
MERCED CLAY LOAM
POND LOAM
ROSSI CLAY LOAM
ROSSI FINE SANDY LOAM
TACHI CLAY
TEMPLE CLAY
TRAVER FINE SANDY LOAM
TRAVER SANDY LOAM
WATER
WAUKENA FINE SANDY LOAM
WAUKENA LOAM
WOO-URBAN LAND COMPLEX
XEROFLUVENTS
YOKUT LOAM

# MENDOTA WILDLIFE AREA

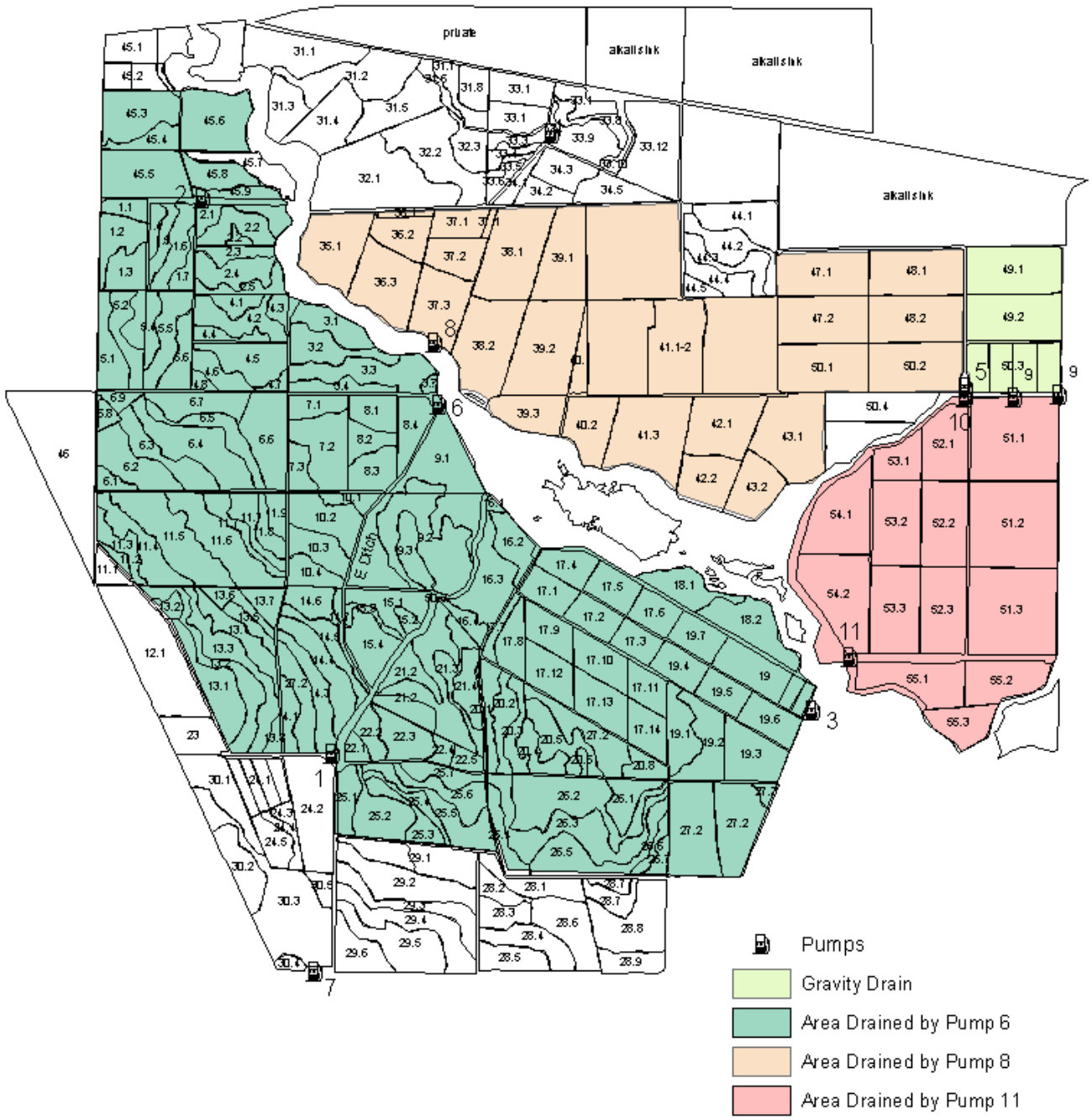
Proposed Moist Soil Wetland Habitat 2010



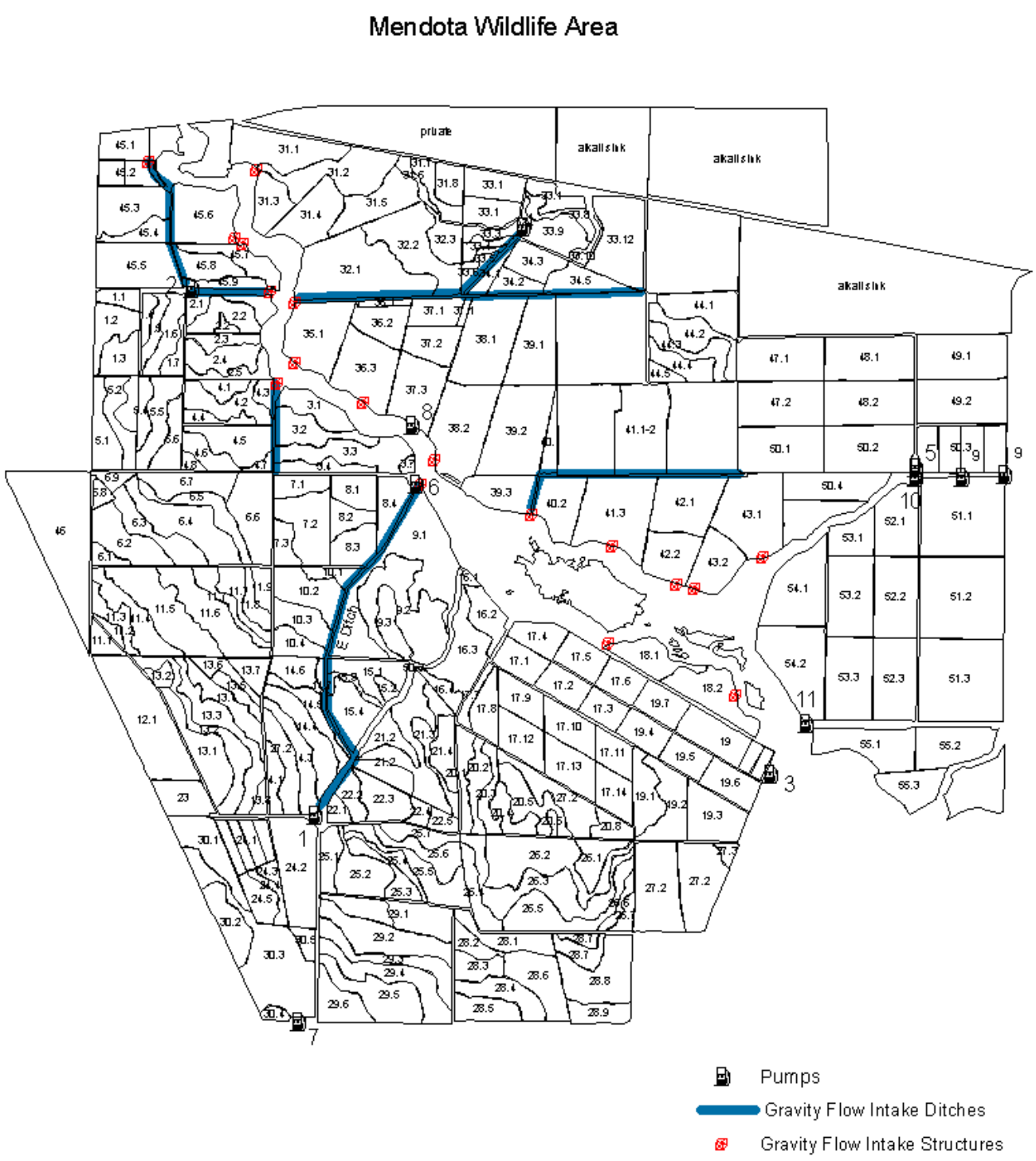
D 1. Figure 2. Internal Flow - Points of Measurement/Pump Sites.



D 1. Figure 3. Internal Flow - Drainage



D 1. Figure 4. Internal Flow - Gravity Intake structures and ditches.
Recirculation System Pump#6, E ditch, Pump#1.



# Mendota Wildlife Area
# Drought Contingency Plan
# March 2007

In the event of reduced water allocations the wildlife area management will be adjusted according to the severity of the water reduction as well as the timing within the water year when the cutback is finalized. Dry year and critically dry year water allocations are based upon the Shasta Lake Index and approximate allocations can be found in Table 1.

Upland Management

Categories of uplands include managed nesting, upland forage, brood habitat, Cereal grain plantings and special ecological communities (Alkali Sink Scrub).

A. Managed Nesting: Typically irrigated in February and July/August.
   Reductions in irrigations will occur with the possibility of February and March irrigations occurring where practicable with drain water from moist soil wetlands.
B. Upland Forage: Typically irrigated June and July
   Most irrigation will be discontinued.
C. Brood Habitat: Irrigated strips from April through August
   Water use will continue with 25% to 40% reduction in acreage.
D. Planted Cereal Grains
   Safflower will be planted and irrigated. Corn, sudan and milo acreage will be reduced by approximately 50%.

Non – irrigated habitats including Alkali Sink Scrub and Fall planted barley will not be affected by reduced water allocations.

Wetland Management

Wetland habitats include moist soil wetlands (swamp timothy, watergrass, and smartweed), permanent wetlands, reverse cycle wetlands, and semi-permanent wetlands.

A. Moist Soil wetlands: Initial fall flooding can begin from August through November, drawdown occurs from February through April.
   Spring and summer irrigation of watergrass and smartweed would be reduced dependant upon percent germination of desired vegetation within the designated fields. Refer to the Drought Contingency Map for field priority for fall floodup based on waterbird use and water holding capability.
B. Permanent wetlands: Flooded year round. No change in management.
C. Reverse cycle wetlands: flooded March through August.
   Possible reduction in acreage based on habitat quality.
D. Semi-permanent Wetlands: Flooded September through July
   Reduced acreage flooded through the spring/summer based on quality of habitat and occurrence of nesting colonies of waterbirds, particularly white-faced ibis.

Table 1. Water Schedules

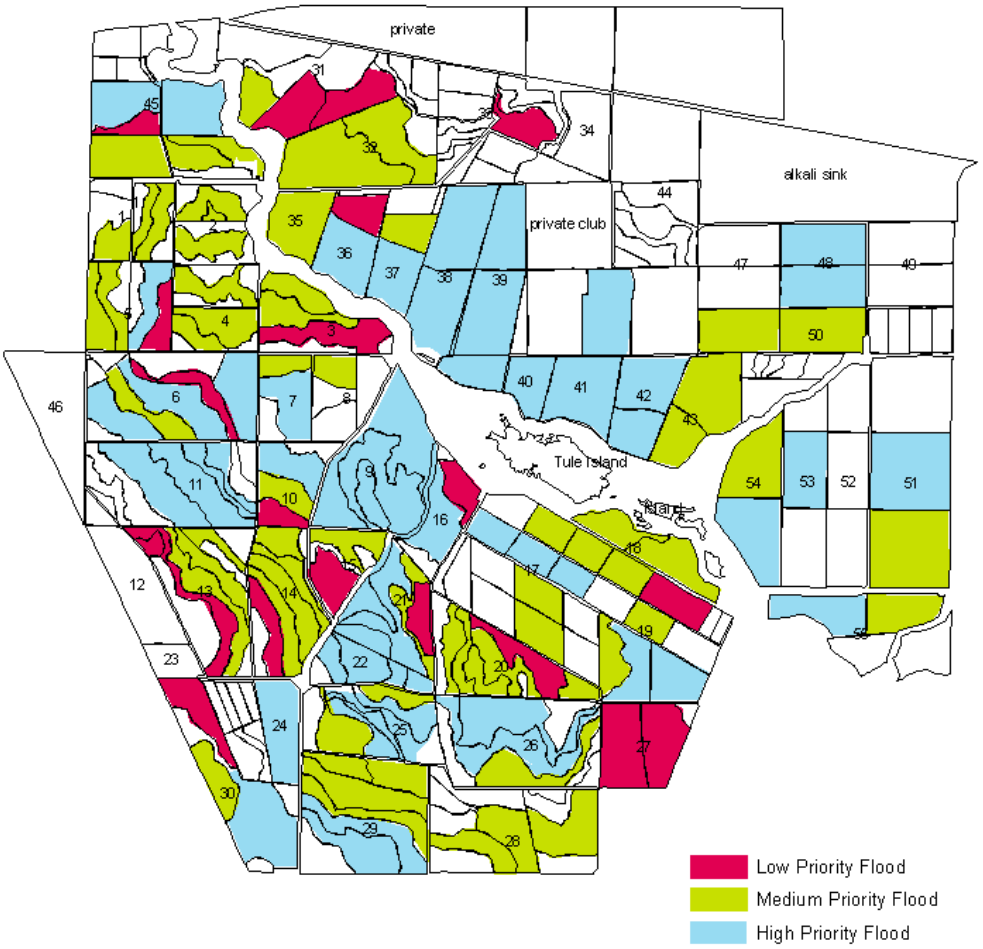
| Mendota Wildlife Area | | | |
|---|---|---|---|
| | Normal Year Contracted Allocation Level 2 | Dry Year 25% Reduction Excluding Riparian and Mitigation | Critically Dry Year 25% reduction |
| March | 500 | 50 | 200 |
| April | 600 | 200 | 500 |
| May | 1800 | 1400 | 700 |
| June | 2500 | 2200 | 2000 |
| July | 2500 | 2200 | 2000 |
| August | 2700 | 2200 | 4800 |
| September | 5300 | 4800 | 5500 |
| October | 5400 | 5500 | 2000 |
| November | 2700 | 2000 | 2000 |
| December | 900 | 450 | 550 |
| January | 1342 | 592 | 345 |
| February | 1352 | 469 | 100 |
| | 27,593 AF | 22,060 AF | 20,695 AF |

Dry years vs. critically dry years based on Shasta Lake index.

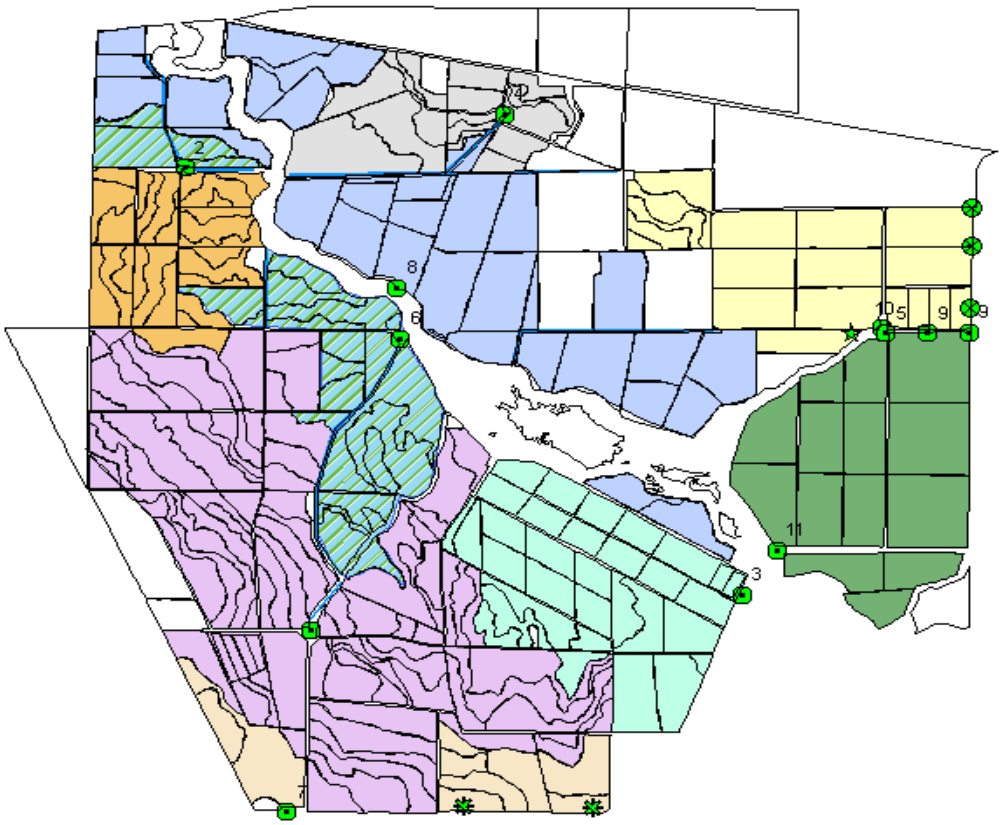
The preceding water use includes pumped water and gravity flow (un-metered), except the un-metered water used on portions of the east side of the Wildlife Area between October and March. This un-metered water technically becomes part of the Mendota Pool and is not charged against the Wildlife Area water allotment.

MENDOTA WILDLIFE AREA

Drought Contingency Plan



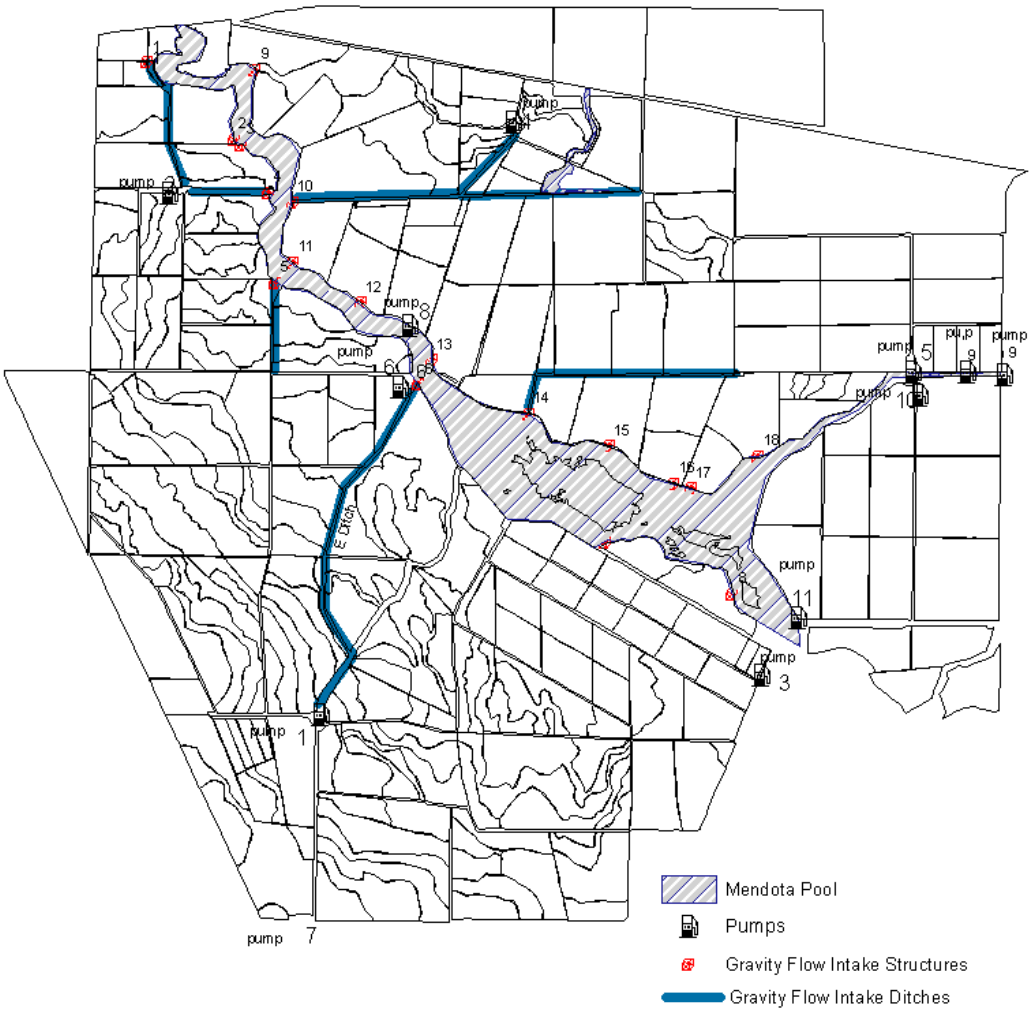
MENDOTA WILDLIFE AREA




**Legend**

- PUMPS
- Traction Wells
- Beck's Well
- 28 Wells
- gravity flow intake ditch
- area of flucuating water
- gravity flow
- Area serviced by Pump#1
- Area serviced by pump#2
- Area serviced by pump#3
- Area serviced by pump#4
- Area serviced by pump#5
- Area serviced by pump#7
- Area serviced by pump#10

Mendota Wildlife Area



**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.**

***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 (define) (acre-feet) | Total (acre-feet) |
|---|---|---|---|---|---|---|---|
| **Method** | **M1** | | | | | | |
| **Jan-2010** | 837 | 0 | 0 | 0 | 0 | 0 | **837** |
| **February** | 1720 | 0 | 0 | 0 | 0 | 0 | **1,720** |
| **Mar-2009** | 527 | 0 | 0 | 0 | 0 | 0 | **527** |
| **April** | 925 | 0 | 0 | 0 | 0 | 0 | **925** |
| **May** | 1470 | 0 | 0 | 0 | 0 | 0 | **1,470** |
| **June** | 2303 | 0 | 0 | 0 | 0 | 0 | **2,303** |
| **July** | 2341 | 0 | 0 | 0 | 0 | 0 | **2,341** |
| **August** | 1545 | 0 | 0 | 0 | 0 | 0 | **1,545** |
| **September** | 5051 | 0 | 0 | 0 | 0 | 0 | **5,051** |
| **October** | 6063 | 0 | 0 | 0 | 0 | 0 | **6,063** |
| **November** | 4109 | 0 | 0 | 0 | 0 | 0 | **4,109** |
| **December** | 79 | 0 | 0 | 0 | 0 | 0 | **79** |
| **TOTAL** | **26,970** | **0** | **0** | **0** | **0** | **0** | **26,970** |

***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** | 184,800 | 10 | 1,848,000 | 23.83 | 212.76 | 1,000 | 0 | E1 | **(1,189)** |
| | | | 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** |
| | | | 0 | 0.00 | 0.00 | | | | **0** |
| | | | 0 | 0.00 | 0.00 | | | | **0** |
| **TOTAL** | **184,800** | | **1,848,000** | **24** | **213** | **1,000** | **0** | | **(1,189)** |
| | | | **42** | **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 | 2,658 | 5.00 | 4.00 | 10,632 | 0.52 | 0.00 | 1.75 | 0.00 | 0.35 |
| Seasonal wetlands: smartweed | 1,020 | 6.00 | 2.50 | 2,550 | 0.52 | 0.00 | 1.75 | 0.00 | 0.35 |
| Seasonal wetlands: watergrass | 1,169 | 8.00 | 4.00 | 4,676 | 0.52 | 0.00 | 1.75 | 0.00 | 0.35 |
| Permanent wetlands | 1,047 | 12.00 | 6.00 | 6,282 | 0.56 | 0.00 | 5.02 | 0.00 | 0.50 |
| Semi-perm wetlands/brood pond | 346 | 10.00 | 4.50 | 1,557 | 0.56 | 0.00 | 1.75 | 0.00 | 0.50 |
| Riparian | 80 | 12.00 | 5.00 | 400 | 0.56 | 0.00 | 5.02 | 0.00 | 0.00 |
| Irrigated pasture | 1,465 | 3.00 | 2.50 | 3,663 | 0.06 | 0.00 | 4.15 | 0.00 | 0.20 |
| Upland | 861 | 2.00 | 3.00 | 2,583 | 0.06 | 0.00 | 4.15 | 0.00 | 0.10 |
| (define) | | | | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| (define) | | | | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Total Habitat Acres** | **8,646** | **6.00** | **3.74** | **32,343** | | | | | |

***Table 4***

***Refuge Water Inventory***

| Year | 2010 | Reference | | |
|---|---|---|---|---|
| **Total Water Supply** | | **Table 1** | | 26,970 |
| **Precipitation** | | **Table 2** | **plus** | 24 |
| **Evaporation** | | **Table 2** | **minus** | 213 |
| **Seepage** | | **Table 2** | **minus** | 1,000 |
| **Operational Losses** | | **Table 2** | **minus** | 0 |
| | | **Deliveries to Managed Lands** | | 25,781 |
| **Managed Land needs** | | **Table 3** | **minus** | 51,863 |
| **Difference** | | **(calculated)** | | (26,082) |
| | | **Balance (outflow?) (Table 3)** | | 8,681 |
| | | **Water Inventory Balance** | | (17,401) |

*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) | other (define) (acre-feet) | Total (acre-feet) |
|---|---|---|---|---|---|---|---|
| **2001** | 27,480 | 0 | 0 | 0 | 0 | 0 | **27,480** |
| **2002** | 27,400 | 1,057 | 0 | 0 | 0 | 0 | **28,457** |
| **2003** | 27,583 | 200 | 0 | 0 | 0 | 0 | **27,783** |
| **2004** | 27,834 | 0 | 0 | 0 | 0 | 0 | **27,834** |
| **2005** | 24,435 | 0 | 0 | 0 | 0 | 0 | **24,435** |
| **2006** | 24,969 | 0 | 0 | 0 | 0 | 0 | **24,969** |
| **2007** | 26,895 | 0 | 0 | 0 | 0 | 0 | **26,895** |
| **2008** | 27,593 | 0 | 0 | 0 | 0 | 0 | **27,593** |
| **2009** | 27,080 | 0 | 0 | 0 | 0 | 0 | **27,080** |
| **2010** | 26,970 | 0 | 0 | 0 | 0 | 0 | **26,970** |
| **Total** | **268,239** | **1,257** | **0** | **0** | **0** | **0** | **269,496** |
| **Average** | **26,824** | **126** | **0** | **0** | **0** | **0** | **26,950** |