CHAPTER II

Need for Action

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
MID-PACIFIC REGION

C-067619

CHAPTER II

NEED FOR ACTION

A. INTRODUCTION

Waterfowl migration remains one of the marvels of nature. Twice each year, for millennia, millions of ducks and geese have flown from one end of the North American continent to the other following the same routes each year. The Central Valley lies at the southerly end of the Pacific Flyway migratory route, and in presettlement times, the valley's vast marshes and dense stands of tules and riparian vegetation provided ideal wintering habitat and attracted large numbers of waterfowl.

Today, most of the marshlands are gone, due to land conversion to other uses. The birds, however, continue to fly their ancient routes and crowd into the remaining habitat to rest, feed, and nest. Since the turn of the century the numbers of ducks and geese wintering in California has plummeted and the loss of wetlands has been a significant factor in the decline. As waterfowl habitat has been modified, Federal and State fish and wildlife agencies, private organizations and duck clubs have developed several managed areas for waterfowl and other wildlife by establishing National Wildlife Refuges, State Wildlife Management Areas, conservation areas and duck clubs. Despite extensive research conducted by Federal, State and private entities, existing data are insufficient to completely quantify the relationship between waterfowl and habitat. The following key information relative to waterfowl is known:

1. Waterfowl populations in the Central Valley are below historical levels for most species.

2. Winter habitat can influence the distribution and abundance of wintering waterfowl.

3. Existing habitat can be enhanced.

4. The condition of waterfowl returning from wintering grounds can influence reproductive capability.

At the present time an opportunity exists to preserve and enhance wildlife use in the Central Valley. As part of its water contracting Environmental Impact Statements currently underway, Reclamation is assessing the impacts of long-term contracts for the remaining uncommitted yield of the Central Valley Project. Reclamation is evaluating the effects of offering sufficient water to meet reasonable needs for wildlife refuges and wetlands. Following completion of the Refuge Water Supply Study and the

Water Contracting Environmental Statements, Congress will have the opportunity to develop necessary legislation and/or provide opportunities for refuge water supplies.

This chapter addresses the existing conditions in the Central Valley--water shortages, diminishing habitat, and related problems--that are known to threaten the maintenance of the Pacific Flyway migratory route, shown on Figure II-1. These needs reflect the data gathered as part of this study and represent a consensus among the biologists contacted within various agencies, and organizations involved in waterfowl management.

B. IMPORTANCE OF THE CENTRAL VALLEY TO THE PACIFIC FLYWAY

Waterfowl migration to the Central Valley begins in August with the arrival of the first birds from the north. The number of wintering waterfowl rapidly increases over the late summer and fall and by late December from three to five million ducks and geese have migrated to the valley from their winter sojourn. In addition, the Central Valley provides migration habitat for 1.3 million more which winter in Mexico.

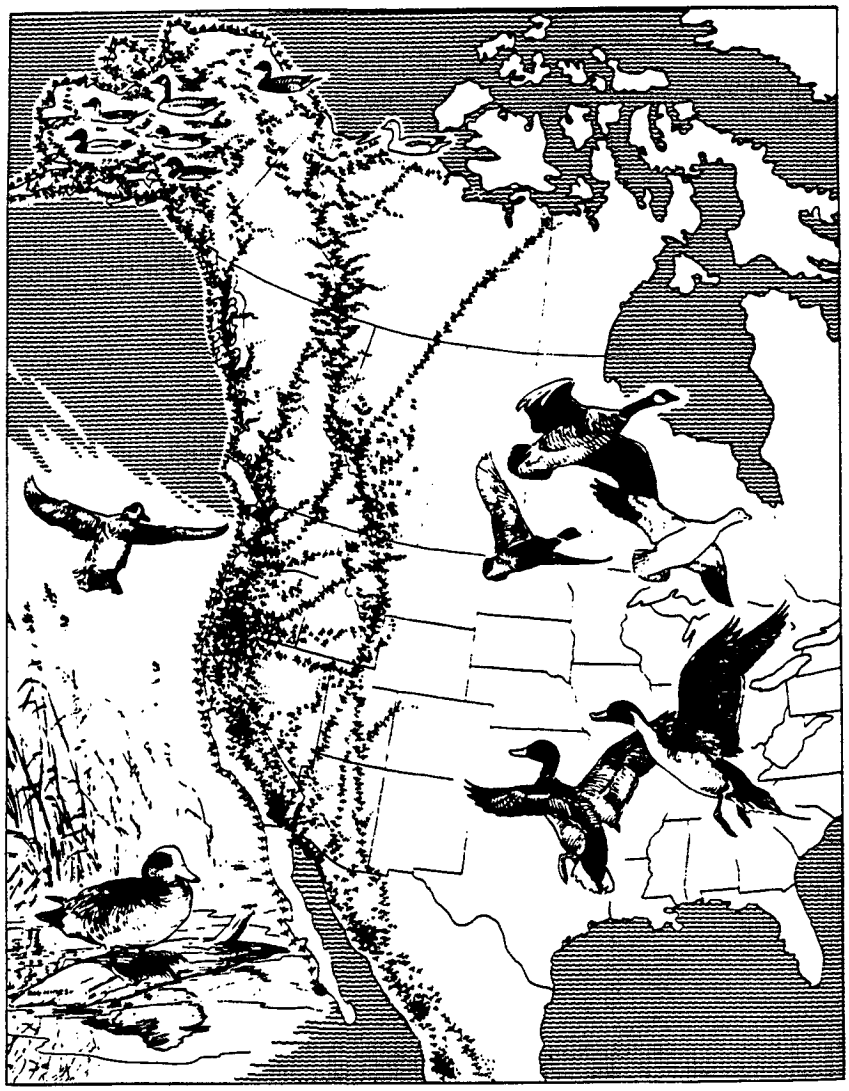
As shown on Figure II-2, the Central Valley is critical to the Pacific Flyway. Central Valley migrants represent about 15- to 20-percent of the total continental wintering waterfowl population and about 60-Percent of the Pacific Flyway's waterfowl. Altogether, nearly 10- to 12-million waterfowl along with millions of other water-related birds annually winter in or pass through California's Central Valley (Gilmer et al., 1982). Many waterfowl migrate through the Valley en route to Mexico.

Maintenance of the Pacific Flyway for waterfowl depends largely on maintaining critical wetland wintering habitat in the Central Valley, about one-third of which is comprised of Federal and State wildlife areas. The Service ranks Central Valley wetland habitat as one of the top five habitats on the priority scale for the countries of U.S. and Canada.

C. CENTRAL VALLEY WATERFOWL

The Central Valley of California has traditionally served as a major wintering ground for millions of migratory birds. Fall flights of waterfowl, shore birds, raptors and passeries return annually to the wetland, riparian and grassland habitats of the valley.

Each year in early August the first flight of ducks from the northern breeding grounds begin arriving in the Central Valley. Substantial members of some species, including over 90-percent of California's wintering mallard duck population, are bred in California. Populations increase through fall and by late December peak near 5 million birds as shown in Figure II-3.



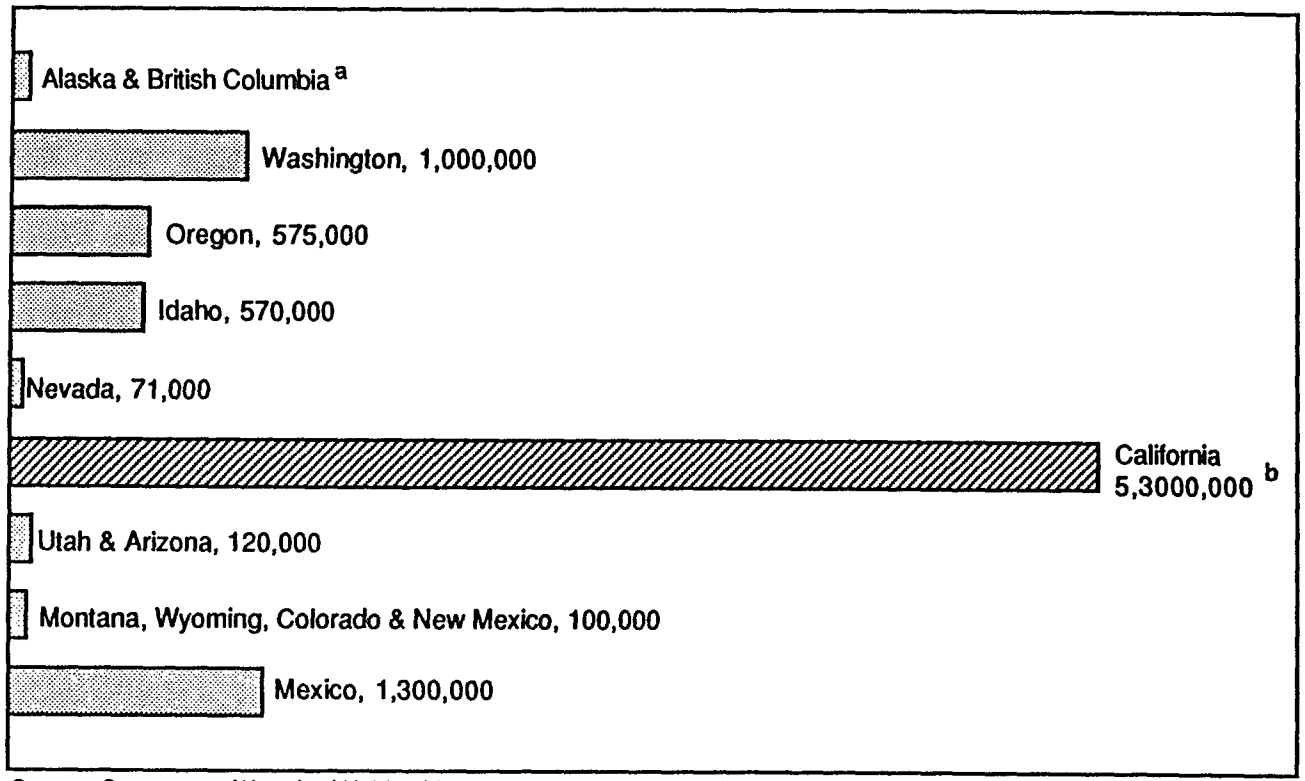
Courtesy of Fish & Wildlife Service

PACIFIC FLYWAY

The migration of waterfowl remains one of the marvels of Nature. Twice each year millions of ducks and geese fly from one end of the North American continent to the other, following the same routes each year. These migration routes are known as flyways, which are defined as definite geographic regions with breeding grounds in the south and a system of migration routes between the two. There are four such flyways on the North American continent, each with its own population of ducks, geese, and other migratory birds.

The Pacific Flyway is the westernmost flyway and encompasses territory in three countries: northern and western Canada, Alaska and all states west of the Rocky Mountains in the United States, and western Mexico. Management of the flyway is governed by international treaties among the United States, Canada, Mexico, and Japan.

FIGURE II-1



Source: Sacramento Waterfowl Habitat Management Committee, undated

[a] Survey data incomplete
[b] The Sacramento Valley accounts for 56% of this total, or about 2,870,000 birds

FIGURE II-2

WINTERING WATERFOWL POPULATIONS FOR STATES AND COUNTRIES OF THE PACIFIC FLYWAY, 28-YEAR AVERAGE, 1954 TO 1981

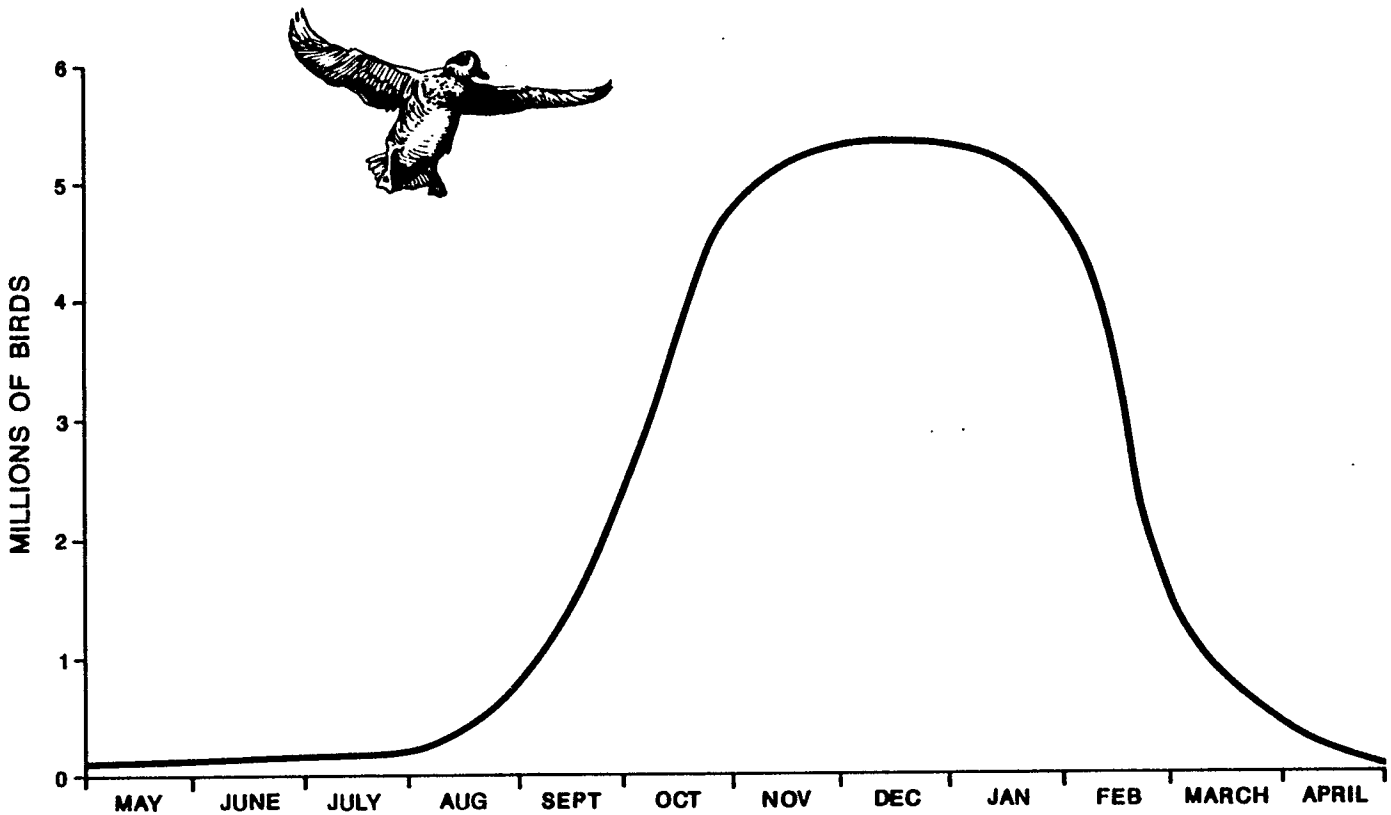


FIGURE II-3

APPROXIMATE PERIOD OF WATERFOWL USE IN THE CENTRAL VALLEY

Waterfowl most common in the Central Valley are listed on Table II-1. Based on midwinter surveys (Pacific Flyway Study Committee, 1972-1981), a large percentage of the Pacific Flyway waterfowl population winters here. Major species include tundra swan (69%), Greater white-fronted geese (90%), cackling Canada geese (84%), pintails (76%), mallards (25%), northern shovelers (77%), greenwinged teal (47%), American widgeon (62%), gadwalls (50%), wood ducks (93%), and canvasbacks (44%). The entire continental population of tule white-fronted geese, endangered Aleutian Canada geese and all but a fraction of Ross' geese winter in the Central Valley. Altogether, about 60% of the Pacific Flyway waterfowl population and 18% of the continental population winters in the Valley.

In recent years Pacific Flyway waterfowl numbers have declined. About 3.6-million ducks were counted in the Pacific Flyway in 1987 (Pacific Flyway Midwinter Waterfowl Survey--1987), which is the lowest population index since coverage was comparable in 1955. The latest index is 12% below 1986 and 9% fewer than the previous record low index of 1985. The 1987 index is 40% below the 10-year average and 43% below the 32-year average. In number of ducks, the loss has been greatest in California.

The Aleutian Canada goose is listed as a Federal endangered species because of its restricted breeding range and low numbers. Currently, nesting occurs only on a limited number of the Aleutian Islands of Alaska. The Aleutian Canada goose's breeding range was more extensive until Russian, and later, American trappers introduced artic foxes to the nesting islands. Extensive recovery efforts are under way to increase population levels by removing foxes from former nesting islands, protecting known staging and migration areas, and implementing hunting closures. Parts of the Colusa, Butte, and San Joaquin Basins are closed to hunting of all Canada geese at varying times to protect the Aleutians. If breeding populations are successfully established on several more of the Islands and a sustaining population is achieved, this subspecies may be transferred to the threatened category and eventually taken off the endangered list.

The tule white-fronted goose is known with certainty to winter only in the Central Valley of California, the three small areas where the goose is known to winter are the Butte Creek Basin near Marysville, the Sacramento National Wildlife Refuge Complex near Willows, and the Suisun Marsh near Fairfield.

White-Fronted and Ross' geese arrive in California in Mid-October. By November they have moved to the Sacramento Valley relying on the existing refuges for loafing areas. The bulk of the Ross' geese move on in December to the San Joaquin Valley, centering on Merced National Wildlife Refuge. In March the geese head back to the Sacramento Valley en route to arctic breeding grounds in Canada.

TABLE II-1

MAJOR CENTRAL VALLEY WATERFOWL SPECIES

Coot

American (Fulica americana)

Ducks

Bufflead (Bucephala albeola)
Canvasback (Aythya valisineria)
Gadwall (Anas strepera)
Goldeneye, Common (Bucephala clangula)
Mallard (Anas platyrhynchos)
Merganser
- Common (Mergus merganser)
- Hooded (Lophodytes cucullatus)
- Red-breasted (Mergus serrator)

Pintail, Northern (Anas acuta)
Redhead (Aythya americana)
Ring-necked Duck (Aythya collaris)
Ruddy Duck (Oxyura jamaicensis)
Scaup:
- Greater (Aythya marila)
- Lesser (Aythya affinis)

Shoveler, Northern (Anas clypeata)
Teal:
- Cinnamon (Anas cyanoptera)
- Green-winged (Anas crecca)

Wigeon, American (Anas americana)
Wood Duck (Aix sponsa)

Geese

Canada (Branta canadensis)(a)
Greater white-fronted (Anser albifrons)
Ross' (Chen rossii)
Snow, Lesser (Chen caerulescens)
Swan

Tundra (Cygnus columbianus)

(a) The Aleutian Canada goose is classified as an endangered species. Almost the entire population of this species is believed to winter in the Central Valley. The cackling Canada goose is another unique subspecies whose populations have declined to relatively low levels and are now possibly imperiled.

In addition to waterfowl, millions of other water-related birds annually winter in or pass through the Valley. These birds originate in breeding habitats primarily in Alaska and the provinces and territories of western Canada.

There are direct benefits to many species of raptors such as the north harrier, swainsons, sharp-shinned and red-tailed hawks. Another species such as the bald eagle (Federal endangered) periodically visits Valley refuges to feed and rest. Modoc National Wildlife Refuge often has numerous golden and bald eagles that spend their winters on the refuge feeding on sick and crippled waterfowl. The greater sandhill crane (State threatened) relies on refuges in the Valley for feeding and sanctuary. Several refuges (Kern, Pixley, Modoc, Merced, San Luis) manage specific areas for this species. Central Valley waterfowl biology is discussed in greater detail in Attachment B.

D. RELATIONSHIP OF WATERFOWL TO WINTER HABITAT

The Pacific Flyway is unlike the other three North American flyways in that most wintering waterfowl are concentrated in the relatively small area of the Central Valley. The significance of wintering habitat has been increasingly recognized by research. Some waterfowl can occupy their wintering habitat for as long as eight months of the year, and many biologists believe that wintering habitat could be the single most important limiting factor for Pacific Flyway waterfowl. To accurately determine the relationship of waterfowl to winter habitat, however, one must understand the factors that most limit waterfowl populations. Unfortunately, the effects of specific habitat components on waterfowl abundance and distribution are not yet well understood. While it is certain that the quantity and quality of wintering habitat can significantly influence the distribution and abundance of waterfowl, the degree which it does so is difficult to demonstrate quantitatively.

An ideal habitat fulfills all of a species' requirements: providing a balance of the food, shelter, water, and sanctuary which it needs to survive. The lack of any essential component can decrease a species' survival or decrease its reproductive success. Either factor can limit its population. Conversion of wetlands to other uses, inadequate water supplies and changing agricultural practices are factors believed to be most limiting to waterfowl habitat. Water quality, disease, and food stress are factors believed to affect habitat quality. Many of these factors are interrelated and changing one factor will affect the others.

It is uncertain which winter habitat variable--food, cover, distribution, or sanctuary--most limits population levels (Figure II-4). Habitat conditions influence the mortality and physical state of waterfowl surviving the winter. The number and condition of the survivors in turn determine their breeding success.

Impacts of Agricultural Practices

Various factors such as improved water management techniques and increased knowledge of plant and soil sciences have encouraged the transformation of land from mixed vegetation to monocultures in the production of commercial crops. Crop production has become more efficient thus reducing the amount of crops left in the fields which in the past has provided food for waterfowl.

E. SIGNIFICANCE OF WETLANDS

Waterfowl wintering in the Central Valley moves among the wetlands of the Sacramento and San Joaquin Valleys, the Delta, and the Suisun Marsh in response to weather changes, water conditions and food availability. Waterfowl distribution and movement patterns are largely predictable and change only during very wet years, when the amount of habitat increases significantly because of flooding and ponding on agricultural lands and in flood bypasses.

Wetlands are among the most productive of all biological systems and their value cannot be overestimated (Odum, 1971). Destruction or lack of wetland habitat results in direct losses of species within the wetland itself and ultimately losses of species that normally forage in wetlands. Wetlands provide necessary habitat for many rare and endangered animal and plant species. More than half of all areas identified as critical habitat under provisions of the Federal Endangered Species Act involve weltand areas. In California, 55 percent of animal species designated as State threatened or endangered depend on wetland habitats for their survival.

Wetlands play an important role in flood control and groundwater recharge, improving water quality, and providing a multitude of recreational opportunities.

Laser field leveling is an example of a change in agricultural practices that has affected the quantity and quality of waterfowl habitat. Poorly leveled fields contain many small levees with vegetation for food and shelter, deep and shallow water, dry spots, and open water areas. These characteristics allow other water plants to grow with the rice and provide habitat diversity. The water plants, waste grain, and weed seeds provide food for waterfowl. In contrast, laser land leveling for rice and other field crops allows uniform application of water and rapid drain-

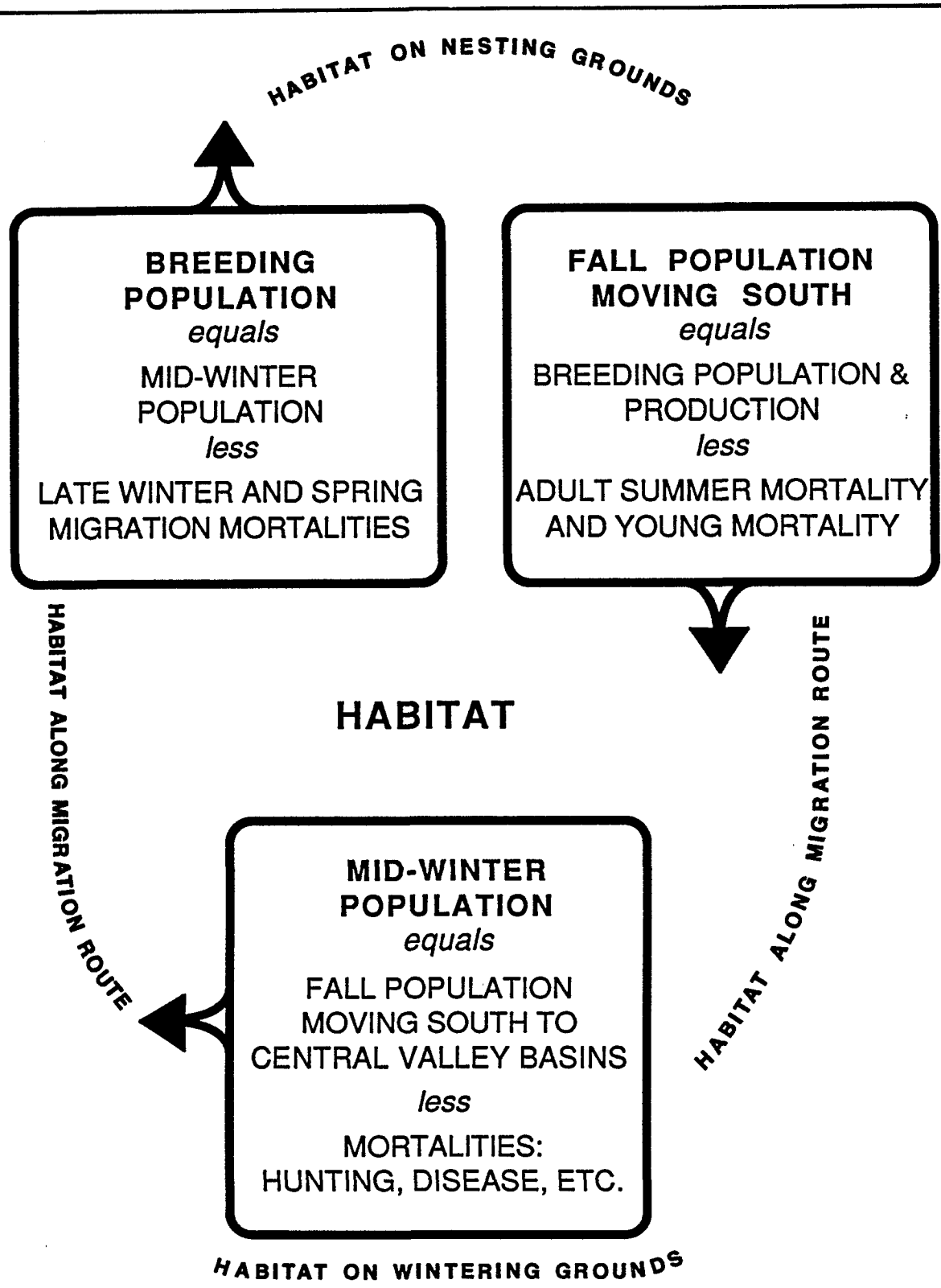


FIGURE II-4

FLOW DIAGRAM SHOWING HOW DIFFERENT LIMITING FACTORS AFFECT PACIFIC FLYWAY WATERFOWL POPULATION

ing of the field without ponding. The rapid drainage reduces smartweed, millet, sedges, rumex, and similar water plants that are used as waterfowl food. Land leveling also reduces the number of levees which support habitat for food and cover.

Historical Loss of Wetlands

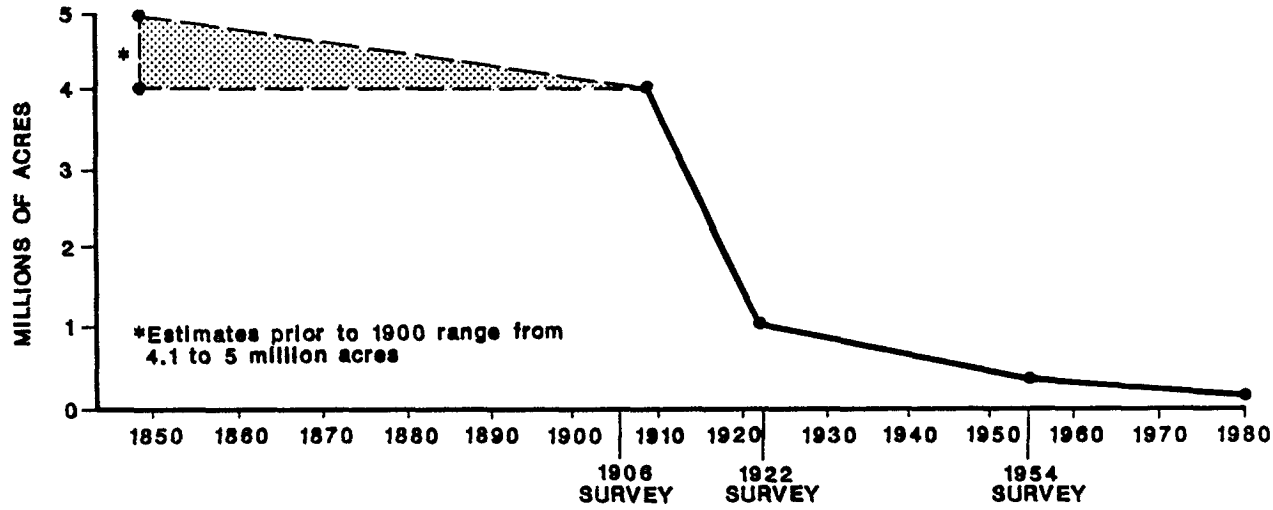
Before the intensive European settlement of California in the 1800's, much of the Central Valley was subject to annual or periodic overflow caused by winter, spring, and early summer run-off and by floodwaters from the Sacramento and San Joaquin Rivers and their tributaries. Depending on the time of year, flooding frequently turned parts of the valley into an inland sea, as the waters moved slowly toward the Delta.

These seasonal marshes resulted in the growth of dense stands of tules over large areas of the flood plain. Adjacent lands that were not under water as frequently or were well drained, supported stands of riparian woodlands. Areas of shallow or poor soils supported annual and perennial grasses and forbs. It is estimated that seasonal or permanent marshes or wetlands comprised about 4 million acres of valley lands and provided a haven to waterfowl migrating south for the winter. Wetlands lost since the 1850's are shown in Figure II-5, and a comparison of the current distribution of wetlands to those of the late 1860's on Figure II-6. The discovery of gold in 1849 and the subsequent influx of immigrants into the State brought dramatic changes in the valley's landscape. No habitat was more altered than the wetlands, which were significantly reduced as the Central Valley became more densely populated and flood control and agricultural development became the principal concerns of valley residents. Major factors responsible for the loss of wetlands have been: (1) the construction of thousands of miles of flood control levees and the subsequent conversion of natural wetlands to agricultural production and urban development; (2) the dredging and filling of estuarine habitat for urban, industrial, and port development; (3) construction of flood control and water storage reservoirs; and (4) the channelization of thousands of miles of natural waterways.

Today, many of the remaining wetlands and associated fish and wildlife resources are being degraded by pollutants such as persistent pesticides, heavy metals, and toxic chemicals from urban, industrial, and agricultural sources and petrochemical spills from land based facilities, ships, and pleasure craft. Still other wetlands are degraded because of increasing salinity and the lack of adequate water supplies at appropriate times of the year.

As shown in Figure II-5, the greatest loss occurred between 1906 and 1922, when approximately 2.5 million acres of wetlands were lost to levees, bypass channels, dams, towns, and croplands.

1850 - 4.1-5.0 MILLION ACRES OF WETLANDS
1906 - 3.7 MILLION ACRES OF WETLANDS
1922 - 1.2 MILLION ACRES OF WETLANDS
1954 - 482,000 ACRES OF WETLANDS
PRESENT - 300,000 ACRES OF WETLANDS



SOURCE: U.S. FISH AND WILDLIFE SERVICE
CONCEPT PLAN FOR WATERFOWL WINTERING
HABITAT PRESERVATION (MAY 1978)

FIGURE II-5

HISTORICAL LOSSES OF WETLANDS IN CALIFORNIA

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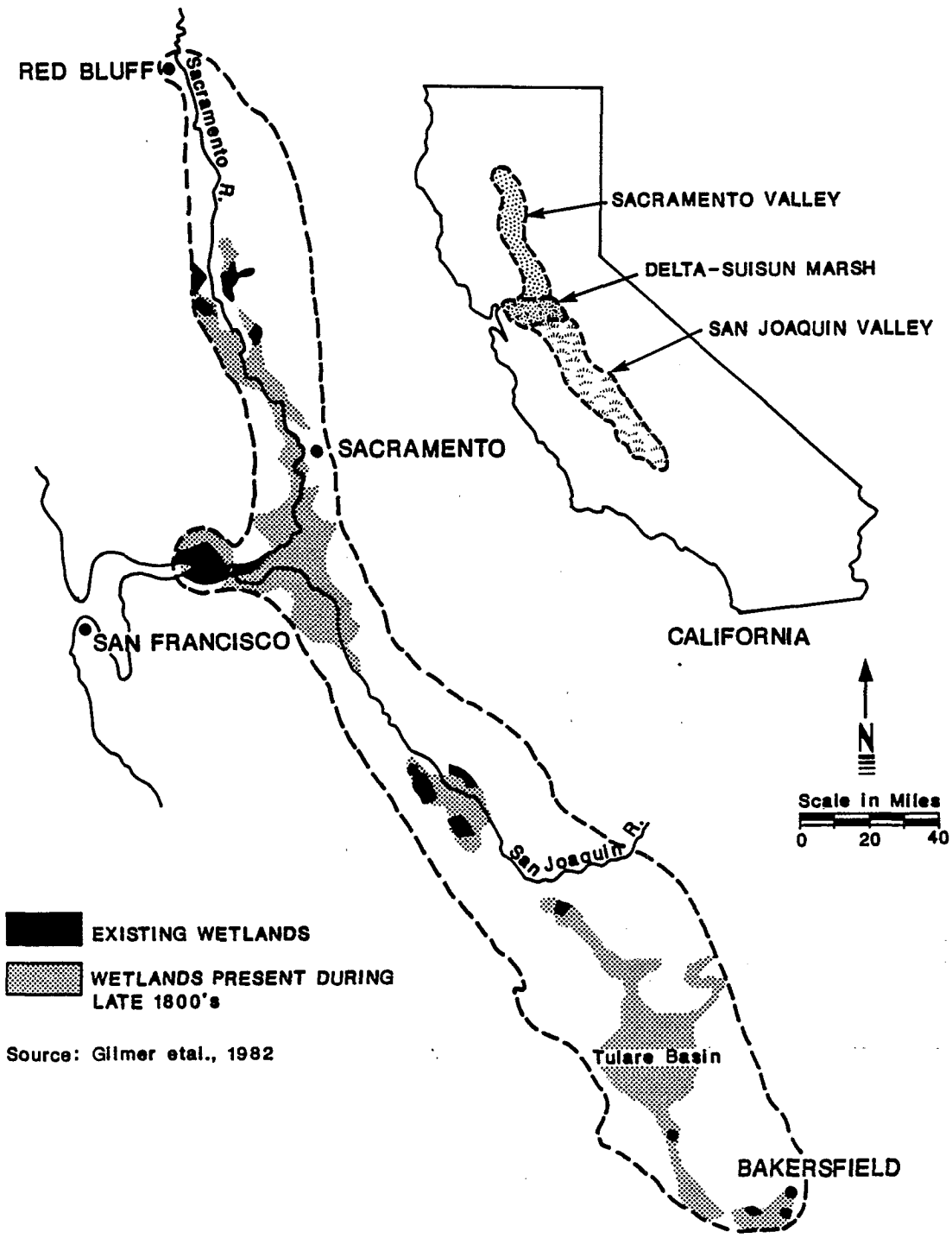

FIGURE II-6

CURRENT DISTRIBUTION OF WETLANDS COMPARED WITH LATE 1880'S

Reduced habitat and a drought in the breeding grounds during the late 1920's and early 1930's resulted in a large reduction in the number of waterfowl in the Central Valley. Extensive crop damage occurred when the birds turned to grain fields and pastures for food. To alleviate crop damage and increase waterfowl numbers, the Department of Fish and Game established the first Waterfowl Management Area in 1929. The first National Wildlife Refuge was established in 1937.

Today only about 300,000 acres of the original acreage remains. About two-thirds is in private ownership, the remaining third is owned by the Federal and State Governments as National Wildlife Refuges and Wildlife Management Areas.

Collectively, the ten Federal National Wildlife Refuges and four State Wildlife Management Areas investigated in this study total 83,936 acres.

Other Habitat

In addition to wetlands, waterfowl habitat includes riparian vegetation. The single most important role for these areas is to provide wintering habitat. Riparian woodlands provide nesting habitat, cover, and food areas for ducks, especially wood ducks. As with wetlands, the historical acreages of riparian woodlands have been reduced to 10- to 15-percent of the original acreages. To benefit waterfowl, the riparian vegetation cannot be located far distances away the wetlands.

F. WATER NEEDS

At the present time, approximately one percent of the total applied fresh water in California is used for wildlife areas. The water used to flood ponds, create marshes, irrigate crops used for waterfowl, and maintain water in ponds and marshes. The majority of the water must be delivered in the fall and winter months to provide initial water and circulation water for wintering habitat. The balance is applied during the growing season to produce waterfowl food plants. If adequate water is not available, feed crops cannot be irrigated and waterfowl are crowded onto smaller areas. Stressful conditions lead to major outbreaks of waterfowl diseases, such as avian botulism and fowl cholera.

Dependable supplies of good quality water are necessary to preserve and increase wetlands and are vital to implementing a managed wetland concept. At the present time, inadequate water supply is a major factor limiting the quantity and quality of Central Valley waterfowl habitat and is a principal problem for the wildlife areas evaluated in this report. None of the refuges

evaluated receive, on a yearly basis, the quantity of water required to operate optimally as determined by the Service and DFG; 8 of the 15 wetland areas studied have no existing dependable supply of water. Estimated annual water requirements at full development for these areas are shown in Figure II-7.

As demands for freshwater increase throughout the Central Valley, the historical supplies of surface water, groundwater, and agricultural return flow, are diminishing. The increasing cost of irrigation water is causing farmers to use their available supplies more carefully. This water conservation results in reduced availability of drain water and water of lower quality. Where such lower quality drain water is used as a wetland water supply, problems have developed. Poor quality agricultural return flows further constrain the use of this supply, and in some areas is no longer considered an acceptable supply source. To supplement surface water supplies, groundwater is available for irrigation in the Sacramento Valley refuges and several San Joaquin Valley refuges. However, groundwater overdraft exists in most of the San Joaquin and Tulare Basins, and the subsequent lowering groundwater tables and deteriorating water quality further aggravate the water supply problem.

Although groundwater is generally not sufficient to provide the entire amount of refuge water, it could provide a supplemental supply as part of a conjunctive use program. A conjunctive use program is the joint management of surface water and groundwater supplies. These programs are developed by determining the water needs, then estimating the safe yield of the aquifer and the amount of surface supplies available. The purpose of a conjunctive use program is to utilize both sources but to avoid overdrafting of the aquifer and reduce the need for additional surface supplies.

Significant increases in total water use for wildlife purposes are not being proposed under the Refuge Water Supply Study. Rather, diminished or deteriorated groundwater or agricultural return flows need to be replaced with dependable water supplies of acceptable quality, delivered at the appropriate time of the year. Four water delivery levels were identified for each refuge as part of this study, as shown on Table II-2. These water delivery levels were used as the basis for evaluation of existing and proposed water supply and conveyance plans, as discussed in Chapter IV of this report.

The difference between full water supply (Level 4) and the existing deficiencies reflected in average annual water deliveries (Level 2) are related to habitat diversity, duration of late winter flooding, brood water, and pond areas. Table II-3 displays the wildlife habitat, bird use days, and public use days under Levels 2 and 4. Bird use days are the total of all migratory waterfowl.

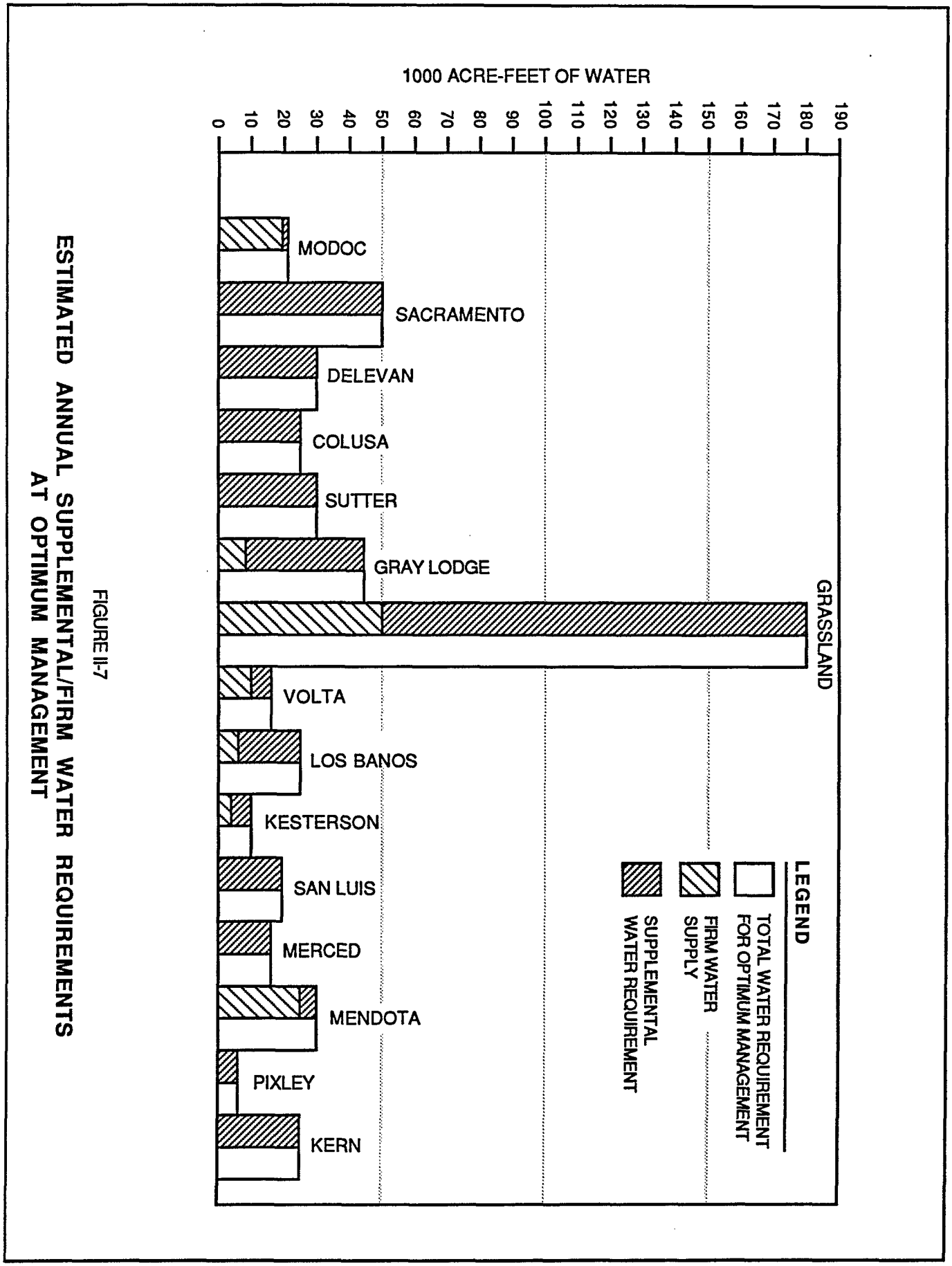

FIGURE II-7

ESTIMATED ANNUAL SUPPLEMENTAL/FIRM WATER REQUIREMENTS AT OPTIMUM MANAGEMENT

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TABLE II-2

REFUGE WATER SUPPLY NEEDS

OCTOBER 31, 1987

Refuge	Level 1 (ac-ft)	Level 2 (ac-ft)	Level 3 (ac-ft)	Level 4 (ac-ft)
A. Modoc	18,550	18,550	19,500	20,550
B. Sacramento	0	46,400	50,000	50,000
C. Delevan	0	20,950	25,000	30,000
D. Colusa	0	25,000	25,000	25,000
E. Sutter	0	23,500	30,000	30,000
F. Gray Lodge	8,000	35,400	41,000	44,000
Total North Area	26,550	169,800	190,500	199,550
G. Grassland	50,000	125,000	180,000	180,000
H. Volta	10,000	10,000	13,000	16,000
I. Los Banos	6,200	16,670	22,500	25,000
J. Kesterson	3,500	3,500	10,000	10,000
K. San Luis	0	13,350	19,000	19,000
L. Merced	0	13,500	16,000	16,000
M. Mendota[a]	24,600	18,900	24,000	29,650
N. Pixley	0	1,280	3,000	6,000
O. Kern	0	9,950	15,050	25,000
Total South Area	94,300	212,150	302,550	326,650
TOTAL	120,885	381,950	493,050	526,200

(a) Water Level 1 needs are shown greater than Level 2. Level 1 needs can not be presently delivered due to limiting water conveyance capacity.

Water Level 1 Current Annual Firm Water

Water Level 2 Current Average Annual Water Deliveries

Water Level 3 Full Use of Existing Developed Lands

Water Level 4 Optimum Management of entire refuge lands.

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TABLE II-3

SUMMARY OF WILDLIFE RESOURCE IMPACTS

Refuge	Water Supply Level 2	Water Supply Level 4
Modoc NWR		
Habitat Acreage	6,181	6,246[a]
Bird Use Days	3,356,500	3,567,500
Public Use Days	14,300	14,300
Sacramento NWR		
Habitat Acreage	7,147	7,225
Bird Use days	63,005,000	64,600,000
Public Use Days	39,900	40,000
Delevan NWR		
Habitat Acreage	3,980	4,740
Bird Use Days	46,848,000	63,430,000
Public Use Days	8,800	8,800
Colusa NWR		
Habitat Acreage	3,356	3,356
Bird Use Days	16,780,000	17,600,000
Public Use Days	7,200	7,200
Sutter NWR		
Habitat Acreage	1,985	2.435
Bird Use Days	9,440,000	10,785,000
Public Use Days	3,600	3,600
Gray Lodge WMA		
Habitat Acreage[b]	8,400	8,400
Bird Use Days	58,300,000	72,300,000
Public Use Days	165,200	191,600[a]
Fishery Days	29,800	37,000
Grassland RCD		
Habitat Acreage[b]	56,000	56,000
Bird Use Days	127,210,000	159,250,000
Public Use Days	95,000	116,000

TABLE II-3 (Continued)

SUMMARY OF WILDLIFE RESOURCE IMPACTS

Refuge	Water Supply Level 2	Water Supply Level 4
Volta WMA		
Habitat Acreage[b]	3,000[c]	3,000
Bird Use Days	25,000[c]	27,100
Public Use Days	5,500[c]	10,600
Los Banos WMA		
Habitat Acreage[b]	3,208	3,208
Bird Use Days	23,768,000	25,869,000
Public Use Days	23,500	28,000
Fishery Days	18,800	42,000
Kesterson NWR		
Habitat Acreage	490	1,420
Bird Use Days	3,757,910	7,157,420
Public Use Days	3,000	4,900
San Luis NWR		
Habitat Acreage	3,150	4,600
Bird Use Days	13,362,130	19,524,200
Publc Use Days	21,000	29,000
Merced NWR		
Habitat Acreage	920	1,200
Bird Use Days	7,522,350	9,805,000
Public Use Days	1,700	6,750
Mendota WMA		
Habitat Acreage[b]	9,440	9,440
Bird Use Days	9,300,000	12,200,000
Public Use Days	34,380	55,695
Fishery Days	37,100	51,400
Pixley NWR		
Habitat Acreage	0	1,600
Bird Use Days	6,000	4,193,400
Public Use Days	50	1,300

TABLE II-3 (Continued)

SUMMARY OF WILDLIFE RESOURCE IMPACTS

Refuge	Water Supply Level 2	Water Supply Level 4
Kern NWR		
Habitat Acreage	2,800	7,000
Bird Use Days	7,197,500	72,996,000
Public Use Days	4,400	11,300

(a) Level 3; data for Level 4 are not available.

(b) Although the total habitat acreage is not proposed to change, the type of habitat would change

(c) Level 1; data for Level 2 are not available.

n/a Data not available.

Longer winter flooding periods at areas with high protein food sources, such as invertebrates, could improve conditions for breeding ducks and will increase their survival rate. If water continues to be available in the spring, the condition of brood ponds could be improved and the overall resident waterfowl populations could be increased. The amount of water available also is related to the vegetation at the pond edges. A pond that has a larger perimeter could provide more feeding areas. In addition, if the area is properly irrigated, more seeds will be produced.

G. CONVEYANCE

In addition to water supply allocations refuge water deliveries depend on conveyance facilities and delivery agreements with local water or irrigation districts. At the present time, contractual agreements with these districts are the principal means of conveying water to the refuges. Conveyance systems for some refuges are inadequate to deliver the water needed for optimum refuge operation. Some refuges' existing systems could generally be improved to increase winter deliveries of water. Some of the water districts that could supply water to the refuges discontinue operations in November to allow for maintenance of the canals at the time when the refuges need to be flooded. Improvements to existing facilities could reduce winter maintenance requirements. In addition, water supplies are interrupted during the winter to allow operation of flood control facilities or to allow fish migration. Coordination with those activities are also being investigated. The Refuge Water Supply Investigations evaluated numerous alternatives to increase the winter deliveries from existing water supplies and improve efficiency.

H. POWER NEEDS

All Central Valley refuges have electrical pumping power requirements. Private utilities supply the electrical power to each refuge's pumping facilities. The type of pumping facilities at a refuge depends whether it pumps groundwater or surface water. Some refuges pump both ground and surface water.

For those refuges that pump large amounts of water, the cost of power has become a major budget item, and the cost has become a constraint on the full use of available water at many San Joaquin Valley refuges and Gray Lodge WMA. Pumping additional groundwater is not considered practical by managing agencies because of the formidable costs.

In several areas, lowering groundwater levels has raised pumping costs. In many cases the cost of electrical power has increased to the point where pumping has been reduced to meet budget constraints.

The Central Valley Project (CVP) could provide inexpensive power to the refuges, but whether the authorization exists to provide project power for fish and the wildlife use or not is being examined. Providing CVP power to the refuge would require reducing the allocation of CVP power to existing preference customers.

I. CAPACITY AVAILABLE IN EXISTING FACILITIES AND TIMING OF DELIVERIES

At the present time, demands for additional water supplies in the San Joaquin Valley received as part of Reclamation's water marketing program total approximately 3.0 million acre-feet annually; these include wildlife area water supplies. Existing capacity in the Delta above existing deliveries is approximately 250,000 acre-feet. Ideally, long term export of water from the Delta would require additional conveyance. The exports from the Delta would not increase, but the application would change (i.e., waterfowl refuges rather than agricultural fields). Several public interest groups in California are concerned about increased transfer of water from the Delta. The Sierra Club, Planning and Conservation League, Environmental Defense Fund, and the Audobon Society have expressed the preference to preserve river flows in the Delta for environmental protection and enhancement rather than exporting water out of the area, and generally oppose any project or plan that could reduce Delta flows from current levels.

In addition, the overall capacity of major water delivery systems in the San Joaquin Valley to provide water to the wildlife areas at the desired time is questionable because of simultaneous demands for water for other uses. The range of available unused capacity for the three Reclamation conveyance facilities is shown on Table II-4. The unused available capacity shown could be used only on an as-available basis, generally during the late summer and fall months. Capacity is available in the California Aqueduct and use of this facility to convey water to the wildlife areas could be negotiated in wheeling agreements with the State of California under the coordinated operation agreement.

TABLE II-4

Range of Available Unused Capacity in Reclamation Facilities

Facility	Average Annual Available Capacity (x 1,000 Acre-Feet)
Delta - Mendota Canal (Upper Portion)	
Historical Flow	300 - 440
Operations Study	38
Projected Contract Delivery	0
Delta - Mendota Canal (Lower Portion)	
Historical Flow	830
Projected Contract Delivery	700
Friant-Kern Canal	1500
Madera Canal	435

J. RESOURCES CAPABILITY

Current annual average (based on the past 10 years) water deliveries to the 15 wildlife areas under study total 381,950 acre-feet (Table II-1). For optimal management, however, these areas can use up to 526,100 acre-feet annually, as determined by Reclamation, Service, and DFG.

During normal or above average rainfall years, surface water sources present the most dependable source of water to the wildlife areas. This supply, along with a developed groundwater pumping program at those refuges where it is feasible or practical to do so will permit the areas to be managed as desired. The extent to which each area will reach its goal of optimum management of wetland habitat will ultimately depend on the allocation of water to each area from the CVP Water contracting studies.

The primary source of surface water which could be made available for wildlife area use is from the CVP through conveyance systems such as the Tehama-Colusa Canal, Delta-Mendota Canal, and the California Aqueduct. To a lesser extent, opportunities to obtain water from the State Water Project and local water districts also exist. Direct diversions from the Sacramento, Feather, and San Joaquin Rivers also occur.

Groundwater is a potential source of water at most wildlife areas; however, with the exception of Gray Lodge Wildlife Management Area and Merced National Wildlife Refuge, none of the areas rely on groundwater as a principal source because of the current availability of less expensive surface water.

In the San Joaquin Valley, groundwater overdraft occurs in the San Joaquin River and Tulare Basins, and the quality may make the water unusable. However, the groundwater situation varies from site to site, and groundwater cannot be overlooked as a potential supply. In many cases, groundwater could serve as a supplement or backup supply to other water supply alternatives.

One disadvantage to relying solely on groundwater is the rate of pump delivery. A limited rate of groundwater pumping constraints effective wildlife management because rapid filling of marsh areas in the fall is often necessary. Historically, agricultural return water has been a source of water supply to several wildlife areas. Because of recent water quality concerns, particularly in the San Joaquin Valley, future use of this water remains questionable.

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