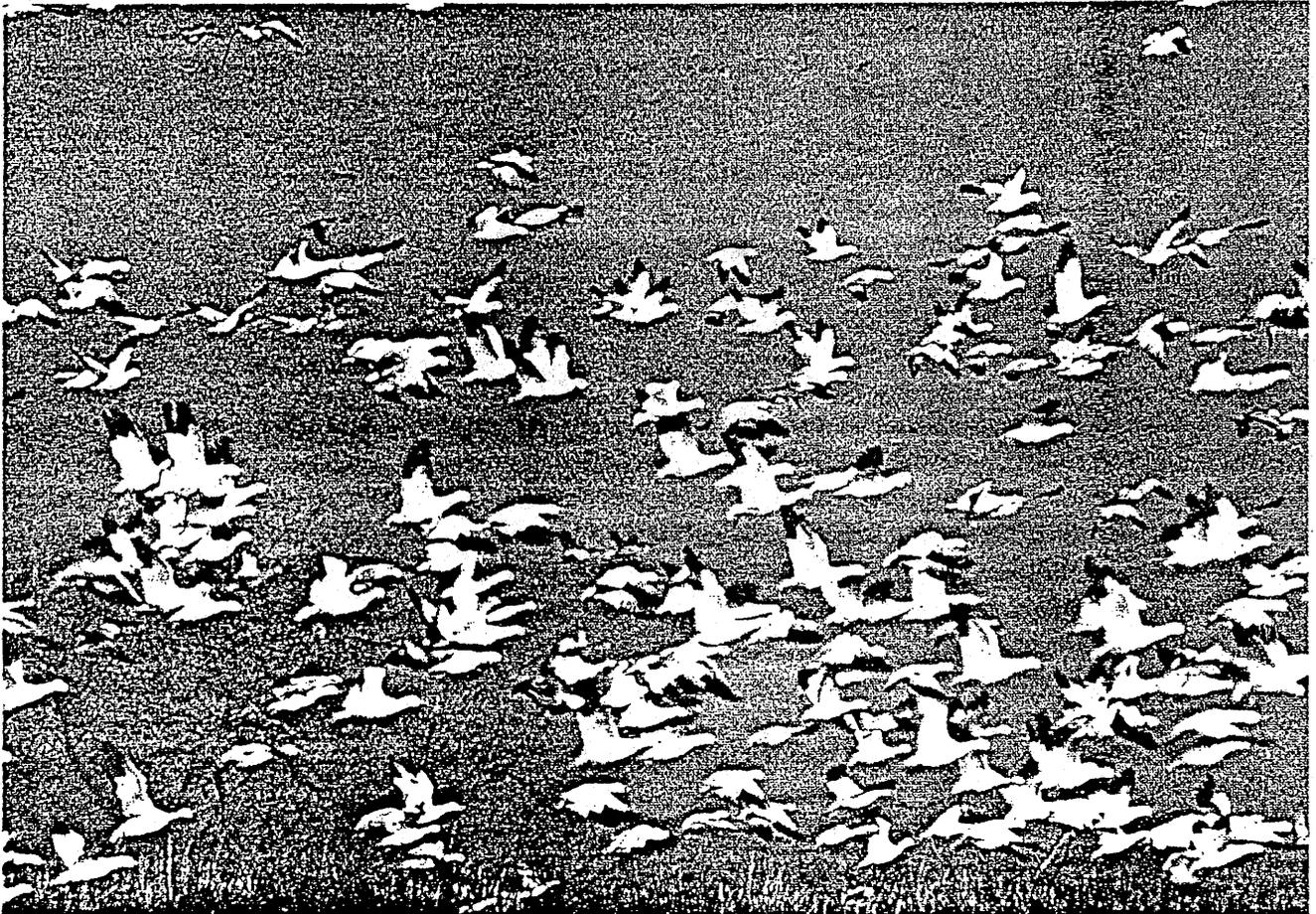

REPORT ON REFUGE WATER SUPPLY INVESTIGATIONS

Central Valley Hydrologic Basin, California



March 1989

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

THIS REPORT WAS PREPARED UNDER THE DIRECTION OF THE REGIONAL DIRECTOR, MID-PACIFIC REGION OF THE BUREAU OF RECLAMATION, PURSUANT TO FEDERAL RECLAMATION LAWS (ACT OF JUNE 17, 1902, 32 STAT. 388 AND ACTS AMENDATORY THEREOF OR SUPPLEMENTARY THERETO). THE PURPOSE OF THIS REPORT IS AS A PUBLIC INFORMATION DOCUMENT. THIS REPORT PROVIDES INFORMATION AND ALTERNATIVES FOR FURTHER CONSIDERATION BY THE BUREAU OF RECLAMATION, THE SECRETARY OF THE INTERIOR, AND OTHER FEDERAL AGENCIES. PUBLICATION OF THE FINDINGS AND RECOMMENDATIONS HEREIN SHOULD NOT BE CONSTRUED AS REPRESENTING EITHER THE APPROVAL OR DISAPPROVAL OF THE COMMISSIONER OF THE BUREAU OF RECLAMATION OR THE SECRETARY OF THE INTERIOR.

EXECUTIVE SUMMARY

INTRODUCTION

The wetlands of California's Central Valley provide critical habitat for migratory birds and for resident wildlife, including many threatened and endangered animal and plant species. The Central Valley is part of the Pacific Flyway, a migratory waterfowl route extending over Canada, the United States, and Mexico. Management of the Flyway is governed by international treaties between the United States, Mexico, and Japan. The Bureau of Reclamation (Reclamation) is the lead agency in a cooperative effort among Federal, State, and local agencies in planning for the development of dependable water supplies for California's Central Valley refuges.

This report presents an analysis of water needs and provides an array of potential water sources and delivery systems for providing a dependable supply of good quality water to ten National Wildlife Refuges (NWR), four State Wildlife Management Areas (WMA), and one privately managed wetland area (RCD) within the Central Valley hydrologic basin of California. The names and locations of these managed wetland areas (collectively referred to as refuges) are presented in Figure S-1.

The intended purpose of this document is to provide information and resource data which, when combined with appropriate information from related investigations discussed in this summary, will be the basis for selecting recommended plans for water delivery to each of the 15 refuges. Those plans together with appropriate environmental documentation will be presented in a Refuge Water Supply Planning Report, which is scheduled to be completed in November, 1989.

SCOPE OF STUDY

The scope of this study is to gather, update, and organize all existing and available information relative to current and desired water use, power needs, surface water delivery systems, groundwater availability, recreation and wildlife resources, and habitat management objectives for each of the 15 refuges. Based upon that information, alternative plans are to be formulated for each refuge to provide dependable water supplies under four water delivery options, as follows:

- Level 1 - Existing firm supply
- Level 2 - Current average annual water supply
- Level 3 - Supply for full use of existing development
- Level 4 - Supply for optimum habitat management

A recommended plan for water delivery to each refuge, using the information relative to water allocation and environmental impacts

currently being developed in the Sacramento River and Delta Export Water Contracting Environmental Impact Statements (EIS's), will be selected from the alternatives and presented in the Refuge Water Supply Planning Report.

STUDY ORGANIZATION

Reclamation is the lead agency for this multi-agency study and is responsible for the preparation of this report and the forthcoming Refuge Water Supply Planning Report. The Fish and Wildlife Service, State Departments of Fish and Game and Water Resources, and California Waterfowl Association comprise the core group of agencies and organizations which participated on the planning team and provided technical expertise relative to water and wildlife resources. The Grassland Resource Conservation District has provided both information on privately operated wetlands and monetary contributions for planning efforts through the California Waterfowl Association.

PROBLEMS AND NEEDS

Background

The Pacific Flyway is the westernmost of four migratory waterfowl routes transecting the North American continent. The Pacific Flyway is unlike the others, however, in that most of the wintering waterfowl concentrate in a relatively small area: California's Central Valley. Historically, the Central Valley contained over 4 million acres of wetlands. However, through the conversion of those lands to other uses, the total available acres of wetlands have been reduced to approximately 300,000 acres. Federal National Wildlife Refuges and State Wildlife Management Areas comprise approximately one third of this acreage, with most of the remainder in private ownership.

Each year about 10 to 12 million waterfowl, along with other migratory birds, are estimated to winter in or pass through the Central Valley, more than in all of the other flyway states combined.

It is a popular misconception that wetland refuges are established and maintained primarily for the benefit of waterfowl (ducks, geese, and swans) and waterfowl hunters. While it is true that hunting is a popular activity at most refuges, such activity is tightly regulated. A portion of the revenue received from hunting activities is used to acquire land for migratory bird refuges and waterfowl production areas. It is important, however, to recognize that refuges also provide a multitude of other uses such as: sanctuaries for the purpose of resting, feeding, and breeding for millions of other migratory birds and resident wildlife; flood control; erosion control; nutrient cycling; groundwater recharge; and numerous recreation and educational opportunities.

RELATED INVESTIGATIONS

Present and future water development and use in the Central Valley is being redefined. Valley-wide studies underway by both Reclamation and the State of California are identifying and examining the agricultural, municipal, industrial, recreational, fish, wildlife, and water quality needs for the Central Valley's river basins. Over the next few years, 1987-1990, the State Water Resources Control Board will conduct hearings on the San Francisco Bay-Sacramento/San Joaquin Delta to receive evidence on present water use and future demand. The Board will determine beneficial and reasonable uses for the Central Valley's water supplies and develop water quality standards for the Bay and Delta accordingly.

Water Contracting EIS's

Reclamation is currently examining existing water use, in-basin needs, and future demands as part of its Sacramento River, American River, and Delta Export Water Contracting Environmental Impact Statements. These EIS's will assess all competing water demands and alternatives for contracting and distributing the uncommitted supply of the Central Valley Project in the Sacramento, American, and San Joaquin River Basins. Agricultural, municipal, industrial, fishery, wildlife, recreation, and navigational needs are being considered, as well as optimization of economic benefits and repayment of the project.

At the same time, a framework within which to coordinate the operations of the Central Valley and State Water Projects has now been effected. Public Law 99-546, enacted October 17, 1986, authorized the Secretary of the Interior to sign and implement the Coordinated Operations Agreement for the integrated, orderly and efficient operations of the Central Valley and State Water Projects.

In enacting the Coordinated Operation Agreement legislation, Congress recognized the significance of wildlife refuges in the overall picture of the Central Valley water use. By terms of the legislation, Reclamation is required to reserve 25 per cent of the remaining uncontracted yield of the Central Valley Project until 1 year after a report on refuge supply has been submitted to Congress.

Other Studies

Several other Reclamation studies and investigations related to increasing water supply, water quality, and water delivery are being conducted. The Offstream Storage Investigation is evaluating storage sites to increase water yield in the San Joaquin Valley. The use of wetlands for offstream storage is a component of this investigation. The San Joaquin Valley Conveyance Study is investigating methods to transport water to the Mid-Valley area of the San Joaquin Valley. The conjunctive use of surface and ground water is being investigated as a means to secure dependable water

supplies and increasing Central Valley yield. The multi-agency San Joaquin Valley Drainage Program is conducting investigations to develop long-term solutions to drainage problems in the San Joaquin Valley.

FINDINGS

This report represents the most comprehensive source of up-to-date information on the refuges of the Central Valley available. Based on the information developed during this study, it is clear that each refuge requires a dependable supply of good quality water to facilitate proper wetland habitat management for the migratory birds of the Pacific Flyway and resident wildlife and flora. The amount of water that is ultimately recommended for each refuge will be based upon the information in this report, the findings of the Sacramento River and Delta Export Water Contracting EIS's, and the findings of the other related investigations described above. Those recommendations will be presented in the forthcoming Refuge Water Supply Planning Report.

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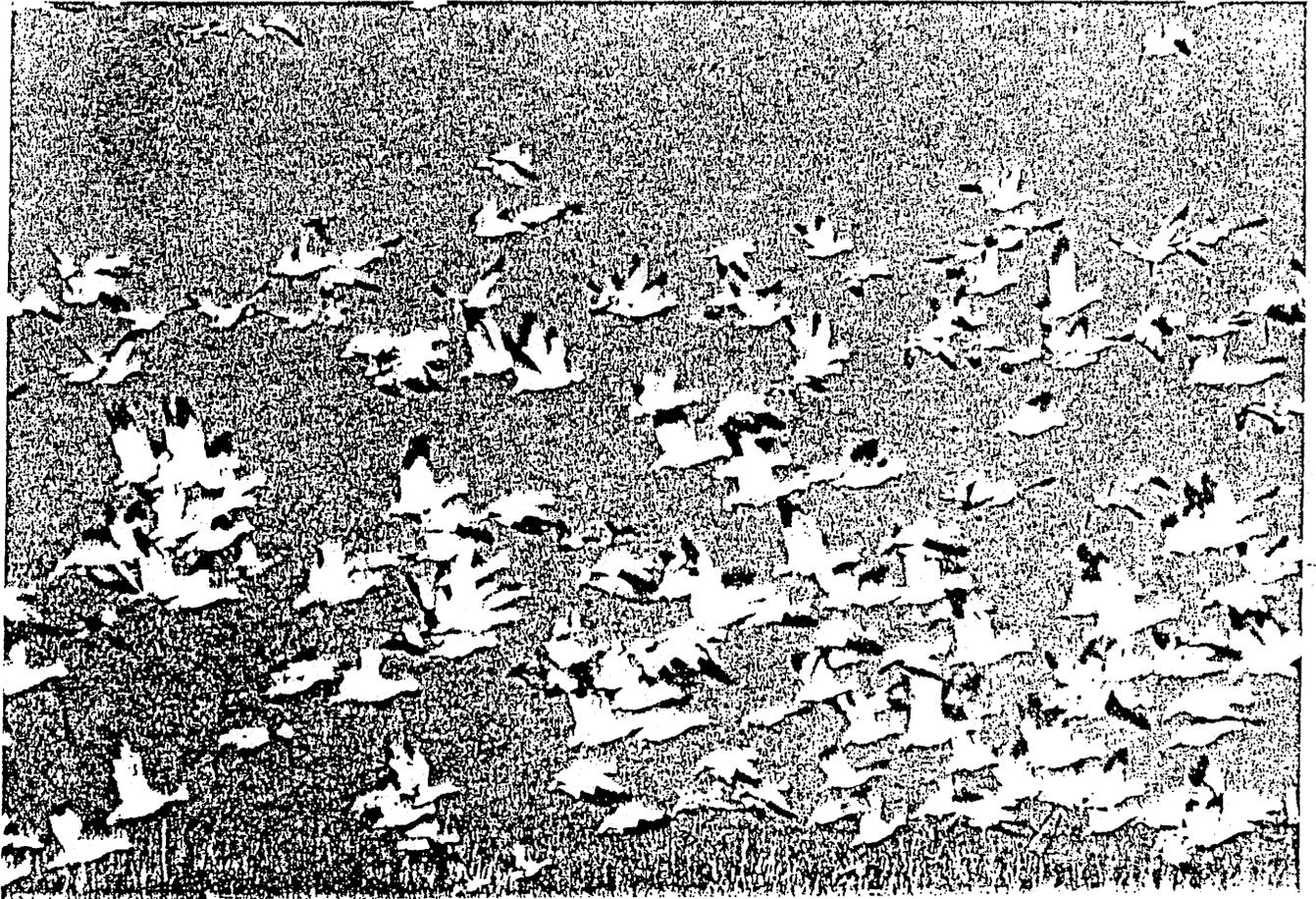
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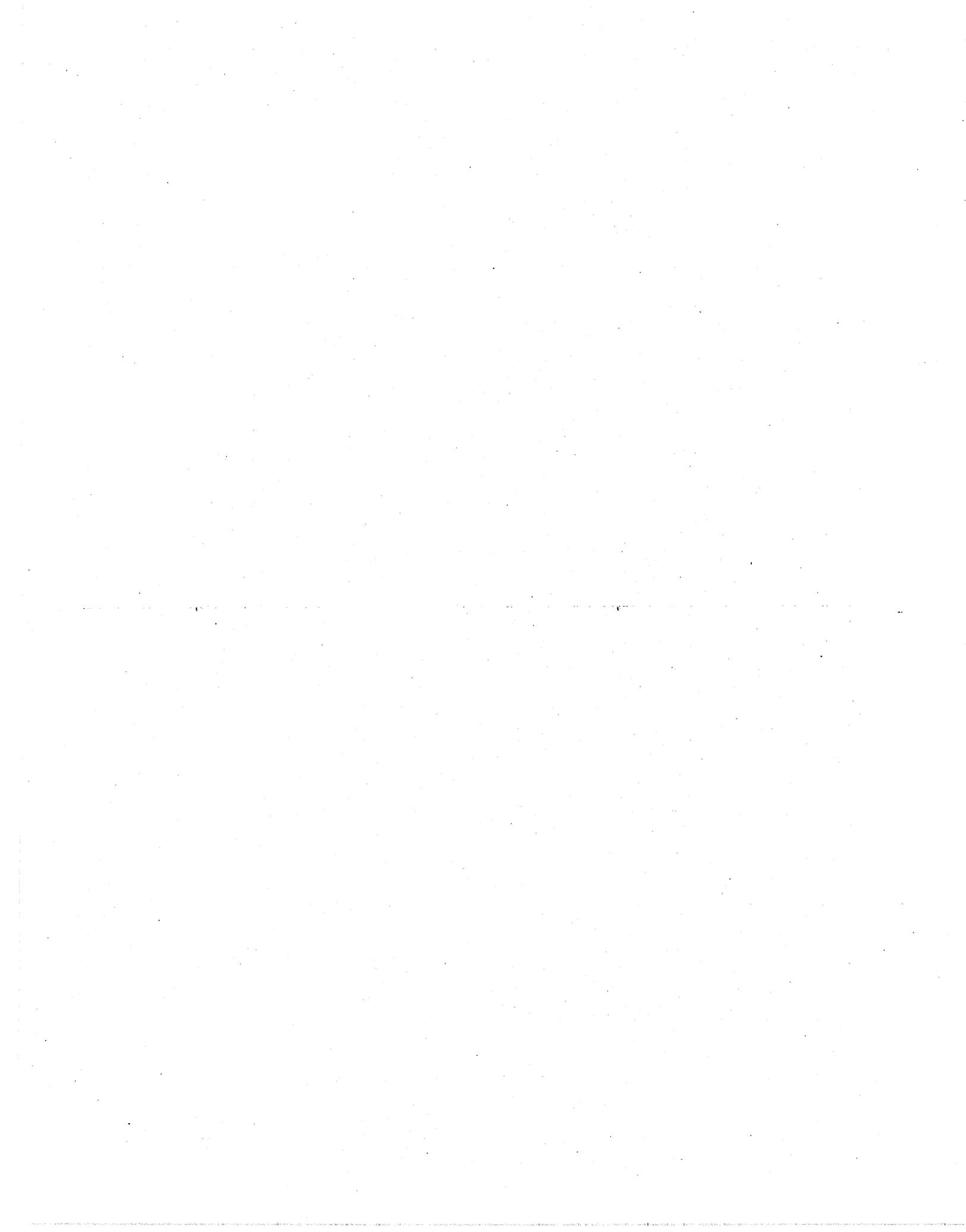
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CHAPTER I

Introduction



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



CHAPTER I

INTRODUCTION

A. STUDY AUTHORITY

The Refuge Water Supply Study is being conducted under the authority of the Reclamation Act of June 17, 1902 and Public Law 99-546 (Coordinated Operation Agreement).

B. PURPOSE, SCOPE, AND OBJECTIVES OF REFUGE WATER SUPPLY STUDY

The Bureau of Reclamation (Reclamation), assisted by the Fish and Wildlife Service (Service) and the California State Departments of Fish and Game (DFG) and Water Resources (DWR), is conducting the Refuge Water Supply Study. The purpose of the study is to investigate and identify potential water sources and delivery systems for providing a dependable water supply to ten national wildlife refuges (NWR), four State wildlife management areas (WMA), and private wetlands within the Grassland Resource Conservation District (GRCD), in California, as previously shown in Figure S-1. The Refuge Water Supply Study was initiated in October 1985 as an extension of the Central Valley Fish and Wildlife Management Study's special study on "Refuge Water Supply, Central Valley Hydrologic Basin, California (USBR, 1986a)." The Grassland Water District was also included in the report and shared in the costs through funding provided by the California Waterfowl Association.

The Refuge Water Supply Study was organized to meet the following primary objectives for each refuge:

1. Confirm and update monthly water requirements based on four water delivery regimes.
2. Determine resource response and recreation use for each water supply regime.
3. Determine groundwater quantity and quality and identify conjunctive use potential.
4. Determine contractual and physical capabilities of water and irrigation districts to deliver water on a monthly basis.
5. Provide preliminary designs and associated costs of delivery systems for each water regime.

6. Evaluate power requirements for delivery systems and wells under each water regime.
7. Develop alternative plans based on water regimes.
8. Develop environmental account for each plan.

This document is one part of the Refuge Water Supply Study, and is intended to provide information and resource data. This data, when combined with information from related investigations, will be the basis for selecting recommended plans for water delivery to each of the 15 refuges. The plans, together with appropriate environmental documentation, will be presented in the Refuge Water Supply Planning Report that is scheduled to be completed in November 1989.

C. DESCRIPTION OF STUDY AREA

The study area is located in California's Central Valley. This valley forms a cleft in the middle of California and is one of the world's largest valleys, over 400 miles long and 50 miles wide. Geologically, it is a trough between the Coast Ranges and the Sierra Nevada, with the Cascades bordering it on the north and the Tehachapi Range on the south. The valley drains through two great river systems which have created two distinct valleys: the Sacramento and the San Joaquin.

The Central Valley is the world's richest agricultural region. Rice and deciduous fruits are more commonly grown in the Sacramento Valley, while grapes and cotton characterize the more intensely developed San Joaquin Valley. Although two centuries ago most of the valley's land would have been considered semi-desert, it is now the richest agricultural region on earth, producing more than 200 crops and 25 percent of all table foods consumed in the United States. Agriculture is not the only industry in the Central Valley, but it dominates the social characteristics.

The Central Valley is one of the fastest growing regions in the United States. However, despite the fact that thousands of acres are lost each year to urban development, the valley has retained much of its rural atmosphere and cultural values.

The one resource conservation district and 14 Federal and State refuges discussed in this report are located in the Central Valley within the specific valleys and counties listed on the following page.

Refuge**County****Sacramento Valley**

Modoc NWR	Modoc
Sacramento NWR	Glenn
Delevan NWR	Colusa
Colusa NWR	Colusa
Sutter NWR	Sutter
Gray Lodge WMA	Butte

San Joaquin Valley

Grassland RCD	Merced
Volta WMA	Merced
Los Banos WMA	Merced
Kesterson NWR	Merced
San Luis NWR	Merced
Merced NWR	Merced
Mendota WMA	Fresno
Pixley NWR	Tulare
Kern NWR	Kern

D. PROBLEMS AND NEEDS

The major issue addressed by the refuge study is the need to provide water to the refuges to maintain or enhance wildlife habitat within the Pacific Flyway. Wildlife habitat includes wetlands, riparian vegetation, and uplands. Since 1850, the amount of wetlands in the Central Valley has decreased from 4 million acres to about 300,000. Private hunting clubs own about two-thirds of this acreage. The remaining land is located in National Wildlife Refuges and State Wildlife Management Areas. During high flood years, the amount of wetlands may increase to 700,000 acres. However, management of existing wetland habitat during dry years is essential for consistent waterfowl populations, especially ducks and swans. 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 from wetlands.

Upland habitat is important for nesting cover, especially for resident dabbling ducks, such as mallards, gadwall, cinnamon teal, northern shoveler, and pintails. Large blocks of undisturbed upland vegetation adjacent to wetlands are preferred. However, birds will use vegetation found in fields and along fences, ditches, and levees, but nesting success is poor due to heavy predation.

The single most important role of the Central Valley wetlands and associated riparian and upland corridors is to provide wintering habitat. In August, the waterfowl population begins to increase to

a peak of between 5 and 6 million birds in December. The population then declines to less than one million birds by March. Some of the most important species from a biological perspective (numbers or impact on the environment) and/or economic factors (consumptive uses) are tundra swans, lesser snow geese, Ross' geese, Pacific white-fronted geese, Canada geese, pintails, mallards, American wigeons, green-winged teal, shovelers, gadwalls, and canvasbacks. Other species that occur in significant numbers include wood ducks and ring-necked ducks. Redheads, cinnamon teals, common goldeneyes, buffleheads, mergansers, and lesser scaups are present in limited number. Most wintering waterfowl move among the wetlands in the Central Valley in response to weather changes, water conditions, food availability, and season.

The wetlands and associated habitat are also important to several Federal listed, proposed, and candidate threatened and endangered species, such as American peregrine falcon, bald eagle, Aleutian Canada goose, San Joaquin kit fox, giant garter snake, and white-faced ibis. In addition, these areas provide habitat for unique species such as yellow-billed cuckoo, white pelicans, common and snowy egrets, grebes, greater and lesser sandhill cranes, American bitterns, American avocets, black-necked stilts, common snipes, long-billed curlews, and tricolored blackbirds.

E. STUDY ORGANIZATION AND MANAGEMENT

The Refuge Water Supply Study is being conducted as an interdisciplinary, interagency investigation. Study organization and areas of responsibility are shown on Figure I-1. A glossary of terms used in this report is presented in Attachment A.

F. PUBLIC PARTICIPATION

The Refuge Water Supply issue has been long-standing and is of significant importance to refuge managers and the public, as the quality and quantity of water available to each refuge ultimately determines the desirability of habitat for migratory birds and resident wildlife. The degree to which these wetland areas are successfully managed is of biological, hydrological, economical, recreational, and educational importance to the state of California, as well as other states and countries along the Pacific Flyway.

Public interest in the development of dependable water supplies for Central Valley refuges is very high as evidenced by inquiry and participation in study activities by individuals, environmental, and wildlife organizations and representatives of the state and Federal legislature.

Since the initiation of the Refuge Water Supply Study in October 1985, numerous meetings have been held with cooperating agency staff and management, environmental and wildlife organizations, and water and irrigation districts to discuss study objectives, issues and concerns, and planning procedures. Two Public

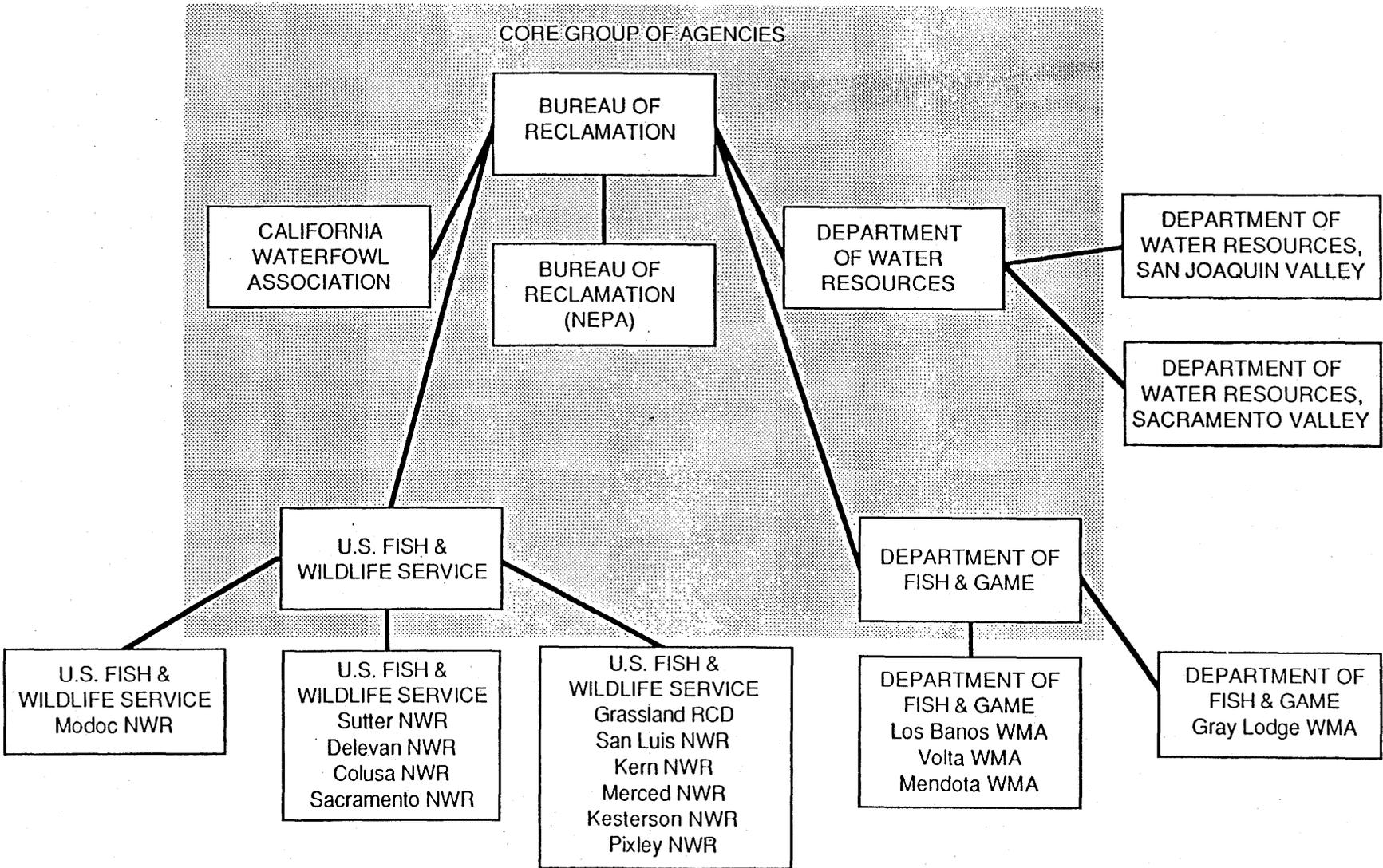


FIGURE I-1
 REFUGE WATER SUPPLY INVESTIGATION
 STUDY ORGANIZATION



Information Documents have been released to provide information on the progress of the study and to solicit public input on alternative water delivery plans and pertinent issues. Response has generally been favorable and supportive of the study. Public participation is discussed in greater detail in Chapter V, Consultation and Coordination.

G. COST SHARING

Preliminary informal discussions with the Service, DFG, and private organizations such as the California Waterfowl Association, Ducks Unlimited, and the Audubon Society indicate that there are substantial opportunities to obtain cost sharing funds to assist in the development of refuge water delivery facilities and perhaps to pay for annual water and power costs.

A letter of inquiry has been submitted to all agencies and organizations which may have an interest in assuring dependable supplies of water for refuges. The letter requests that potential funding sources and programs for this purpose be identified and asks for indication of intent to participate in a cost-sharing program. The replies to the inquiry will be included in an appendix to the Refuge Water Supply Planning Report.

H. RELATED INVESTIGATIONS

The Refuge Water Supply Study is one of numerous studies that have been conducted by various agencies and organizations addressing the problems of waterfowl management and loss of wetland habitat occurring in the Central Valley over the past quarter century. The relationship of the Refuge Water Supply Study to other ongoing Reclamation investigations is shown on Table I-1. These reports include ongoing studies by the State of California and private organizations. In addition, a considerable amount of legislation and programs affecting Central Valley habitat has been written.

1. Background to Present Study

A series of Reclamation studies have addressed fish and wildlife problems related to the Central Valley Project (CVP) or other water and land activities within the Central Valley. In 1978, as part of its Total Water Management Study for the Central Valley Basin of California, Reclamation published Working Document No. 12, "Fish and Wildlife Problems, Opportunities, and Solutions," a survey of major fish and wildlife problems and improvement opportunities within the geographical area encompassed by the CVP (USBR, 1978).

Based on the data developed in Working Document No. 12, Reclamation in 1979 initiated the Central Valley Fish and Wildlife Management Study, a broad-based, interagency, appraisal-level study to develop a comprehensive baseline on the Central Valley's fish and wildlife resources and to propose solutions to water-

**TABLE I-1
RELATIONSHIP OF REFUGE WATER SUPPLY STUDY
TO OTHER INVESTIGATIONS**

Study	Location	Purpose	Scope	Environmental Issues	Legal and Institutional Constraints
Refuge Water Supply Study and Planning Report	Central Valley	To investigate and identify potential water sources and delivery system for 15 wildlife areas and identify a preferred alternative(s) for providing a reliable water supply to each wildlife area within existing constraints.	Scope includes: (1) Analysis of resource responses to various quantities of water delivery. (2) development of water supply alternatives. Site specific and cumulative impacts will be addressed in appropriate water marketing environmental statement.	<ul style="list-style-type: none"> o Water quality o Endangered species o Preservation of wetlands o Impacts to Pacific Flyway 	<ul style="list-style-type: none"> o Water rights o Contractual restrictions on CVP water and power availability o Legal review of water delivery authority.
Sacramento River Water Contracting Environmental Impact Statement	Sacramento River Basin	To address options for fulfilling both the near- and long-term Sacramento River are agricultural, municipal, and environmental water needs that could be serviced with CVP water from Shasta and Clair Engle Reservoirs, and cumulative impacts of meeting those needs.	Includes: (1) Water users in the Sacramento River CVP service area with needs for water that cannot be satisfied with safe yield ground water or enhanced conservation; (2) the direct, secondary, and cumulative impacts expected to occur as a result of a range of federal water marketing alternatives; (3) the conjunctive use aspect of the Refuge Water Supply Study and the cumulative impacts of providing water to the wildlife areas.	<ul style="list-style-type: none"> o Cumulative impacts to Delta o Altered flows o Fish migration & production o Bank protection o Riparian/wildlife habitat o Endangered species o Water quality 	<ul style="list-style-type: none"> o Water rights transfers o CDA standards for Delta o Conjunctive use o Rate Setting policy
American River Water Contracting Environmental Impact Statement	American River Basin	To address options for meeting near- and long-term agricultural, municipal and environmental water needs in the American River Basin that could be served with CVP water and impacts on instream flows of meeting those needs.	Includes: (1) Water users in the American River service area, including downstream water users; (2) cumulative impacts expected to occur as a result of a range of federal water marketing alternatives.	<ul style="list-style-type: none"> o Lower American River flows o Fish and wildlife o Water quality o Recreation o Delta 	<ul style="list-style-type: none"> o Present water rights as affected by D-1400 and D-893
Delta-Export Water Contracting Environmental Impact Statement	CVP Service Area South of Delta	To identify water needs within the valley and analyze impacts of alternative marketing plans.	Full scope of study has not yet been identified. The full range of issues will be discussed in agency and public scoping meetings to be scheduled later in 1987. Valley refuges, Mid-Valley Canal, and wheeling of water through State of California plants are issues presently identified.	Full scope of environmental issues not yet identified. Issues will include impacts to the Delta and drainage	Unknown at this time
Consolidated and Expanded Place of use Environmental Impact Report	Existing and Potential CVP Service Area	To consolidate the CVP place of use and allow water from each permit area to be used consistent with existing water rights anywhere in the CVP; conform the purpose of use to allow a full range of uses in each of the user's water rights permits, expand the place of use to officially permit service to areas already being serviced outside the existing permitted place of use; and extend time required to complete water marketing.	Generic/programmatic overview of where the broader issues (Delta, future expansion) will be covered; detailed site-specific treatment of the potential impacts of Reclamation and/or SWRCB actions in the area.	<ul style="list-style-type: none"> o Relationship to other Reclamation petitions and water marketing program o Cumulative impacts on fish and wildlife o Impact of expansion o Impact of service areas outside expanded place of use 	This is an EIR being prepared for the SWRCB's use. No new water deliveries by Reclamation into the expanded place of use until environmental compliance is completed for the specific place of use.
Offstream Storage Study	Potential Offstream Reservoir Sites	To provide additional water for the CVP and to evaluate methods to combine offstream storage with existing facilities to increase system capacity south of Delta and reduce independence on surface water development.	Scope includes: (1) New and previously examined offstream storage sites in the Central Valley; (2) integration of waterfowl habitat return flows with agricultural deliveries.	<ul style="list-style-type: none"> o Additional Delta imports o Water quality o Impacts to wildlife habitat o Threatened & endangered species o Drainage & instream flows 	<ul style="list-style-type: none"> o CVP place of use o Corps permits o Additional point of diversion o Water quality & water rights o Groundwater management
San Joaquin Valley Drainage Program	Complete Watershed of the San Joaquin River, including the Tulare Lake Basin	To evaluate alternatives for the completion of drainage facilities of the San Luis Unit and adjoining Delta-Mendota Canal service area of the CVP.	Scope includes all areas potentially affected by discharge and management of agricultural drainage water from the San Joaquin Valley.	<ul style="list-style-type: none"> o Public health o Water quality o Agricultural productivity o Wetlands/wildlife habitat o Drainage transport & disposal o Water supply 	<ul style="list-style-type: none"> o Water contracts o SWRCB regulations o Pacific Flyway treaties o Public health standards

related problems and issues. Two reports addressing waterfowl or waterfowl habitat were completed: New Waterfowl Habitat Potential within the Central Valley, California, September 1986 (USBR, 1986d); and Refuge Water Supply, Central Valley Hydrologic Basin, California 1986 (USBR, 1986a). The latter study investigated and identified water needs and sources of dependable water supply for 12 refuges in the Central Valley and served as a primary resource document for water supply investigations presented in this report.

2. Other Reclamation Studies

The Refuge Water Supply Study interacts with many other water resource studies currently underway in the Central Valley. One of the most significant studies involves the preparation of Environmental Impact Statements (EISs) for water contracting of uncommitted CVP water in the Sacramento River Basin, American River Basin, and basins requiring delta export of water, including the San Joaquin, Santa Clara, and Pajaro valleys. These Water Contracting EIS's will address the options for fulfilling water needs for agricultural and municipal users as well as refuges. The Off-Stream Storage Investigation is evaluating plans for storage of surplus CVP water on the refuges. The San Joaquin Drainage Program is being conducted by an interagency group which includes Reclamation, Service, U.S. Geological Survey, DFG and DWR.

The National Environmental Policy Act (NEPA) requirements for cumulative impacts associated with water delivery and allocation to the refuge and wildlife management areas are being addressed in the Sacramento River and Delta Export Water Contracting EISs.

3. Coordinated Operation Agreement

On October 27, 1986, the President signed Public Law 99-546, which authorized the Secretary of the Interior to enter into and implement the Coordinated Operation Agreement between the Federal CVP and the State Water Project. The agreement allows coordination of the two projects to meet State Water Resources Control Board Decision 1485 water quality standards. Section 104 of the agreement stipulates that 25 percent of the firm yield of the Central Valley Project currently not committed under long-term contracts is to be reserved until one year after the Secretary of the Interior transmits a report on refuge water supply investigations in the Central Valley Basin to Congress.

