
CHAPTER IV B

Sacramento National Wildlife Refuge Alternative Plans



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

CHAPTER IV B

SACRAMENTO NATIONAL WILDLIFE REFUGE

Sacramento National Wildlife Refuge (Refuge) was established in 1937 through the purchase of 10,776 acres. Funds were provided by the Emergency Conservation Fund Act of 1933 and Emergency Relief Appropriations for the purpose of providing a refuge and breeding grounds for migratory birds and resident wildlife, as prescribed under Executive Order 7562. The Refuge is located about five miles south of the City of Willows. The Refuge, managed by the Service, provides wintering and resting areas for ducks, geese, and swans; and reduces waterfowl damage to crops on neighboring farms.

The Refuge is part of a group of refuges located in the Colusa Basin. The Colusa Basin is a drainage area extending from Stony Creek in the north to Cache Creek in the south, and between the Sacramento River on the east and the Coast Range Mountains on the west. Historically, flood waters from the Sacramento River and the east side of the Coast Range Mountains flooded the marshes in the Colusa Basin during the winter and spring. Flood control projects have minimized the flooding; however, wetland habitat does occur within the "Colusa Trough" and within flooded rice fields. Only small marsh areas occur near agricultural sumps that collect agricultural run-off. The Colusa Basin also includes Delevan NWR, and Colusa NWR, as well as numerous private hunting clubs. The clubs flood the marshes primarily during the hunting season.

The Refuge consists of permanent ponds, seasonal marshes, rice fields, and millet fields. Rice and millet are grown and left in the fields to be used as waterfowl food. The marshes also support sources of waterfowl food such as swamp timothy and invertebrate populations. The upland areas of the Refuge provide habitat for geese, upland birds, and other wildlife species. The amount of land used for fields, ponds, and upland uses varies depending upon the amount of water available each year.

A. WATER RESOURCES

The Refuge holds four appropriative water licenses to divert up to 60 cfs from Logan Creek. However, the rights are subject to depletion by other rights with higher priorities.

The Refuge also receives surplus Central Valley Project (CVP) water on an as-available basis from the Sacramento River. The CVP water is delivered through facilities owned and operated by Glenn-Colusa Irrigation District (GCID).

1. Surface Waters

Surplus CVP water is transported from the Sacramento River at the Red Bluff Diversion Dam through the Tehama-Colusa Canal (TCC) to

the western Sacramento Valley. Diversions from the TCC provide water to the Wasteway Cross Channel and the Williams Outlet. The GCID conveys surplus CVP water through exchange agreements with the CVP to the Colusa Basin refuges.

Natural flows and surplus CVP water from the TCC or Black Butte Reservoir are conveyed to the Refuge by GCID. Black Butte Reservoir, located on Stony Creek approximately nine miles upstream of Orland, was constructed by the Corps of Engineers for flood control purposes. Water from Black Butte Reservoir is conveyed by GCID through Stony Creek which has high conveyance losses.

Stony Creek is not recognized under Contract No. 14-06-200-8181A with Reclamation as a point of delivery from the TCC. Reclamation has the option of providing that water from Stony Creek or from the Sacramento River via the TCC.

Under Contract 14-06-200-8181A, GCID conveys a maximum of 50,000 acre-feet/year of surplus CVP water to the Refuge. The contract allows up to a 25 percent conveyance loss. A pumping station at Hamilton City pumps water from the Sacramento River into the GCID Main Canal. Due to the configuration of the GCID lateral system, a portion of the water supplied by GCID is from agricultural return flows.

Agricultural return flows are currently diverted from Logan Creek under appropriative water rights acquired by the Refuge. The Refuge has four licenses that permit the diversion of up to 60 cfs from Logan Creek to supply 4,575 acres of the Refuge. The rights are subject to depletion by other water rights with earlier priority dates, and therefore, are not considered to be a dependable water supply. In addition, water may not be available from Logan Creek during July and August. Water quality in Logan Creek may be poorer during the late agricultural season due to the presence of agricultural return flows.

Winter water supply problems at the Refuge are affected by operation of the Red Bluff Diversion Dam, the TCC, and the GCID canals. The TCC has been used to provide surplus CVP water to GCID Main Canal during the winter months. During the past two years, the gates at the Red Bluff Diversion Dam have been raised from December through March to improve fish passage at the Red Bluff Diversion Dam. The gates at the Red Bluff Diversion Dam were raised to allow unimpeded movement of winter-run chinook salmon adults and downstream migration of juveniles. The opening of the gates is presently a year-to-year experiment with no commitment to a long-term operation. A study has been conducted by the Service (funded by Reclamation) to identify methods to improve passage of salmon and steelhead trout at the Red Bluff Diversion Dam. The Service is scheduled to submit a final report on the study to Reclamation by September 30, 1988. Reclamation will evaluate this study and release a report in 1989 detailing the actions to be taken.

Without use of the TCC, surplus CVP water must be provided to the GCID Main Canal from other sources, such as Black Butte Reservoir. Under existing contracts, surplus water must be first used to meet agricultural contracts. During the past two years when the Red Bluff Diversion Dam gates have been opened, all surplus water has been allocated to agricultural users.

2. Water Conveyance Facilities

The GCID Main Canal supplies water to the Refuge through Lateral 26-2 and Lateral 35-1C. The GCID Lateral 26-2 provides water by gravity flow to the northwest corner of the Refuge where the Refuge's west canal distributes water to the western and northern portions of the Refuge. However, the GCID Main Canal is dewatered at the end of November for maintenance.

Water also can be provided to the Refuge from the GCID Main Canal via Lateral 35-1C, as shown in Figure IVB-1. Water in Lateral 35-1C can be pumped into the Refuge's west canal or diverted to the Refuge at Dam 3. During previous winter seasons when water was provided through the TCC, the GCID has created a 10-mile long backwater pool in the GCID Main Canal to gain sufficient elevation to allow diversions into the lateral.

Water also can be supplied from Logan Creek through diversions at Diversion Dam 1 to serve the eastern portion of the Refuge when the GCID canals are dewatered or when insufficient natural flows occur. The flows in Logan Creek depend upon precipitation and upstream agricultural return flows and may vary significantly throughout the year. Additional diversions could be made from Logan Creek during the winter if Diversion Dams 2 and 3 were modified. Currently, these diversion dams are removed during flood periods and cannot be replaced until after the wet weather season ends.

The Refuge reuses water to maximize its water use and maintain circulation in the ponds. However, re-circulation is difficult without construction of several lift stations, return canals, and underground power lines to serve the lift stations. The water flows through three to four ponds prior to discharge to Logan Creek or other drainage facilities. Water that returns to Logan Creek from the northern portion of the Refuge can be re-diverted at Diversion Dams 2 and 3 for reuse on the southern portion. The Refuge receives a seven percent return-flow and water right credit from GCID to compensate for re-diverted flows. This credit is generally between 2,800 and 3,300 acre-feet per year.

3. Groundwater

The Refuge is located in low-lying alluvial plains and fans of the Coast Range Mountains underlain by the Tehama Formation. The southeastern portion is located within flood plain deposits of the Sacramento River flood basin. The groundwater is located within 10

to 25 feet of the ground surface. Based upon existing data, the water quality appears to be suitable for irrigation and waterfowl needs. The safe yield of the aquifer under the Refuge has been estimated by Reclamation to be 12,900 acre-feet.

Because of high power costs, groundwater is not currently used for water supply. Two wells were drilled on the Refuge in 1978. One well was drilled to a depth of 260 feet and produced 1,200 gpm. The other well was drilled to a depth of 195 feet and produced less than 500 gpm.

B. FORMULATION & EVALUATION OF ALTERNATIVE PLANS

The Service estimates that 50,000 acre-feet of water would be required for full development and optimum management of the entire Refuge. For the purposes of assessing the impacts of water delivery alternatives, four levels of water supply have been identified, as presented in Table IVB-1. Each of the water supply levels provide a different volume of water, and are summarized as follows:

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

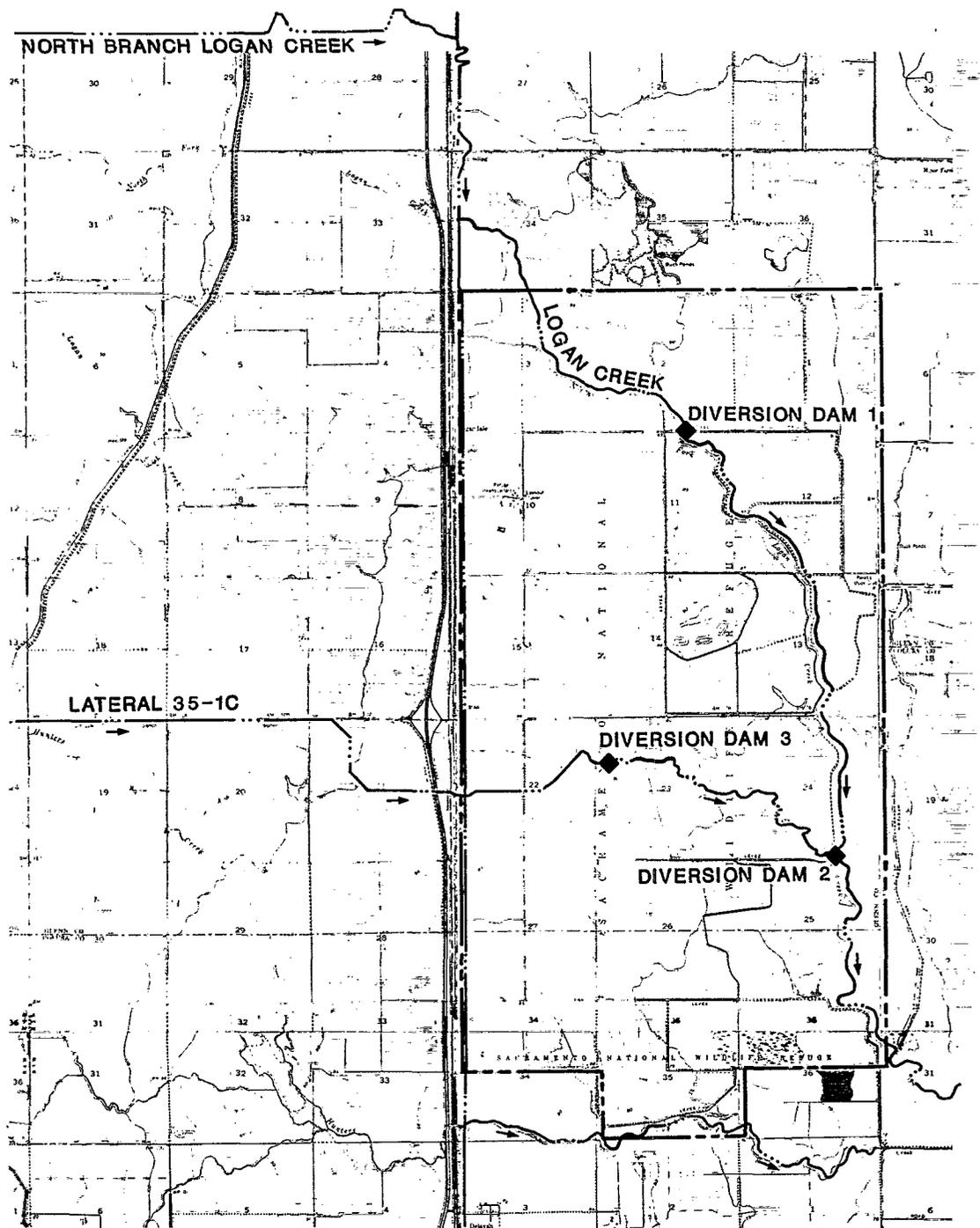
1. Delivery Alternative for Level 1 (No Action Alternative) (0 acre-feet)

Because the Refuge does not have a firm water supply, no facilities are required.

2. Delivery Alternatives for Level 2 (46,400 acre-feet)

Alternatives developed for Level 2 would provide more reliable water conveyance facilities throughout the year. Alternatives 2A, 2B, and 2C would provide water if the GCID Main Canal is dewatered. Alternative 2D provides facilities to improve the reliability of winter water deliveries from GCID. Alternative 2E would provide wells to be used in a conjunctive use program.

Alternative 2A - Construct Pipeline from Tehama-Colusa Canal. A five-mile, 100 cfs pipeline would be constructed from the TCC to the northwest corner of the Refuge. This canal would be used to convey both summer and winter water. If water was available from Black Butte Reservoir, water would be conveyed through the Orland Project's South Canal and Lateral 40 to the TCC.



LEGEND

- REFUGE BOUNDARY
- WATER COURSE
- DIRECTION OF FLOW

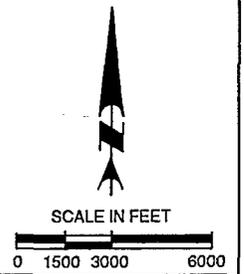


FIGURE IV B-1

**SACRAMENTO NATIONAL WILDLIFE REFUGE
EXISTING WATER SUPPLY FACILITIES**



TABLE IV B-1
 DEPENDABLE WATER SUPPLY NEEDS
 ALTERNATIVE SUPPLY LEVELS FOR THE SACRAMENTO NWR

Month	<u>Supply Level 1</u> ac-ft	<u>Supply Level 2</u> ac-ft	<u>Supply Level 3</u> ac-ft	<u>Supply Level 4</u> ac-ft
January	0	1,200	1,250	1,250
February	0	1,200	1,250	1,250
March	0	300	1,250	1,250
April	0	300	300	300
May	0	2,100	2,250	2,250
June	0	2,600	2,750	2,750
July	0	4,000	4,200	4,200
August	0	6,300	6,700	6,700
September	0	7,500	7,900	7,900
October	0	9,300	9,850	9,850
November	0	8,300	8,800	8,800
December	0	3,300	3,500	3,500
Total	0	46,400	50,000	50,000

Notes:

- Supply Level 1: Existing firm water supply
- Supply Level 2: Current average annual water deliveries
- Supply Level 3: Full use of existing development
- Supply Level 4: Optimum management

Sources: USBR, 1986a; USFWS, 1986d

Alternative 2B - Deliver CVP Water through Kanawha Water District. CVP water would be delivered from the TCC through the Kanawha Water District Laterals 5-5 and 6-5 to the north branch of Logan Creek which would convey the water under Interstate Highway 5, the frontage road, and the Southern Pacific Railroad tracks. A pipeline would be constructed from the terminus of the north branch of Logan Creek to the northwest corner of the Refuge, as shown in Figure IV B-2. Six turnouts would be enlarged on the Kanawha Water District laterals and a pump station would be constructed at the Refuge. This alternative would provide winter water to the Refuge when the GCID Main Canal is dewatered, and would require a conveyance agreement with Kanawha Water District for winter water deliveries. During the summer, the Refuge would receive water from GCID.

Alternative 2C - Construct Pipeline to Transport CVP Water from Tehama-Colusa Canal. CVP water would be conveyed through the Kanawha Water District Lateral 6-5 which would discharge to a new pipeline and pump station which would convey water to the refuge. A pump station would be constructed to transport water onto the Refuge. This alternative would provide winter water to the Refuge when the GCID Main Canal is dewatered, and would require a conveyance agreement with Kanawha Water District for winter water deliveries. During the summer, the Refuge would receive water from GCID.

Alternative 2D - Deliver CVP Water from Tehama-Colusa Canal to Glenn-Colusa Irrigation District Lateral 35-1C. CVP water would be conveyed from TCC through the GCID Main Canal to the GCID Lateral 35-1C. The water requirements for this alternative would be higher than for the other alternative plans because the total volume of water must include a 10-mile long backwater pool in the GCID Main Canal that would allow gravity diversion of water into the GCID Lateral 35-1C.

Water would flow by gravity from the GCID Lateral 35-1C to serve the southeastern portions. Water would be pumped from the GCID Lateral 35-1C to the Refuge's west canal to serve the southwestern portions of the Refuge. The capacity of the GCID Lateral 35-1C would be increased from 25 cfs to 90 cfs. To increase the capacity of the GCID Lateral 35-1C, a 30-inch diameter reinforced concrete pipe (RCP) culvert and two 36-inch diameter RCP culverts at road crossings would be replaced with 42-inch diameter culverts to eliminate the hydraulic restrictions, as shown in Figure IV B-2. In addition, the lower portions of the GCID Lateral 35-1C would be cleaned.

This alternative would provide winter water to the Refuge when the GCID Main Canal is dewatered. During the summer, the Refuge would also would receive water from GCID.

Alternative 2E - Implement a Conjunctive Use Plan. Fifty-nine wells would be constructed on the Refuge to deliver the maximum

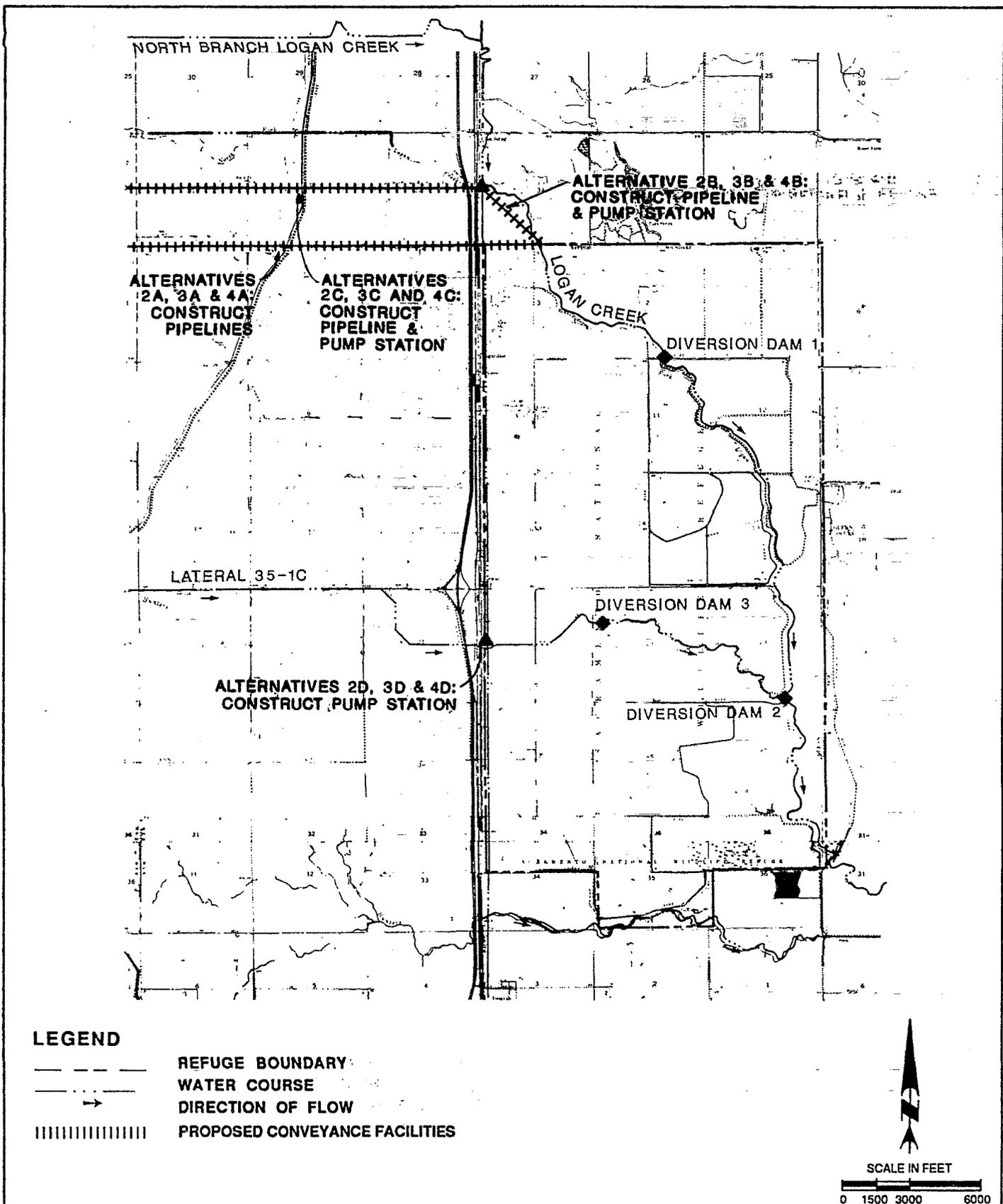


FIGURE IV B-2

SACRAMENTO NATIONAL WILDLIFE REFUGE
ALTERNATIVE WATER SUPPLY FACILITIES



month water demand. The exact locations of the wells on the Refuge would be determined in a future study. The wells would be developed as part of a conjunctive use program. During dry years, water demands would be supplied by wells, as discussed in Chapter III. During wet years, the wells would probably not be needed if CVP water is provided. Implementation of this alternative also would require implementation of Alternatives 2A, 2B, 2C, or 2D.

3. Delivery Alternatives for Level 3 (50,000 acre-feet)

Water deliveries under Level 3 are similar to Level 2. Therefore, the same alternatives considered for Level 2 were evaluated for Level 3.

Alternative 3A - Construct Pipeline from Tehama-Colusa Canal. This alternative is identical to Alternative 2A.

Alternative 3B - Deliver CVP Water through Kanawha Water District. This alternative is identical to Alternative 2B.

Alternative 3C - Construct Pipeline to Transport CVP Water from Tehama-Colusa Canal. This alternative is identical to Alternative 2C.

Alternative 3D - Deliver CVP Water from Tehama-Colusa Canal to Glenn-Colusa Irrigation District Lateral 35-1C. This alternative is identical to Alternative 2D.

Alternative 3E - Implement a Conjunctive Use Plan. Sixty-two wells would be constructed on the Refuge to deliver the maximum month water demand. This alternative would be similar to Alternative 2E.

4. Delivery Alternatives for Level 4 (50,000 acre-feet)

Water Supply Level 4 is equal to Level 3. Therefore, the alternatives for Level 4 would be the same as discussed under Levels 3 and 4.

Alternative 4A - Construct Pipeline from Tehama-Colusa Canal. This alternative is identical to Alternative 2A.

Alternative 4B - Deliver CVP Water through Kanawha Water District. This alternative is identical to Alternative 2B.

Alternative 4C - Construct Pipeline to Transport CVP Water from Tehama-Colusa Canal. This alternative is identical to Alternative 2C.

Alternative 4D - Deliver CVP Water from Tehama-Colusa Canal to Glenn-Colusa Irrigation District Lateral 35-1C. This alternative is identical to Alternative 2D.

Alternative 4E - Implement a Conjunctive Use Plan. Sixty-two wells would be constructed on the Refuge to deliver the maximum month water demand. This alternative would be similar to Alternative 2E.

5. Summary of Alternatives

The beneficial and adverse effects of each alternative were compared with respect to the criteria listed in Chapter III.

There are no alternatives for Level 1 because no firm water supply exists.

Alternatives 2A, 3A, and 4A would provide water throughout the year without pumping and through Refuge-owned facilities. Alternatives 2B and 2C, Alternatives 3B and 3C, and Alternatives 4B and 4C would convey water to the Refuge during the winter through Kanawha Water District facilities and during the summer through GCID facilities. These alternatives would require pumping of the water onto the Refuge. Alternatives 2D, 3D, and 4D would convey water to the Refuge through GCID facilities during both summer and winter. Alternatives 2A through 2D, Alternatives 3A through 3D, and Alternatives 4A through 4E would convey winter water from TCC. The winter water would be pumped from the Sacramento River at Red Bluff or possibly surplus water from Black Butte Reservoir.

Alternatives 2E, 3E, and 4E would provide wells to be used during during dry years when CVP water may not be available. This alternative would cause overdraft conditions because the water needs would exceed the safe yield under the Refuge. These alternatives also would require implementation of surface water alternatives (Alternatives 2A, 2B, 2C, and 2D; Alternatives 3A, 3B, 3C, and 3D; and Alternatives 4A, 4B, 4C, and 4D).

Alternatives 2B, 2C, and 2D; Alternatives 3B, 3C, and 3D; and Alternatives 4B, 4C, and 4D would require long-term conveyance agreements with irrigation districts to transport water to the Refuge. Alternatives 2B and 2C, Alternatives 3B and 3C, and Alternatives 4B and 4C would require winter operation of Kanawha Water District facilities. Alternatives 2D, 3D, and 4D would require winter operation of the GCID facilities.

C. COST & ECONOMIC ANALYSIS

Costs for the alternative plans to provide adequate water supplies under Levels 2, 3, and 4 are presented in Table IV B-2. The construction costs include factors to cover engineering, contingencies, and overhead. Annual operation and maintenance (O&M) costs include only the local cost of delivering water. The annual O&M costs do not include costs to purchase CVP water. During the advanced planning phase, these costs will be refined further.

Construction of the facilities under all of the alternatives would result in additional money being spent in the economy of Glenn and

TABLE IV B-2
SUMMARY OF ESTIMATED COSTS OF ALTERNATIVES
SACRAMENTO NWR

Items	Alternatives				
	2A	2B	2C	2D	2E
Additional Water (ac-ft)	46,400	46,400	46,400	46,400	46,400
Construction Cost					
Wells	\$ --	\$ --	\$ --	\$ --	\$3,304,000 (i)
Diversion Structures	17,000 (a)	60,000 (c)	--	--	--
Pipelines/Canals	1,923,500 (b)	100,300 (d)	448,300 (f)	65,500 (g)	--
Pump Stations	--	161,000 (e)	161,000 (e)	105,000 (h)	--
Subtotal	\$1,940,500	\$321,300	\$609,300	170,500	\$3,304,000
Other Costs	--	--	--	--	1,940,500 (j)
Total	\$1,940,500	\$321,300	\$609,300	\$170,500	\$5,244,500
Annualized Construction Cost (8.87%, 30 yrs)	\$ 186,680	\$ 30,900	\$ 58,620	\$ 16,400	\$ 504,520
Additional Annual Costs					
Operation & Maintenance (k)	\$ 10,000	\$ 3,500	\$ 3,600	\$ 2,500	\$ 112,000 (n)
Power	--	14,300 (l)	14,300 (l)	14,300 (l)	278,400 (m, n)
Local Conveyance Cost (o)	--	69,600	69,600	69,600	--
Subtotal	\$ 10,000	\$ 87,400	87,500	86,400	390,400
Other Costs	--	--	--	--	5,000 (j, m)
Total	\$ 10,000	\$ 87,400	87,500	86,400	\$ 395,400
Total Annual Costs	\$ 196,680	\$118,300	\$146,120	\$102,800	\$ 899,920
Cost/Additional Acre-Foot	\$ 4.30	\$ 2.60	\$ 3.20	\$ 2.20	\$ 19.40

TABLE IV B-2
SUMMARY OF ESTIMATED COSTS OF ALTERNATIVES
SACRAMENTO NWR
(Continued)

Items	Alternatives				
	3A & 4B	3B & 4B	3C & 4C	3D & 4D	3E & 4E
Additional Water (ac-ft)	50,000	50,000	50,000	50,000	50,000
Construction Costs					
Wells	\$ ---	\$ ---	\$ ---	\$ ---	\$3,472,000 ^(p)
Diversion Structures	17,000 ^(a)	60,000 ^(c)	---	---	---
Pipelines/Canals	1,923,500 ^(b)	100,300 ^(d)	448,300 ^(f)	655,500 ^(g)	---
Pump Stations	---	161,000 ^(e)	161,000 ^(e)	105,000 ^(h)	---
Subtotal	\$1,940,500	\$321,300	\$609,300	\$160,500	\$3,472,000
Other Costs	---	---	---	---	1,940,500 ^(j)
Total	\$1,940,500	\$321,300	\$609,300	\$160,500	\$5,412,500
Annualized Construction Cost (8.87%, 30 yrs)	\$ 186,680	\$ 30,900	\$ 58,620	\$ 15,440	\$ 520,680
Additional Annual Costs					
Operation & Maintenance ^(k)	\$ 10,000	\$ 3,500	\$ 3,600	\$ 2,500	\$ 118,000 ^(m)
Power	---	16,050 ^(l)	16,050 ^(l)	16,050 ^(l)	300,000 ^(m,n)
Local Conveyance Cost ^(o)	---	75,000	75,000	75,000	---
Subtotal	\$ 10,000	\$ 94,550	94,650	93,550	\$ 418,000
Other Costs	---	---	---	---	5,000 ^(j,m)
Total	\$ 10,000	\$ 94,550	\$ 94,650	\$ 93,550	\$ 423,000
Total Annual Costs	\$ 196,680	\$125,450	\$153,270	\$108,990	\$ 943,680
Cost/Additional Acre-Foot	\$ 3.90	\$ 2.50	\$ 3.10	\$ 2.20	\$ 18.90

TABLE IV B-2
SUMMARY OF ESTIMATED COSTS OF ALTERNATIVES
SACRAMENTO NWR
(Continued)

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- Notes: Alternatives 2A, 3A, 4A: Construct Pipeline from Tehama - Colusa Canal
Alternatives 2B, 3B, 4B: Deliver CVP Water through Kanawha Water District
Alternatives 2C, 3C, 4C: Construct Pipelines to Transport CVP Water from Tehama - Colusa Canal
Alternatives 2D, 3D, 4D: Deliver CVP Water from Tehama - Colusa Canal to GCID Lateral 35-1C
Alternatives 2E, 3E, 4E: Implement a Conjunctive Use Plan
- (a) 100 cfs turnout on TCC.
- (b) 26,400-feet, 54-inch diameter pipeline.
- (c) Six turnouts on Kanawha Water District laterals.
- (d) 3,800 feet long, 18-inch diameter pressure pipeline.
- (e) 60 cfs, 7-foot lift pump.
- (f) 13,200 foot, 24-inch diameter pressure pipeline.
- (g) Enlarge 6,600-feet of Lateral 35-1C to 60 cfs, including three 42-inch diameter siphons.
- (h) 20 cfs, 10-foot lift pump to lift water into GCID Lateral 35-1C.
- (i) 59 wells, 400-feet deep, 100-foot lift.
- (j) Alternative 2E assumes implementation of Alternative 2A, Alternative 3E assumes implementation of Alternative 3A, and Alternative 4E assumes implementation of Alternative 4A.
- (k) Basis for O&M costs are discussed in Appendix F.
- (l) Unit Pumping Cost = \$1.00/af; only for winter water.
- (m) Values were multiplied by 0.5 because facilities are assumed to be used only 5 out of 10 years.
- (n) Unit Pumping Cost = 12.00/af.
- (o) Unit Conveyance Cost = \$1.50/af.
- (p) 62 wells, 400-feet deep, 100-foot lift.

Colusa Counties during the construction period. The construction could be completed within one summer season by construction workers who reside within the area.

Because all of the Refuge is developed, the additional water would not increase public use levels significantly. Therefore, the economy of the surrounding communities would not be impacted by the alternatives. However, if no water is provided (Level 1) the existing vegetation will die and the waterfowl use will decrease, therefore public use will decrease significantly.

D. WILDLIFE RESOURCES

The annual bird use on the Refuge is approximately 56,024,000 use-days based upon census data from 1987. Approximately 77 and 18 percent of the bird use are by ducks and geese, respectively. Fish and wildlife resources associated with the Refuge are presented in Table IV B-3. The listed threatened and endangered species associated with the Refuge are the bald eagle, Haliaeetus leucocephalus; peregrine falcon, Falco peregrines anatum; Aleutian Canada goose, Branta canadensis leucopareia; and valley elderberry longhorn beetle, Desmocerus californicus dimorphus. Candidate species associated with the Refuge include the white-faced ibis, Plegadis chichi; tricolored blackbird, Agelaius tricolor; and California hibiscus, Hibiscus californicus, as listed in Table IV B-4.

The alternative plans would provide a dependable water supply throughout the Refuge which is nearly totally developed. Therefore, the water would be used to improve habitat and not to develop additional wetlands. The improved habitat would increase the number of bird use-days, as indicated in Table IV B-5.

Implementation of any of the alternative plans probably would not adversely affect the listed and candidate threatened and endangered species of birds and would improve habitat that could be used by the white-faced ibis and Aleutian Canada goose. No additional lands would be flooded; therefore, upland species would probably not be adversely affected. Detailed field investigations would be required during the advanced planning phase of the project. Implementation of a plan would result in overall beneficial environmental effects. The No Action Alternative would result in the loss of habitat and associated recreation and wildlife use. Additional regional environmental analyses will be completed as part of the Water Contracting EIS's.

E. SOCIAL ANALYSIS

The social consequences of constructing and operating the facilities under any of the alternatives would be positive due to continued public use.

TABLE IV B-3

FISH AND WILDLIFE RESOURCES

SACRAMENTO NWR

Ducks

Hooded Merganser	Blue-Winged Teal ^(a)	Common Merganser ^(a)
Mallard ^(a)	Northern Shoveler ^(a)	Ring Necked Duck
Gadwall ^(a)	Pintail ^(a)	Common Goldeneye
European Wigeon	Wood Duck ^(a)	Greater Scaup
American Wigeon	Redhead ^(a)	Lesser Scaup
Green winged Teal ^(a)	Canvasback	Buffle Head
Cinnamon Teal ^(a)	Ruddy Duck ^(a)	

Geese and Swans

Snow Goose	White-fronted Goose	Cackling Canada Goose
Ross' Goose	Canada Goose	Lesser Canada Goose
Tundra Swan		

Coots

American Coot^(a)

Shore and Wading Birds

Western Grebe ^(a)	Virginia Rail ^(a)	Common Snipe
Eared Grebe	Sora ^(a)	Long-billed Dowitcher
Pied-billed Grebe ^(a)	Common Gallinule ^(a)	Least Sandpiper
Double-crested Cormorant	Ring-billed Gull	Dunlin
White Pelican	Caspian Tern ^(a)	Western Sandpiper
American Bittern ^(a)	Forster's Tern	Greater Yellowlegs
Least Bittern ^(a)	Black Tern ^(a)	Long-billed Curlew
Great Blue Heron ^(a)	Wilson's Phalarope	Killdeer ^(a)
Great (common) Egret ^(a)	Green-backed Heron ^(a)	Greater Sandhill Crane
Snowy Egret ^(a)	American Avocet	Black-crowned Night Heron ^(a)
	Black-Necked Stilt	

TABLE IV B-3
FISH AND WILDLIFE RESOURCES

SACRAMENTO NWR
(Continued)

Upland Game

Ringed-necked Pheasant ^(a) California Quail ^(a)	Rock Dove	Mourning Dove ^(a)
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Raptorial Birds

Turkey Vulture Sharp-shinned Hawk ^(a) Rough-legged Hawk Great Horned Owl ^(a)	Black-shouldered Kite ^(a) Cooper's Hawk ^(a) American Kestrel ^(a) Red Shouldered Hawk ^(a)	Marsh Hawk Red-tailed Hawk ^(a) Barn Owl ^(a) Golden Eagle
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Fish

Steelhead Trout Cat fish	Salmon Black Crappie	Largemouth Bass
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Furbearers

Opossum Raccoon Skunk	Gray Fox Beaver Muskrat	Coyote Mink
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Others

Black-tailed Deer

Notes:

(a) Birds nesting on refuge

Source: USFWS computerized annual printout for NWR Birds, Department of Interior, USFWS (RF11650-2 9-79) (July 1973 to June 1974, NWRS Public Use Report (1)) and refuge records.

TABLE IV B-5
WILDLIFE RECREATIONAL BENEFITS AND RESOURCE IMPACTS
SACRAMENTO NWR

	No Action Alternative	Alternatives				
		2A	2B	2C	2D	2E
Habitat Acres						
Permanent Pond	--	115	115	115	115	115
Seasonal Marsh	--	6,180	6,180	6,180	6,180	6,180
Watergrass	--	565	565	565	565	565
Rice	--	287	287	287	287	287
Bird Use Days						
Ducks	--	41,789,000	41,789,000	41,789,000	41,789,000	41,789,000
Geese	--	12,247,000	12,247,000	12,247,000	2,247,000	12,247,000
Waterbirds	--	1,988,000	1,988,000	1,988,000	1,988,000	1,988,000
Endangered Species	--	300	300	300	300	300
Total	--	56,024,300	56,024,300	56,024,300	56,024,300	56,024,300
Public Use Days						
Consumptive	--	6,300	6,300	6,300	6,300	6,300
Non-Consumptive	--	32,900	32,900	32,900	32,900	32,900
Total	--	39,200	39,200	39,200	39,200	39,200
Total Annual Cost	\$--	\$ 196,680	\$ 118,300	\$ 146,120	\$ 102,800	\$ 899,920
Incremental Cost/Additional 1000 Bird Use Days	N/A	\$ 3.50	\$ 2.10	\$ 2.60	\$ 1.80	\$ 16.10
Incremental Cost/Additional Public Use Day	N/A	\$ 5.00	\$ 3.00	\$ 3.70	\$ 2.60	\$ 23.00

TABLE IV B-5
WILDLIFE RECREATIONAL BENEFITS AND RESOURCE IMPACTS
SACRAMENTO NWR
(Continued)

	Alternatives				
	3A & 4A	3B & 4B	3C & 4C	3D & 4D	3E & 4E
Habitat Acres					
Permanent Pond	125	125	125	125	125
Seasonal Marsh	6,200	6,200	6,200	6,200	6,200
Watergrass	600	600	600	600	600
Rice	300	300	300	300	300
Bird Use Days					
Ducks	42,450,000	42,450,000	42,450,000	42,450,000	42,450,000
Geese	12,380,000	12,380,000	12,380,000	12,380,000	12,380,000
Waterbirds	2,020,000	2,020,000	2,020,000	2,020,000	2,020,000
Endangered Species	300	300	300	300	300
Total	56,850,300	56,850,300	56,850,300	56,850,300	56,850,300
Public Use Days					
Consumptive	6,500	6,500	6,500	6,500	6,500
Non-Consumptive	33,000	33,000	33,000	33,000	33,000
Total	39,500	39,500	39,500	39,500	39,500
Total Annual Cost	\$ 196,680	\$ 125,450	\$ 153,270	\$ 108,990	\$ 943,680
Incremental Cost/Additional					
1000 Bird Use Days	\$ 3.50	\$ 2.20	\$ 2.70	\$ 1.90	\$ 16.60
Incremental Cost/Additional					
Public Use Day	\$ 5.00	\$ 3.20	\$ 3.90	\$ 2.80	\$ 23.90

Notes:

- Alternatives 2A, 3A, 4A: Construct Pipeline from Tehama - Colusa Canal.
 Alternatives 2B, 3B, 4B: Deliver CVP water through Kanawha Water District.
 Alternatives 2C, 3C, 4C: Construct Pipeline to transport CVP water from Tehama - Colusa Canal.
 Alternatives 2D, 3D, 4D: Deliver CVP water from Tehama - Colusa Canal to GCID Lateral 35-C.
 Alternatives 2E, 3E, 4E: Implement a Conjunctive Use Plan.

F. POWER ANALYSIS

The Pacific Gas & Electric Company serves the Refuge under the PA-1 rate schedule for agricultural users. A facility must be an authorized function of the CVP to receive project-use power. The authority to deliver the CVP project-use power to the Refuge is currently being examined and will be detailed in the Refuge Water Supply Planning Report. A more detailed discussion of project-use power and wheeling agreements is provided in the Power Analysis section of Chapter II.

G. PERMITS

Construction under any of the alternatives would require several permits. Glenn and Colusa Counties would issue permits for construction of wells under Alternatives 2E, 3E, and 4E. The counties also would issue permits for construction along streams and roads to ensure that existing drainage facilities would not be adversely affected. If water is transferred through the north branch of Logan Creek under Alternatives 2B or 2C, Alternatives 3B or 3C, or Alternatives 4B or 4C, approvals would be required from the California Department of Water Resources, State Water Resources Control Board, and DFG. A Corps of Engineers permit would be required for construction in wetlands. Approvals from GCID would be required for construction under Alternatives 2D, Alternatives 3D, and Alternatives 4D.