

2. Alternatives Analysis

2.1 Introduction

CEQA Guidelines Section 15126.6 requires that an EIR describe and evaluate a reasonable range of alternatives that would feasibly meet most of the basic project objectives but would avoid or substantially lessen significant Project impacts. CEQA also requires that an EIR evaluate the “No Project” alternative along with its impacts. An EIR need only examine in detail alternatives that the lead agency determines could feasibly attain most of the objectives of the project and would avoid or substantially lessen at least one of the significant environmental effects of the project.

The National Environmental Policy Act’s (NEPA’s) implementing regulations are administered by the Council on Environmental Quality (CEQ) (40 CFR 1500 et seq.). Section 1502.14 of the CEQ Regulations for Implementing NEPA requires that an EIS rigorously explore and objectively evaluate all reasonable alternatives to the project, including a No Action Alternative and reasonable alternatives not within the jurisdiction of the lead agency. Additionally, NEPA requires that an EIS devote substantial treatment to each alternative considered in detail, including the proposed action, so that reviewers may evaluate their comparative merits.

This chapter summarizes the alternatives development process and alternatives analysis for the NODOS Project. A more detailed description of this comprehensive and iterative process is included in the NODOS Project Feasibility Report.

The proposed Project is defined as north-of-the-Delta offstream storage that should achieve, as much as possible, the following objectives: 1) Improve water supply reliability for agricultural, urban, and environmental uses, 2) Increase survival of anadromous and endemic fish populations, 3) Improve environmental and drinking water quality in the Delta, 4) Provide flexible hydropower generation to support integration of renewable energy sources, 5) Develop additional recreation opportunities, and 6) Provide incremental flood damage reduction opportunities.

2.2 Approach to Alternatives Analysis

2.2.1 Overview of the Alternatives Analysis

The NODOS Project alternatives analysis was completed in phases. The study of the NODOS Project was originally derived from the CALFED Bay-Delta Program’s (CALFED Program) identification of a range of activities that, if implemented, could concurrently improve the quality and reliability of California’s water supplies as well as ecosystem conditions and levee integrity in the Sacramento-San Joaquin Delta. Among many recommended activities, the CALFED Program identified the need for an additional 3.0-MAF of storage north of the Delta to meet environmental and water supply needs. The CALFED Program also expressed a preference for offstream over onstream storage to avoid redirected impacts to fisheries and other aquatic species. The CALFED Program initially identified 52 potential surface storage locations¹ but retained only 12 reservoir locations statewide for further study (CALFED, 2000). For a

¹The results of this inventory are presented in the March 7, 1997 draft report, *CALFED Bay-Delta Program Storage and Conveyance Component Inventories* (CALFED, 1997). The inventory includes 51 potential surface water storage sites. Subsequently, the August 2000 *CALFED Initial Surface Water Storage Screening Report* added the San Luis Enlargement to the list of potential sites.

summary of the CALFED Program Inventory of Potential Surface Water Storage Sites, refer to Appendix 2A. Red Bank, Newville, Colusa, and Sites are four (of the 12) reservoir locations that are offstream and located north of the Delta. Consistent with these recommendations, DWR initiated studies of the four north-of-the-Delta offstream storage alternatives in 1997.

The consideration and evaluation of these four alternatives is described below. DWR and Reclamation eliminated the Red Bank and Colusa alternatives based upon a comparison of environmental effects and feasibility considerations, which are documented in the 2000 NODOS Investigation Progress Report and in the 2006 NODOS Initial Alternatives Information Report. This allowed DWR and Reclamation to compare and evaluate the No Project/No Action Alternative, the Newville Reservoir Alternative, and the Sites Reservoir Alternative in greater detail, consistent with NEPA and CEQA requirements. Based on the detailed evaluation of these alternatives, the Sites Reservoir Alternative was selected as the preferred proposed project alternative.

DWR and Reclamation have also completed a more detailed evaluation of effects, consistent with CEQA and NEPA requirements, of three configurations of Sites Reservoir, hereafter called Alternative A, Alternative B, and Alternative C. The results and conclusions of these evaluations are found in Chapters 6 through 35. For purposes of CEQA, these alternatives should be considered as three variations of the Sites Reservoir Alternative (i.e. the preferred Project alternative). For NEPA purposes, Alternative A, Alternative B, Alternative C, and the No Project/No Action Alternative were evaluated in detail in accordance with the Council on Environmental Quality regulation 1502.14b.

2.2.2 Alternatives Considered

The four north-of-the-Delta offstream storage reservoir alternatives are described below and are shown on Figure 2-1:

- **Red Bank Alternative:** The Red Bank Alternative would be located approximately 17 miles west of the City of Red Bluff in Tehama County. This project would be comprised of a 104-TAF Dippingvat Reservoir on South Fork Cottonwood Creek, and a 250-TAF Schoenfield Reservoir on Red Bank Creek. The primary source of water would be from South Fork Cottonwood Creek, with water diverted from Dippingvat Reservoir to Schoenfield Reservoir. Two small dams and reservoirs, Lanyan and Bluedoor, would be located on small tributaries of Red Bank Creek and would be part of the conveyance from Dippingvat to Schoenfield. Dippingvat Reservoir would be an onstream storage facility used for short-term storage and diversion; Schoenfield is considered to be an offstream storage facility. This alternative location was designed to allow water stored in Schoenfield Reservoir to be released down Red Bank Creek directly into the Tehama-Colusa Canal intake. The Red Bank Alternative was conceived to provide an alternative water supply to the Tehama-Colusa Canal which would not require operation of the Red Bluff Diversion Dam (RBDD) during critical fish passage periods (estimated to be approximately two months per year).
- **Newville Reservoir Alternative:** The Newville Reservoir Alternative would be located upstream from Black Butte Reservoir, approximately 18 miles west of the City of Orland and 23 miles west-southwest of the City of Corning in Glenn and Tehama counties. Alternative reservoir sizes of 1.9-MAF and 3.0-MAF were considered. The 1.9-MAF reservoir would be formed by a dam on North Fork Stony Creek and a saddle dam at Burrows Gap. The 3.0-MAF reservoir would require up to five additional saddle dams and a dike. A small diversion dam and diversion from Thomes Creek would transfer water to the reservoir. Other water source options include Stony Creek and the Sacramento

River. Multiple conveyance options would be possible using existing infrastructure (e.g., canals), new infrastructure (e.g., canals, tunnels, and/or pipelines), or a combination of new and existing facilities.

- Sites Reservoir Alternative:** The Sites Reservoir Alternative, which would be located in Antelope Valley, approximately 10 miles west of the town of Maxwell in Glenn and Colusa counties, would be formed by constructing two major dams on Stone Corral Creek and Funks Creek. Evaluation of the Sites Reservoir Alternative focused on a 1.8-MAF reservoir that would also require the construction of nine saddle dams along the southern edge of the Hunters Creek watershed. Diversions from the Colusa Basin Drain (CBD), the Sacramento River, and local tributaries could provide potential sources of water supply for Sites Reservoir. Multiple conveyance options would be possible, with 13 optional conveyance systems (using existing and new conveyance infrastructure) from the Sacramento River, two from CBD, and two from Stony Creek.
- Colusa Reservoir Alternative:** The Colusa Reservoir Alternative would be located in north-central Colusa County and south-central Glenn County, approximately 12 miles southwest of the community of Willows and 10 miles west of Maxwell. The Colusa Reservoir Alternative, a 3.0-MAF storage project, would include the area inundated by the 1.8-MAF Sites Reservoir (described above) plus the adjacent Logan Creek and Hunters Creek watersheds to the north (known as the Colusa Cell). The Colusa Cell would require four major dams along Logan Ridge in addition to those described for Sites Reservoir: one for Logan Creek and three for Hunters Creek and its tributaries. The Colusa Cell would add up to 67 percent greater storage capacity to Sites Reservoir. Water source and conveyance options for diversion and delivery to offstream storage would be similar to those for Sites Reservoir. Diversions from the Colusa Basin Drain (CBD), the Sacramento River, and local tributaries would provide potential sources of water supply for the Colusa Reservoir Alternative. Multiple conveyance options would be possible using existing infrastructure (e.g., canals), new infrastructure (e.g., canals, tunnels, and/or pipelines), or a combination of new and existing infrastructure.

Previous studies, going back as far as the 1940s, were conducted at each of the four reservoir alternative locations. Data gathered during the NODOS Investigation was used to supplement those studies to allow for comparative evaluation of the alternatives. During the NODOS Investigation, geology, geotechnical, and engineering studies were conducted. Wetland delineations and cultural resources surveys were also conducted, as well as studies of the following environmental resources: vernal pool species, rare plants, plant communities, valley elderberry longhorn beetles, mammals, birds, fish, amphibians, and reptiles. Studies were conducted at similar levels of effort for each reservoir alternative and focused primarily on the reservoir footprints. The results of these studies were summarized in the July 2000 *North of the Delta Offstream Storage Investigation Progress Report* (DWR 2000). Environmental resources data collected for the four reservoir alternatives for the 2000 Progress Report are summarized in Tables 2-1 through 2-9.

**Table 2-1
Jurisdictional Wetlands and Waters of the U.S. Delineation within the Four Potential Reservoir Locations**

Wetlands Type	Acreage by Reservoir Location			
	Sites	Colusa*	Newville	Red Bank
Alkaline	19	35	3	0
Emergent	2	0	6	included with seasonal
Riparian	22	11	77	76
Seasonal	153	263	304	7

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**Table 2-1
Jurisdictional Wetlands and Waters of the U.S. Delineation within the Four Potential Reservoir Locations**

Wetlands Type	Acreage by Reservoir Location			
	Sites	Colusa*	Newville	Red Bank
Total Jurisdictional Wetlands	196	309	390	83
Streams	159	111	165	118
Ponds	16	24	66	34
Other Waters	175	135	231	152
Total Waters of U.S.	371	444	621	235
Reservoir Area	14,162	13,664	17,073	4,905

*Colusa Reservoir would include the footprint of Sites Reservoir. Total acreage reported for Colusa Reservoir reflects data from the Colusa Cell only; these totals would therefore be in addition to the total acreage reported for Sites Reservoir.

**Table 2-2
Total Acreage of Potential Special-Status Shrimp Species Habitat within the Four Potential Reservoir Locations**

Reservoir Location	Total Extent of Potential Special-Status Shrimp Species Habitat (Acres)		
	1998 Survey	1999 Survey	Difference
Red Bank	0.0	0.0	0.0
Newville	26	26	0
Sites	73	71	-2
Colusa*	12	12	0

*Colusa Reservoir would include the footprint of Sites Reservoir. Total acreage reported for Colusa Reservoir reflects data from the Colusa Cell only; these totals would therefore be in addition to the total acreage reported for Sites Reservoir.

**Table 2-3
Acreage Estimates of the Dominant Vegetation Communities Mapped within the Four Potential Reservoir Locations**

Vegetation Community	Acreage By Reservoir Location			
	Sites	Colusa ^a	Newville	Red Bank
Grassland	12,602	13,540	14,492	565
Woodland (oak)	923	20	1,839	899
Woodland (foothill pine)	0	0	0	2,826
Chaparral	5	0	363	98
Riparian	52	37	64	73
Vegetated wetland	23	15	0	1
Cultivated grain	277	0	0	0
Vegetation Subtotal	13,882	13,612	16,758	4,462
Other ^b	280	51	315	142
Total Reservoir Acreage	14,162	13,663	17,073	4,604

^aColusa Reservoir would include the footprint of Sites Reservoir. Total acreage reported for Colusa Reservoir reflects data from the Colusa Cell only; these totals would therefore be in addition to the total acreage reported for Sites Reservoir.

^bOther classification refers to disturbed/developed acreage within the inundation elevations.

**Table 2-4
State-Listed, Federally-Listed, and Special Concern Avian Species
Which May Occur at the Four Potential Reservoir Locations**

Species	Status ^a	Reservoir Location			
		Sites	Colusa ^b	Newville	Red Bank
Aleutian Canada Goose	FT				
American bittern	MNBMC				
American white pelican	CSSC				
Bank swallow	ST		X		
Barrow's goldeneye	CSSC				
Bell's sage sparrow	MNBMC				
Burrowing owl	CSSC, MNBMC	X	X	X	
California gull	CSSC	X			
California horned lark	CSSC, MNBMC	X	X	X	X
Common loon	CSSC, MNBMC				
Cooper's hawk	CSSC	X	X	X	X
Double-crested cormorant	CSSC		X		
Ferruginous hawk	CSSC, MNBMC	X			
Golden eagle	CSSC	X	X	X	X
Grasshopper sparrow	MNBMC		X		
Greater sandhill crane	ST		X		
Hermit warbler	MNBMC				
Lark sparrow	MNBMC	X	X	X	X
Lawrence's goldfinch	MNBMC		X		X
Least bittern	MNBMC				
Loggerhead shrike	CSSC, MNBMC	X	X	X	X
Long-billed curlew	CSSC, MNBMC	X	X	X	
Long-eared owl	CSSC	X	X	X	X
Merlin	CSSC	X		X	X
Mountain plover	CSSC, MNBMC				
Northern goshawk	CSSC, MNBMC				
Northern harrier	CSSC	X	X	X	X
Northern spotted owl	FE, SE				
Osprey	CSSC				X
Peregrine falcon	SE				
Prairie falcon	CSSC	X	X	X	X
Purple martin	CSSC				
Sharp-shinned hawk	CSSC	X	X		X
Short-eared owl	CSSC, MNBMC				
Southern bald eagle	SE, FT	X	X	X	X
Swainson's hawk	ST				
Tri-colored blackbird	CSSC, MNBMC	X	X	X	

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**Table 2-4
State-Listed, Federally-Listed, and Special Concern Avian Species
Which May Occur at the Four Potential Reservoir Locations**

Species	Status ^a	Reservoir Location			
		Sites	Colusa ^b	Newville	Red Bank
Vaux's swift	CSSC, MNBMC				
Western snowy plover	CSSC, MNBMC				
Western yellow-billed cuckoo	SE, MNBMC				
White-faced ibis	CSSC, MNBMC				
White-faced kite	MNBMC	X			
Willow flycatcher	SE				
Yellow warbler	CSSC	X			
Yellow-breasted chat	CSSC				

^aListing status as of 2000 when initial surveys were completed.

^bColusa Reservoir would include the footprint of Sites Reservoir. Avian species reported for Colusa Reservoir reflect data from the Colusa Cell only; the total number of avian species that could occur within the Colusa Reservoir location would therefore be in addition to the species that could occur within the Sites Reservoir location.

Key:

CSSC = California Species of Special Concern
 FE = Federal Endangered
 FT = Federal Threatened
 FPT = Federal Proposed Threatened
 MNBMC = Migratory Nongame Birds of Management Concern (USFWS)
 SE = State Endangered
 ST = State Threatened
 X = Observed at reservoir site indicated

**Table 2-5
Sites Reservoir Avian Transect Results
(Density in Birds/Square Mile)**

Species	Summer	Fall	Winter	Spring
Burrowing owl	0.24	0.05		
California horned lark	4.83	1.58	2.90	6.57
Cooper's hawk		0.03		0.06
Ferruginous hawk			0.12	
Golden eagle	0.23	0.20	0.26	0.32
Lark sparrow	NS	NS	0.47	1.46
Loggerhead shrike	0.93	1.60	1.17	0.47
Long-billed curlew			14.59	1.26
Northern harrier	0.05	0.50	1.53	0.58
Sharp-shinned hawk		0.40		0.03
Southern bald eagle			0.07	
Tri-colored blackbird				5.38
White-tailed kite	0.12			0.12
Miles of transect per season	37.5	88.0	75.0	150.5

Note:

NS = Not Sampled

**Table 2-6
Colusa Reservoir Avian Transect Results*
(Density in Birds/Square Mile)**

Species	Summer	Fall	Winter	Spring
Bank swallow		0.14		
Burrowing owl		0.14		0.03
California horned lark	85.00	7.38	22.63	36.66
Cooper's hawk		0.14	0.27	
Double-crested cormorant				0.10
Golden eagle	0.22	0.32	0.24	0.30
Lark sparrow	NS	NS		0.80
Loggerhead shrike	0.89	2.15	1.84	2.82
Long-billed curlew				4.53
Northern harrier	1.00	0.67	0.87	0.50
Prairie falcon		0.14		
Sandhill crane		0.67		
Sharp-shinned hawk		0.14		
Southern bald eagle		0.04	0.03	0.10
Tri-colored blackbird	41.50			20.32
Miles of transect per season	20.0	74.5	38.0	87.5

*Colusa Reservoir would include the footprint of Sites Reservoir. Observed avian species reported for Colusa Reservoir reflect data from the Colusa Cell only; the total number of species observed would therefore be in addition to the observed species reported for Sites Reservoir

Note:

NS = Not Sampled

**Table 2-7
Newville Reservoir Avian Transect Results
(Density in Birds/Square Mile)**

Species	Summer	Fall	Winter	Spring
California horned lark	NS	NS	0.52	0.75
Cooper's hawk	NS	NS	0.17	
Golden eagle	NS	NS	0.10	0.13
Lark sparrow	NS	NS	7.64	1.50
Loggerhead shrike	NS	NS	2.05	0.90
Merlin	NS	NS	0.04	
Northern harrier	NS	NS	0.15	0.06
Prairie falcon	NS	NS	0.05	0.12
Southern bald eagle	NS	NS	0.08	
Tri-colored blackbird	NS	NS	0.69	2.41
Miles of transect per season			58.5	58.5

NS=Not Sampled

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**Table 2-8
Red Bank Project Avian Transect Results
(Density in Birds/Square Mile)**

Species	Summer	Fall	Winter	Spring
Cooper's hawk		0.07	0.16	0.26
Garden eagle	0.09	0.25	0.30	0.32
Lark sparrow	NS	NS	0.18	4.79
Lawrence's goldfinch			0.36	0.78
Merlin				0.07
Northern harrier		0.08	1.07	0.26
Osprey				0.13
Prairie falcon			0.0	0.13
Sharp-shinned hawk		0.19	0.40	0.06
Southern bald eagle		0.11	0.05	0.26
Miles of transect per season	25.5	53.0	55.0	68.0

NS = Not Sampled

**Table 2-9
Sensitive Mammals Observed within the Four Potential Reservoir Locations**

Species	Sites	Colusa*	Newville	RedBank
American badger	X	X	X	
Pallid bat	X	X	X	X
Ringtail	X		X	
San Joaquin pocket mouse			X	
Western red bat	X			X
Yuma myotis	X		X	X

*Colusa Reservoir would include the footprint of Sites Reservoir. Observed mammal species reported for Colusa Reservoir reflect data from the Colusa Cell only; the total number of species observed would therefore be in addition to the observed species reported for Sites Reservoir.

2.2.3 Alternatives Considered but Rejected from Further Consideration

Following an evaluation of the results of the NODOS Investigation Progress Report (DWR, 2000), the Red Bank and Colusa alternatives were eliminated from further consideration. The reasons for eliminating these two alternatives are provided below.

2.2.3.1 Red Bank Alternative

The following issues contributed to the decision to eliminate the Red Bank Alternative from further consideration:

- Because the primary storage for the Red Bank Alternative (Schoenfield Reservoir) would be offstream, the Red Bank Alternative was initially retained. However, the supply source (Dippingvat Reservoir) would be onstream, which would result in greater environmental impacts and implementation challenges. If Dippingvat Reservoir was removed from the alternative, another water supply source would be needed to fill Schoenfield Reservoir, and the storage volume of the Red Bank Alternative would be reduced to 0.25-MAF. This reduced storage volume would reduce the alternative's ability to provide broad benefits (when compared to the other location alternatives considered). In addition to the small storage capacity, initial geotechnical investigations indicated the potential for excessive reservoir leakage.

- The Red Bank Alternative location has greater habitat diversity than the other locations considered. More than 60 percent of the Red Bank Alternative location consists of blue oak-foothill pine habitat and approximately 20 percent consists of blue oak woodland habitat. In comparison, approximately 99, 85, and 89 percent of the Colusa, Newville, and Sites reservoir alternative locations, respectively, are dominated by annual grassland habitat. Consequently, the Red Bank Alternative site is able to support numerous wildlife species, and supports a relatively high winter deer use compared to the other locations.
- Cottonwood Creek is the largest undammed tributary in the upper Sacramento River Basin and is the most important source of sediments to the Sacramento River. These sediments are necessary for river meander, riparian recruitment, and spawning habitat. The Red Bank Alternative would substantially reduce sediment contributions to the Sacramento River.
- The South Fork of Cottonwood Creek also provides spawning habitat for fall-run and late-fall-run Chinook salmon, and supports spring-run Chinook salmon in some years. In addition to these potential fishery impacts, the California red-legged frog, federally listed as threatened, was observed during field surveys. As evaluated, this alternative would result in significant and unavoidable adverse effects to spring-run Chinook salmon and steelhead on the South Fork Cottonwood Creek.

Because of the potential for greater environmental impacts, the Red Bank Alternative was not recommended for further consideration. In addition, the conceptual purpose of the Red Bank Alternative was to supply the Corning and T-C canals early in the irrigation season, which would allow the RBDD gates to be raised an additional month or more. Subsequent to the elimination of the Red Bank Alternative from further consideration, NMFS released a Biological Opinion (2000) that requires phasing out the use of the RBDD gates. Construction of the Red Bluff Diversion Dam Fish Passage Improvement Project, which allows the RBDD gates to remain open permanently, was completed in September 2012. This new infrastructure and required operational change makes the proposed Red Bank Alternative obsolete.

2.2.3.2 Colusa Reservoir Alternative

The following issues contributed to the decision to eliminate the Colusa Reservoir Alternative from further consideration:

- The Colusa Reservoir Alternative surface area (28,000 acres) would be two times larger than the surface area of the Sites Reservoir Alternative (14,000 acres). Colusa's larger reservoir footprint (1.9 times the 1.9-MAF (14,500 acres) and 1.6 times the 3.0-MAF (7,000 acres) Newville Reservoir options), and its larger facilities would have an overall greater environmental impact than the other smaller reservoir alternatives.
- The potential reservoir size of the Colusa, Newville, and Sites alternatives were compared with respect to their capital construction cost for reservoir storage, yield, and unit cost of storage per deliverable Project yield. This comparison helped identify, on an annualized basis, the relative cost-effectiveness of each measure. The total capital storage cost (in 2004 dollars) for Sites Reservoir (1.8-MAF) was estimated at \$320,250,000; Colusa Reservoir (3.0-MAF) at \$1,411,520,000; and Newville Reservoir (1.9-MAF) at \$235,134,000. Colusa Reservoir's high total capital storage cost (4.4 to 6.0 times the cost of the Newville and Sites reservoir alternatives respectively) made the Colusa Reservoir Alternative the least cost effective alternative.
- A preliminary economic assessment was conducted to compare the average annual cost of storage per yield for the three reservoirs. The estimated average annual cost per yield would be similar in

magnitude for the Sites Reservoir Alternative (\$64 per acre-foot) and the Newville Reservoir Alternative (\$47 per acre-foot), but would be comparatively excessive for the Colusa Reservoir Alternative (\$235 per acre-foot). The Sites Reservoir Alternative's average annual cost for storage per unit yield would be approximately 36 percent greater than the Newville Reservoir Alternative. The Colusa Reservoir Alternative's average annual cost for storage per unit yield would be approximately 367 percent greater than the Sites Reservoir Alternative and approximately 500 percent greater than Newville Reservoir Alternative, while the increase in yield between the Colusa Reservoir Alternative and the Sites and Newville reservoir alternatives would only be approximately 19 percent.

All of the environmental and cultural resources effects of the Colusa Reservoir Alternative would be additive to those of the Sites Reservoir Alternative, as the Colusa Reservoir Alternative includes the entire reservoir footprint of the Sites Reservoir Alternative. These potential environmental effects would include substantial additional loss of wildlife habitat (13,664 acres) and impacts to wetlands and waters of the U.S., including an additional loss of 444 acres of waters of the U.S. above those identified for the 1.8 MAF Sites Reservoir Alternative. All other environmental effects would be additive to those of the 1.8 MAF Sites Reservoir Alternative. The Colusa Reservoir Alternative was determined to be infeasible due to cost, and undesirable based on substantially greater environmental effects as compared to either the Sites or Newville reservoir alternatives. Additionally, comparatively the Colusa Reservoir Alternative would fail to substantially lessen any significant effects. Because of this comparative lack of efficiency and greater environmental impact, the Colusa Reservoir Alternative was not recommended for further consideration.

2.3 Alternatives Selected for Analysis

The Sites and Newville reservoir alternatives were retained for further consideration. In addition, a No Project Alternative and No Action Alternative were added for consideration.

2.3.1 Background

DWR and Reclamation retained both the Sites and Newville reservoir alternatives for further analysis, as both alternatives were considered technically feasible and not enough data had been gathered to provide a meaningful comparison between the two alternatives. The NODOS Investigation continued engineering, geologic, environmental, and cultural resource data collection on the reservoir footprints. Additionally, these evaluations were expanded to include other major project facilities including diversions, conveyance routes, road relocations, recreation areas, and regulating reservoirs for both the Sites and Newville reservoir alternatives. These data allowed a more complete and robust comparison of the environmental effects of the two alternatives. DWR's November 5, 2001 Notice of Preparation (NOP) and Reclamation's November 9, 2001 Notice of Intent (NOI) indicated that the No Project, No Action, Sites Reservoir, and Newville Reservoir alternatives would be analyzed in the NODOS Project EIR/EIS. Reclamation's NOI also allowed for the evaluation of other alternatives to meet NODOS Project objectives, including conjunctive use or Shasta Reservoir enlargement, either as stand-alone projects or in conjunction with other NODOS Project alternatives.

Subsequent evaluations by other programs determined that the potential for conjunctive use is limited because Sacramento Valley groundwater basins recharge annually, leaving no space for operable storage (NHI and GCID 2011; URS 2007). Conjunctive use was, therefore, not retained as a feasible alternative.

Reclamation is investigating Shasta Lake enlargement as part of its Shasta Lake Water Resources Investigation. State involvement in this project is effectively barred by Public Resources Code

section 5093.542, which authorizes DWR to participate in studies involving the technical and economic feasibility of enlargement of Shasta Dam but otherwise prohibits DWR or any State department or agency to assist or cooperate with any other entity on a project "...that could have an adverse effect on the free-flowing condition of the McCloud River, or on its wild trout fishery." As a result, Shasta Lake enlargement was not retained as a feasible alternative to meet NODOS Project objectives. Along with the No Project/No Action alternative, the Sites and Newville reservoir alternatives were retained for further analysis.

The alternatives were evaluated based on their ability to meet the following NODOS Project primary and secondary objectives (Table 2-10).

**Table 2-10
North-of-the-Delta Offstream Storage Project Primary and Secondary Planning Objectives***

Primary Objectives	Secondary Objectives
Improve water supply reliability for agricultural, urban, and environmental uses.	Develop additional recreation opportunities in the study area
Improve environmental and drinking water quality in the Delta.	Provide incremental flood damage reduction opportunities
Increase survival of anadromous fish populations, as well as the health and survivability of other aquatic species	
Provide flexible hydropower generation to support integration of renewable energy sources	

*Primary planning objectives are the first priority that Project alternatives must address; Secondary planning objectives are opportunities that should be considered, to the extent possible, while meeting the Primary objectives.

Source: DWR and Reclamation, 2008.

The alternatives retained for further analysis are described below.

2.3.2 No Project/No Action Alternative

Existing Conditions, the No Project Alternative, and the No Action Alternative are described below to explain how the No Project/No Action Alternative was developed. The nature of the CEQA No Project Alternative and NEPA No Action Alternative are discussed briefly and separately below, but because the alternatives are, in this case, the same, all subsequent references will be to the No Project/No Action Alternative.

2.3.2.1 Existing Conditions

The CEQA Baseline for assessing significance of impacts of the proposed Project is the environmental setting, or Existing Conditions, at the time a NOP is issued, as provided for in CEQA Guidelines section 15125. However, the CEQA lead agency has the discretion, where appropriate, to fully or partially update baseline conditions beyond the time of the issuance of the NOP. The CEQA Baseline is developed to assess the significance of impacts of the proposed Project in relation to the actual environment upon which the proposed Project will operate. Generally, this environment is represented by conditions that exist at the time the NOP is issued. However, if the preparation of the EIR occurs over many years, it may be more relevant to expand the definition to include programs, projects, or policies that have been implemented during the preparation of the EIR.

The NOP for the proposed Project was published on November 5, 2001. However, because the preparation of this environmental document has occurred over many years, it was deemed necessary to update the baseline condition to June 2009 to include programs, projects, or policies that have been implemented during the document's preparation. Changes in the regulatory environment since November

2001 have fundamentally changed water management in California and necessitate updating the baseline conditions for environmental analyses in this DEIR/EIS. These changes include the issuance of new biological opinions (BO) by the U. S. Fish and Wildlife Service (USFWS) in December 2008 and the National Marine Fisheries Service (NMFS) in June 2009 on the operations of the State Water Project and Central Valley Project. Consequently, June 2009 (following the release of NMFS' BO) was selected as the proposed Project's Existing Conditions date.

2.3.2.2 No Project Alternative

CEQA requires an analysis of an alternative in which the proposed Project is not implemented. CEQA calls this scenario the No Project Alternative. The No Project Alternative allows decision-makers to use the EIR to compare the impacts of approving the proposed Project with the future conditions of not approving the proposed Project. Under CEQA, the No Project Alternative is the baseline for assessing the significance of impacts of the proposed Project (CEQA Guidelines section 15126.6 subsection (c) (1)). Analysis of the No Project Alternative proceeds along different lines depending upon the nature of the project. Where, as here, the project is a development project on identifiable property, the "no project" alternative is the circumstance under which the project does not proceed (CEQA Guidelines section 15126.6 subsection (e) (3)(B)). The No Project Alternative compares the environmental effects of the property remaining in its existing state against environmental effects which would occur if the project is approved.

CEQA Guidelines section 15126.6, subdivision (e)(2), indicates that No Project conditions include reasonably foreseeable changes in Existing Conditions and changes that would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services.

Many of the reasonably foreseeable programs and projects included within the No Project Alternative will affect water supply, water quality, or anadromous fisheries. To clearly identify and separate the environmental effects of these reasonably foreseeable projects and programs included under the No Project Alternative, this DEIR/EIS includes analyses of both the Existing Conditions and the No Project Alternative compared to the proposed Project.

2.3.2.3 No Action Alternative

Similar to CEQA, NEPA also requires an analysis of an alternative in which the proposed Project is not implemented. The NEPA Baseline for assessing environmental effects, including cumulative effects, of the proposed Project and alternatives is defined as the No Action Alternative. The No Action Alternative also demonstrates the future consequences of not meeting the need of the proposed Project. The No Action Alternative generally focuses on programs, projects, or policies that would affect or be affected by the proposed Project or the alternatives. The No Action Alternative represents a projection of current conditions to reasonably foreseeable future conditions that could occur if the proposed Project or alternatives are not implemented. The No Action Alternative includes Existing Conditions and future actions that are authorized; approved through completion of NEPA, CEQA, and Endangered Species Act compliance processes; funded; and permitted.

The No Action Alternative assumptions are consistent with the requirements and limitations prescribed by CEQA; therefore, analysis of the No Action Alternative is the same as for the No Project Alternative, and the two are treated as one alternative in this document. The No Project/No Action Alternative assumptions include the assumptions related to the State Water Project (SWP) and Central Valley Project (CVP), ongoing programs and policies by governmental and nonprofit entities, and assumptions related to

annual actions that vary every year. The No Project/No Action Alternative includes projects and programs with clearly defined management and/or operational plans, including facilities being constructed as of June 2009². The No Project/No Action Alternative also includes projects and programs that received approvals and permits in 2009 to remain consistent with existing management direction. Those actions are consistent with the continuation of existing management direction or level of management for plans, policies, and operations by the lead agencies and other agencies. Table 2-11 provides a summary of SWP and CVP operations included in the No Project/No Action Alternative.

**Table 2-11
Summary of SWP and CVP Operations Included in the No Project/No Action Alternative**

Non-SWP and CVP Project: Water Rights: Pursuant to water rights and SWRCB Decision for Existing Facilities
Federal and State Refuges with Level 2 Water Supplies: Firm Level 2 water needs
Level 4 Refuge Supplies: Met through water acquisition by Reclamation
American River Demands: Water Rights: Full water rights CVP Contracts: Full contracts, including Freeport Regional Water Project
Operations of SWP Facilities: Existing Facilities with NMFS BO and USFWS BO conditions FERC License Renewal for Oroville Project South Bay Aqueduct Improvement and Enlargement Project
Operations of CVP Facilities: Existing Facilities with NMFS BO and USFWS BO conditions New Red Bluff Diversion Dam Fish Passage Improvement Facilities Interim implementation for San Joaquin River Restoration Plan Freeport Regional Water Project Delta Mendota Canal-California Aqueduct Intertie
Operations of non-CVP Facilities: City of Stockton Delta Water Supply Project Contra Costa Water District's Middle River Intake and Pump Station (previously known as the Alternative Intake Project) Contra Costa Fish Screen Project (Rock Slough) Los Vaqueros Reservoir Expansion to 160 TAF of total storage capacity (60 TAF increase in storage capacity over existing capacity of 100 TAF) Full implementation of Grasslands Bypass Project

Notes:

NMFS = National Marine Fisheries Service
TAF = thousand acre-feet
USFWS = U.S. Fish and Wildlife Service

The projects and programs that are included in the No Project/No Action Alternative are summarized in Table 2-12. For a more detailed description of each project or program included in the No Project/No Action Alternative, refer to Appendix 2B.

The No Project/No Action Alternative includes continued implementation of operations, maintenance, enforcement, and protection programs by federal, State, and local agencies and non-profit groups, as summarized in Table 2-13, and described in detail in Appendix 2C.

² The lead agencies have established June 2009 as the Existing Conditions date; it is characterized in Chapters 6 through 31 as the Environmental Setting/Affected Environment discussion.

**Table 2-12
Projects and Programs Included in the No Project/No Action Alternative**

Agency	Project/Program	Comments
California Department of Water Resources	Mayberry Farms Subsidence Reversal and Carbon Sequestration Project	Completed in 2010.
Contra Costa Water District	Contra Costa Canal Fish Screen Project	Completed in late 2011.
Contra Costa Water District, Bureau of Reclamation, and California Department of Water Resources	Middle River Intake and Pump Station (previously known as the Alternative Intake Project)	Completed in July 2010.
California Department of Water Resources	Federal Energy Regulatory Commission License Renewal for Oroville Project	Final EIR in 2008. FERC license will be issued and operations will be in accordance with NMFS BO.
Freeport Regional Water Authority and U.S. Bureau of Reclamation	Freeport Regional Water Project	Completed in 2011.
Reclamation District 2093	Liberty Island Conservation Bank	Being implemented. Permits and approvals acquired in 2009.
City of Stockton	Delta Water Supply Project - Phase I	Completed in 2012.
U.S. Bureau of Reclamation and State Water Resources Control Board	Battle Creek Salmon and Steelhead Restoration Project	Construction started in 2009. Estimated completion in 2014.
Tehama Colusa Canal Authority and U.S. Bureau of Reclamation	Red Bluff Diversion Dam Fish Passage Improvement Project	Completed in September 2012.
U.S. Bureau of Reclamation, California Department of Fish and Wildlife, and Natomas Central Mutual Water Company	American Basin Fish Screen and Habitat Improvement Project	Estimated completion in 2014.
U.S. Bureau of Reclamation	Delta-Mendota Canal/California Aqueduct Intertie	Completed in April 2012.
U.S. Bureau of Reclamation, U.S. Army Corps of Engineers, Sacramento Area Flood Control Agency, and Central Valley Flood Protection Board	Folsom Dam Safety and Flood Damage Reduction Project	Being constructed. Estimated completion in 2015.
Yolo County	General Plan Update	Adopted in November 2009.
Zone 7 Water Agency and California Department of Water Resources	South Bay Aqueduct Improvement and Enlargement Project	Completed in 2012.

Note:

BO = Biological Opinion

NMFS = National Marine Fisheries Service

Many ongoing programs include development of future projects that would require separate environmental documentation as well as continued operations, maintenance, and/or enforcement activities. The No Project/No Action Alternative does not include future projects that have not been specifically defined or do not have completed environmental documentation. It is recognized that it is the intent of the SWP and CVP to comply with the NMFS Operations BO and USFWS Operations BO, although the specific actions for new facilities have not been identified or evaluated at this time.

PRELIMINARY – SUBJECT TO CHANGE

**Table 2-13
Ongoing Programs Included in the No Project/No Action Alternative**

Agency	Program
California Department of Boating and Waterways	Egeria Densa Control Programs
California Department of Boating and Waterways	Water Hyacinth Control Programs
California Department of Fish and Wildlife	Invasive Species Program
California Department of Fish and Wildlife	California Aquatic Invasive Species Management Plan
California Department of Fish and Wildlife	Zebra Mussel Rapid Watch Program and Response Plan for California
California Department of Fish and Wildlife	Fish Screen Passage Program
California Department of Fish and Wildlife	Delta-Bay Enhanced Enforcement Program
California Department of Fish and Wildlife	Ecosystem Restoration Program Conservation Strategy
California Department of Fish and Wildlife	Lower Sherman Island Wildlife Area Land Management Plan
California Department of Fish and Wildlife	Yolo Bypass Wildlife Area Land Management Plan
California Department of Fish and Wildlife and U.S. Fish and Wildlife Service	Hatchery and Stocking Program
California Department of Fish and Wildlife, California Department of Food and Agriculture, and California State Parks	Watercraft Inspection Programs
California Department of Water Resources	Delta Levees Flood Protection Program
California Department of Water Resources	Levee Repair-Levee Evaluation Program
California Department of Water Resources	Interagency Ecological Program
California Department of Water Resources	South Delta Temporary Barriers Program
California Department of Water Resources	Stockton Deep Water Ship Channel Demonstration Dissolved Oxygen Project
California Department of Water Resources	Zebra Mussel Watch Program
California Department of Water Resources and California Department of Fish and Wildlife	Delta Fish Agreement (Four Pumps Project)
California Department of Water Resources and Yuba County Water Agency	Lower Yuba River Accord
California State Lands Commission	Marine Invasive Species Program
Central Valley Regional Water Quality Control Board	Cache Creek, Bear Creek, Sulfur Creek, Harley Gulch Mercury TMDL
Central Valley Regional Water Quality Control Board	Irrigated Lands Regulatory Program
California Partners in Flight	Riparian Habitat Joint Venture
Central Valley Joint Venture Program	Central Valley Joint Venture
Contra Costa County and East Contra Costa County Habitat Conservancy	East Contra Costa County Habitat Conservation Plan and Natural Community Conservation Plan
Delta Protection Commission	Delta Protection Commission Land Use and Resource Management Plan Update
East Bay Municipal Utility District	Lower Mokelumne River Spawning Habitat Improvement Project
National Marine Fisheries Service, Bureau of Reclamation, and California Department of Water Resources	BO on the Long-Term Operations of the CVP and SWP (Sacramento River Winter-run Chinook Salmon, Central Valley Spring-run Chinook Salmon, Central Valley Steelhead, Southern Distinct Population Segment of North American Green Sturgeon, and Southern Resident Killer Whales)
Sacramento County	Sacramento International Airport Master Plan

PRELIMINARY – SUBJECT TO CHANGE

**Table 2-13
Ongoing Programs Included in the No Project/No Action Alternative**

Agency	Program
Sacramento Area Flood Control Agency, Central Valley Flood Protection Board, and U.S. Army Corps of Engineers	Flood Management Program
Sacramento County, Sacramento, Citrus Heights, Elk Grove, Folsom, Galt, and Rancho Cordova	Sacramento Stormwater Quality Partnership
San Francisco Bay Regional Water Quality Control Board	San Francisco Bay Mercury TMDL
San Joaquin Council of Governments	San Joaquin County Multi-Species Habitat Conservation and Open Space Plan
San Joaquin County, Stockton, Tracy, and State Water Resources Control Board	San Joaquin County, Stockton, and Tracy Stormwater Management Programs
Bay Area Stormwater Management Association Agencies	Bay Area Stormwater Management Programs
U.S. Army Corps of Engineers	Delta Dredged Sediment Long-Term Management Strategy
U.S. Army Corps of Engineers	Suisun Bay Channel Operations and Maintenance
U.S. Army Corps of Engineers	Suisun Channel (Slough) Operation and Maintenance
U.S. Bureau of Reclamation and California Department of Water Resources	Water Year 2010 Interim Flows Project (San Joaquin River)
U.S. Bureau of Reclamation and U.S. Fish and Wildlife Service	Anadromous Fish Screen Program
U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, National Marine Fisheries Service, California Department of Water Resources, and Department of Fish and Wildlife	San Joaquin River Restoration Program
U.S. Coast Guard	Ballast Water Management Program
U.S. Fish and Wildlife Service	Stone Lakes National Wildlife Refuge Comprehensive Conservation Plan
U.S. Fish and Wildlife Service	North American Waterfowl Management Plan
U.S. Fish and Wildlife Service, U.S. Bureau of Reclamation, and California Department of Water Resources	BO on the Long-Term Operations of the CVP and SWP (Delta Smelt)
U.S. Fish and Wildlife Service, U.S. Bureau of Reclamation, and California Department of Fish and Wildlife	San Joaquin Basin Action Plan
University of California, Davis and California Department of Water Resources	Smelt Hatchery Program
Yolo County	Yolo County Stormwater Management Program

Note:

BO = Biological Opinion

The following are other key assumptions for the No Project/No Action Alternative:

- The California Endangered Species Act (CESA) and the Federal Endangered Species Act (ESA) would continue to be implemented on a case-by-case basis for future programs and projects that have a potential to take listed species pursuant to each act.
- The No Project/No Action Alternative assumes settlement water rights holders in the Sacramento and San Joaquin river watersheds will use their full contract amounts by 2025 based on their contracts with Reclamation.
- The No Project/No Action Alternative assumes continued operations of flood management facilities by the federal, State, and local agencies. In addition, the No Project/No Action Alternative assumes that, without future engineering and environmental analyses, levee failures due to flooding, erosion,

subsidence, wave action, seismic events, burrowing animals, physical encroachment (such as barge collisions), or other causes would be repaired as part of ongoing programs. The No Project/No Action Alternative assumes that these repairs also would occur on privately owned levees that are integral to the main waterways in the Delta, such as repairs that occurred to privately owned levees following the 1996 and 1997 floods.

- The No Project/No Action Alternative also includes existing facilities for SWP, CVP, and Contra Costa Water District, and the Tehama-Colusa Canal and Glenn-Colusa Irrigation District Canal. Summary descriptions of these facilities are provided in Appendix 2D.
- Operations of the SWP and CVP by DWR and Reclamation, respectively, are described in the August 2008 Biological Assessment for the Long-term OCAP for the CVP and SWP prepared by Reclamation and modified by the 2009 NMFS BO and 2008 USFWS BO.
- SWP and CVP operational assumptions also include continued operations under the Coordinated Operations Agreement; SWRCB Decision 1641 (D-1641); use of Joint Points of Diversion (which allows DWR and Reclamation to use both the SWP and CVP diversion capacity capabilities in accordance with D-1641); SWRCB Water Quality Control Plan adopted in 2006; and implementation of the *Central Valley Project Improvement Act including environmental water actions in accordance with Section 3406(b)(2)*.
- The No Project/No Action Alternative assumes completion of the RBDD Fish Passage Improvement Project, and year-round gates out operations.
- The No Project/No Action Alternative does not assume new Delta conveyance facilities to be in place, rather Delta exports would continue to be pumped through the Banks and Jones pumping plants.
- The No Project/No Action Alternative does not include assumptions of future changes in facilities operations, land use, or policies to accommodate or mitigate the adverse impacts associated with climate change.
- The No Project/No Action Alternative does not include assumptions for climate change related to sea level rise and changes in precipitation patterns, including changes in ratios between snow and rainfall. A sensitivity analysis to account for climate change effects on the proposed Project was performed and is presented in Chapter 25 Climate Change and Greenhouse Gas Emissions.
- Population growth is expected to continue to occur in California throughout the period of project analysis (i.e., 100 years).

2.3.3 Sites Reservoir Alternative

The description of the Sites Reservoir Alternative was developed to include details for the appurtenant facilities shown in Figures 2-2 and 2-3. Evaluation of the alternative continued to focus on a 1.8-MAF reservoir size, although a range of reservoir sizes were also considered.

During this phase of the investigation, non-irrigation season flows in the CBD, the Sacramento River, and local tributaries remained potential sources of water supply for the offstream Sites Reservoir Alternative. Potential conveyance systems from these sources to the reservoir included existing and/or enlarged Tehama-Colusa (T-C) and Glenn-Colusa Irrigation District (GCID) canals, or a new conveyance facility from the Sacramento River near Moulton Weir and/or from the CBD to the existing Funks Reservoir on

the T-C Canal. Conveyance from Stony Creek was also considered. All conveyance alternatives required enlargement of the existing Funks Reservoir to provide adequate storage capacity for pumping of water into the reservoir and hydropower generation. Major project facilities would be situated near the Funks Creek damsite, including outlet works, power plant, intake structure, and maintenance facilities. Additionally, up to five potential recreation facility locations were identified to meet the secondary objective of developing additional recreation opportunities in the study area.

Construction of Sites Reservoir would require relocation of two county roads (Sites Lodoga and Huffmaster roads) and the community of Sites.

2.3.4 Newville Reservoir Alternative

The description for the Newville Reservoir Alternative was also developed and refined to include details for the appurtenant facilities shown in Figures 2-4, 2-5, 2-6, and 2-7. Evaluation of the alternative focused on the 1.9-MAF reservoir size. A 3.0-MAF reservoir size was also considered and evaluated. However, all of the environmental and cultural resources effects, as well as the cost, of the 3.0-MAF reservoir would be additive to those of the 1.9-MAF reservoir. The 3.0-MAF Newville Reservoir was therefore not evaluated further.

The Sacramento River and existing Black Butte Reservoir were considered, in addition to Thames Creek, as potential sources of water supply for the Newville Reservoir Alternative. Potential conveyance systems from these sources to the reservoir included the existing or enlarged T-C Canal with a new conveyance between the GCID and T-C canals, a new conveyance from the T-C Canal to the existing Black Butte Reservoir, and a new conveyance from Black Butte Reservoir to the Newville Reservoir Alternative. A new conveyance from a proposed Thames Creek diversion at a location north and west of the Newville Reservoir Alternative was also considered. Additionally, five potential recreation areas were identified to meet the secondary objective of developing additional recreation opportunities in the study area.

Construction of the Newville Reservoir Alternative would require relocation of portions of three county roads, including Round Valley Road, Garland Road, and County Road 306.

2.4 Resource Impact Comparison for Selected Alternatives

A review of potential impacts to biological and cultural resources for the Sites Reservoir and Newville Reservoir alternatives indicated a greater impact potential for the Newville Reservoir Alternative. Potential impacts for both reservoir alternatives, as well as the No Project/No Action Alternative, are described below.

2.4.1 Cultural Resources

Table 2-14 presents a comparison of the cultural resources survey results for the Sites Reservoir (1.8-MAF) and Newville Reservoir (1.9-MAF) alternatives. Newville Reservoir Alternative data represent totals for the reservoir footprint only, while Sites Reservoir Alternative data include data associated with all major proposed Project facilities, including conveyance routes, road relocations, recreation areas, hydropower facilities, and a terminal regulating reservoir. Despite the smaller survey area, the Newville Reservoir Alternative location contains substantially more cultural resources than the Sites Reservoir Alternative location, including more middens. Middens are indicative of long periods of site occupation and are an important cultural resource, as they can be expected to yield substantial cultural information and human remains. Under the No Project/No Action Alternative, no impacts to cultural resources or cemeteries are expected.

**Table 2-14
Comparison of Potential Cultural Resource Impacts associated with the Sites Reservoir
and Newville Reservoir Alternatives**

Cultural Resource	Number of Cultural Resources Identified	
	Sites Reservoir Alternative	Newville Reservoir Alternative*
Historic and prehistoric sites*	147	250
Cemeteries	2	2
Middens	57	80

*Newville Reservoir Alternative survey data for reservoir footprint only

2.4.2 Terrestrial Biological Resources

2.4.2.1 Wildlife Habitat

The Newville Reservoir Alternative could result in the permanent direct habitat loss of up to 24,866 acres, compared to 18,308 acres at the Sites Reservoir Alternative. The Newville Reservoir Alternative location also contains greater habitat and structural diversity, with the potential affected acreage of every habitat type greater for the Newville Reservoir Alternative than the Sites Reservoir Alternative (Table 2-15). Under the No Project/No Action Alternative, no permanent loss of most habitat types is expected to occur. Blue oak woodlands would likely continue to be lost due to ongoing fuelwood harvest at both reservoir alternative locations.

**Table 2-15
Potential Permanent Habitat Loss Comparison between the Sites Reservoir
and Newville Reservoir Alternatives**

Habitat Type	Potential Permanent Habitat Loss (acres)*	
	Sites Reservoir Alternative	Newville Reservoir Alternative
Annual grassland	16,311	17,556
Blue oak woodland	924	2,532
Wetlands	249	525
Riparian	75	476
Chaparral	1	422
Agricultural	250	1,744
Valley oak woodland	4	104
Juniper woodland	0	36
Shale barren	0	268
Blue oak/foothill pine	494	1,203
Total acreage	18,308	24,886

*Acreage values include all project features including reservoirs, dams, road relocations, and conveyance routes where habitat would be permanently modified.

2.4.2.2 Wildlife Species

Several invertebrate species protected under the federal Endangered Species Act have the potential to occur at or near both the Sites Reservoir and Newville Reservoir alternatives locations, including valley elderberry longhorn beetle, vernal pool fairy shrimp, Conservancy fairy shrimp, and vernal pool tadpole shrimp.

Protocol-level surveys conducted at the Sites Reservoir Alternative location indicate that none of the federally-listed vernal pool invertebrates are present. Vernal pools at the Newville Reservoir Alternative location were not surveyed.

Protocol-level surveys indicate that nearly twice as many elderberry stems would be affected, and that the presence of the valley elderberry longhorn beetle is much higher (based on surveyed emergence holes), at the Newville Reservoir Alternative location than at the Sites Reservoir Alternative location (Table 2-16). Under the No Project/No Action Alternative, no significant loss of vernal pool habitat is expected. Continued long-term degradation related to disking for dryland grain production will likely continue at the Sites Reservoir Alternative location. No significant additional loss of elderberry shrubs at either reservoir alternative is expected under the No Project/No Action Alternative.

**Table 2-16
Valley Elderberry Longhorn Beetle Survey Results Comparison between the Newville Reservoir and Sites Reservoir Alternatives**

VELB* Survey Criteria	Number Observed per Location	
	Sites Reservoir Alternative	Newville Reservoir Alternative
Total elderberry stems	672	1201
Elderberry stems with emergence holes	18	264

*VELB = valley elderberry longhorn beetle

Comparison of Sites and Newville reservoir alternatives indicate that both locations have the potential for short-term construction-related impacts to the giant garter snake, which is State and federally listed as threatened. Under the No Project/No Action Alternative, no short-term or long-term impacts to giant garter snake are expected.

The California red-legged frog, federally listed as threatened, was found during field surveys in the vicinity of the Newville Reservoir Alternative location. This species was not found during field surveys at the Sites Reservoir Alternative location. No adverse effects to California red-legged frog are expected under the No Project/No Action Alternative.

Comparison of the Sites and Newville reservoir alternatives indicate comparable occurrence of, and potential impacts to, State and federally listed birds and mammals. Both reservoir alternative locations would result in take under the Bald and Golden Eagle Protection Act. No substantial take of State or federally listed birds or mammals are expected under the No Project/No Action Alternative. Some minor degradation of golden eagle nesting and foraging habitat will likely continue under the No Project/No Action Alternative due to ongoing fuelwood harvest and ground squirrel control activities at both reservoir alternative locations.

The Newville Reservoir Alternative would impact a portion of the Thomes Creek deer herd's winter range. The Sites Reservoir Alternative location does not include deer winter range. Under the No Project/No Action Alternative, degradation of deer wintering habitat at the Newville Reservoir Alternative location will likely continue due to fuelwood harvest of oaks.

2.4.3 Aquatic Biological Resources

The Newville Reservoir Alternative includes a diversion on Thomes Creek. This diversion is included as a project component (even though it is onstream) because it can provide approximately 200-TAF per year

of additional water to storage by gravity (without requiring pumping). Subsequent engineering evaluation indicated substantial design difficulties in providing a suitable diversion which can pass both fish and sediment at this location. This diversion would result in substantial adverse effects to spring-run Chinook salmon, steelhead, and sediment passage. Without feasible fish passage measures, adverse effects to anadromous fisheries would occur. These adverse effects would not be consistent with the NODOS Project primary planning objective of increased survival of anadromous fish populations, or CALFED’s direction to avoid significant redirected impacts including those associated with new onstream reservoirs. By comparison, the tributary streams that would be affected by the Sites Reservoir Alternative, which include Stone Corral and Funks creeks, are ephemeral and do not support anadromous fisheries.

Under the No Project/No Action Alternative, no changes to anadromous fish habitat or populations are expected at either reservoir alternative location. However, many programs and projects included under the No Project/No Action Alternative are designed specifically to improve fish habitat and increase fish populations in the Sacramento Valley and Delta, including the Red Bluff Diversion Dam Fish Passage Improvement Project, Battle Creek Salmon and Steelhead Restoration Project, Contra Costa Canal Fish Screen Project, American Basin Fish Screen and Habitat Improvement Project, the CDFW Fish Screen and Passage Program, Delta Fish Agreement, OCAP Biological Opinions, and the Lower Yuba River Accord.

2.4.4 Botanical Resources

Field studies indicate that the Newville Reservoir Alternative contains greater numbers of rare plant species, higher priority plant species, and greater numbers of rare plant populations than the Sites Reservoir Alternative (Table 2-17). No substantial impacts to rare plant populations are expected at either reservoir alternative location under the No Project/No Action Alternative. Continued minor degradation of some rare plant populations will likely occur due to land use practices such as dryland farming, year-round grazing, and herbicide use.

**Table 2-17
Comparison of Rare Plant Species and Populations at the Sites
and Newville Reservoir Alternatives**

Listing Status	Number of Rare Plants Observed (species/populations)	
	Sites Reservoir Alternative	Newville Reservoir Alternative
State or federal threatened or endangered	0	0
State or federal species of concern	0	3/57
CNPS 1A	0	0
CNPS 1B	0	5/122
CNPS 2	0	0
CNPS 3	0	0
CNPS 4	4/37	7/183

Note:

CNPS=California Native Plant Society List

2.4.5 Wetlands and Waters of the U.S.

Comparison of the Newville and Sites reservoir alternatives indicates that the Newville Reservoir Alternative would impact significantly greater amounts of wetlands and waters of the U.S. (Table 2-18),

including jurisdictional wetlands, than the Sites Reservoir Alternative. No substantial loss of wetlands or waters of the U.S. are expected at either reservoir alternative location under the No Project/No Action Alternative. Minor continued degradation of vernal pool habitats will likely continue due to disking for dryland grain farming.

**Table 2-18
Comparison of Potential Impacts to Wetlands and Waters of the U.S. between the Sites and
Newville Reservoir Alternatives.**

Resource	Wetlands and Waters of the U.S. Potentially Impacted (acres)	
	Sites Reservoir Alternative	Newville Reservoir Alternative
Wetlands	196	390
Waters of the U.S.	175	231
Total wetlands and waters*	371	621

*Reservoir footprint data comparisons

2.4.6 Energy and Greenhouse Gas Emissions

The Newville Reservoir Alternative would require more energy for pumping than the Sites Reservoir Alternative because minimum conveyance distances would be greater (18 to 23 miles for Newville Reservoir, compared to one to 13 miles for Sites Reservoir), more pumping plants would be required, and higher pumping elevations (approximately 400 feet higher pumping elevation for Newville Reservoir) would be required for conveyance for Newville Reservoir Alternative. Higher conveyance-related energy requirements associated with the Newville Reservoir Alternative would result in relatively greater operational greenhouse gas emissions than for the Sites Reservoir Alternative. In addition, due to its greater embankment volume (35 million cubic yards for the Newville Reservoir Alternative vs. 22 million cubic yards for the Sites Reservoir Alternative), the Newville Reservoir Alternative would result in greater construction equipment hours and, therefore, greater GHG emissions during construction. Under the No Project/No Action Alternative, little change in the current levels of GHG emissions is expected because agricultural cultivation is the largest contributor of GHG emissions within the reservoir alternative locations, and the amount of land under cultivation at those locations is not expected to change.

2.4.7 Surface Water Resources

The Sites Reservoir Alternative would increase water supply reliability for agricultural, municipal, industrial, and environmental water users. The Newville Reservoir Alternative would increase water supply reliability for agricultural water users in the Sacramento Valley directly, and then potentially for other users by exchange. Elimination of the Thames Creek Diversion for the Newville Reservoir Alternative due to its infeasibility would significantly increase the alternative's construction costs, as other water sources 1) require much longer and more expensive conveyances, and 2) would have long-term greater operational costs, as they require pumpage instead of gravity to fill or refill the reservoir. Water supply reliability would be improved under the No Project/No Action Alternative with implementation of the many projects and programs included in the No Project/No Action Alternative, including South Bay Aqueduct Improvement and Enlargement Project, Freeport Regional Water Project, Delta Mendota Canal-California Aqueduct Intertie, City of Stockton Delta Water Supply Project, Contra Costa Water District's Middle River Intake and Pump Station Project, and Los Vaqueros Reservoir Expansion. Water supply reliability is increasingly linked to conservation measures issued under the federal Endangered Species Act. Some fish restoration actions identified under the No Project/No Action

Alternative may serve to expedite species recovery and ultimately result in improved water supply reliability. Examples include the Red Bluff Diversion Dam Fish Passage Improvement Project, Battle Creek Salmon and Steelhead Restoration Project, Contra Costa Canal Fish Screen Project, American Basin Fish Screen and Habitat Improvement Project, the CDFW Fish Screen and Passage Program, Delta Fish Agreement, OCAP Biological Opinions, and the Lower Yuba River Accord.

2.4.8 Flood Management

The Sites Reservoir Alternative could provide some local flood management benefits to lands that are currently prone to flooding during high flow events on Funks and Stone Corral creeks; the Newville Reservoir Alternative would have little flood management potential since the reservoir would be located upstream of Black Butte Reservoir, an existing flood management facility. Diversion facilities on Thomes Creek would have little or no ability to store water or provide downstream flood protection. Under the No Project/No Action Alternative, the Folsom Dam Safety and Flood Damage Reduction Project would improve flood protection for the Lower American River and the City of Sacramento.

2.4.9 Cost and Engineering Feasibility

Comparison of cost and engineering feasibility of the Sites and Newville reservoir alternatives indicate that both alternatives are technically feasible. However, construction and operational costs would be greater for the Newville Alternative due to greater embankment requirements, and greater conveyance length and lift. Costs and engineering feasibility associated with the No Project/No Action Alternative are not applicable.

2.4.10 Sites-Newville Impact Comparison Conclusion

Surveys indicated that the Sites Reservoir and Newville Reservoir Alternatives would have similar potential impacts to giant garter snakes, State- and federally-listed birds and mammals, and that both would result in take under the Bald and Golden Eagle Protection Act. However, surveys also indicated that the Newville Reservoir Alternative would have a much higher potential for adverse impacts to cultural resources, wildlife habitat and diversity, elderberry plants and the valley elderberry longhorn beetle, the red-legged frog, deer winter range, rare plants and plant populations, and anadromous fish.

In addition, the Newville Reservoir Alternative would be more expensive to construct and operate than the Sites Reservoir Alternative, and would result in relatively greater construction and operation-related greenhouse gas emissions.

2.5 Preferred Proposed Project Alternative

DWR and Reclamation selected the Sites Reservoir Alternative as the preferred proposed Project alternative to be retained for further study and more detailed evaluation because of the consistently higher potential for biological and cultural resources impacts associated with the Newville Reservoir Alternative, and because the Newville Reservoir Alternative would not avoid or reduce any of the significant adverse effects associated with the Sites Reservoir Alternative.

Once the Sites Reservoir Alternative was identified as the preferred proposed Project alternative (hereafter proposed Project), all other necessary proposed Project features were conceptually developed and refined, including analyses of reservoir storage size, conveyance, and operational alternatives to maximize achievement of the NODOS Project objectives.

2.5.1 Sites Reservoir Storage Size Alternatives

DWR and Reclamation considered various storage sizes of Sites Reservoir, including 800 TAF, 1.27 MAF, 1.81 MAF, and 2.1 MAF. These four storage sizes were selected to reflect a range of storage values that would allow for a useful comparison of the costs and benefits estimates. These four storage sizes also represent points on the cost curve where the proposed Project’s costs would change significantly due to the need for new Project features, such as dams or embankments.

Table 2-19 presents a summary of each Sites Reservoir storage size that was initially considered, including the total number of dams that would be required to impound Sites Reservoir and the total embankment volume that would be required for each of the four storage sizes.

**Table 2-19
Summary of Dams and Embankment Volume of Potential Sites Reservoir Storage Sizes**

Reservoir Storage (MAF)	Maximum Water Surface Elevation (feet)	Reservoir Surface Area (acres)	Total Number of Dams ^a (main + saddle)	Total Embankment Volume (CY)
0.80	440	10,200	2 + 3	6,900,000
1.27	480	12,400	2 + 7	11,018,400
1.81	520	14,200	2 + 9	22,009,000
2.10	540	15,100	2 + 7 ^b	33,800,000

^aTotal number of dams includes the Sites and Golden Gate dams and the saddle dams.

^bSaddle dams 7, 8, and 9 become one continuous embankment for the 2.1-MAF reservoir.

Notes:

MAF = million acre-feet

CY = cubic yards

Source: DWR, 2004

Based on a review of the reservoir rim topography, site geology, and a cursory evaluation of the relationship between embankment volume and reservoir storage, DWR and Reclamation determined early in the investigation that a 2.1-MAF reservoir may present significant design challenges. Reservoir elevations at or above 540 feet elevation would likely require grouting of the lower saddle areas along the relatively steep ridges of the eastern rim to ensure the proposed Project would perform satisfactorily. This treatment, combined with the increasing relationship between embankment material volume and reservoir surface elevations, would result in larger unit costs (reservoir cost per acre-foot of storage) for reservoir elevations above 540 feet elevation. Therefore, the Sites Reservoir storage capacities below 540 feet elevation were considered to be more economical on a unit cost basis. Limiting the maximum reservoir elevation to 520 feet elevation would provide assurance that unknown conditions (such as leakage) on the relatively steeper slopes of the eastern reservoir rim would not result in large increases in proposed Project costs during the later stages of design. Therefore, a maximum reservoir elevation of 540 feet, corresponding to a reservoir size of 2.1 MAF, was eliminated from further consideration. Reservoir storage capacities of 800 TAF, 1.27 MAF, and 1.81 MAF were, therefore, carried forward for further consideration, including initial alternative development and evaluation.

2.5.2 Sites Reservoir Conveyance Alternatives

Preliminary operations simulations indicated that 3,000 to 6,000 cfs of total inflow capacity would be needed to reliably fill Sites Reservoir. Because Sites Reservoir would be located offshore, water would need to be diverted to and released from the reservoir. As a result, diversion and conveyance facilities

would be needed to transport water to Sites Reservoir, and to deliver water from Sites Reservoir to service areas, the Sacramento River, and other locations to meet various water resources needs and uses.

It was determined that, to maximize operational flexibility, the diversion and conveyance facilities would need to be able to:

- Release water directly from Sites Reservoir to meet local needs in the vicinity of the existing GCID and T-C canals
- Release water in an integrated manner with existing CVP and SWP operations to facilitate meeting additional needs throughout the Bay-Delta system
- Release water directly to the Sacramento River to meet additional needs throughout the Bay-Delta system and provide downstream benefits for Delta water quality and water supply reliability (through additional supplies or alternative source) for CVP, SWP, and Level 4 wildlife refuge water supply. Additionally, the ability to release water directly to the Sacramento River would allow Sites Reservoir to respond to Delta emergencies, including releasing flows to repel saltwater intrusion following a Delta levee failure.

Conveyance facilities alternatives that would divert water from the Sacramento River included the existing GCID and T-C canals, and a new pipeline, known as the Delevan Pipeline. Tributary source conveyance facilities alternatives included new pipelines from the CBD and Stony Creek. Conveyance facilities alternatives that were evaluated initially had a range of capacity sizes, known as options (Table 2-20), and are illustrated schematically in Figure 2-8.

**Table 2-20
Conveyance Facilities Alternatives Considered for Sites Reservoir**

Conveyance Facility Alternative	Source	Option Capacity Description
GCID Canal ^a	Sacramento River at Hamilton City	Existing 1,800-cfs capacity Expand to 3,000-cfs capacity Expand to 4,000-cfs capacity Expand to 5,000-cfs capacity
T-C Canal ^a	Sacramento River at Red Bluff	Existing 2,100-cfs capacity Modify to 2,700-cfs capacity Expand to 4,000-cfs capacity Expand to 5,000-cfs capacity
Delevan Pipeline ^b	Sacramento River opposite Moulton Weir	1,500-cfs capacity 2,000-cfs capacity 3,000-cfs capacity 4,000-cfs capacity 5,000-cfs capacity
Colusa Basin Pipeline ^b	Colusa Basin Drain	1,000-cfs capacity 3,000-cfs capacity
Stony Creek Pipeline ^b	Stony Creek at Black Butte Afterbay	1,000-cfs capacity 2,100-cfs capacity

^aExisting conveyance facility.

^bProposed new conveyance facility.

Notes:

cfs = cubic feet per second

GCID = Glenn-Colusa Irrigation District

T-C = Tehama-Colusa

Source: DWR and Reclamation, 2008.

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Each of the options for the conveyance alternatives were evaluated based on cost, the importance of providing direct release to the Sacramento River, and preliminary assessments of potential environmental and cultural resources impacts. Table 2-21 summarizes preliminary cost estimates for the conveyance alternative options and indicates the ability of the option to provide direct releases to the Sacramento River.

**Table 2-21
Preliminary Cost and Sacramento River Direct Release Potential for the Sites Reservoir
Conveyance Options**

Conveyance Facility Alternative	Option Capacity Description	Cost Estimate ^a (millions)	Ability to Provide Direct Release to Sacramento River?
GCID Canal ^b	Existing 1,800-cfs capacity	\$178.5 ^d	No
	Expand to 3,000-cfs capacity	\$302.3	No
	Expand to 4,000-cfs capacity	\$463.8	No
	Expand to 5,000-cfs capacity	\$552.3	No
T-C Canal ^b	Existing 2,100-cfs capacity	\$0	No
	Modify to 2,700-cfs capacity	\$110.9	No
	Expand to 4,000-cfs capacity	\$398.2	No
	Expand to 5,000-cfs capacity	\$556.5	No
Delevan Pipeline ^c	1,500-cfs capacity	\$364.9	Yes
	2,000-cfs capacity	\$421.4	Yes
	3,000-cfs capacity	\$574.3	Yes
	4,000-cfs capacity	\$747.2	Yes
	5,000-cfs capacity	\$917.2	Yes
Colusa Basin Pipeline ^c	1,000-cfs pipeline capacity	\$145.9	No
	3,000-cfs pipeline capacity	\$362.9	No
Stony Creek Pipeline ^c	1,000-cfs capacity	\$87.9	No
	2,100-cfs capacity	\$168.3	No

^aCosts are 2007 preliminary construction costs and do not include mitigation, engineering, or administrative costs.

^bExisting conveyance facility.

^cProposed new conveyance facility.

^dCosts are not \$0 due to the cost of restoring the design capacity of the GCID Canal for 14 miles. This cost was later removed because GCID would restore the 14 miles of Canal to design capacity as part of its required annual maintenance.

Notes:

cfs = cubic feet per second

GCID = Glenn-Colusa Irrigation District

T-C = Tehama-Colusa

Source: DWR and Reclamation, 2008.

Based on DWR's and Reclamation's conveyance evaluation, the following options were eliminated from further consideration:

- GCID Canal Expansions:** Expansion of the GCID Canal would require the acquisition of temporary and permanent rights-of-way. For example, the larger GCID Canal expansion options would require approximately 1,890 acres of land during construction. Permanent land area acquired for the canal expansion would be 940 acres, of which 727 acres are classified as prime agricultural land (preliminary estimates based on field survey). California's desire to preserve agricultural land is reflected in the California Land Conservation Act, also known as the Williamson Act. Other environmental considerations in the canal expansion footprint would include the loss of 286 elderberry stems greater than 1-inch in diameter, adverse effects to salmon and steelhead related to siphon enlargements, loss of giant garter snake habitat, disturbance of nesting habitat for the

Swainson's hawk, and extensive loss of jurisdictional wetlands, including vernal pools. The potential impacts to prime agricultural land and environmental resources associated with these facilities support the recommendation not to further evaluate GCID Canal expansions.

- **T-C Canal Modification and Expansions:** There were 2,468 acres of agricultural land determined to be within 100 feet of the T-C Canal modification and expansion area footprint; of these, 1,244 acres are classified as prime agricultural land (preliminary estimates based on field survey). Environmental considerations in the expansion area footprint would include the loss of vernal pool plants and invertebrates, loss of California tiger salamander habitat, loss of 170 elderberry stems greater than 1-inch in diameter, adverse effects to salmon and steelhead related to siphon enlargements, potential giant garter snake habitat loss, disturbance of nesting habitat for the Swainson's hawk, and loss of jurisdictional wetlands, including vernal pools. These potential impacts to prime agricultural land and environmental resources support the recommendation not to further evaluate T-C Canal modifications or expansion.
- **4,000 and 5,000 cfs Delevan Pipeline:** These options were determined to be inefficient and infeasible due to cost, which would be \$747 million and \$917 million, respectively. These preliminary construction cost estimates are presented in 2007 dollars and do not include mitigation, engineering, or administrative costs. Additionally, the smaller pipeline sizes were determined to be able to reliably fill and drain Sites Reservoir when combined with other conveyance options.
- **Colusa Basin Pipeline:** The water from the CBD is considered to be of relatively poor water quality when compared to Sacramento River water and is, therefore, less desirable. The CBD is the single largest source of agricultural return flows to the Sacramento River; as a result, it has elevated values for alkalinity, electrical conductivity, and total dissolved solids. Nitrogen and phosphorus concentrations also are generally higher in the CBD. Water taken from the CBD into Sites Reservoir and then released back through the conveyance system could cause water quality impacts to local agricultural users and create a new point source of relatively lower quality water if discharged into the Sacramento River. Therefore, neither Colusa Basin Pipeline conveyance option was recommended for further consideration.
- **Stony Creek Pipeline:** The Stony Creek Pipeline conveyance options would rely on increased capacity of the T-C Canal downstream of Orland. The T-C Canal modification and expansion conveyances were eliminated from further consideration (as indicated above); therefore, the Stony Creek Pipeline conveyance options were also eliminated from further consideration.

The conveyance options retained were:

- T-C Canal at its existing capacity of 2,100 cfs
- GCID Canal at its existing capacity of 1,800 cfs
- A new Delevan Pipeline at capacities of 1,500 cfs, 2,000 cfs, and 3,000 cfs

The T-C and GCID canals at their existing capacities would be the most cost-effective conveyance options. These conveyance options were retained because they could be combined to provide conveyance packages with up to 6,900 cfs total capacity for use in initial alternative development. In addition, these conveyance options allowed for an evaluation of benefits associated with the proposed Delevan Pipeline's ability to return water directly to the Sacramento River.

2.5.3 Sites Reservoir Operational Alternatives

Eight initial Sites Reservoir operational alternatives, each with a range of conveyance packages and operational emphases, were considered and evaluated with the CalSim-II operations model in the NODOS Plan Formulation Report (DWR and Reclamation, 2008). The operational alternatives assumed a Sites Reservoir storage size of 1.8 MAF. All of the initial Project operational alternatives evaluated met the proposed Project's primary objectives, but to varying degrees. The proposed Project operational alternative that emphasized a balanced mix of benefits to water supply reliability, water quality, and ecosystem enhancement generated the greatest net annual economic benefit and minimized environmental impacts, and therefore was selected as the operational scenario for detailed evaluation in this environmental document. This operational alternative was the only one evaluated that resulted in economic benefits that exceeded costs (i.e. benefit-cost ratio greater than 1.0). The other operational alternatives that prioritized one benefit category (i.e. water supply reliability, water quality, or ecosystem enhancement) were eliminated from further consideration.

2.5.4 Sites Reservoir Storage, Conveyance, and Operations Formulation

Based on the initial evaluation of storage, conveyance and operational alternatives, the following proposed Project features were retained for further evaluation:

- Sites Reservoir Storage: 800 TAF, 1.27 MAF, and 1.81 MAF
- Sites Reservoir Conveyance: existing T-C Canal (2,100-cfs capacity), existing GCID Canal (1,800-cfs capacity), and new Delevan Pipeline (1,500-cfs, 2,000-cfs, and 3,000-cfs capacity)
- Operational scenario that emphasized a balanced mix of benefits to water supply reliability, water quality, and ecosystem enhancement

To further evaluate and optimize reservoir storage and conveyance options, preliminary costs were estimated and operations modeling was performed. Table 2-22 identifies the reservoir storage and conveyance facility options that were evaluated and their associated total capital costs.

The purpose of the operations modeling was to reduce the number of possible Project combinations and to help formulate Sites Reservoir alternatives with the most efficient conveyance options and reservoir storage sizes. The operations simulations modeling was performed using an assumed operational scenario that provided a balanced mix of water supply reliability, water quality, and ecosystem enhancement. This operational scenario was similar to the operational scenario described above that generated the greatest net economic benefits. The water supply yield of the conveyance options and Sites Reservoir storage combinations was analyzed for long-term average and driest period's average hydrologic conditions. Preliminary economic evaluation was performed to value the water supply yield benefits for each combination. Net annual economic benefits were estimated and used as the primary economic metric to rank and compare the combinations as shown in Table 2-23.

Based on the preliminary operations simulations described above, a 3,000-cfs Delevan Pipeline was eliminated from consideration. Preliminary modeling results of the above-listed conveyance options indicated that a 2,000-cfs conveyance was adequate to meet the proposed Project objectives. Constructing a larger Delevan Pipeline would require a larger intake/discharge structure that would result in greater environmental impacts due to its presence in an area that has sensitive habitat. Constructing a larger pipeline would also significantly increase the construction cost and operational expense. Therefore, a 3,000-cfs Delevan Pipeline was not considered further.

**Table 2-22
Sites Reservoir Storage and Conveyance Options Combinations**

Reservoir Storage (TAF)	Conveyance				Capital Cost (\$Billion, 2007)*
	T-C+GCID Capacity (cfs)	Delevan Pipeline		Total Diversion Capacity (cfs)	
		Diversion Capacity (cfs)	Release Capacity (cfs)		
800	3,900	0	0	3,900	\$1.96
800	3,900	1,500	1,125	5,400	\$2.92
800	3,900	2,000	1,500	5,900	\$3.13
800	3,900	3,000	2,250	6,900	\$3.56
1,270	3,900	0	0	3,900	\$2.22
1,270	3,900	1,500	1,125	5,400	\$3.15
1,270	3,900	0	1,500	3,900	\$3.09
1,270	3,900	2,000	1,500	5,900	\$3.36
1,270	3,900	3,000	2,250	6,900	\$3.79
1,810	3,900	0	0	3,900	\$2.64
1,810	3,900	1,500	1,125	5,400	\$3.56
1,810	3,900	0	1,500	3,900	\$3.50
1,810	3,900	2,000	1,500	5,900	\$3.77
1,810	3,900	0	2,250	3,900	\$3.82
1,810	3,900	3,000	2,250	6,900	\$4.19

*This date is associated with the cost estimates from the NODOS Investigation Plan Formulation Report (DWR and Reclamation 2008).

Notes:

cfs = cubic feet per second
 GCID = Glenn-Colusa Irrigation District
 TAF = thousand acre-feet
 T-C = Tehama-Colusa

Source: DWR, 2011.

Table 2-23 presents a preliminary estimate of the net annual economic benefit that is associated with each reservoir storage and conveyance options combination that was retained, ranked in order of highest to lowest potential net annual economic benefit.

As shown in Table 2-23, the first three reservoir storage and conveyance options combinations are estimated to perform much better than the remainder of the reservoir storage and conveyance options combinations that were considered. These three reservoir size and conveyance options combinations were combined with new hydropower facilities to develop three configurations of Sites Reservoir denoted as Alternative A, Alternative B, and Alternative C in this DEIR/S. These action alternatives and the No Project/No Action Alternative provided a range of alternatives for further refinement and detailed analysis in the Feasibility Report and DEIR/EIS. The Red Bank, Colusa, Newville, and Sites reservoir alternatives considered and described previously and these refined action alternatives together provide a reasonable range and serve to meet the requirements of CEQA; NEPA; other pertinent federal, State, and local laws, regulations, and policies; and the Principles and Guidelines (P&Gs) presented in the U.S. Water Resources Council's *Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies* (USWRC,1983). Following is a brief description of the No Project/No Action Alternative and Alternatives A, B, and C that are evaluated in this DEIR/EIS:

- **No Project/No Action Alternative:** The No Project/No Action Alternative assumes that no actions would be taken to provide storage north of the Delta to improve water supply reliability, to enhance

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the survivability of anadromous fish or drinking water quality in the Delta, or to improve flexible hydropower generation.

- **Alternative A – 1.27-MAF Sites Reservoir with Delevan Pipeline:** Alternative A includes a 1.27-MAF Sites Reservoir with conveyance to and from the reservoir provided by the existing T-C and GCID canals and a new Delevan Pipeline (2,000-cfs diversion/1,500-cfs release). This alternative also includes new hydropower facilities.
- **Alternative B – 1.81-MAF Sites Reservoir with Release-only Delevan Pipeline:** Alternative B includes a 1.81-MAF Sites Reservoir with conveyance to and from the reservoir provided by the existing T-C and GCID canals, and a new release-only Delevan Pipeline (1,500-cfs release). This alternative also includes new hydropower facilities.
- **Alternative C – 1.81-MAF Sites Reservoir with Delevan Pipeline:** Alternative C includes a 1.81-MAF Sites Reservoir with conveyance to and from the reservoir provided by the existing T-C and GCID canals and a new Delevan Pipeline (2,000-cfs diversion/1,500-cfs release). This alternative also includes new hydropower facilities.

**Table 2-23
Preliminary Net Economic Benefit Estimates for Sites Reservoir Storage and Conveyance Options Combinations**

Reservoir Storage (TAF)	Conveyance				Net Annual Benefit (\$Million, 2007)
	TC+GCID Capacity (cfs)	Delevan Pipeline		Total Diversion Capacity (cfs)	
		Diversion Capacity (cfs)	Release Capacity (cfs)		
1,810	3,900	0	1,500	3,900	\$16.3
1,270	3,900	2,000	1,500	5,900	\$16.2
1,810	3,900	2,000	1,500	5,900	\$14.1
1,270	3,900	1,500	1,125	5,400	\$7.6
1,810	3,900	1,500	1,125	5,400	\$7.9
1,810	3,900	0	2,250	3,900	\$4.1
1,270	3,900	0	1,500	3,900	-\$0.7
800	3,900	1,500	1,125	5,400	-\$14.1
800	3,900	2,000	1,500	5,900	-\$17.4
1,270	3,900	0	0	3,900	-\$18.1
800	3,900	0	0	3,900	-\$23.0
1,810	3,900	0	0	3,900	-\$33.7

Notes:

cfs = cubic feet per second

GCID = Glenn-Colusa Irrigation District

TAF = thousand acre-feet

T-C = Tehama-Colusa

Source: DWR, 2011.

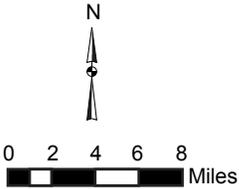
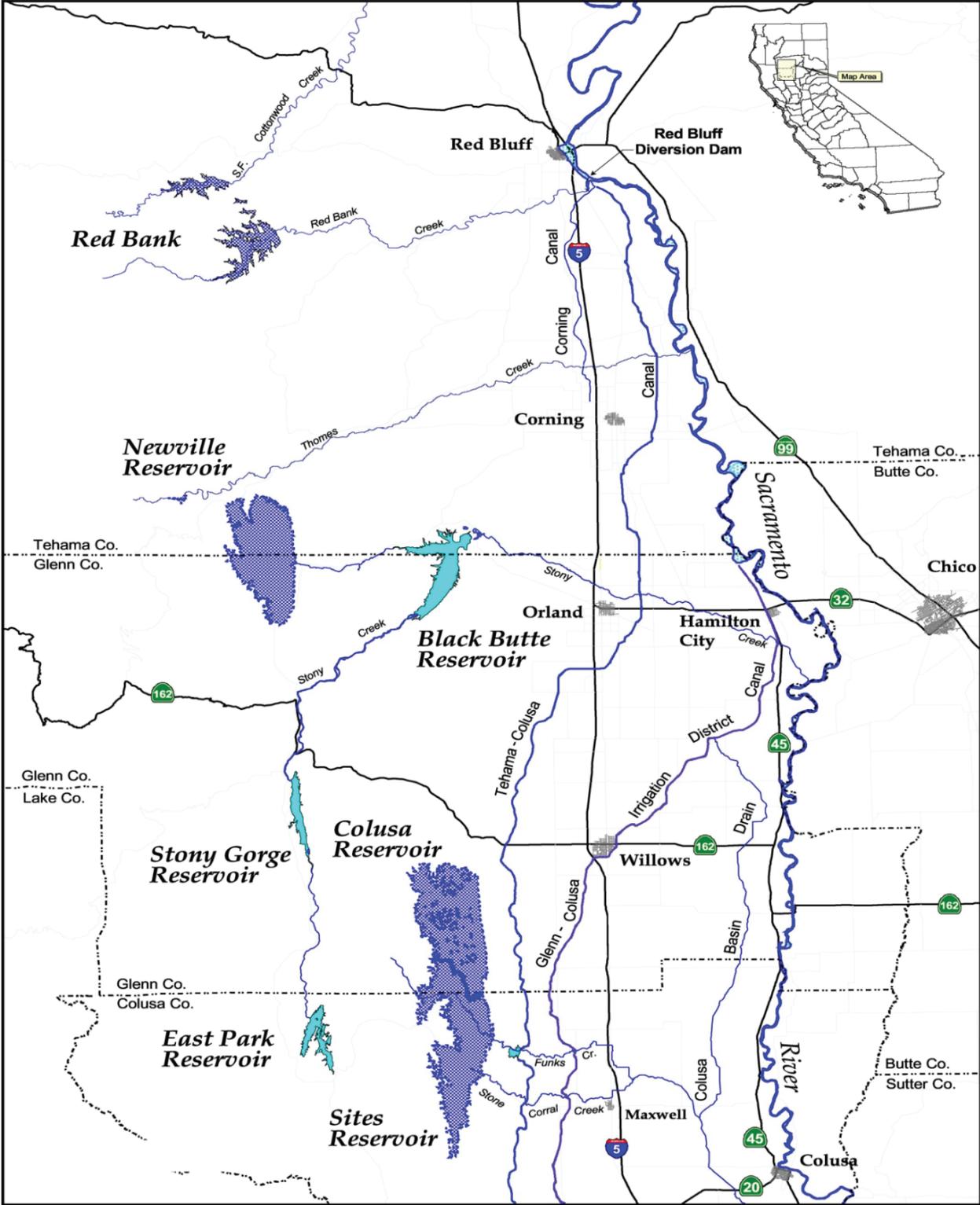
Maps and detailed descriptions of each of the proposed Project action alternatives, including descriptions of construction, operation, and maintenance activities associated with each proposed Project feature, as

well as a description of assumed Project operations, are provided in Chapter 3 Description of the Proposed Project/Proposed Action and Alternatives.

2.6 References

- CALFED Bay-Delta Program (CALFED). 2000. CALFED Initial Surface Water Storage Screening. August.
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- California Department of Water Resources (DWR). 2000. North-of-the-Delta Offstream Storage Investigation Progress Report. July.
- The Natural Heritage Institute and Glenn Colusa Irrigation District (NHI and GCID). 2011. Northern Sacramento Valley Conjunctive Water Management Investigation Final Report. December.
- URS Corporation (URS). 2007. Aquifer Storage Recovery (ASR) System and North-of-the-Delta Offstream Storage (NODOS) Investigation Technical Memorandum. Revised February 9.
- U.S. Water Resources Council (USWRC). 1983. U.S. Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies.

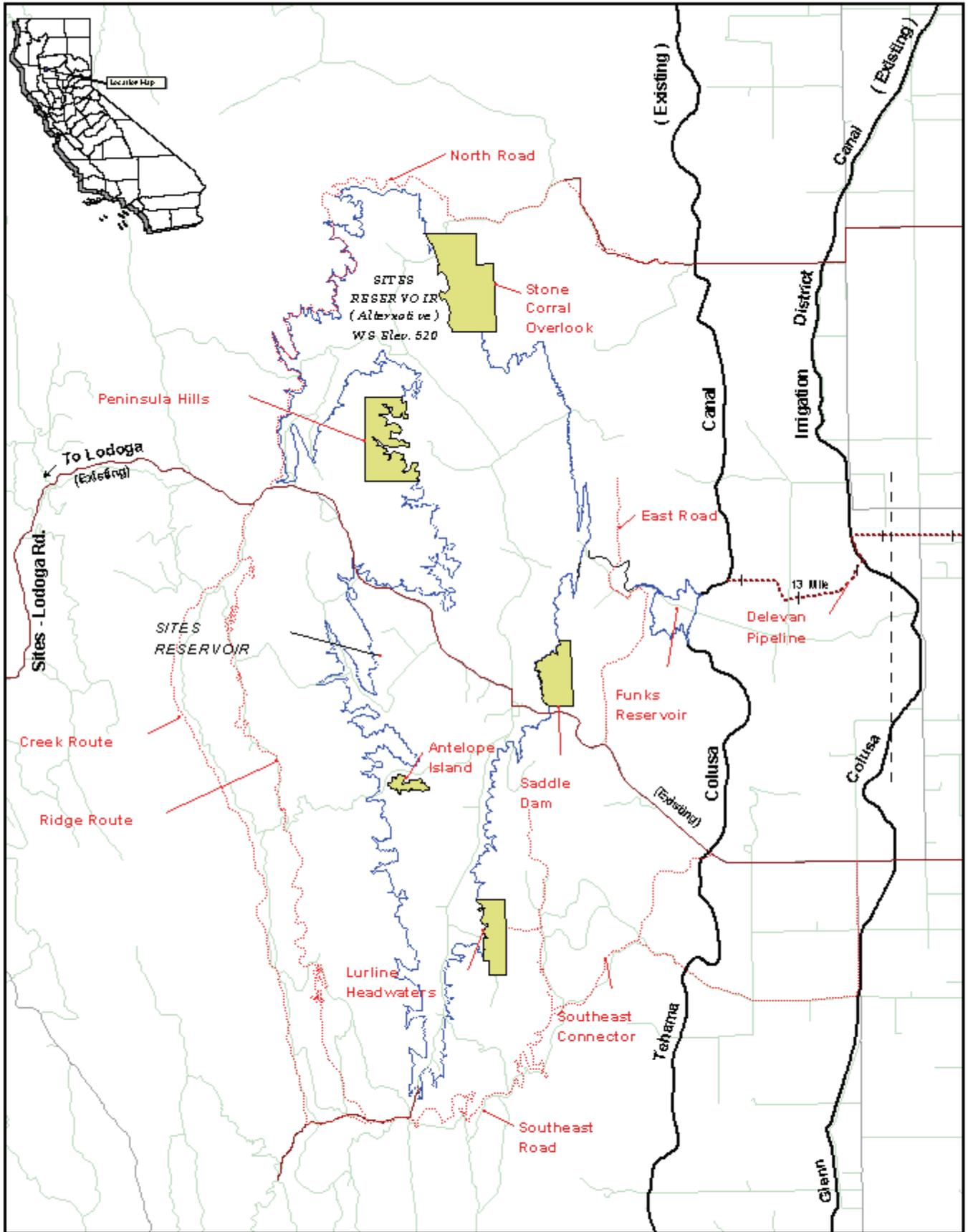
Figures



Legend

-  Existing Reservoirs
-  Proposed Reservoirs

FIGURE 2-1
Location of the Four Potential Reservoir Alternative Locations
North-of-the-Delta Offstream Storage Project



- - - - - Proposed Road Relocations
- Existing Roads
- Proposed Reservoir Boundary
- Proposed Recreation Areas

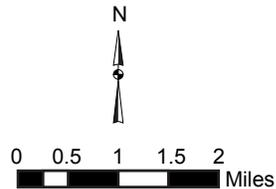
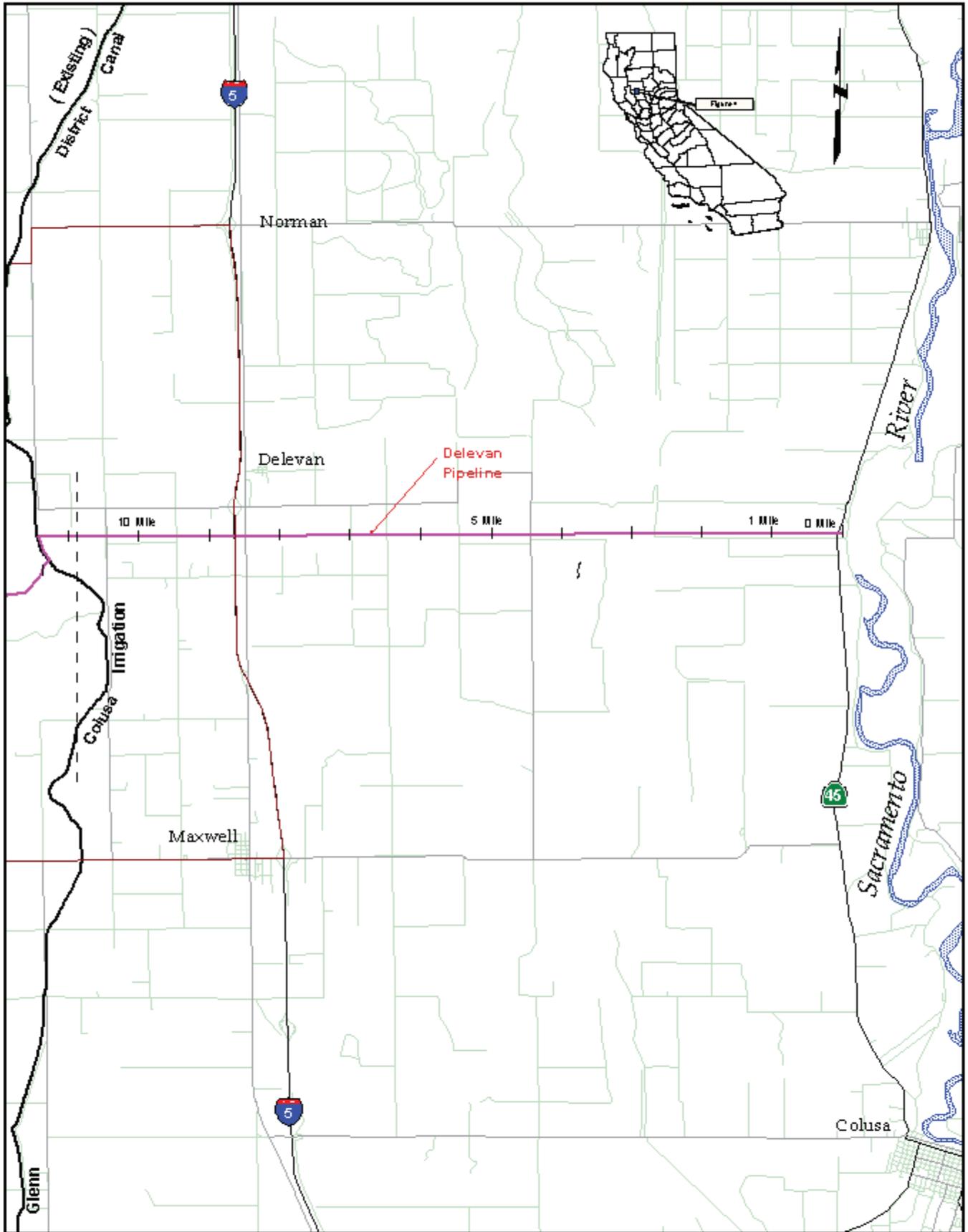


FIGURE 2-2
Sites Reservoir Alternative
Project Features
North-of-the-Delta Offstream Storage Project



Proposed Conveyance Routes

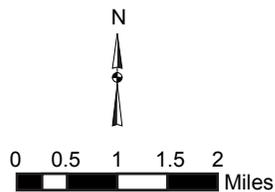
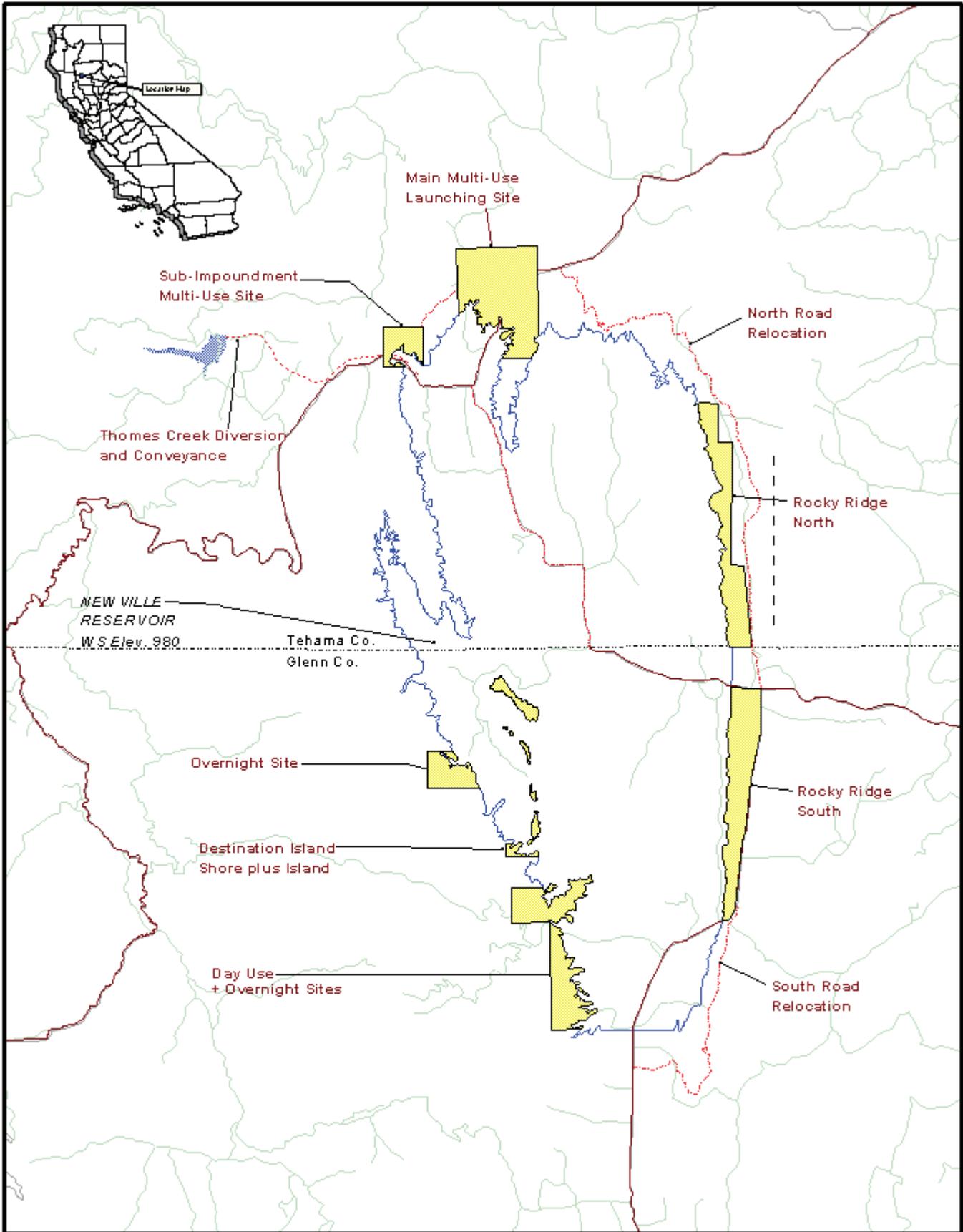


FIGURE 2-3
Sites Reservoir Alternative
Project Features
North-of-the-Delta Offstream Storage Project



- Proposed Road Relocations
- Existing Roads
- Proposed Reservoir Boundary
- Proposed Recreation Areas

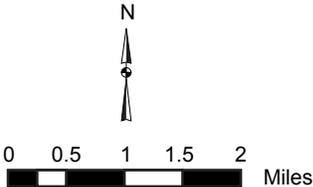


FIGURE 2-4
Newville Reservoir Alternative
Project Features
North-of-the-Delta Offstream Storage Project

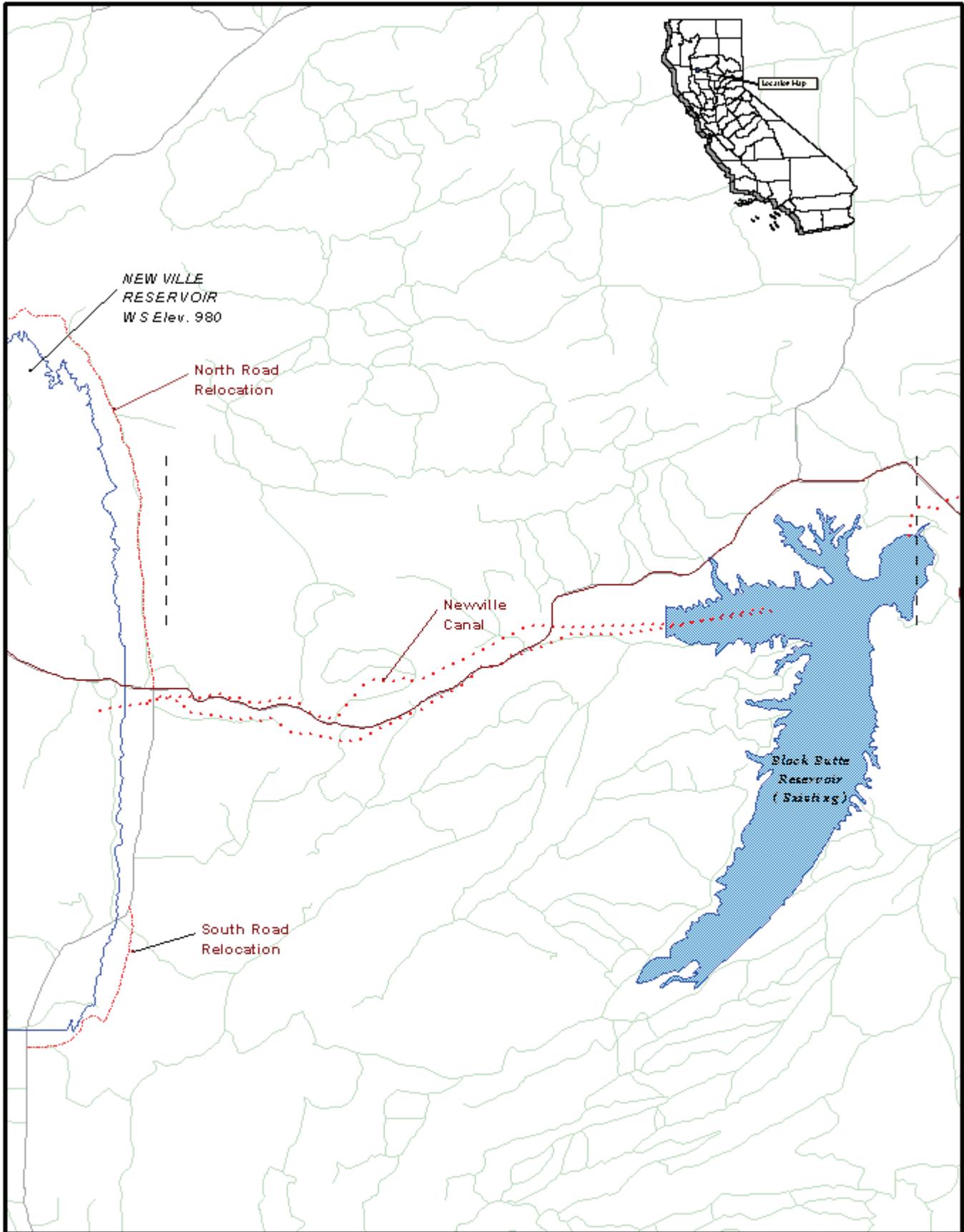
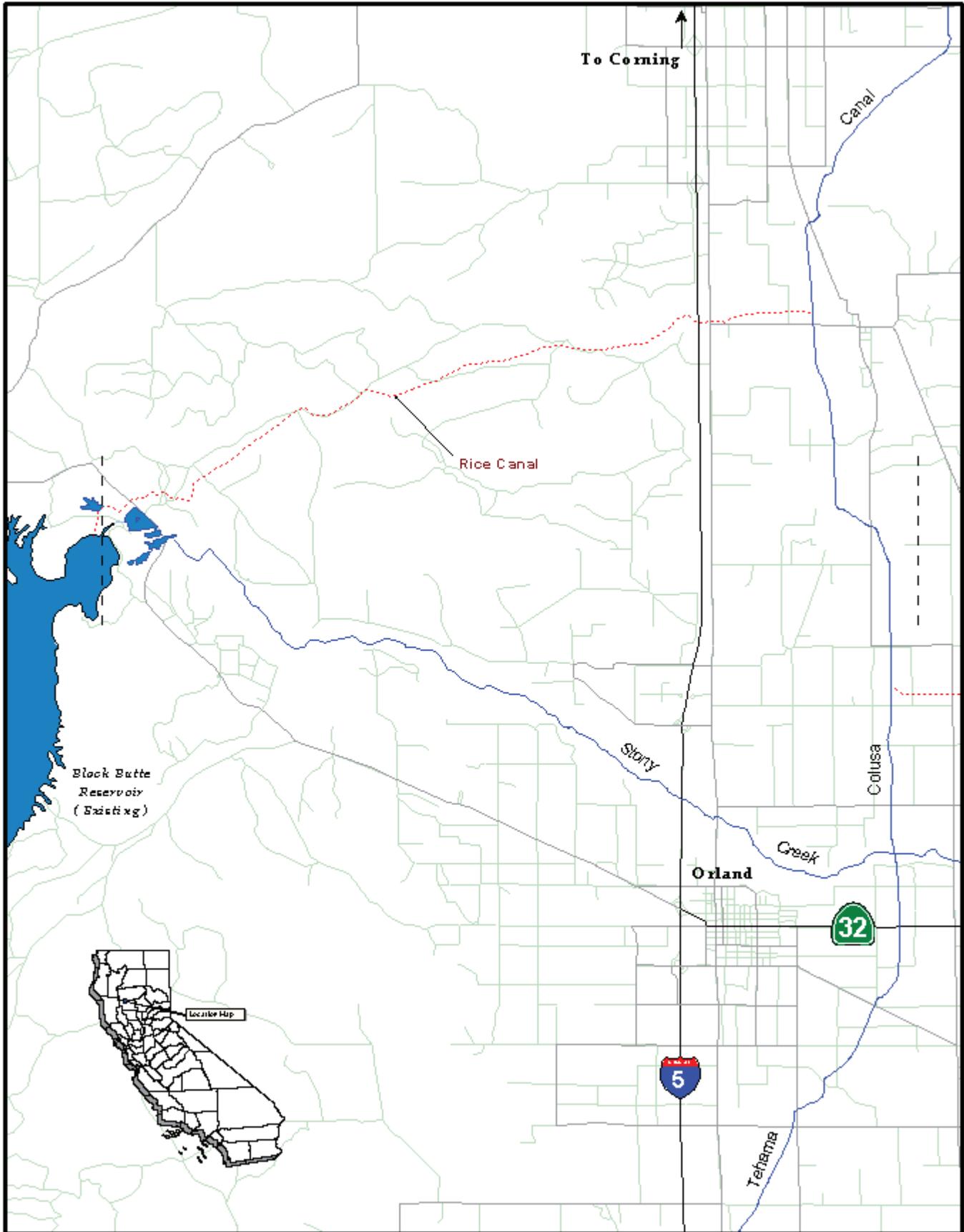


FIGURE 2-5
Newville Reservoir Alternative
Project Features
North-of-the-Delta Offstream Storage Project



..... Proposed Conveyance Routes

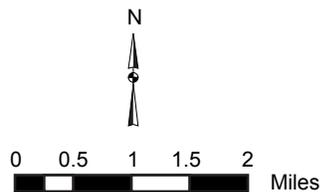
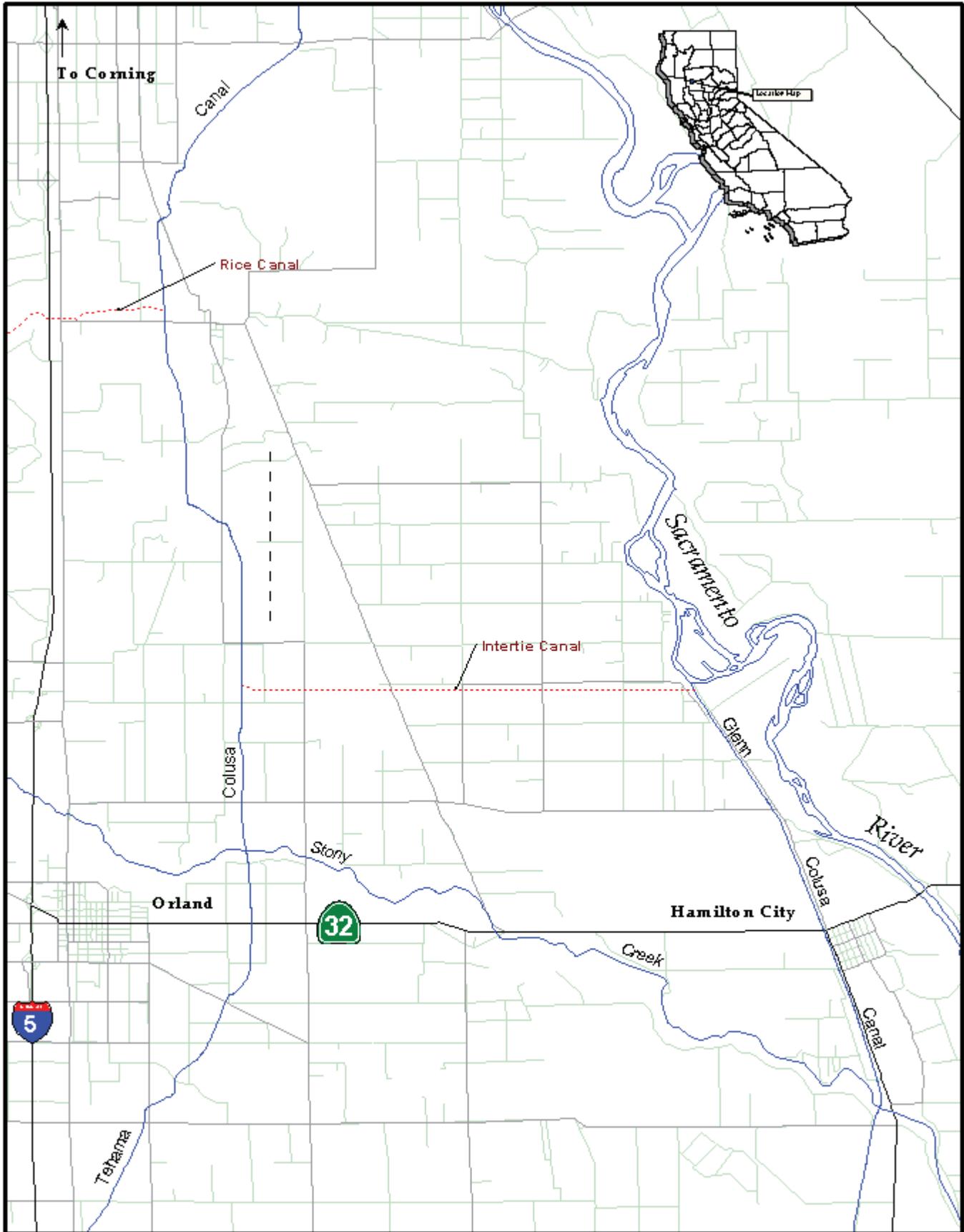


FIGURE 2-6
Newville Reservoir Alternative
Project Features
North-of-the-Delta Offstream Storage Project



..... Proposed Conveyance Routes

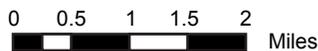
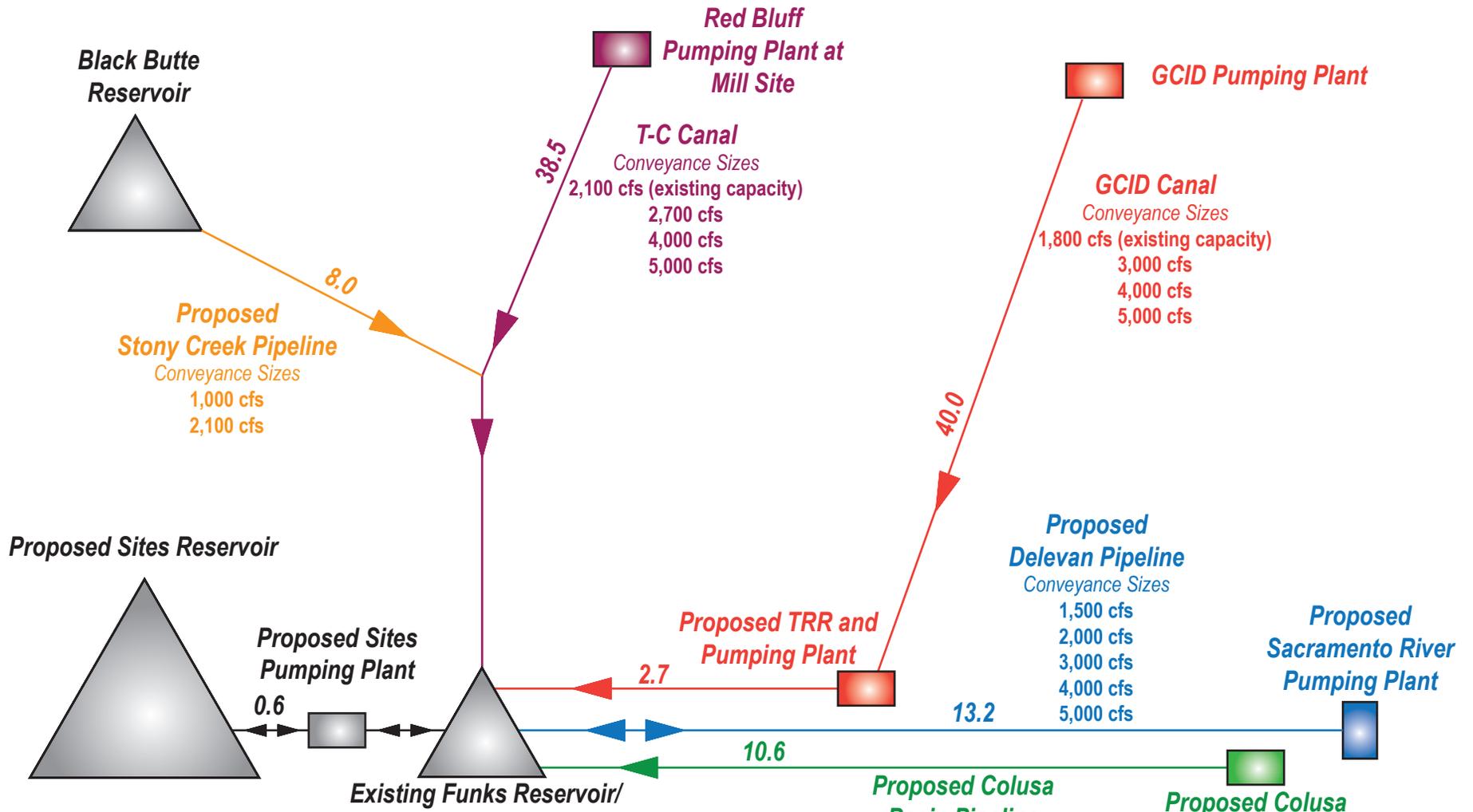


FIGURE 2-7
Newville Reservoir Alternative
Project Features
North-of-the-Delta Offstream Storage Project



Legend

- ▶ Typical Direction of Flow
- T-C = Tehama-Colusa
- GCID = Glenn-Colusa Irrigation District
- TRR = Terminal Regulating Reservoir
- cfs = cubic feet per second

Note: Canal lengths are provided in miles.

FIGURE 2-8
Potential Conveyance Alternatives
for Sites Reservoir
North-of-the-Delta Offstream Storage Project