



UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
3616 W. Thomas, Suite 6
Phoenix, Arizona 85019

December 27, 1989

D-21-89-F-052

Memorandum

To: Regional Director, Bureau Of Reclamation, Lower Colorado River,
Boulder City, Nevada (Attn: LC-153A ENV 4.00)

From: Acting Field Supervisor

Subject: Biological Opinion for Verde River Safety of Dams Modifications

This biological opinion is the Fish and Wildlife Service's (Service) response to your October 12, 1989 request to initiate formal consultation pursuant to Section 7 of the Endangered Species Act (Act) of 1973 as amended. It represents the Verde River Safety of Dams (SOD) repair activities on the Verde River, Maricopa County, Arizona. The 90-day consultation period for the bald eagle (Haliaeetus leucocephalus) began on October 16, 1989, the date your request was received in our office.

BIOLOGICAL OPINION

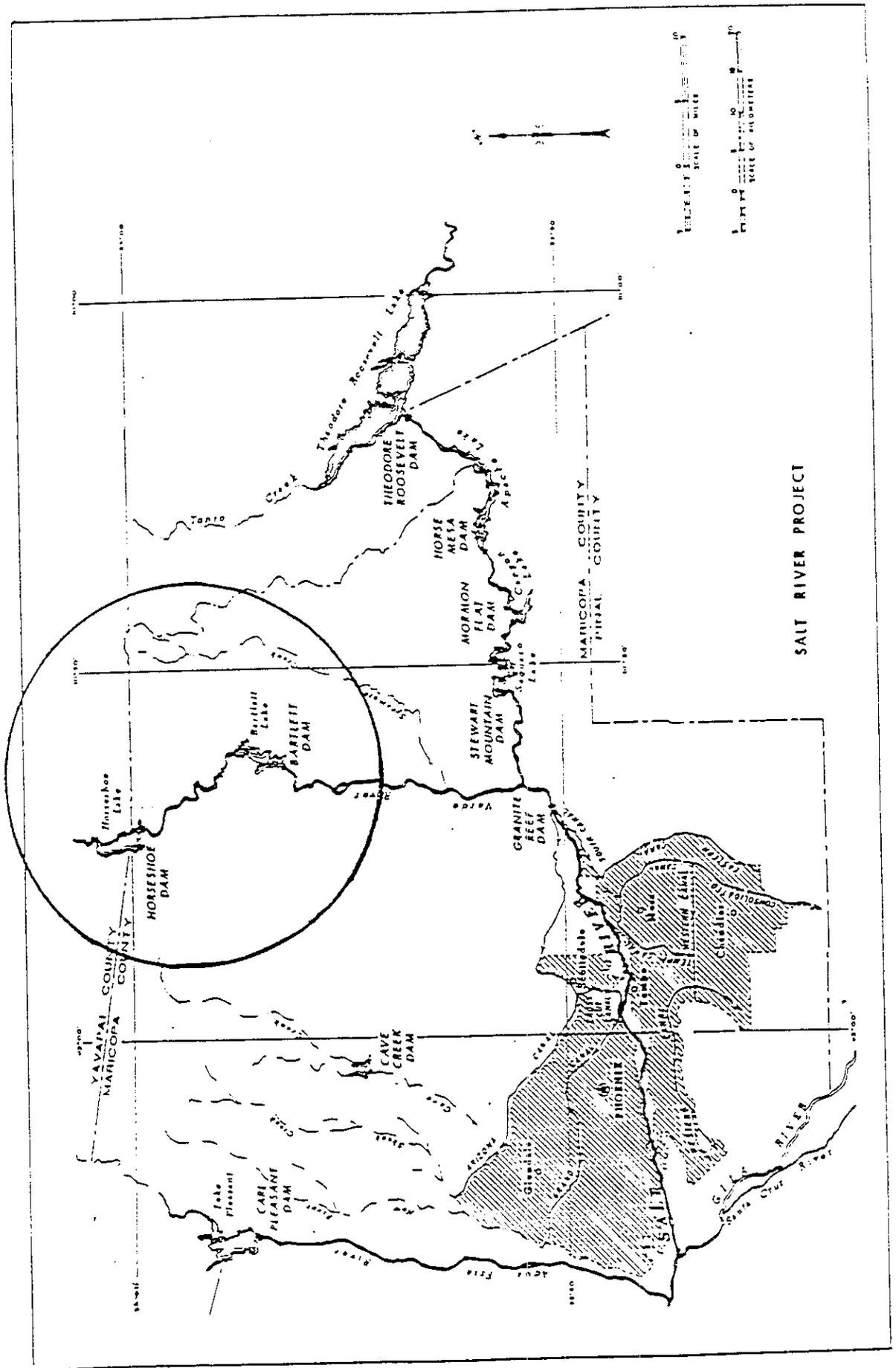
It is my biological opinion that the Verde River Safety of Dams Modifications are not likely to jeopardize the continued existence of the bald eagle's southwestern population.

BACKGROUND INFORMATION

The Bureau of Reclamation (Reclamation) is proposing to modify Horseshoe Dam and Bartlett Dam on the Verde River in central Arizona (Figure 1) to correct known SOD deficiencies. Horseshoe and Bartlett Dams are owned by the United States and operated by the Salt River Project Agricultural Improvement and Water District (SRP). Reclamation has evaluated the integrity of the two dams and recommended corrective actions in their June 1985 report, "Salt River Project Dams, Salt River Project, Arizona, Safety of Dams Program, Modification Report and Amendment."

Horseshoe Dam and Bartlett Dam have known safety deficiencies. Hydrologic analysis based on revised calculations of the Probable Maximum Flood (PMF) on the Verde River indicate that both dams have insufficient spillway and outlet capacity to contain and/or pass the PMF without overtopping. Such an occurrence would jeopardize the safety of the dam, downstream developments, and human safety.

SOD modifications to SRP dams were addressed in the final environmental impact study for the Regulatory Storage Division of the Central Arizona project (U.S. Bureau of Reclamation 1984). The selected Plan 6 alternative proposed corrective actions for SOD deficiencies on the Verde River through



Salt River Project

Figure 1. Horseshoe and Bartlett Dams on the Verde River

construction of Cliff Dam between Horseshoe and Bartlett Dams and strengthening the Bartlett Dam foundation and abutments. Horseshoe Dam would have been breached. The Service issued a biological opinion on the Central Arizona Water Control Study (CAWCS), Plan 6, on March 8, 1983, concluding that impacts were likely to jeopardize the continued existence of the southwestern bald eagle population. On August 15, 1985, the Service issued another jeopardy opinion on the potential impacts of Cliff Dam on the recently discovered Cliff bald eagle nest.

An agreement between a coalition of environmental organizations and the Arizona Congressional delegation was made in 1987 to remove Cliff Dam from Plan 6. This agreement required that the Modification Report be amended to incorporate an alternative SOD solution on the Verde River. Therefore, several alternative SOD solutions for the Verde River have been identified.

Project Description

Horseshoe Dam

Horseshoe Dam is located on the Verde River 58 miles northeast of Phoenix and impounds water from the Verde River (Figure 1). The dam was constructed by Phelps-Dodge Corporation between 1944 and 1946. Title to the dam was vested with the United States in 1944. Horseshoe Dam is an earthfilled structure 194 feet high with a crest length of 1,140 feet. The existing spillway is a concrete-lined channel adjacent to the right abutment, and three radial gates control the flow through the spillway. The spillway capacity is 242,000 cubic feet per second (cfs) and its crest is 2,000 feet. The dam contains over one million cubic yards (cy) of earth and rock embankment material. The reservoir has a capacity of 131,427 acre-feet (af) of water with a surface area of 2,762 acres at an operating level of 2,026 feet. An auxiliary alternative with two schemes is under consideration for the proposed Horseshoe Dam Project.

Auxiliary Alternative - scheme 1 (Fuse Plug Auxiliary Spillway) - Reclamation proposes to construct a zoned earthfill "fuse plug" auxiliary spillway in the ridge that leads into the right abutment of the existing dam (Figure 2). It would be located about 2,000 feet west of the existing dam. The fuse plug section would be an embankment dike designed to erode at a controlled rate when overtopped during routing of floods. The fuse plug spillway would have a crest length of about 810 feet and crest elevation of 2044 feet. Outflow from the spillway would be directed into a spillway channel (about 800 feet wide and 1,600 feet long) extending from the fuse plug section toward the river. The fuse plug section would have a design capacity of about 390,000 cfs at elevation 2043 feet.

Auxiliary Alternative - scheme 2 (Labyrinth Spillway) - Reclamation would construct a "labyrinth" auxiliary spillway in the same location as the fuse plug auxiliary spillway (Figure 3). A labyrinth spillway would provide increased capacity over normal overflow spillways due to its longer crest length created by "folding" the spillway crest into a repetitive accordion

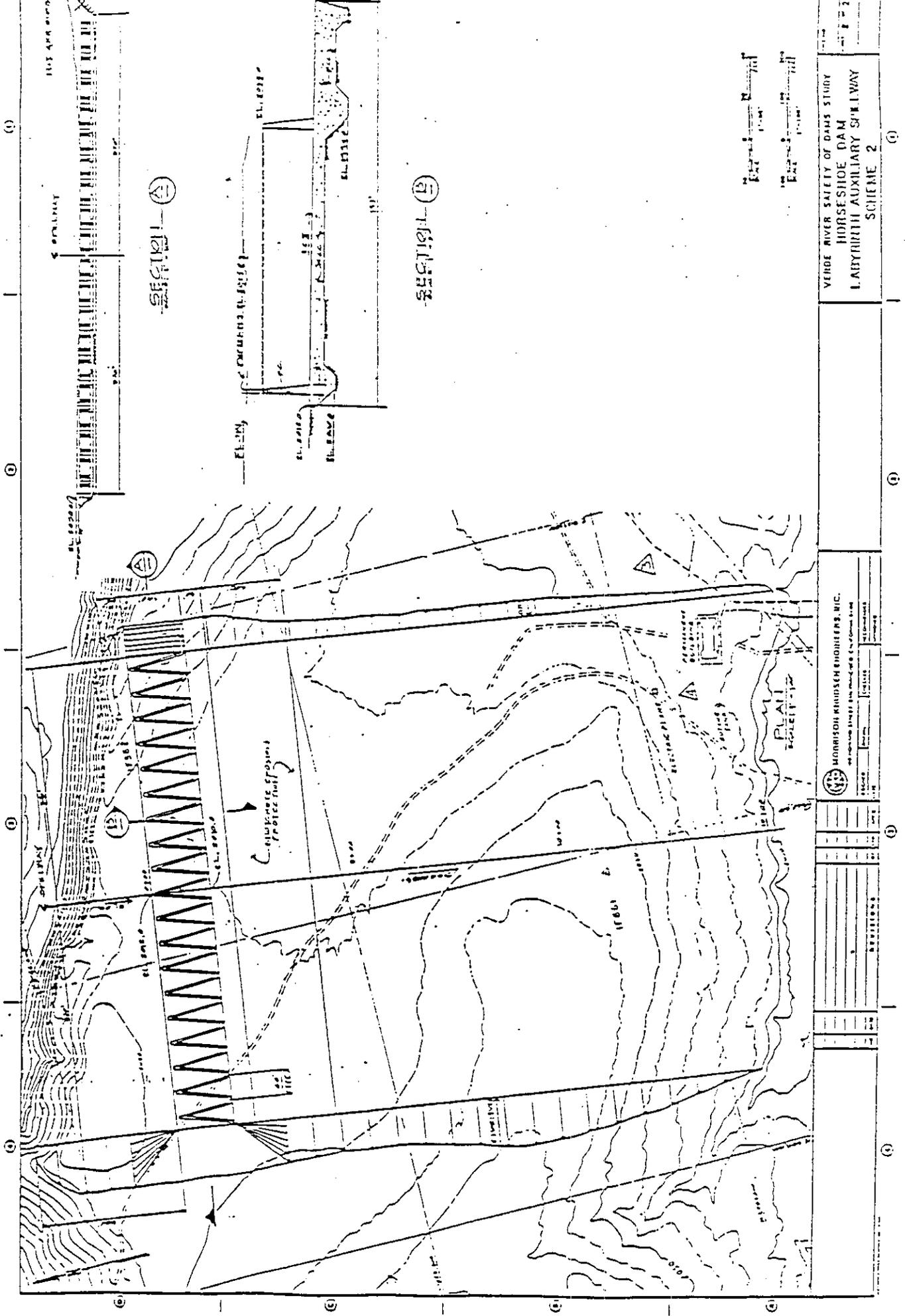


Figure 3. Horseshoe Dam auxiliary alternative - scheme 2 labyrinth spillway.

section, thereby creating a longer effective crest length in an equivalent space. The spillway would have a crest length of about 1,140 feet with a crest elevation of 2035 feet. Outflow from the spillway would be directed into a wider and shorter (about 1,140 feet wide and 1,400 feet long) spillway channel than designed for the fuse plug spillway scheme. The spillway would have a design capacity of about 380,000 cfs at elevation 2043 feet.

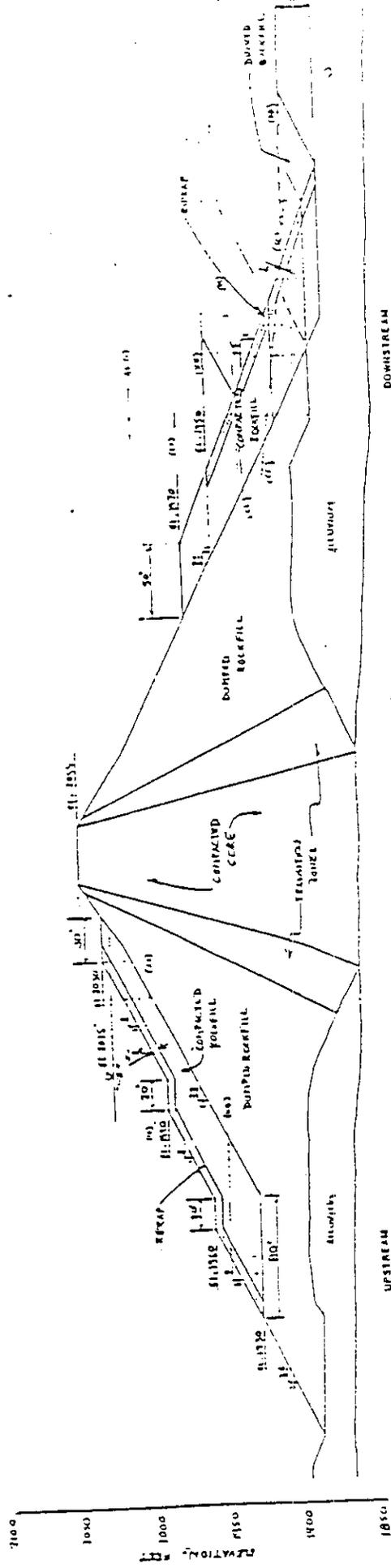
An additional modification to Horseshoe Dam would consist of removal and replacement of the upper portion of the dam and exterior of the dam, rockfill shells, or construction of upstream and downstream reinforcing buttresses (Figure 4) to reinforce Horseshoe Dam against seismic instability, if that is determined to be a problem. Construction of the buttresses, if required, represents the maximum stability modification. Riprap would be added at the downstream toe of the dam to prevent erosion from high tailwater during spills.

Bartlett Dam

Bartlett Dam is located on the Verde River approximately 48 miles northeast of Phoenix (Figure 1). The dam was constructed by Reclamation between 1936 and 1939. It is a multiple-arch concrete structure 287 feet high with a crest length of 800 feet. A small saddle dam, about 110 feet long, is located about one-fourth mile south of the left buttress of the main dam. The crest of the dam is at 1,799.5 feet. The reservoir has a capacity of 178,716 af and a surface area of 2,775 acres at water surface elevation 1798 feet. The existing spillway consists of one concrete-lined channel at the right abutment controlled by three crawler gates. The spillway crest elevation is 1748 feet and its design capacity is 175,000 cfs. Two alternatives are being proposed to correct the safety deficiencies of Bartlett Dam.

Alternative A (Saddle Fuse Plug Auxiliary Spillway) - Reclamation would construct a "fuse plug" auxiliary spillway in a low saddle about 2,000 feet south of the existing dam (Figure 5). The spillway would be about 600 feet wide. The fuse plug would have a height of about 35 feet and be separated into three sections with divider walls. The crest elevation would be 1805 feet. The crest of Bartlett Dam would be raised by approximately 12 feet to provide the required surcharge for operation of the fuse plug spillway. An access road to the saddle spillway would be constructed.

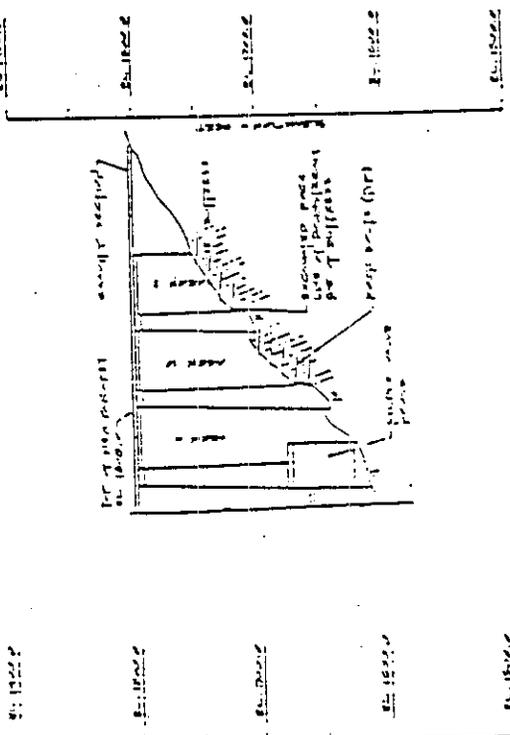
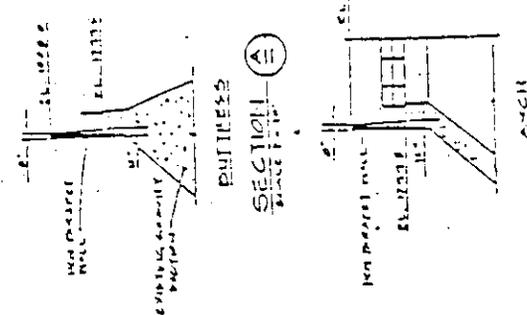
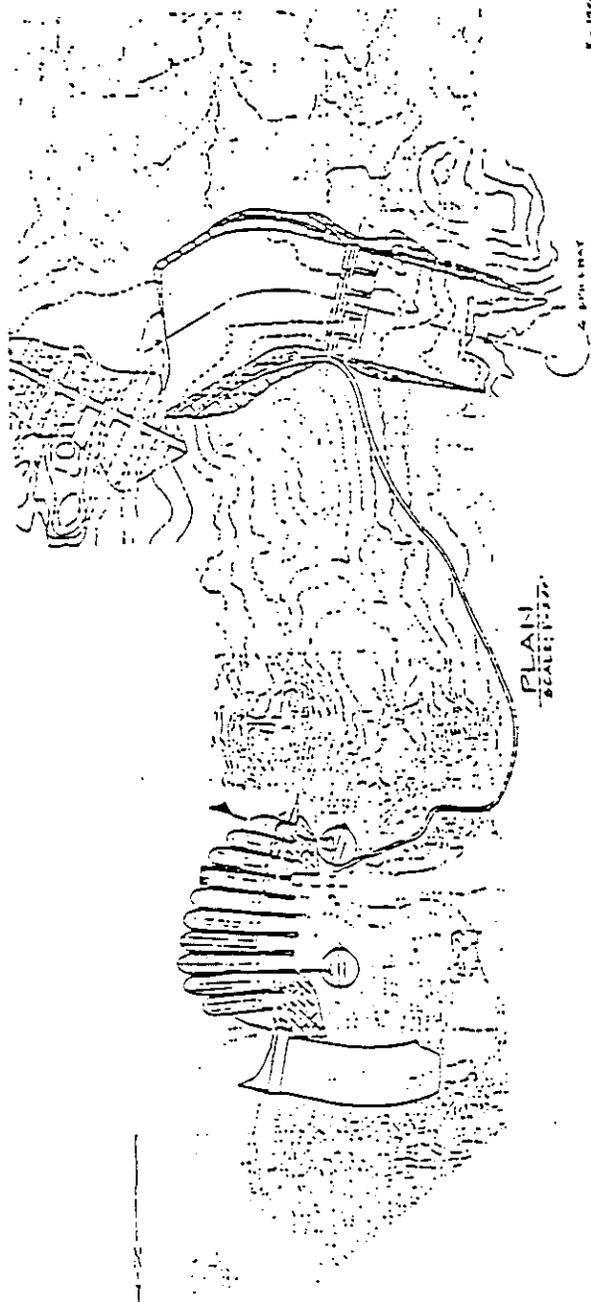
Alternative B (Overtopping Protection) - Reclamation would construct concrete overlays on the abutments and the downstream toe of the dam. The concrete overlay would vary from 5 to 15 feet in thickness. Additional concrete overlay would extend about 300 feet downstream of the dam to protect the existing spillway and its foundation. A concrete weir would be constructed about 300 feet downstream from the existing dam to increase tailwater depths during overtopping.



HORSESHOE DAM
 US & DS FULL SLOPE ROCK BUTTRESS IF
 EQ ANALYSIS INDICATES STRENGTHENING
 REQUIRED HIGH SLOPE DESIGN OPTION

HORSESHOE DAM
 BUTTRESS SECTION
 0 10 20
 SCALE FEET

Figure 4.



LETZ ENGINEERING CONSULTANTS, E. E. Egan, Inc.

LETZ ENGINEERING CONSULTANTS, E. E. Egan, Inc.

VERDE RIVER SAFETY OF DAMS STUDY
 BARTLETT DAM
 5 GATE AUXILIARY SPILLWAY
 SCHEME B

1100 NORTH DUNDAS STREET, TORONTO, ONT. M5G 1A5
 (416) 593-8888
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Figure 5. Bartlett Dam alternative A - saddle fuse plug auxiliary spillway.

Bald Eagle Nest Sites

Horseshoe Bald Eagle Nest

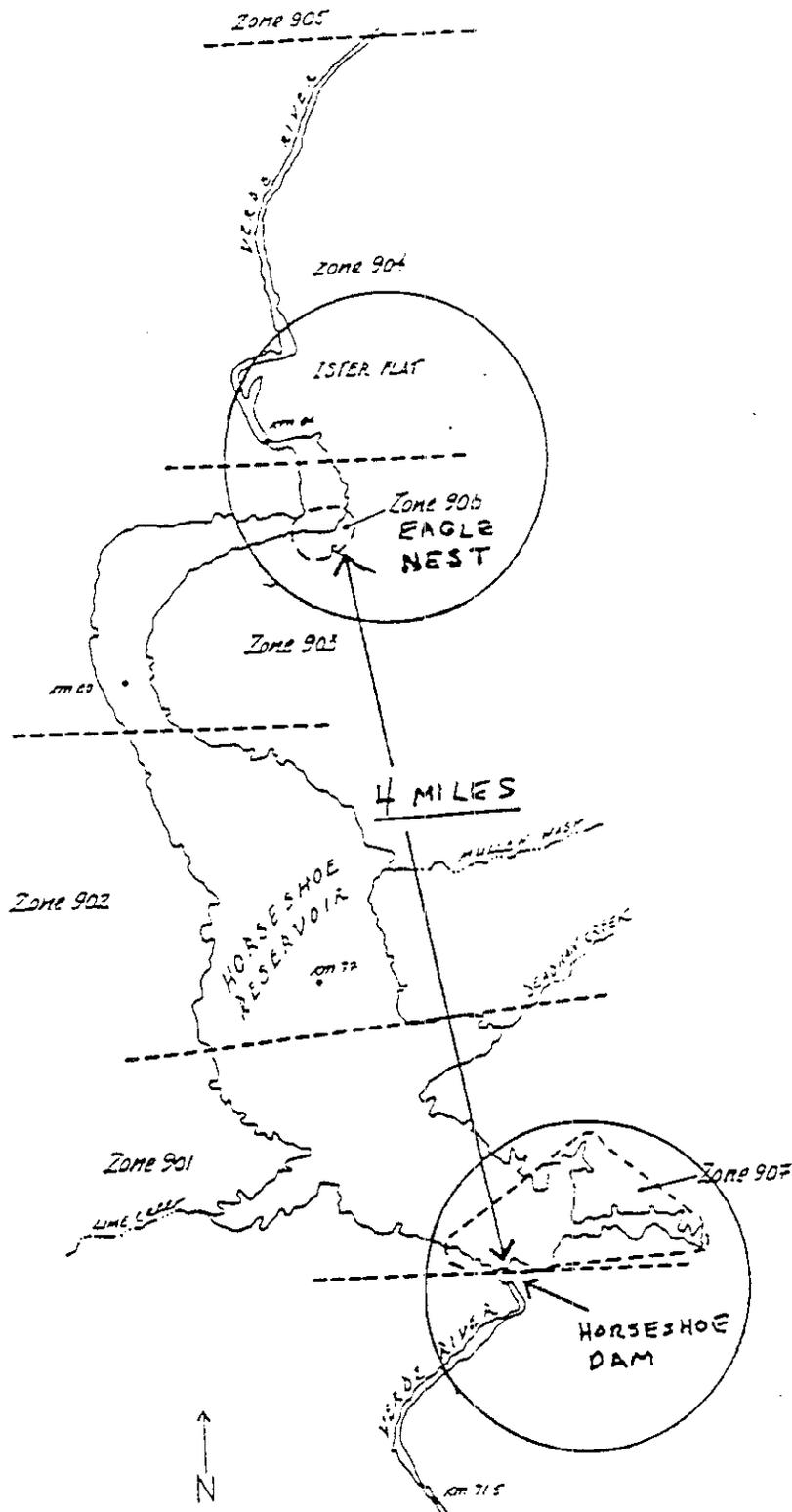
A bald eagle nest is located approximately four miles upstream from Horseshoe Dam on the upper end of Horseshoe Reservoir (Figures 6 and 7). It has produced 15 young since being discovered in 1975. The home range for the pair of eagles covers approximately 18 river miles, extending from about the confluence of Sycamore Creek and Verde River downstream to just below Horseshoe Dam (BioSystems Analysis, Inc. 1988). Figure 6 also displays the forage zones for this pair of bald eagles. The majority of known foraging events occurred in zones 902 and 903 in the upper two-third's of Horseshoe Lake (Table 1). Of the 117 successful foraging events from known locations, 88 or 75 percent (%) occurred in these two areas. Both forage areas are open water sites in the reservoir. The primary prey item was fish. Of the 117 food items observed being brought to the nest, 97 (83%) were fish species. The two species most frequently identified were black crappie and carp.

Cliff Bald Eagle Nest

The Cliff nest is located on the Verde River approximately eight miles south of Horseshoe Dam and ten miles north of Bartlett Dam (Figure 8). Four young have fledged from this nest since its discovery in 1984. In some years, the pair mainly stayed in an area limited to 1,300-1,600 feet up and downstream from the nest. However, the eagles were occasionally observed upstream to Horseshoe Dam, and it was speculated that the birds may go downstream near Bartlett Reservoir.

Of the total 176 food items reported from 1985-89, 124 (70%) were fish (Dixon and Maack 1988, Camara and Motzkin 1985, Cooper 1985, and Williams 1985). Most of the observed forage events were near the nest, however, foraging also occurred upstream and downstream of the nest. The downstream area was used more than the upstream area. Williams (1985) stated, "The eagles limited use of the upstream habitat could have been due to the availability of high quality fishing in the 400-yard stretch of river below the nest,"

The reports from 1985-1988 recorded a total of 191 eagle responses to human disturbances. These disturbances varied from gunfire, fishing, hiking, and vehicle use to aircraft flying in close proximity to the nest. Kuder and Sinor (1989) considered human disturbance within the nest territory to be a major factor in causing abandonment of the nest in 1989.



Zones indicate eagle foraging areas. Zones 902 and 903 were most often used.

FIGURE 6
 Map of the Horseshoe region,
 Horseshoe, Eagle Nest, Dam
 Prepared by *[illegible]*

From: Biosystems Analysis,
 1988

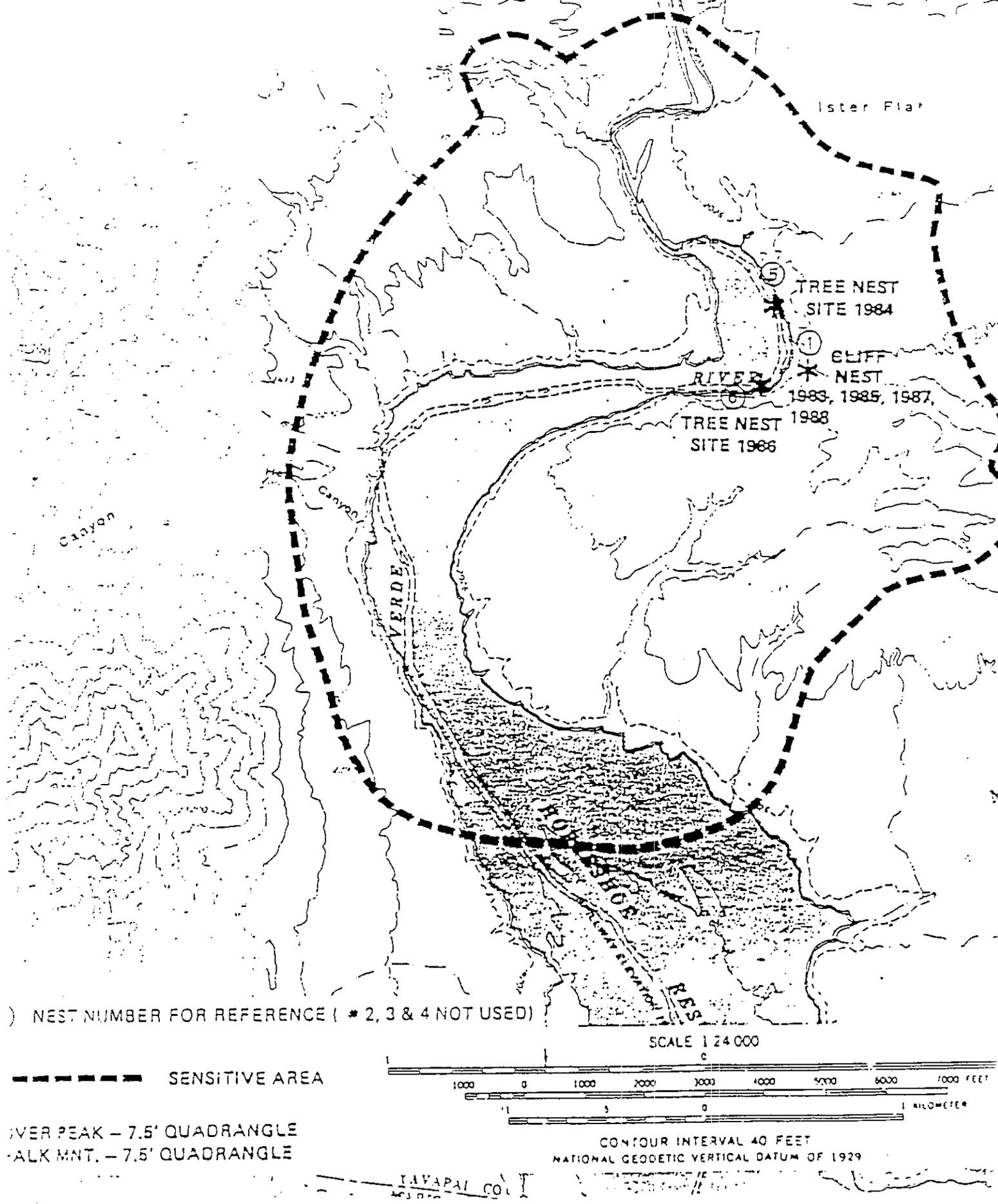


Figure 7. Horseshoe Bald Eagle Nest.

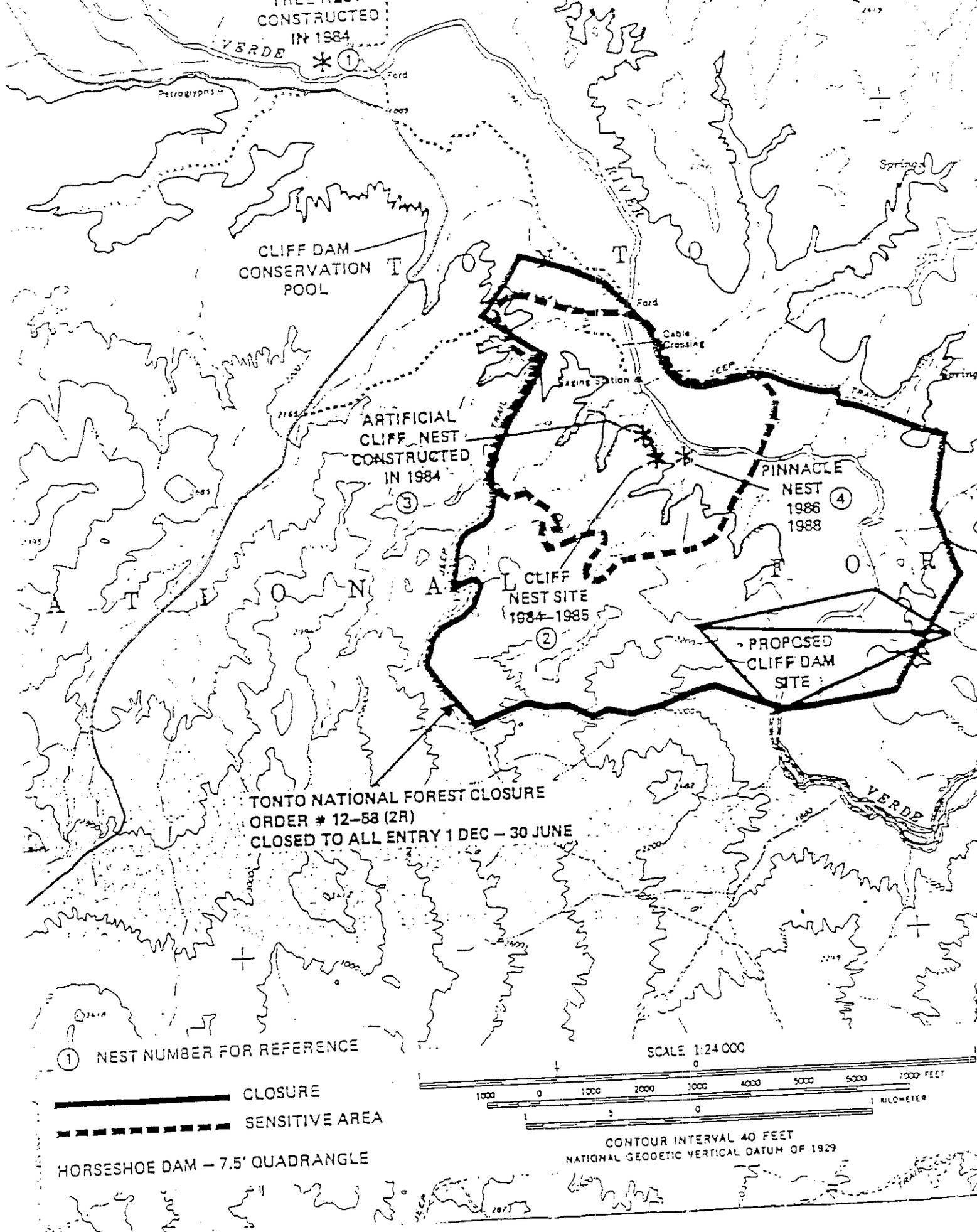


Figure 8. Cliff Bald Eagle Nest.

Table 1. Distribution by zones of foraging locations by the telemetered adult pair at Horseshoe territory (From: BioSystems Analysis, Inc. 1988).

Zone	AFO2	AFO3	Unk.	Total
901 Dam to Deadman's Cove	0	4	0	4
902 Deadman's Cove	7	12	0	19
903 Upper Lake (Kms 79.7-83.0)	37	32	0	69
904 Km 83.5-88.0	3	3	0	6
905 Upstream of Km 88.0	1	0	0	1
906 Immediate Nest Area	2	0	0	2
907 Dam Area	2	1	0	3
444 Unknown	6	5	2	13
TOTAL	58	57	2	117

Bartlett Eagle Nest

Another bald eagle nest is located approximately 2.3 miles downstream from Bartlett Dam (Figure 9). The nest and forage site is believed to have been used since at least 1935. While information before 1970 is limited, 17 young have fledged in the 19 years since 1970. The 1988 home range of the Bartlett eagles was relatively small compared to other bald eagles being studied in Arizona and this pair foraged mainly near the nest. The major prey item was suckers; most of these were taken at a riffle near the nest, designated as "river kilometer (km) 34.5." Other riffles had forage species present and were occasionally used by the eagles. During high flows when riffle habitat declined and turbidity and water temperatures increased, the eagles diversified their search for prey and Bartlett Reservoir became a foraging area. BioSystems Analysis Inc. (1988) suggested that prolonged availability of spawning suckers below Bartlett Dam resulted from low elevation water releases from the dam, combined with relatively high minimum flows in 1988 and reduced thermal loading which maintained water temperatures at the optimum for sucker spawning throughout the spring. In 1989, nest watchers (Adams and Linskens 1989) noted that while BioSystems researchers recorded this pair foraging from the north end of Bartlett Reservoir downstream to Needle Rock (Figure 10), the eagles mainly stayed along the Verde River within approximately one mile of the nest. In 1989, they continued to forage most extensively from the riffle at river km 34.5, followed by the riffle at km 35.2, and in Bartlett Reservoir. A total of 84% of the observed prey items were fish; suckers accounted for 58% of this total number.

IMPACTS OF THE ACTION

Horseshoe Bald Eagle Nest

This breeding area was occupied by a pair of bald eagles during the 1989 breeding season. This eagle pair nested and hatched one young; however, it did not fledge. The nest is located on the upper end of Horseshoe Reservoir, approximately four miles upstream from Horseshoe Dam. Foraging events in 1988 occurred primarily within the mid- and upper reservoir areas. Potential effects on this pair of eagles include reduced forage opportunities at and below the dam site. However, the dam area accounted for less than three percent of the 117 recorded forage events. Temporary disturbance at the dam area is not likely to affect this breeding area.

Cliff Bald Eagle Nest

The Cliff nest is located approximately eight miles south of Horseshoe Dam and approximately ten miles north of Bartlett Dam. A pair of bald eagles occupied this breeding area in 1988 and fledged two eaglets. In 1989 this pair again occupied the breeding area, but the nest was unsuccessful. A

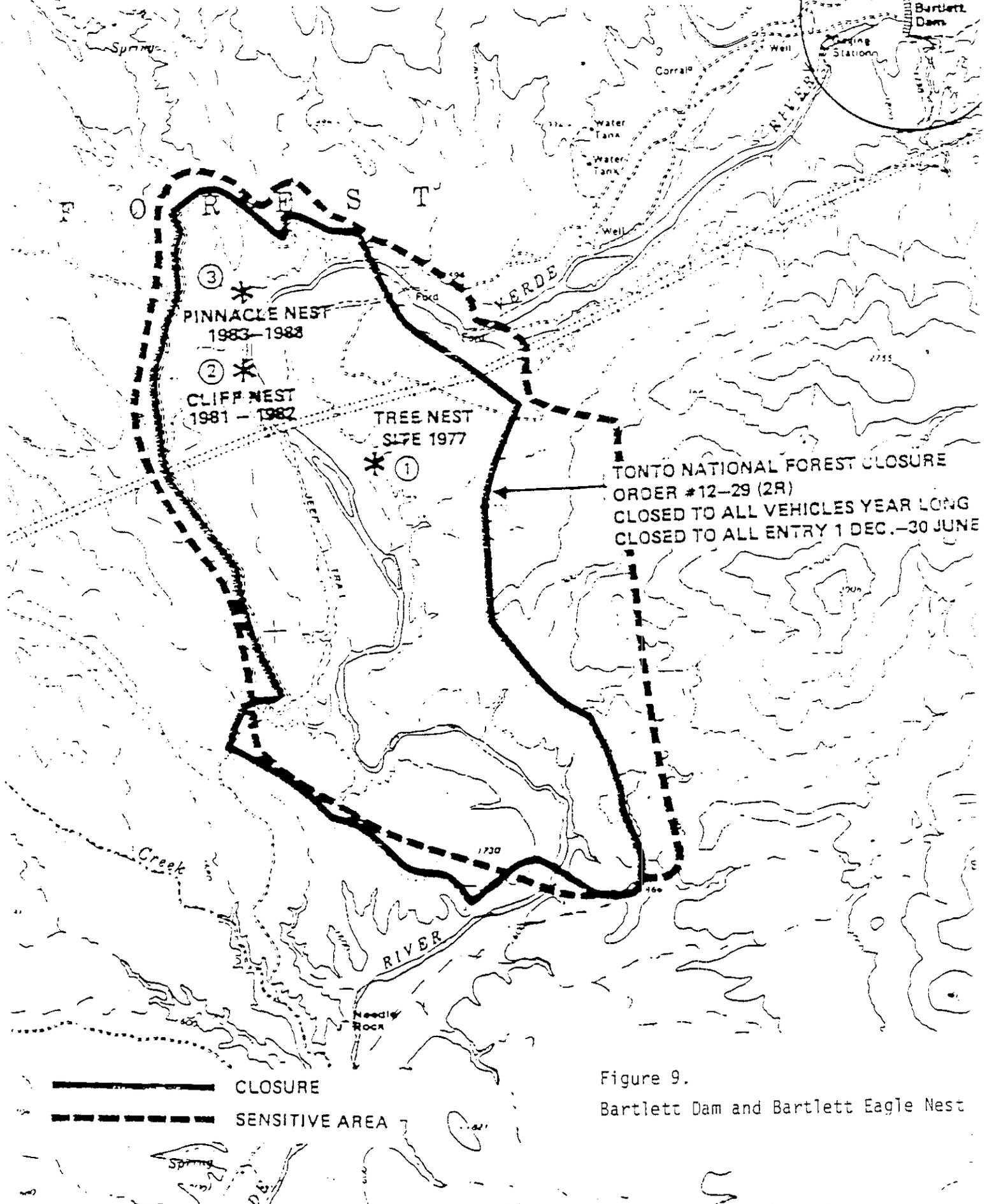
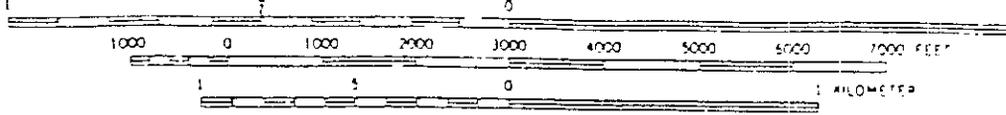


Figure 9.
Bartlett Dam and Bartlett Eagle Nest

majority of the foraging activity in 1988 occurred within the immediate vicinity of the nest site. At times the pair were also seen heading towards Horseshoe Lake and returning with prey.

Potential effects on this pair include a temporary increase in human disturbance from the work-force doing modification work on Horseshoe and Bartlett Dams. Because of the distance from construction to the Cliff breeding area location, the project construction at both dam sites is not likely to affect the breeding eagles at this area.

Bartlett Bald Eagle Nest

The Bartlett breeding area was first known to be occupied in 1935 and again in 1940, but productivity data are absent for this period. Two cliff nests currently exist at the site, both located on the regulated river approximately two miles below Bartlett Dam. In 1988 and 1989, the breeding bald eagle pair fledged young. This pair mainly foraged from one riffle immediately downstream from the nest.

Potential effects on the breeding bald eagles near Bartlett Lake include construction and blasting activities at the dam, increased human presence near the dam work area, and a possible interruption of foraging activities in certain areas during construction. The nearest construction activity would take place approximately two miles from the nest and primary forage sites. Associated construction activities would include use of about 30 heavy equipment and other vehicles and blasting within the area. Bald eagles are less likely to flush when approached by vehicles compared to humans on foot (Knight and Skagen 1986). The increase in vehicular traffic at the construction site and blasting activities at the construction site will adversely impact the bald eagles breeding at this site.

Changing water releases during construction has the potential to reduce the riffle at the primary eagle foraging site, thus forcing the eagles to forage elsewhere. It would require the expenditure of more energy by the eagles and increase their time away from the nest. However, releases of water from the dam are expected to remain normal under all alternatives.

INCIDENTAL TAKE

Section 9 of the Act, as amended, prohibits any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or attempt to engage in any such conduct) of listed species without a special exemption. Harm is further defined to include significant habitat modification and degradation that results in death and injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering. Under the terms of Section 7(b)(1) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered taking within the bounds of the Act provided that such taking is in compliance with the incidental take statement.

The Service does not anticipate that the proposed actions at Horseshoe Dam will result in any incidental take of the bald eagle pairs at the Horseshoe and Cliff breeding areas. Accordingly, no incidental take is authorized. Should any take occur, Reclamation must reinitiate formal consultation with the Service and provide the circumstances surrounding the take.

The Service anticipates that as a result of the construction and blasting activities and associated haul roads at Bartlett Dam approximately three bald eagles will be harassed. This harassment will result from human disturbances and blasting at the construction site by significantly reducing available bald eagle nesting and foraging habitat. This loss of foraging habitat will significantly disrupt bald eagle breeding and feeding behavior and may bear negatively upon bald eagle nesting and fledging success.

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize the take at the Bartlett nest site:

1. Prohibit blasting and helicopter use at the Bartlett Dam construction site during the bald eagle breeding and wintering period from December 1 to July 1;
2. Prohibit vehicle and foot traffic in the Bartlett eagle breeding area as defined by Tonto National Forest closure order #12-29(2R) from December 1 to July 1; and
3. Monitor bald eagle behavior at the Bartlett breeding area by continuing the bald eagle nest watch program. In addition, report any adverse affects to eagles as a result of construction activity.

In order to be exempt from the prohibitions of Section 9 of the Act, the following terms and conditions, which implement the reasonable and prudent measures described above, must be complied with:

1. Reclamation will provide reports detailing the progress and management practices affecting the reasonable and prudent measures; and
2. The effectiveness of the reasonable and prudent measures will be reported to the Service by Reclamation.

If, during the course of the action, the amount or extent of the incidental take limit is exceeded, the Federal agency must reinitiate consultation with the Service immediately to avoid violation of Section 9. Operations must be stopped in the interim period between the initiation and completion a new consultation if it is determined that the impact of the additional taking will cause an irreversible and adverse impact on the species. The Federal agency should provide an explanation of the causes of the taking.

CONSERVATION RECOMMENDATIONS

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. The term "conservation recommendations" has been defined as suggestions of the Service regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information.

1. Early monitoring of the nesting and forging activities of the bald eagle pair at the Bartlett nest site should be conducted if construction begins in November.
2. If nest watchers believe construction activities at Bartlett Dam show adverse effects to the bald eagle pair, Reclamation should be notified accordingly. Construction activity should cease and consultation with the Service should begin.

In order for the Service to be kept informed of actions that either minimize or avoid adverse effects or benefit listed species or their habitats, the Service is requesting notification of the implementation of any conservation recommendations.

This concludes formal consultation on this action. Reinitiation of formal consultation is required if the amount or extent of incidental take is exceeded, if new information reveals effects of the action that may impact listed species or critical habitat in a manner or to an extent not considered in this opinion, if the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion, and/or if a new species is listed or critical habitat designated that may be affected by the action.

If we may be of further assistance, please call Denise Baker or Sam F. Spiller (Field Supervisor) (Telephone: 602/379-4720 or FTS 261-4720).

Sincerely,



Frank Baucom

cc: Regional Director, Fish and Wildlife Service, Albuquerque, New Mexico
(FWE/HC)
Director, Arizona Game and Fish Department, Phoenix, Arizona
(Attn: Larry Riley)
Project Manager, Bureau of Reclamation, Arizona Projects Office,
Phoenix, Arizona (Attn: APO 150)

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