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Cons. # 2-22-05-F-522

Memorandum

To: Area Manager, Albuquerque Area Office, Bureau of Reclamation

From: Supervisor, New Mexico Ecological Services, Albuquerque, New Mexico

Subject: Biological Opinion on the Effects of the Tiffany Sediment Plug Removal

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion on the proposed Tiffany Sediment Plug Removal located in the Tiffany Junction Reach of the Middle Rio Grande, Soccoro County, New Mexico, and its effects on the endangered Rio Grande silvery minnow (Hybognathus amarus) (silvery minnow), the threatened bald eagle (*Hailiaeetus leucocephalus)* (eagle), and to proposed critical habitat for the southwestern willow flycatcher (*Empidonax traillii extimus*) (flycatcher). This document replaces the biological opinion transmitted on September 1, 2005. Your August 2, 2005 request for formal consultation, in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C, 1531 et seq.), was received on August 4, 2005. You also requested conferencing for proposed critical habitat for the flycatcher at the “may affect, not likely to adversely affect” level. Critical habitat for the flycatcher was proposed on October 12, 2004 and overlaps with portions of the project area.

This biological opinion (BO) is tiered off of the Service’s March 17, 2003 programmatic biological opinion on the Bureau of Reclamation’s Water and River Maintenance Operations, Army Corps of Engineers’ Flood Control Operation, and Non-Federal Actions on the Middle Rio Grande, New Mexico. This BO is based on information provided in the 2005 Tiffany Sediment Plug Removal Biological Assessment (BA), July 2005, meetings between Reclamation and the Service, e-mail and telephone conversations between our staffs; data in our files; literature review; and other sources of information available to the Service. A complete administrative record of this consultation is on file at the Service’s New Mexico Ecological Services Field Office (NMESFO).

The current BO does not rely on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statute and the August 6, 2004, Ninth Circuit Court of Appeals decision in Gifford Pinchot Task Force v. USDI Fish and Wildlife Service (CIV No. 03-35279) to complete the following analysis with respect to critical habitat. This consultation analyzes the effects of the action and its relationship to the function and conservation role of silvery minnow critical habitat to determine whether the current proposal destroys or adversely modifies critical habitat.

You have determined that the proposed plug removal project may affect, is not likely to adversely affect, the eagle and flycatcher critical habitat. We concur with these determinations for the following reasons:

Eagle

The work area will be surveyed daily prior to activity. If, as a result of those surveys, an eagle is observed within 0.25 mi upstream or downstream of the active project site in the morning before project activity starts, or following breaks in project activity, the contractor will suspend all activity until the bird leaves of its own volition, or a Reclamation biologist, in consultation with the Service, determines that the potential for harassment is minimal. If an eagle arrives during construction activities or is beyond that distance, construction need not be interrupted. If eagles are found consistently in the immediate project area during the construction period, Reclamation will contact the Service to determine whether formal consultation is necessary. Implementation of these actions will reduce effects to the eagle to an insignificant level.

Flycatcher Critical Habitat

The project area is located within the boundaries of proposed critical habitat for flycatcher. The primary constituent elements of the proposed critical habitat include: 1) nesting habitat with trees and shrubs that include, but are not limited to, willow species and boxelder; 2) dense riparian vegetation with thickets of trees and shrubs ranging in height from 2 to 30 meters (m) (6 to 98 feet) (ft) with lower-stature thickets of (2-4 m or 6-13 ft tall) found at higher elevation riparian forests and tall-stature thickets at found at middle-and lower- elevation riparian forests; 3) areas of dense riparian foliage at least from the ground level up to approximately 4 m (13 ft) above ground or dense foliage only at the shrub level, or as a low, dense tree canopy; 4) sites for nesting that contain a dense tree and/or shrub canopy (the amount of cover provided by tree and shrub branches measured from the ground) (i.e. a tree or shrub canopy with densities ranging from 50 to 100 percent); 5) dense patches of riparian forests that are interspersed with small openings of open water or marsh or shorter/sparser vegetation, that creates a mosaic that is not uniformly dense; and 6) a variety of insect prey populations. The proposed action would not result in the removal of any vegetation or affect any other primary constituent elements of proposed habitat. Indirect effects on habitat (through off-road vehicle activity) would be insignificant, temporary, and primarily via airboat.

The remainder of this biological opinion will deal with the effects of implementation of the proposed action on the silvery minnow.

Consultation History

Consultation history began in late May, 2005 with informal conversations between Service and Reclamation staff about the development of a sediment plug in the Tiffany area. On June 13, 2005, staff from both agencies participated in a fieldtrip and airboat ride to the project area. Subsequent meetings were held on July 8, and 12, 2005. A draft BA was submitted to the

Service to review on July 22, 2005. The Final BA with request for formal consultation was received by the Service on August 4, 2005. A Final BO was transmitted on September 1, 2005, but has been revised in response to new information received on September 3, 2005. A meeting between the Service and Reclamation was held on September 7, 2005 to incorporate this information and resolve any potential concerns with the proposed action.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

The proposed action involves the removal of sediment plugs, which form along the Tiffany Junction Reach of the Middle Rio Grande, New Mexico. Plug removal work will occur in Fall 2005 and in subsequent years, should sediment plugs reform, through 2015. In 2005, the sediment plug is located just below rangeline SO-1683, approximately 1.5 miles upstream of the Burlington Northern and Santa Fe (BN&SF) Railroad Bridge (Figure 1). As of June 2005, the plug was 0.9 miles in length, and increasing in length upstream at a rate of approximately 150 feet per day (Figure 2). Removal of the sediment plug is necessary to restore efficient water delivery, and relieve high water against the Tiffany levee.

The recommended action is to excavate a small pilot channel through the middle of the active channel of the Middle Rio Grande. The small pilot channel would be approximately 20 feet wide, 5 feet deep, and range in length from 0.9 - 4.5 miles, which depends on when the action begins and the degree of scouring or excavation that may be encountered in the plug itself. Excavated material ranging from 17,600 – 88,150 cubic yards will remain in the active channel, being spoiled directly on either side of the pilot channel (Figure 3). Once completed, it is anticipated that river flows will continue to widen the pilot channel, and thus the active channel, to its preexisting width of approximately 150 feet. Thus, it is advantageous to complete the excavation process prior to the ending of spring runoff flows.

The Tiffany Sediment Plug Removal Project is estimated to take 4 - 6 weeks to complete. The New Mexico Interstate Stream Commission and other resource management agencies (Army Corps of Engineers, U.S. Fish and Wildlife Service, and New Mexico Environment Department) will work collaboratively to accomplish the proposed action. Close monitoring of the plug and levee will continue upon completion of the project to ensure proper flushing of the material in the active channel, as well as to prevent further damage to the levee. Further widening may be necessary after project completion but would take place only if the project area is dry.

<u>Access</u>
An amphibious excavator will use a network of established roads to access the active channel near rangeline SO-1664. The excavator will proceed down the west side channel or main channel to the sediment plug, depending on its current location (Figure 4). An additional access point will be located downstream of the plug and upstream of the railroad bridge for personnel transport. This access would occur by airboat and would not require any vegetation clearing.

Excavation

For pilot channel excavation, the sediment plug is divided into three construction zones; the downstream zone, upstream zone, and transition zone. The downstream zone is characterized as the part of the channel that is completely plugged and dry, where sediment has deposited and filled the active channel to the banks. Within this area, all water exists solely in the over-bank areas. The upstream zone is the area in which the sediment plug is continuing to span upstream. This area has an aggrading bed, where sediment is being deposited and water is forced into the over-bank areas. Within the upstream zone, some water flow remains in the active channel. The transition zone is the small overlapping area that exists between the downstream and upstream zones.

An amphibious excavator will begin to remove depositing sediment in the active channel (forming the pilot channel) at the downstream end of the sediment plug, in the downstream zone, and proceed upstream to the transition zone. The removed material will be spoiled directly on either side of the excavation. This excavated area will be deemed the downstream channel. Pilot channel excavation within the upstream zone, here after referred to as the upstream channel, will start on the upstream side of the transition zone and proceed upstream to a location not influenced by the plug. Within the upstream zone, the excavator will pull sediment laterally to one side to open the channel and reduce the likelihood of burying silvery minnows. This process of removing sediment will allow silvery minnows to move away from the equipment, pilot channel, or personnel.

The sediment plug within the transition zone will remain in place until after both the downstream and upstream pilot channels have been excavated. The plug within the transition zone can be characterized as a low berm extending downstream from the water's edge, approximately 10 feet. The berm will be maintained while the downstream and upstream pilot channels are constructed. Near construction's end, the berm will be breached to connect the upstream and downstream pilot channels. Under the direction of a Reclamation biologist, the amphibious excavator will lower the berm 6 – 12 inches at a time to pull sediment into the downstream channel. If Reclamation is supplementing flows at Bosque del Apache National Wildlife Refuge (Refuge), pumping will be increased to provide sufficient water to fill the thalweg (i.e. a line following the lowest points of a valley) and reconnect flow to the Fort Craig pumping site.

If the active river channel is dry at the start of construction, no transition or upstream zone will be delineated, and the entire pilot channel will be excavated using the techniques described for the downstream channel. All refueling and personnel transport will occur with the use of a personnel carrier. With no silvery minnow present near the work area, no silt curtain will be used.

If isolated pools containing silvery minnows are encountered within the plug area during construction, excavation will occur using the above described techniques, in segments, so that contact with water containing silvery minnows is minimized. Each segment will be treated in the same manner as an intact plug. Excavators will dig a pilot channel in the dry downstream zone, leave a low berm in the transition zone, and then excavate through the upstream zone. The berm in the transition zone will be breached to connect upstream and downstream portions and allow pools to drain. Reclamation and Service biologists will be on site to ensure all silvery minnows exit or are rescued from drying pools. Excavation will then continue upstream past the pool to subsequent segments.

Conservation Measures

Silvery minnow behavior during excavation of the upstream channel and breaching of the transition zone is uncertain. The Reclamation's construction techniques outlined above are designed to minimize direct contact with silvery minnows, and the potential for minnows to be stranded in isolated pools as water levels in the over-bank areas recede. The techniques allow silvery minnows present near the work area to move freely as a means of avoiding contact with the pilot channel, construction equipment, or personnel. The Reclamation has also provided the following Environmental Commitments to minimize direct or indirect effects to silvery minnows:

1. A Reclamation fishery biologist will supervise breaching of the berm to connect the upstream and downstream pilot channels.

2. Construction of the upstream channel will be scheduled during minimal summer flows to avoid draining off-channel areas, and minimize direct or indirect effects to silvery minnows.

3. A silt curtain will be installed at the mouth of the downstream channel during construction to exclude fish from the work area. An airboat can readily pass over the silt curtain to access the excavator for refueling.

4. Reclamation will coordinate with the Service to have a biologist(s) on site to rescue any silvery minnows stranded as a result of construction activities.

5. Reclamation will continue to coordinate with the Service to determine the need and/or timing of pumping from the Low Flow Conveyance Channel (LFCC) to maximize the benefits of these operations and minimize the adverse effects to silvery minnows as it relates to this proposed project.

Action Area

The action area for the proposed action is defined as the San Acacia Division/Reach of the Rio Grande and the width of the river channel from levee to levee within this reach. The San Acacia Division/Reach includes the river area from the San Acacia Diversion Dam to the headwaters of Elephant Butte Reservoir. Adult and young-of-year (YOY) silvery minnow present in the upstream zone may be directly affected by contact with construction equipment or personnel during pilot channel excavation of the upstream channel. Silvery minnows may also be affected during the lowering of the berm in the transition zone. Adult and YOY fish present in the over-bank areas between the northern and southern ends of the sediment plug may be indirectly affected as habitat behind and among the plug is modified.

STATUS OF THE SPECIES AND CRITICAL HABITAT

Species Description

The silvery minnow currently occupies a 170 mile (275 km) reach of the middle Rio Grande, New Mexico, from Cochiti Dam, Sandoval County, to the headwaters of Elephant Butte Reservoir, Soccorro County (U.S. Fish and Wildlife Service 1994). The silvery minnow is a stout minnow, with moderately small eyes, a small, sub-terminal mouth, and a pointed snout that projects beyond the upper lip (Sublette *et al.* 1990). The back and upper sides of the silvery minnow are silvery to olive, the broad mid-dorsal stripe is greenish, and the lower sides and abdomen are silver. Maximum length attained is about 3.5 inches (90 mm). The only readily apparent sexual dimorphism is the expanded body cavity of ripe females during spawning (Bestgen and Propst 1994).

The silvery minnow has had an unstable taxonomic history, and in the past was included with other species of the genus *Hybognathus* due to morphological similarities. Phenetic and phylogenetic analyses corroborate the hypothesis that it is a valid taxon, distinctive from other species of *Hybognathus* (Cook *et. al.* 1992, Bestgen and Propst 1994). The silvery minnow (*Hybognathus amarus*) is now recognized as one of seven species in the genus *Hybognathus* in the United States and was formerly one of the most widespread and abundant minnow species in the Rio Grande basin of New Mexico, Texas, and Mexico (Pflieger 1980, Bestgen and Platania 1991). Currently, *Hybognathus amarus* is the only remaining endemic pelagic spawning minnow in the Middle Rio Grande. The speckled chub (*Extrarius aestivalus*), Rio Grande shiner (*Notropis jemezanus*), phantom shiner (*Notropis orca*), and bluntnose shiner (*Notropis simus simus*) are either extinct or have been extirpated from the Middle Rio Grande (New Mexico Department of Game and Fish 1998b, Bestgen and Platania 1991).

<u>Legal Status</u>

The silvery minnow was federally listed as endangered under the ESA of 1973, as amended, on July 20, 1994 (U.S. Fish and Wildlife Service 1994). The species is also listed as an endangered species by the State of New Mexico. Primary reasons for listing the silvery minnow involved a number of factors, described in the Reasons for Listing section (below).

Critical habitat was proposed for the silvery minnow on June 6, 2002 (67 FR 39205) and was finalized on February 19, 2003 (68 FR 8088). The critical habitat designation extends approximately 157 mi (252 km) from Cochiti Dam, Sandoval County, New Mexico downstream to the utility line crossing the Rio Grande, a permanent identified landmark in Socorro County, New Mexico. The critical habitat designation defines the lateral extent (width) as those areas bounded by existing levees or, in areas without levees, 300 feet (91.4 meters) of riparian zone adjacent to each side of the bankfull stage of the Middle Rio Grande. Some developed lands within the 300 feet lateral extent are not considered critical habitat because they do not contain the primary constituent elements of critical habitat and are not essential to the conservation of the silvery minnow. Lands located within the exterior boundaries of the critical habitat designation, but not considered critical habitat include: developed flood control facilities, existing paved roads, bridges, parking lots, dikes, levees, diversion structures, railroad tracks, railroad trestles, water diversion and irrigation canals outside of natural stream channels, the Low Flow

Conveyance Channel, active gravel pits, cultivated agricultural land, and residential, comercial, and industrial developments. The Pueblo lands of Santo Domingo, Santa Ana, Sandia, and Isleta within this area are not included in the critical habitat designation. Except for these areas, the final remaining portion of the silvery minnows occupied range in the Middle Rio Grande is designated as critical habitat (68 FR 8088).

Habitat

The silvery minnow travels in schools and tolerates a wide range of habitats (Sublette *et al.* 1990); yet, generally prefers low velocity (< 0.33 feet per second, 10 centimeters/second [cm/sec]) areas over silt or sand substrate that are associated with shallow (< 15.8 inches [40 cm]) braided runs, backwaters or pools (Dudley and Platania 1997). Habitat for the silvery minnow includes stream margins, side channels, and off-channel pools where water velocities are low or reduced from main-channel velocities. Stream reaches dominated by straight, narrow, incised channels with rapid flows are not typically occupied by the silvery minnow (Sublette *et. al.* 1990, Bestgen and Platania 1991).

Adult minnows are most commonly found in backwaters, pools, and habitats associated with debris piles; whereas, Young of Year (YOY) occupy shallow, low velocity backwaters with silt substrates (Dudley and Platania 1997). A study conducted between 1994 and 1996 characterized habitat availability and use at two sites in the Middle Rio Grande at Rio Rancho and Socorro (Dudley and Platania 1997). From this study, Dudley and Platania (1997) reported that the silvery minnow was most commonly found in habitats with depths less than 19.7 inches (50 cm). Over 85 percent were collected from low velocity habitats (< 0.33 feet/sec [10 cm/sec]) (Dudley and Platania 1997, Watts *et al.* 2002).

Critical Habitat

The Service has determined the primary constituent elements of silvery minnow critical habitat based on studies on silvery minnow habitat and population biology (68 FR 8088). The primary constituent elements of critical habitat for the silvery minnow include:

1. A hydrologic regime that provides sufficient flowing water with low to moderate currents capable of forming and maintaining a diversity of aquatic habitats, such as, but not limited to the following: backwaters (a body of water connected to the main channel, but with no appreciable flow), shallow side channels, pools (that portion of the river that is deep with relatively little velocity compared to the rest of the channel), and runs (flowing water in the river channel without obstructions) of varying depth and velocity – all of which are necessary for each of the particular silvery minnow life-history stages in appropriate seasons (e.g., the silvery minnow requires habitat with sufficient flows from early spring (March) to early summer (June) to trigger spawning, flows in the summer (June) and fall (October) that do not increase prolonged periods of low or no flow, and relatively constant winter flow (November through February));

2. The presence of eddies created by debris piles, pools, or backwaters, or other refuge habitat within unimpounded stretches of flowing water of sufficient length (i.e., river

miles) that provide a variation of habitats with a wide range of depth and velocities;

3. Substrates of predominantly sand or silt; and

4. Water of sufficient quality to maintain natural, daily, and seasonally variable water temperatures in the approximate range of greater than 1 ºC (35 ºF) and less than 30 ºC (85 ºF) and reduce degraded conditions (e.g., decreased dissolved oxygen, increased pH).

These primary constituent elements provide for the physiological, behavioral, and ecological requirements essential to the conservation of the silvery minnow.

Life History

The species is a pelagic spawner that produces 3,000 to 6,000 semi-buoyant, non-adhesive eggs during a spawning event (Platania 1995, Platania and Altenbach 1996). Adults spawn in about a one-month period in late spring to early summer (May to June) in association with spring runoff. Platania and Dudley (2000, 2001) found that the highest collections of silvery minnow eggs occurred in mid- to late May. In 1997, Smith (1999) collected the highest number of eggs in mid-May, with lower frequency of eggs being collected in late May and June. These data suggest multiple silvery minnow spawning events during the spring and summer, perhaps concurrent with flow spikes. It is unknown if individual silvery minnows spawn more than once a year or if some spawn earlier and some later in the year.

An artificial flow spike of 1,800 cfs (51 cubic meters/second) for 24 hours was released from Cochiti Dam on May 19, 1996. This flow spike apparently stimulated a spawning event and resulted in the collection of 49 silvery minnow eggs by researchers at Albuquerque on May 22, the day after the spike passed (Platania and Hoagstrom 1996). A late spawn was documented in the Isleta and San Acacia Reaches in July 2002, following a high flow event produced by a thunderstorm. This spawn was smaller than the typical spawning event in May, but a significant number of eggs were collected (N = 496) in two hours of effort (J. Smith, Service, *pers. comm.* 2002). In 2002, small spawning events of a few eggs were documented in all reaches (except the Cochiti Reach) as late as August 7 (J. Smith, Service, *pers. comm.* 2002).

Platania (2000) found that development and hatching of eggs are correlated with water temperature. Eggs of the silvery minnow raised in 30° C water hatched in approximately 24 hours while eggs reared in 20 – 24° C water hatched within 50 hours. Eggs were 0.06 inches (1.6 mm) in size upon fertilization, but quickly swelled to 0.12 inches (3 mm). Recently hatched larval fish are approximately 0.15 inches (3.7 mm) in standard length and grow about 0.005 inches (0.15 mm) in size per day during the larval stages. Eggs and larvae have been estimated to remain in the drift for 3 – 5 days, and could be transported from 134 to 223 miles (216 to 359 km) downstream depending on river flows. Approximately three days after hatching, the larvae move to low velocity habitats where food (mainly phytoplankton and zooplankton) is abundant and predators are scarce. Young-of-year attain lengths of 1.5 to 1.6 inches (39 to 41 mm) by late autumn (U.S. Fish and Wildlife Service 1999). Age 1 fish are 1.8 to 1.9 inches (45 to 49 mm) by the start of the spawning season. Most growth occurs between June (post spawning) and

Platania (1995) suggested that historically the downstream transport of eggs and larvae of the silvery minnow over long distances was likely beneficial to the survival of their populations. This behavior may have promoted recolonization of reaches impacted during periods of natural drought (Platania 1995). The spawning strategy of releasing floating eggs allows the silvery minnow to replenish populations downstream; yet, the current presence of diversion dams (Angostura, Isleta, and San Acacia Diversion Dams) prevents recolonization of upstream habitats (Platania 1995). As populations are depleted upstream, and diversion structures prevent upstream movements, isolated extirpations of the species through fragmentation may occur (U.S. Fish and Wildlife Service 1999). Adults, eggs and larvae are also transported downstream to Elephant Butte Reservoir. It is believed that none of these fish survive because of poor habitat and predation from reservoir fishes (U.S. Fish and Wildlife Service 1999).

The silvery minnow is herbivorous (feeding primarily on algae); this is indicated indirectly by the elongated and coiled gastrointestinal tract (Sublette *et al.* 1990). Additionally, detritus, including sand and silt, is filtered from the bottom (Sublette *et al.* 1990, Service 1999).

Population Dynamics

Generally, a population of silvery minnows consists of only two age classes (Service 1999). The majority of spawning silvery minnows are one year old. Two year old fish comprise less than 10 percent of the spawning population. High silvery minnow mortality occurs during or subsequent to spawning, consequently very few adults are found in late summer. By December, the majority (> 98 percent) of individuals are YOY (Age 0). This population ratio does not change appreciably between January and June, as Age 1 fish usually constitute over 95 percent of the population just prior to spawning.

Platania (1995) found that a single female in captivity could broadcast 3,000 eggs in eight hours. Females produce 3 to 18 clutches of eggs in a 12-hour period. The mean number of eggs in a clutch is approximately 270 (Platania and Altenbach 1996). In captivity, silvery minnows have been induced to spawn as many as four times in a year (C. Altenbach, City, *pers. comm.* 2000). It is not known if they spawn multiple times in the wild. The high reproductive potential of this fish appears to be one of the primary reasons that it has not been extirpated from the Middle Rio Grande. However, the short life span of the silvery minnow increases the population instability. When two below-average flow years occur consecutively, a short-lived species such as the silvery minnow can be impacted, if not completely eliminated from the dry reaches of the river (U.S. Fish and Wildlife Service 1999).

Distribution and Abundance

Historically, the silvery minnow occurred in 2,465 mi (3,967 km) of rivers in New Mexico and Texas. They were known to have occurred from Española upstream from Cochiti Lake; in the downstream portions of the Chama and Jemez Rivers; throughout the Middle and Lower Rio Grande to the Gulf of Mexico; and in the Pecos River from Sumner Reservoir downstream to the confluence with the Rio Grande (Sublette *et al.* 1990, Bestgen and Platania 1991). The current distribution of the silvery minnow is limited to the Rio Grande River between Cochiti Dam and Elephant Butte Reservoir, which amounts to approximately 5 percent of its historic range.

The construction of mainstem dams (e.g. Cochiti Dam) and irrigation diversion dams have contributed to the decline of the silvery minnow. The construction of Cochiti Dam in particular has affected the silvery minnow by reducing the magnitude and frequency of flooding events that help to create and maintain habitat for the species. In addition, the construction of Cochiti Dam has resulted in degradation of silvery minnow habitat within the Cochiti Reach. Flow in the river at Cochiti Dam is now generally clear, cool, and free of sediment. There is relatively little channel braiding, and areas with reduced velocity and sand or silt substrates are uncommon. Substrate immediately downstream of the dam is often armored cobble (rounded rock fragments generally 8 to 30 cm (3 to 12 inches) in diameter). Further downstream the riverbed is gravel with some sand material. Ephemeral tributaries including Galisteo Creek and Tonque Arroyo introduce sediment to the lower sections of this reach, and some of this is transported downstream with higher flows (U.S. Fish and Wildlife Service 2001b; 1999). The Rio Grande gains sediment below Angostura Dam and becomes a predominately sand bed river with low, sandy banks in the downstream portion of the reach. The construction of Cochiti Dam also created a barrier between silvery minnow populations. As recently as 1978, the silvery minnow was collected upstream of Cochiti Lake; however surveys since 1983 suggest that the fish is now extirpated from this area (U.S. Fish and Wildlife Service 1999).

Silvery minnow catch rates have declined two to three orders of magnitude between 1993 and 2004. Additionally, relative abundance of silvery minnows declined from approximately 50 percent of the total ichthyofaunal community in 1995 to about 5 percent in 2004. However, the October density of silvery minnows was significantly higher ($p<0.05$) in 2004 than in 2003 and autumnal catch rates increased by more than an order of magnitude between those years. Silvery minnow catch rates in 2004 were comparable to those in 2001. Despite seasonal fluctuations in the abundance of this species, recent samples indicate an increase over the last two years with gains occurring in all three reaches. Although population levels in 2004 only approached the lows observed following extensive river drying in 1996, it is noteworthy that the percent increase between 2003 and 2004 was the single largest (i.e., over an order of magnitude) observed since the onset of systematic sampling (1993). Similar trends were also evident from a comparison of annual catch rates (Platania and Dudley 2005).

Increased discharge in the Rio Grande during 2004 contrasted with the extended low-flow conditions observed throughout the Middle Rio Grande during 2002 and 2003. The timing of the 2004 flow spike was typical of a flow increase that would normally occur at the onset of the spring runoff period. Elevated and extended flows during 2004 likely resulted in more favorable conditions for the growth and survivorship of newly hatched silvery minnow larvae. It is possible that even low numbers of eggs and larvae could have resulted in greatly increased recruitment success because of the inundation of shoreline habitats, abandoned side channels, and backwaters. Low velocity and shallow areas provide the warm and productive habitats required by larval fishes to successfully complete their early life history.

Spring runoff in 2005 was also above average, leading to a peak of over 6,000 cfs at Albuquerque and sustained high flows (> 3,000 cfs) for more than two months. These flows likely resulted in improved conditions for spawning and recruitment. Monitoring reports for 2005 show increased numbers over 2004 (Dudley and Platania, *pers. comm*. 2005)

<u>Middle Rio Grande Distribution</u>
Generally, the density of silvery minnows increases from upstream (Angostura Reach) to downstream (San Acacia Reach). During surveys in 1999, over 98 percent of the silvery minnows captured were downstream of San Acacia Diversion Dam (Dudley and Platania 2002). This distributional pattern has been observed since 1994 (Dudley and Platania 2002) and is attributed to downstream drift of eggs and larvae and the inability of adults to repopulate upstream reaches because of diversion dams.

In 2004, Dudley et al. (2005) found that catch rates were generally highest in the Angostura Reach and approximately equal in the Isleta and San Acacia reaches. The Angostura Reach yielded the most silvery minnow (n=2,226) in 2004, followed by the Isleta Reach (n=442), and San Acacia Reach (n=371). This pattern is explained by the addition of hatchery and salvaged fish to the Angostura Reach as well as perennial flow in Angostura. By contrast, the Rio Grande south of San Acacia Diversion Dam has been routinely dewatered. Fish in the San Acacia Reach are generally trapped in drying pools, and unless rescued and returned to flowing water, die.

Reasons for Listing/Threats to Survival
The silvery minnow was federally listed as endangered for the following reasons:

1. Regulation of stream waters, which has led to severe flow reductions, often to the point of dewatering extended lengths of stream channel;

2. Alteration of the natural hydrograph, which impacts the species by disrupting the environmental cues the fish receives for a variety of life functions, including spawning;

3. Both the stream flow reductions and other alterations of the natural hydrograph throughout the year can severely impact habitat availability and quality, including the temporal availability of habitats;

4. Actions such as channelization, bank stabilization, levee construction, and dredging result in both direct and indirect impacts to the silvery minnow and its habitat by severely disrupting natural fluvial processes throughout the floodplain;

5. Construction of diversion dams fragment the habitat and prevent upstream migration;

6. Introduction of nonnative fishes that directly compete with, and can totally replace the silvery minnow, as was the case in the Pecos River, where the species was totally replaced in a time frame of 10 years by its congener the plains minnow (Hybognathus placitus); and

7. Discharge of contaminants into the stream system from industrial, municipal, and agricultural sources also impact the species (Service 1993b, 1994).

These reasons for listing continue to threaten the species throughout its currently occupied range in the Middle Rio Grande.

Recovery Efforts

The final recovery plan for the silvery minnow was released in July 1999 (Service 1999c) and is currently undergoing revision. The primary objectives for recovery are to increase numbers of the silvery minnow, enhance its habitat in the Middle Rio Grande valley, and to reestablish the species in at least three other areas in its historic range.

ENVIRONMENTAL BASELINE

Drought, as an overriding condition of the last decade in the southwest, is an important factor in the environmental baseline. The Rio Grande basin has received below normal precipitation, only adding to the long-term moisture deficits. The wet fall and early winter of 2002 provided some drought relief; however, long term moisture deficits averaging 9 inches over the past three years and deficits as high as 15 inches over the past 5 years contribute to current drought conditions in northern New Mexico, an area that supplies water to the Rio Grande basin (National Weather Service 2003a).

The United States Geological Survey (USGS) in Albuquerque, New Mexico reports that stream flow conditions for April 2005 were well above average to significantly above average statewide. The 2005 water year to date percent of average stream flow volumes range from average to significantly above average. Stream flow for April 2005 has significantly improved compared to the April 2004 (National Weather Service 2005a). Nevertheless, while the runoff forecasts are good, reservoir levels continue to be below average across the state. It would take a least another year or two of well above average precipitation to reach pre-drought reservoir conditions.

Status of the Species within the Action Area

Past actions have eliminated and severely altered habitat conditions for the silvery minnow. These actions can be broadly categorized as changes to the natural hydrology of the Rio Grande and changes to the morphology of the channel and floodplain. Other factors that influence the environmental baseline are water quality, the release of captively propagated silvery minnows, on-going research efforts, and past projects in the Middle Rio Grande. Also of importance is the current drought, the expected weather pattern for the near future, and how it may affect flow in the Rio Grande. Each of these topics are discussed below.

<u>Changes in Hydrology</u>

There have been two primary changes in hydrology as a result of the construction of dams on the Rio Chama and Rio Grande that affect the silvery minnow: loss of water and changes to the magnitude and duration of peak flows.

Loss of Water

Prior to measurable human influence on the system, up to the fourteenth century, the Rio Grande was a perennially flowing, aggrading river with a shifting sand substrate (Biella and Chapman 1977). There is now strong evidence that the Middle Rio Grande first began drying up periodically after the development of Colorado's San Luis Valley in the mid to late 1800s (Scurlock 1998). After humans began exerting more influence on the river, there are two documented occasions when the river became intermittent; during prolonged, severe droughts in 1752 and 1861 (Scurlock 1998). The silvery minnow historically survived low-flow periods because such events were infrequent and of lesser magnitude than they are today. There were also no diversion dams to block repopulation of upstream areas, the fish had a much greater geographical distribution, and there were oxbow lakes, cienegas, and sloughs that supported fish until the river became connected again.

Lack of water is the single most important limiting factor for the survival of the species. Water management and use has resulted in a large reduction of suitable habitat for the silvery minnow. Agriculture accounts for 90 percent of surface water consumption in the Middle Rio Grande (Bullard and Wells 1992). The average annual diversion of water in the Middle Rio Grande by the Middle Rio Grande Conservancy District (MRGCD) was 535,280 af (65,839 hectare-meters) for the period from 1975 to 1989 (Reclamation 1993). In 1990, total water withdrawal (groundwater and surface water) from the Rio Grande Basin in New Mexico was 1,830,628 af, significantly exceeding a sustainable rate (Schmandt 1993). Water withdrawals have not only reduced overall flow quantities, but also caused the river to become locally intermittent and/or dry for extended reaches. Irrigation diversions and drains significantly reduce water volumes in the river. However, the total water use (surface and groundwater) in the Middle Rio Grande by the MRGCD may range from 28 – 37 percent (S.S. Papadopulos & Associates, Inc. 2000; USGS 2002c). In addition, a portion of the water diverted by the MRGCD returns to the river and may be re-diverted (in some cases more than once) (Bullard and Wells 1992; MRGCD, in litt. 2003).

River reaches particularly susceptible to drying are immediately downstream of the Isleta Diversion Dam (river mile 169), a 5-mile (8-km) reach near Tome (river miles 150 – 155), a 5-mile (8-km) reach near the U.S. Highway 60 Bridge (river miles 127 – 132), and an extended 36-mile (58-km) reach from near Brown's Arroyo (downstream of Socorro) to Elephant Butte Reservoir. Extensive fish kills, including tens of thousands of silvery minnows, have occurred in these lower reaches when the river has dried (C. Shroeder, Service, pers. comm. 2002). Since 1996, an average of 32 miles of the Rio Grande has dried, most in the San Acacia Reach. The most extensive drying has occurred in the last two years when 70 and 68 miles, respectively, were dewatered. Most documented drying events lasted an average of two weeks, before flows returned.

Predatory birds have been seen hunting and consuming fish from isolated pools during river intermittence (J. Smith, NMESFO, pers. comm. 2003). Though the number of fish present in any pool is unknown, it must be assumed that many of the fish preyed upon in these pools are silvery minnows. Thus, while some dead silvery minnows were collected during the shorter drying events, it is assumed that many more mortalities occurred than were documented.

Population monitoring efforts of the fish community in the Middle Rio Grande show that silvery minnow catch rates declined about two orders of magnitude from 1993 to 2004. Analysis of silvery minnow catch rates in 2004 revealed significant differences ($p<0.05$) in mean catch rates between population monitoring localities. The Angostura Reach yielded the most silvery minnows in 2004, followed by the Isleta Reach, and the San Acacia Reach. Additionally, relative abundance of Rio Grande silvery minnow has declined since 1995. However, the October density of silvery minnows was significantly higher ($p<0.05$) in 2004 than in 2003 and autumnal catch rates had increased by an order of magnitude between those years. This is attributed to increases in flow rates in the fall and winter of 2004.

During recent years, the City of Albuquerque and other San Juan-Chama (SJC) project contractors allowed the use of their SJC water for the purpose of providing flows in the river that were crucial for the silvery minnow population in the San Acacia Reach. Albuquerque is currently in the process of building a water diversion facility to fully utilize its SJC water for municipal uses; this water is not expected to be available for silvery minnow conservation.

Water in the active river channel has been reduced with the construction of drains along both banks of the Rio Grande. The majority of the Middle Rio Grande valley has drains paralleling the river. The west side of the Rio Grande has 160 miles (258 km) of drains, including the LFCC, in a 180-mile (290 km) stretch between Cochiti Dam and the Narrows at Elephant Butte Reservoir. This represents 89 percent of the total length between Cochiti Dam and Elephant Butte Reservoir. The east-side drains also parallel the river to San Acacia Diversion Dam for a distance of 100.5 miles (162 km).

The LFCC that parallels the river for 75 miles (121 km) was designed to expedite delivery of compact water to Elephant Butte Reservoir during low flow conditions. Water was diverted to the LFCC from the Rio Grande from 1959 to 1985. The LFCC has a capacity of approximately 2,000 cfs. Because the LFCC is at a lower elevation than the river bed, there is seepage from the river to the LFCC. This causes a significant loss of surface flows in the river channel. If the flow in the Rio Grande is 2,000 cfs or less, diverting water into the LFCC can dewater the river from the San Acacia Diversion Dam south to Elephant Butte Reservoir. The LFCC has not been fully operational since 1985, because of outfall problems at Elephant Butte Reservoir. In 1997, 1998, and 2001, experimental operations occurred in the upper 10 miles of the LFCC for sedimentation studies; however, the diverted flows were returned to the Rio Grande through a temporary outfall near Escondida. It is estimated that 67 percent of the flow in the Rio Grande is lost to seepage in the project area, with much of this water seeping into the LFCC (Jim Wilber, Reclamation, pers. comm. 1999).

In 2000, a program was initiated to pump water from the LFCC back into the river. The initial pumping program had a total of three stations in the San Acacia Reach. These pumps augmented flows throughout the reach within and below the Refuge. This program reduced the amount of intemittency in the river in 2000 and 2001. In 2002, the pumping was expanded to five stations located in the San Acacia Reach from about 3 miles upstream of US 380 to near Old Fort Craig. The pumping stations at the southern boundary of the Refuge and Fort Craig have created approximately 16 miles of flowing water. A new pumping station located approximately 4 miles north of the southern boundary of the Refuge will provide approximately 4 miles of additional flowing water when sufficient water is in the LFCC. With these pumping stations, flow can be maintained for approximately 20 continuous miles of river, from near the middle of the Refuge, to Elephant Butte. However, if the pumps fail, the river may become intermittent. Reclamation has contractors that check the pumps, but mechanical failures can go undiscovered for several hours. Unexpected disasters such as engine fires (one occurred in mid-July of 2002) can severely affect the ability of pumps to deliver water (G. Pargas, Tetra Tech, *pers. comm*. 2002)

Changes to Size and Duration of Peak Flows

Water management has also resulted in a loss of peak flows that historically initiated spawning. The reproductive cycle of the silvery minnow is tied to the natural river hydrograph. A reduction in peak flows and/or improper timing of flows may inhibit reproduction. Lack of a peak flow was especially severe in the spring and summer of 1996 because of drought. The Service was concerned that silvery minnow reproduction might not occur or would be seriously reduced. A moderate flow spike was coordinated with the cooperation of the City of Albuquerque. River and habitat conditions prior, during, and following the spike were monitored. This spike was successful in triggering a spawn and temporarily improved habitat conditions (Platania and Hoagstrom 1996).

Again in the spring of 2002, there was concern that silvery minnows would not spawn because of a lack of spring runoff due to an extended drought. Runoff for the year was predicted to be the lowest in 100 years at around 2 percent of normal at San Marcial (National Weather Service 2002). Water was released (1650 cfs) from Cochiti Dam on May 14, 2002, to provide a cue for silvery minnow spawning. In response to the release, a significant silvery minnow spawning event occurred and was documented in all reaches except the Cochiti Reach (S. Gottlieb, UNM, *in litt.* 2002).

In addition to providing a cue for spawning, flood flows also maintain a channel morphology to which the silvery minnow is adapted. The changes in channel morphology that have occurred from the loss of flood flows is discussed below.

<u>Changes to Channel Morphology</u>

Historically, the Rio Grande was sinuous, braided, and freely migrated across the floodplain. Changes in natural flow regimes, narrowing and deepening of the channel, and restraints to channel migration (i.e., jetty jacks) adversely affect the silvery minnow. These effects result directly from constraints placed on channel capacity by structures built in the floodplain. These environmental changes have and continue to degrade and eliminate spawning, nursery, feeding, resting, and refugia areas required for species survival and recovery (Service 1993a).

The active river channel through the reaches where the silvery minnow persists in the Angostura and San Acacia Reaches is being narrowed by the encroachment of vegetation, resulting from continued low flows and the lack of overbank flooding. The lack of flood flows has allowed non-native riparian vegetation such as saltcedar and Russian olive to encroach on the river channel (Reclamation 2001). These non-native plants are very resistant to erosion, resulting in narrowing of the channel. When water is confined to a narrower cross-section, its velocity increases. Fine sediments such as silt and sand are carried away leaving coarser bed materials such as gravel and cobble. Habitat studies during the winter of 1995 and 1996 (Dudley and Platania 1996), demonstrated that a wide, braided river channel with low velocities resulted in higher catch rates of silvery minnows, and narrower channels resulted in fewer fish captured. The availability of wide, shallow habitats that are important to the silvery minnow are decreasing. Narrow channels have few backwater habitats with low velocities that are important for silvery minnow fry and juveniles.

Within the current range of the silvery minnow, human development and use of the floodplain have greatly restricted the width available to the active river channel. A comparison of river area between 1935 and 1989 shows a 52-percent reduction, from 26,598 acres (10,764 ha) to 13,901 acres (5,626 ha) (Crawford *et al.* 1993). These data refer to the Rio Grande from Cochiti Dam downstream to the "Narrows" in Elephant Butte Reservoir. Within the same stretch, 234.6 miles (378 km) of levees occur, including levees on both sides of the river. Analysis of aerial photography taken by Reclamation in February 1992, for the same river reach, shows that of the 180 miles (290 km) of river, only 1 mile (1.6 km), or 0.6 percent of the flood plain has remained undeveloped.

Development in the flood plain, makes it difficult, if not impossible, to send large quantities of water downstream that would create low velocity side channels that the silvery minnow prefers. For example, the channel capacity under the railroad bridge at San Marcial has prevented higher releases from Cochiti Dam during spring runoff to avoid damage to the bridge. The construction of houses in the flood plain on the east side of the river at Socorro requires that releases from Cochiti Dam are reduced to prevent damage to these homes. These reduced releases decrease the available habitat for the silvery minnow and make encroachment into the floodplain by non-native species possible.

Water Quality

Both point (pollution discharges from a pipe) and non-point (diffuse sources of pollution) sources affect the Middle Rio Grande. Major point sources are waste water treatment plants (WWTPs) and feedlots. Major non-point sources include agricultural activities (e.g., fertilizer and pesticide application, livestock grazing), storm water run off, and mining activities.

Effluents from WWTPs contain contaminants that may affect the water quality of the river. The largest WWTP discharges are from Albuquerque, followed by Rio Rancho, Los Lunas, and Bernalillo, (mean annual discharge flows are 80.4, 2.5, 0.9, and 0.7 cfs, respectively; (Bartolino and Cole 2002). Since 1998, total residual chlorine (chlorine) and ammonia, as nitrogen (ammonia), have been discharged unintentionally at concentrations that exceed protective levels for the silvery minnow.

In addition to chlorine and ammonia, WWTP effluents may also include cyanide, chloroform, organophosphate pesticides, semi-volatile compounds, volatile compounds, heavy metals, and pharmaceuticals and their derivatives, which can pose a health risk to silvery minnows when discharged in concentrations that exceed the protective water quality criteria (J. Lusk, Service, *in litt.* 2003). Even if the concentration of a single element or compound is not harmful by itself, chemical mixtures may be more than additive in their toxicity to silvery minnows (Buhl 2002). The long-term effects and overall impacts of chemicals on the silvery minnow are not known.

Large precipitation events wash sediments and pollutants into the river from surrounding lands through storm drains and intermittent tributaries. Contaminants of concern to the silvery minnow that are frequently found in storm water include the metals aluminum, cadmium, lead, mercury, and zinc, organics such as oils, the industrial solvents trichloroethene and tetracholoroethene (TCE), and the gasoline additive methyl tert-butyl ether (USGS 2001).

Sediment is the sand, silt, organic matter, and clay portion of the river bed, or the same material suspended in the water column. Ong *et al.* (1991) recorded the concentrations of trace elements and organochlorine pesticides in suspended sediment and bed sediment samples collected from the Middle Rio Grande between 1978 and 1988. These data were compared to numerical sediment quality criteria (Probable Effects Criteria [PEC]) proposed by MacDonald *et al.* (2000). According to MacDonald *et al.* (2000) most of the PECs provide an accurate basis for predicting sediment toxicity to aquatic life and a reliable basis for assessing sediment quality in freshwater ecosystems. Although PECs were developed to assess bed (bottom) sediments, they also provide some indication of the potential adverse effects to organisms consuming these same sediments when suspended in the water column. Some concentrations of trace elements and organochlorine pesticides in suspended sediment collected from the Rio Grande floodway at San Acacia and San Marcial exceeded the PECs for copper, chromium, and zinc. The concentrations of trace elements and organochlorine pesticides in bed sediments were much lower than the PECs, suggesting a differential adherence pattern to suspended sediments and bed sediments and dilution by clean sediments. Additional trace elements were elevated in suspended sediments collected from the Rio Grande at San Felipe. The concentrations of contaminants adhered to suspended sediments may pose a health risk to silvery minnows depending on ingestion rates, bioavailability, and the relative sensitivity of this species (Rand and Petrocelli 1985, pp.496-502).

Pesticide contamination occurs from agricultural activities, as well as from the cumulative impact of residential and commercial landscaping activities. The presence of pesticides in surface water depends on the amount applied, timing, location, and method of application. Water quality standards have not been set for many pesticides, and existing standards do not consider cumulative effects of several pesticides in the water at the same time. Roy *et al.* (1992) reported that DDE, a degradation product of DDT, was detected most frequently in whole body fish collected throughout the Rio Grande. He suggested that fish in the lower Rio Grande may be accumulating DDE in concentrations that may be harmful to fish and their predators. In a study at the Refuge, Ong *et al.* (1991) found detectable levels of DDE in American coot (*Fulica americana*) and carp (*Cyprinius carpio*). Carter (1997) reported that sediment collected and analyzed in the Rio Grande had detectable concentrations of DDE, but that no other organochlorine insecticides or polychlorinated biphenyls were detected. Whole-body fish samples were also collected at the site of sediment collection and analyzed for organic compounds. Organic compounds were reported more frequently in samples of fish, and more types of organic compounds were found in whole-body fish samples than in bed-sediment samples. Concentrations of DDE, polychlorinated biphenyls, cis-chlordane, trans-chlordane, trans-nonachlor, and hexachlorobenzene were also detected in whole-body samples of fish. The presence of DDT and its metabolites, DDD and DDE, in bed sediment and whole-body fish confirms the persistence of this pesticide in the Rio Grande. Although DDT applications have stopped and concentrations in fish tissue have declined dramatically, DDT compounds may still pose adverse health risks to fish species when bioaccumulated from contaminated environments (Rand and Petrocelli 1985).

In addition to the compounds discussed above, several other constituents are present and affect the water quality of the Rio Grande. These include nutrients such as nitrates and phosphorus, total dissolved solids (salinity), and radionuclides. Each of these also has the potential to affect the aquatic ecosystem and health of the silvery minnow. As the river dries, pollutants will be concentrated in the isolated pools. Even though these pollutants do not cause the immediate death of silvery minnows, the evidence suggests that the amount and variety of pollutants present in the Rio Grande, could compromise their health and fitness (Rand and Petrocelli 1985)

Silvery Minnow Propagation and Augmentation

In 2000, the Service identified captive propagation as an appropriate strategy to assist in the recovery of the silvery minnow. Consistent with Service policy (65 FR 183), captive propagation is conducted in a manner that will, to the maximum extent possible, preserve the genetic and ecological distinctiveness of the silvery minnow and minimize risks to existing wild populations.

Silvery minnows are currently housed at five facilities in New Mexico. The New Mexico facilities are: the Dexter Fish Hatchery; New Mexico State University Coop Unit (Las Cruces); Rock Lake State Fish Hatchery; the Service's New Mexico Fishery Resources Office (NMFRO), and the City of Albuquerque's propagation facilities. These facilities are actively propagating and rearing silvery minnows. In 2000, the total combined capacity of these facilities was approximately 175,000 silvery minnow juveniles and adults (J. Brooks and J. Landye, Service, in litt. 2000). Silvery minnows are also held in South Dakota at the U.S. Geological Survey, Biological Resources Division (USGS-BRD) Lab, but there is no active spawning program at this facility.

Since 2000 over 600,000 silvery minnows have been propagated and released into the wild. At the onset of the project, adult wild silvery minnows from the San Acacia Reach and eggs from near San Marcial were collected for a pilot propagation and augmentation program. Wild gravid adults were successfully spawned in captivity at the City of Albuquerque's propagation facilities. Approximately 500 silvery minnows were induced to spawn producing approximately 203,600 eggs (Platania and Dudley 2001b). These eggs were raised for 2 to 3 days and released as larval fish at Bernalillo (91,600) and Los Lunas (112,000) (Platania and Dudley 2001b).

Over 300,000 marked fish have been released by the NMFRO since 2002 under a formal augmentation effort funded by the Collaborative Program. Currently, wild eggs are collected after peak flows, hatched at the facilities listed above and released into the wild as larval fish to augment spawning the following year. Silvery minnows are released into the Angostura Reach of the river near Alameda Bridge to ensure downstream repopulation. Eggs left in the wild have a very low survivorship and this ensures that an adequate number of spawning adults are present to repopulate the river each year. While hatcheries continue to successfully spawn silvery minnows, wild eggs are collected and adults spawned in captivity to ensure genetic diversity within the remaining population.

Ongoing Research

There is on-going research by the NMFRO and University of New Mexico (UNM) to examine the movement of silvery minnows. The fish are marked with a visible fluorescent elastomer tag and released in large numbers in a few locations. Crews sample upstream and downstream from the release site in an attempt to capture the marked fish. In January 2002, approximately 13,000 silvery minnows were released by UNM into the San Acacia Reach. In June 2002, 2,082 silvery minnows were released by NMFRO 1,640 ft (500 m) above the Alameda Bridge in Albuquerque; in December 2002, 41,500 silvery minnows were released in Rio Rancho; and in January 2003, approximately 61,000 silvery minnows were released in Bernalillo. The last three releases were made by NMFRO. In addition to providing information on movement, these releases have augmented the wild population.

Preliminary results indicate that the majority of silvery minnows dispersed. However, one individual was captured 15.7 miles (25.3 km) upstream from its release site (S. Platania, UNM, pers. comm. 2003). Monitoring within 48 hours after the release of the 41,500 silvery minnows resulted in the capture of 937 fish. Of these, 928 were marked and 927 were collected downstream of the release point. However, the results of this study are too preliminary to draw any solid conclusions at this time.

In 2002, a hybridization study involving the plains minnow and silvery minnow was conducted to determine the genetic viability of hybrids. The results are preliminary because the number of trials was low and because there is some question about the fitness of the females used in the experiments. The plains minnow and silvery minnow did spawn with each other and the hybrid eggs hatched. However, none of the larvae lived longer than 96 hours. The control larvae (non-hybrids) for both the plains minnow and silvery minnow lived until the end of the study (24 days) (Caldwell 2002). It is important to know if hybridization (or competition) with the plains minnow occurs.

Due to the increased efforts in captive propagation, recent studies by UNM have focused on the genetic composition of the silvery minnow. This research indicates that the net effective population size (Ne) (the number of individuals that contribute to maintaining the genetic variation of a population) of the silvery minnow in the wild is between 60-250 fish (T. Turner, UNM, pers. comm. 2003). It has been suggested that a Ne of 500 fish is needed to retain the long-term adaptive potential of a population (Franklin 1980). No significant genetic differences have been found in populations isolated in the different reaches of the Rio Grande (D. Alo UNM, pers. comm. 2002). Because the number of wild fish in the river appears to be low, the addition of thousands of silvery minnows raised in captivity could impact the genetic structure of the population. The propagation effort should be sufficient to maintain 100,000 to 1,000,000 fish in the wild (T. Turner, UNM, pers. comm. 2003). For instance if it were determined that 50,000 silvery minnow were in the wild, a minimum of 50,000 adult fish should be in propagation facilities. We do not know how many fish are in the wild so it is difficult at this time to determine the exact number needed in propagation facilities. However, to insure against a catastrophic event where most wild fish are lost, it is suggested that 100,000 to 1,000,000 silvery minnow should be kept in propagation facilities to maintain a sufficient amount of genetic variability for propagation efforts (T. Turner, UNM, pers. comm. 2003). Approximately 300,000 silvery minnows are currently being maintained in captivity (M. Ulibarri, USFWS *pers. comm.* 2005).

Permitted and/or Authorized Take

Take is authorized by section 10 and incidental take permitted under section 7. These permits and/or authorizations are issued by the Service. Applicants for section 10 permits must also acquire a permit from the State to "take" or collect silvery minnows. Many of the permits issued under section 10 allow take for the purpose of collection and salvage of silvery minnows and eggs for captive propagation. Eggs, larvae, and adults are also collected for scientific studies to further our knowledge about the species and how best to conserve the silvery minnow. Since 2000, the Service has reduced the amount of take permitted for voucher specimens as a result of the increasingly precarious status of the species in the wild. Incidental take is authorized through section 7 consultation for silvery minnows associated with the March 2003, programmatic biological opinion on water operations and maintenance in the Middle Rio Grande and the City of Albuquerque Drinking Water Project (October 9, 2003).

Factors Affecting the Species within the Action Area

On the Middle Rio Grande, the following past and present federal, state, private, and other human activities, in addition to those discussed above, have affected the silvery minnow and its critical habitat:

1. Release of Carryover Storage from Abiquiu Reservoir to Elephant Butte Reservoir: The Corps consulted with the Service on the release of water during the winter of 1995. Ninety-eight thousand af (12,054 hectare-meters) of water was released from November 1, 1995, to March 31, 1996, at a rate of 325 cfs (9.8 cm). This discharge is above the historic winter flow rate. Substantial changes in the flow regime that do not mimic the historic hydrograph can be detrimental to the silvery minnow. For example, during the winter release habitat study, Dudley and Platania (1996) observed an apparent increase in flow between two winter sampling trips, January 19-26, 1996, and February 3-5, 1996, resulting in a decrease in low-velocity and side-channel habitats favored by silvery minnows.

2. Corrales, Albuquerque, and Belen Levees: These levees contribute to floodplain constriction and habitat degradation for the silvery minnow. Levees at these sites result in a reduction in the amount and quality of suitable habitat for the silvery minnow.

3. Low Flow Conveyance Channel Experimental Operations: In December 1994, Reclamation submitted a biological assessment addressing the diversion of water from the Rio Grande into the LFCC to study the effects of channel gradient and sedimentation on water delivery. The federal action evaluated the alternative of installing a temporary outfall to the river and diverting water during spring runoff for three consecutive years. Experimental diversions into the LFCC began in May 1997 and continued through June 1997. Experimental diversions began again in early March 1998, and continued until the end of spring runoff. This resulted in the entrainment of silvery minnow eggs and subsequent recruitment of silvery minnow adults into the LFCC. Experimental operations began again on May 20, 2001. Since then, no entrainment of silvery minnows has been documented. This lack of

entrainment has led to speculation that there was little or no spawning occurring in the upstream reaches.

In March 2002, the Service received a biological assessment from Reclamation for additional LFCC experimental operations and for parrot feather removal. The Service completed a draft biological opinion for this project and transmitted it to Reclamation on January 14, 2003.

4. Tiffany Plug Removal: In 1995, Reclamation implemented a project similar to the current proposed action. The purpose of the project was to direct water flow through the excavation, rather than allow water to flow into the adjacent floodplain. The project resulted in a straighter, narrower, and deeper channel, which reduced the hydrologic diversity needed by the silvery minnow.

5. Temporary Channel to Elephant Butte: This Reclamation project involves the construction of a temporary channel through the delta area of Elephant Butte Reservoir to increase the efficiency of sediment and water conveyance. An additional project goal was to initiate some degradation of the river bed through the San Marcial Reach to increase overall channel capacity and potentially allow for higher peak releases from Cochiti dam during subsequent spring runoff periods.

   Measures were implemented to minimize impacts on the silvery minnow and its associated habitat and to enhance local riparian conditions. These environmental actions included: adding sinuosity to the temporary channel; constructing the channel with variable width; constructing low water crossings along the temporary channel to allow overbank flows to inundate existing native riparian vegetation and encourage native revegetation; a channel widening project in the southern reach of the Refuge to improve aquatic and riparian habitat; and creation of an inflow channel to a portion of the eastern floodplain north of Black Mesa to encourage sediment deposition and new habitat creation.

6. Silvery Minnow Augmentation: The Service completed an intra-Service section 7 consultation on the salvage and controlled propagation of silvery minnows in 2000. This consultation covered the collection of free floating silvery minnow eggs below the San Marcial Railroad Bridge and the collection of wild adult silvery minnows for spawning. This consultation set forth measures to limit silvery minnow mortality during collection and rearing.

7. Salvage of Silvery Minnows: The Service completed an intra-Service section 7 consultation of the salvage of silvery minnows from isolated pools in 2000. This consultation set forth measures to limit silvery minnow mortality during collection.

8. Creation of a Conservation Pool for Storage of Native Water in Abiquiu and Jemez Canyon Reservoirs and Release of a Spike Flow: The City created space (100,000 af) in Abiquiu Reservoir and the Corps created space in Jemez Canyon Reservoir to store

Rio Grande Compact credit water for use in 2001, 2002, and 2003 for the benefit of listed species. The conservation pool was created with the understanding that the management of this water would be decided in later settlement meetings or during water operations conference calls. In addition, a supplemental release (spike) occurred in May 2001 to accommodate movement of sediment as a part of habitat restoration and construction on the Rio Grande and Jemez River on the Santa Ana Pueblo.

9. Bosque del Apache National Wildlife Refuge Water Management Plan: The Refuge completed an intra-Service section 7 consultation in May 2001 for the use of 869 af of the consumptive appropriation water right of 8,691 af from the Rio Grande for the years 2001 through 2004 to aid in maintenance of habitat for the silvery minnow if: (1) The Refuge is presented with data indicating that the addition of limited Refuge water will foster survival of the species; (2) an equal or greater percentage of water by other water users in the Middle Rio Grande Valley is also contributed; and (3) legal permitting from the Office of the State Engineer is obtained prior to the emergency transfer request. However, the Refuge maintains that its consumptive water right is actually 12,417 af (referred to in the Permit No. 2 and Rg-1937 *et a*l. ENGLD with a priority date of January 4, 1906, approved by the New Mexico Office of the State Engineer).

10. Programmatic Biological Opinion on the Effects of Actions Associated with the U. S. Bureau of Reclamation's, U.S. Army Corps of Engineers', and non-Federal Entities' Discretionary Actions Related to Water Management on the Middle Rio Grande: The Service completed this biological opinion on March 2003, determining the effects of water management by the applicants on the silvery minnow and flycatcher. This biological opinion had one RPA with several elements. These elements set forth a flow regime in the Middle Rio Grande and described habitat improvements necessary to alleviate jeopardy to both the silvery minnow and flycatcher. One element of the RPA requires Reclamation to manage river recession to facilitate salvage operations. Pumps are currently in use at the South boundary of the Refuge to manage recession in the channel and in overbank areas. At the request of the Service, Reclamation has agreed to maintain the water quality of in-channel and overbank pools in the Action Area, through the use of pumps. Pumps are turned on for 1-2 days every 10-14 days. Water quality and quantity is monitored by Reclamation and the Service, in cooperation with the Interstate Stream Commission's "River Eyes" staff as described in Reclamation's August 5, 2005 "Operating Procedures for River Eyes and Low Flow Conveyance Channel Pumping Operations." Exact pumping schedules are coordinated among the parties and are increased or decreased depending on river conditions. Pumps will be permanently turned off when the Service is prepared to rescue silvery minnows in these pools.

Summary

The remaining population of the silvery minnow is restricted to about 5 percent of its historic range. Every year since 1996, there has been at least one drying event in the river that has further reduced the silvery minnow population. During 2004, approximately 68 miles within the approximately 200 miles of silvery minnow occupied range was dry for several days. Dead silvery minnows have been documented during channel drying events from 1999 to 2005 (Platania and Dudley 1999; J. Smith, NMESFO, *pers. comm.* 2002; Service 2002b; M. Hatch, *pers. comm*. 2005; Service 2005). However, the October density of silvery minnows was significantly higher ($p<0.05$) in 2004 than in 2003 and autumnal catch rates had increased by an order of magnitude between those years. This is attributed to a number of factors including augmentation and increases in flow rates in the fall and winter of 2004.

Spring runoff in 2005 was also above average, leading to a peak of over 6,000 cfs and sustained high flows (> 3,000 cfs) for more than two months. These flows likely resulted in improved conditions for spawning and recruitment. Spring monitoring reports for 2005 show increased numbers over 2004 (J. Brooks, NMFRO, *pers. comm*. 2005).

The population is unable to expand its distribution, because three diversion dams currently block upstream movement and Elephant Butte Reservoir blocks downstream movement (Service 1999). Augmentation of silvery minnows with captive-reared fish will continue, however continued monitoring and evaluation of these fish is necessary to obtain information regarding the survival and movement of individuals.

Water withdrawals from the river and water releases from dams severely limit the survival of silvery minnows. The consumption of shallow groundwater and surface water for municipal, industrial, and irrigation uses continues to reduce the amount of flow in the Rio Grande and eliminate habitat for the silvery minnow (Reclamation 2002b). However, under state law, the municipal and industrial users are required to offset the effects of groundwater pumping on the surface water system. The City, for example, has been offsetting their surface water depletions with 60,000 af per year (Reclamation 2002b). The combined effect of water withdrawals and the drought mean that discharge from WWTPs and irrigation return flows will have greater importance to the silvery minnow and a greater impact on water quality. Lethal levels of chlorine and ammonia have been released from the WWTPs in the last several years. In addition, a variety of organic chemicals, heavy metals, nutrients, and pesticides have been documented in storm water channels feeding into the river and the river itself and contribute to the overall degradation of water quality.

EFFECTS OF THE ACTION

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, which will be added to the environmental baseline. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

Direct Effects

Direct effects to the silvery minnow are likely to occur during pilot channel excavation within the upstream zone. Silvery minnows may be crushed or removed from the water by the amphibious excavator at the northern end of sediment plug segments where the pilot channel meets the main river channel or any pools containing silvery minnows. Also, silvery minnows may also be crushed or removed from the water during the berm removal process, as the excavator removes sediment below flowing water.

Indirect Effects
Indirect effects to the silvery minnow include loss of and alteration of approximately 300 acres of suitable habitat. Removal of the sediment plug will reduce backwater habitat, eliminating nursery and wintering habitat for the silvery minnow in this reach of the river. As a result, there will be a reduction in the quality of habitat for eggs and larvae. Most eggs and larvae will not be retained in this portion of the river, but disperse downstream where suitable and unsuitable habitat exists.

Critical Habitat Effects
Some of the primary constituent elements of silvery minnow critical habitat will be adversely affected by the proposed action. Specifically, the proposed action would dewater low-velocity nursery habitat in the overbank area. This habitat is necessary for development and hatching of eggs and the survival of the species from larvae to adult. Low-velocity habitat provides food, shelter, and sites for reproduction, which are essential for the survival and reproduction of Rio Grande silvery minnow.

However, we find that the effects to the function and conservation role of critical habitat relative to the entire designation are not significant because the impacts will be temporary and occur in a very small area relative to the overall critical habitat designation. Therefore, we conclude that the primary constituent elements of silvery minnow critical habitat will serve the intended conservation role for species with implementation of the proposed action.

Cumulative Effects
Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA. Cumulative effects include:

1. Increases in development and urbanization in the historic floodplain that result in reduced peak flows because of the flooding threat. Development in the floodplain makes it more difficult, if not impossible, to transport large quantitites of water that would overbank and create low velocity habitats that silvery minnow prefer. Development also reduces overbank flooding favorable for the silvery minnow.

2. Increased urban use of water, including municipal and private uses. Further use of surface water from the Rio Grande will reduce river flow and decrease available habitat for the silvery minnow.

3. Contamination of the water (i.e., sewage treatment plants, runoff from small feed lots and dairies, and residential, industrial, and commercial development). A decrease in water quality and gradual changes in floodplain vegetation from native riparian species to non-native species (i.e., saltcedar) could adversely affect the silvery

minnow and its habitat. Silvery minnow larvae require shallow, low velocity habitats for development. Therefore, encroachment of non-native species results in less habitat available for the silvery minnow.

4. Human activities that may adversely impact the silvery minnow by decreasing the amount and suitability of habitat include dewatering the river for irrigation; increased water pollution from non-point sources; habitat disturbance from recreational use, suburban development, and removal of large woody debris.

The Service anticipates that these types of activities will continue to threaten the survival and recovery of the silvery minnow by reducing the quantity and quality of habitat through continuation and expansion of habitat degrading and destroying actions.

CONCLUSION

After reviewing the current status of the silvery minnow, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, it is the Service's biological opinion that the Tiffany Sediment Plug Removal, as proposed in the 2005 biological assessment, is not likely to jeopardize the continued existence of the silvery minnow.

We found that the proposed action has the potential to cause adverse effects to approximately 300 acres of designated critical habitat. Nevertheless, it is anticipated that these impacts will be short-term and will not affect the role of critical habitat relative to the conservation of the silvery minnow and to the overall critical habitat designation. We also do not expect the effects of the proposed action to appreciably alter the function and intended conservation role of silvery minnow critical habitat.

This conclusion is based on the following:

1. The conservation measures included in the BA minimize adverse effects to the silvery minnow and designated critical habitat;

2. The implementation of the proposed action is not expected to impede the survival or recovery of the silvery minnow within its current occupied range.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

The measures described below are non-discretionary and must be undertaken by the Federal agencies so that they become binding conditions of any Federal grant or permit issued to the applicant as appropriate, for the exemption in section 7(o)(2) to apply. The Federal agencies have a continuing duty to regulate the activity covered by this incidental take statement. If the Federal agencies: fail to assume and implement the terms and conditions the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Federal agencies must report the progress of the action and its impact on the species to the Service as specified in the incidental take statement. [50 CFR §402.14(I)(3)]

Amount or Extent of Take Anticipated
The Service anticipates as many as 50 silvery minnows could be taken during each instance of sediment removal. The incidental take is expected to be in the form of harm, harass, and kill.

Silvery minnows taken under salvage operations will count toward the Service's Regional Director's 10(a) (1) (A) permit.

Effect of the Take
The Service has determined that this level of anticipated take is not likely to result in jeopardy to the silvery minnow, because the number that may be taken is small compared to the number currently present within the action area. The conservation measures included in the BA will be implemented to minimize or avoid effects to the silvery minnow.

Reasonable and Prudent Measures
Pursuant to section 7(b)(4) of the Act, the following reasonable and prudent measure (RPM) is necessary and appropriate to minimize impacts of incidental take of the silvery minnow due to sediment plug removal activities.

1) Reclamation shall minimize the take of silvery minnows due to plug removal over the next ten years.

Terms and Conditions
In order to be exempt from the prohibitions of section 9 of the ESA, Reclamation must comply with the following terms and conditions. These terms and conditions implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1.1) To implement RPM 1, Reclamation shall, in cooperation the ESA Collaborative Program and the Army Corps of Engineers, investigate opportunities to realign the river in the Tiffany Reach. This effort may be combined with the San Marcial Railroad Bridge relocation project to improve channel capacity and reduce the likelihood that sediment plugs will develop in the future.

The Service believes that no more than 50 silvery minnows will be incidentally taken, per year, as a result of the proposed action. The reasonable and prudent measure, with its implementing terms and conditions, is designed to minimize the impact of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measure provided. The federal agency must immediately provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measure.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service recommends the following conservation activities.

1. Monitor silvery minnow populations within the Action Area.

2. Continue to work collaboratively to assist in salvage and recovery of the silvery minnow.

3. Monitor fluctuations of groundwater in the shallow and deep aquifers to better understand the groundwater/surface water relationship.

4. Encourage adaptive management of flows and conservation of water to benefit listed species.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

RE-INITIATION NOTICE

This concludes formal consultation and conferencing on the actions described in the August 2, 2005, biological assessment. This consultation is valid until September 2, 2015. As provided in 50 CFR § 402.16, re-initiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) The amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this biological opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. Consultation must be reinitiated prior to the expiration of this biological opinion to ensure continued compliance with sections 7 and 9 of the ESA. In instances where the amount or extent of incidental take is exceeded, any Federal operations causing such take must cease pending re-initiation.

You may ask the Service to confirm the conference report as a letter of concurrence issued through informal consultation if critical habitat for the flycatcher is designated. The request must be in writing. If the Service reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used during the conference, the Service will confirm the conference report as the letter of concurrence on the project and no further section 7 consultation will be necessary.

In future correspondence on this project, please refer to consultation number 2-22-05-F-0522. If you have any questions or would like to discuss any part of this biological opinion, please contact Jennifer Parody of my staff at (505) 761-4710.

Sincerely,

Susan MacMullin
Field Supervisor

cc: Assistant Regional Director, Region 2 (ES)
Regional Section 7 Coordinator, Region 2 (ES)

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FIGURES

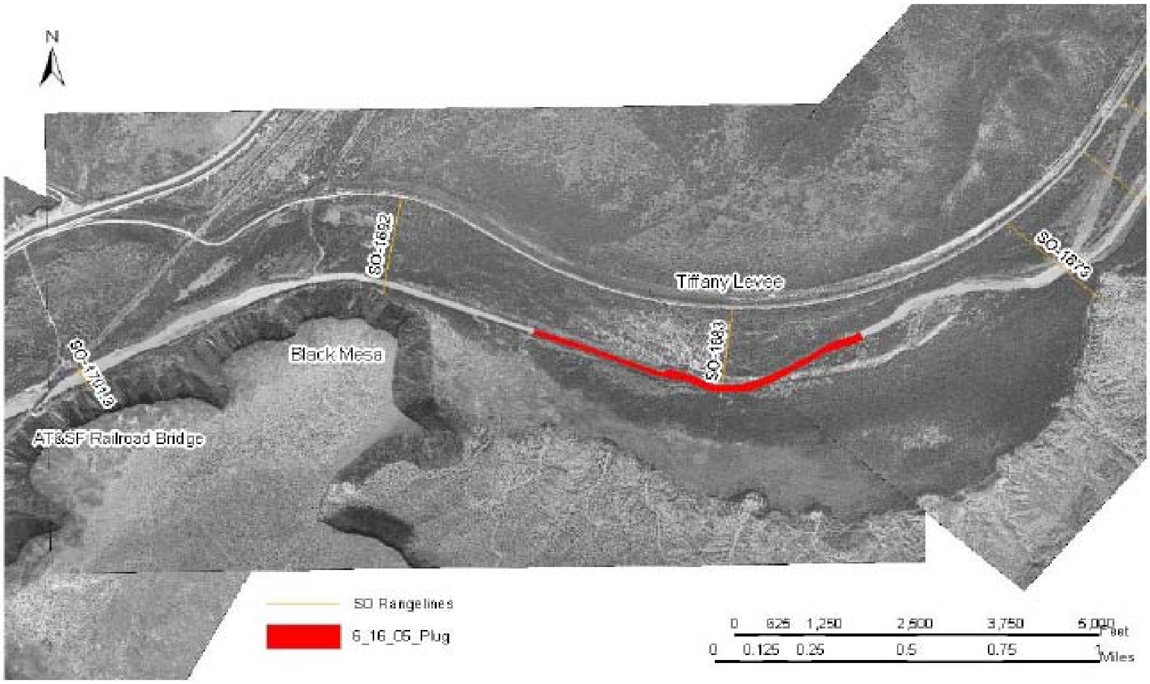

Figure 1. Approximate location of sediment plug on June 16, 2005.

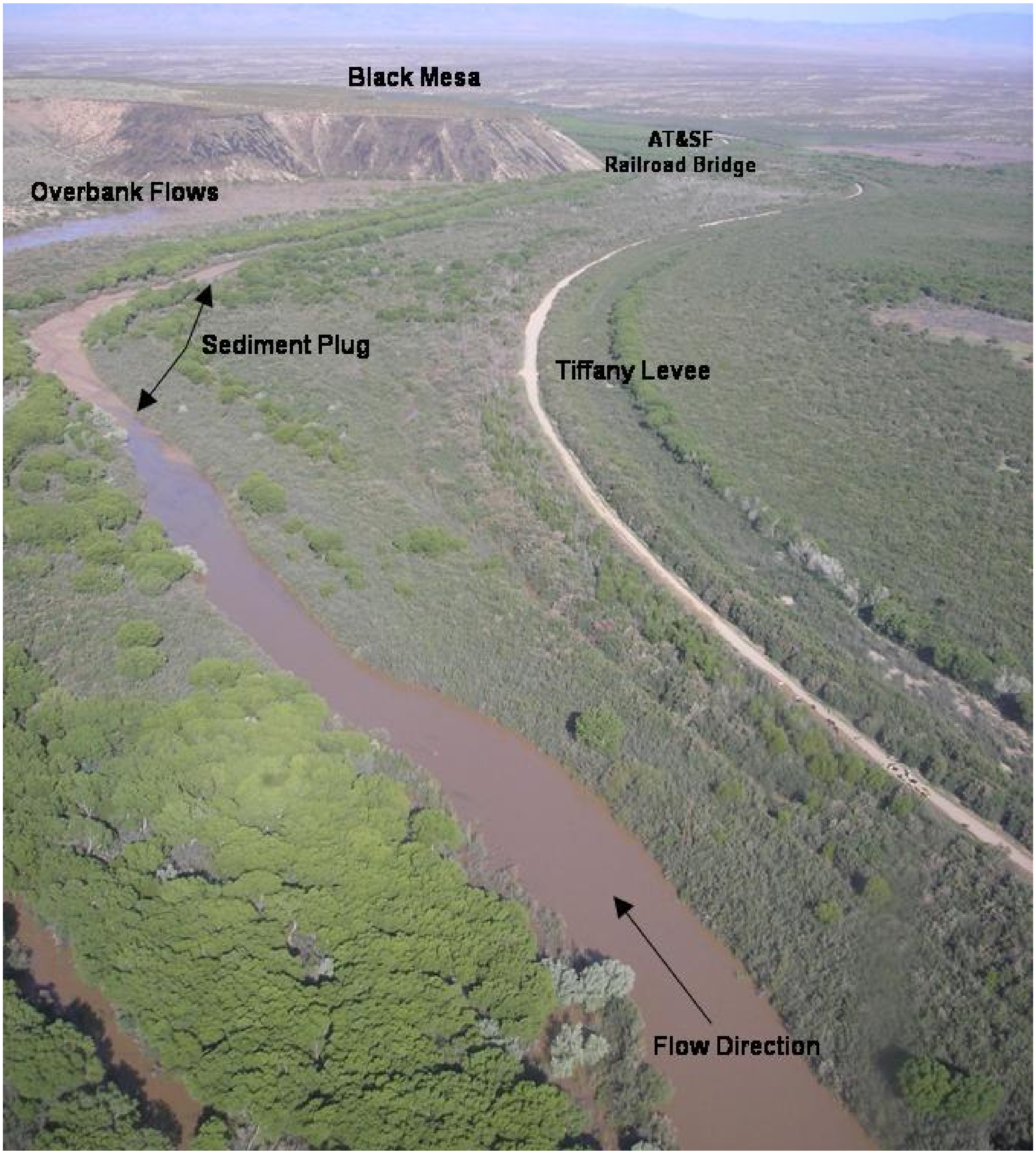

Figure 2. South-facing view of plug and Tiffany reach of the Rio Grande on June 10, 2005.

Figure 3. Pilot channel being excavated through a previously formed sediment plug (August 1991 photo).

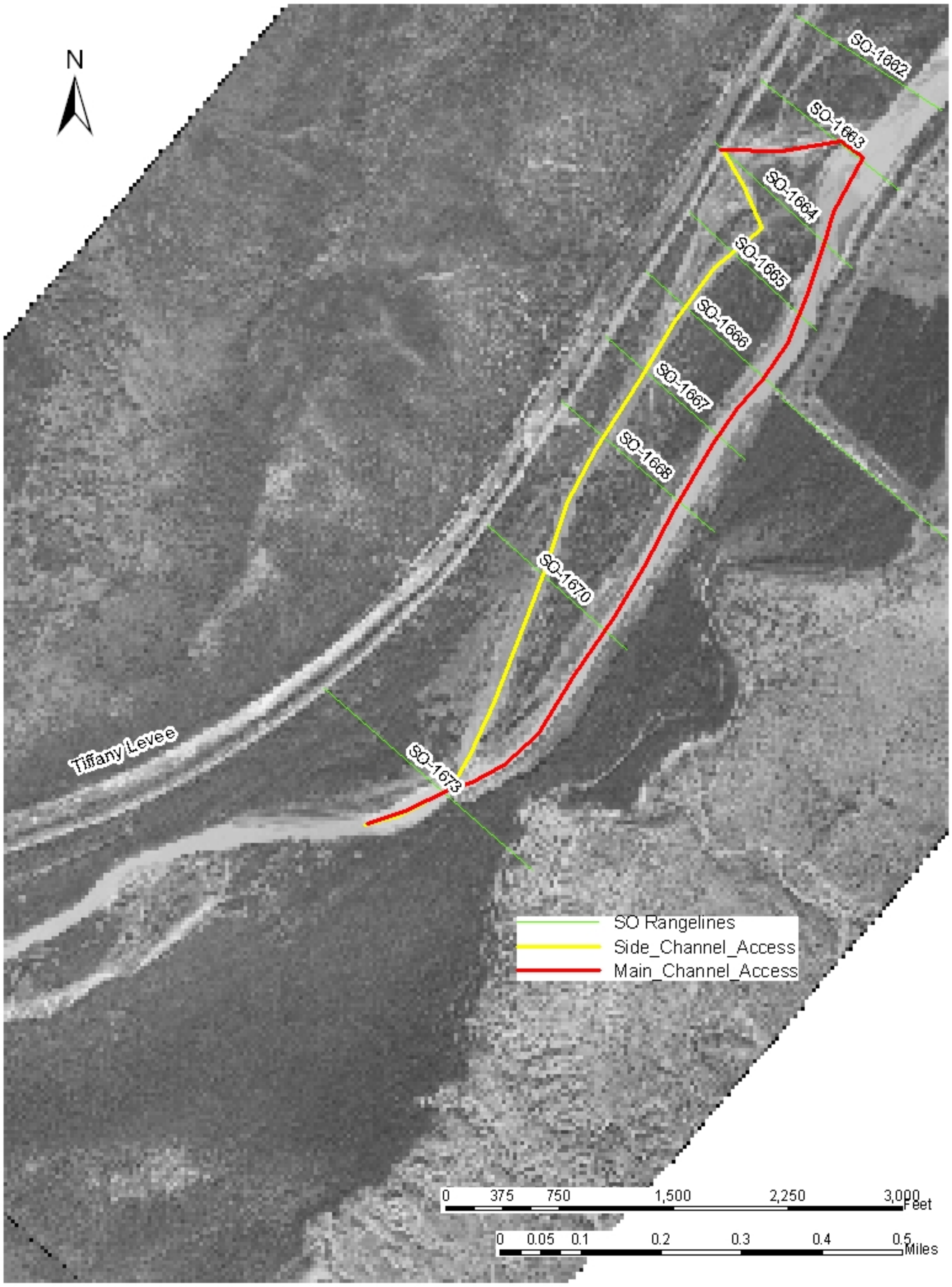

Figure 4. Access routes for equipment.