United States Department of the Interior

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Memorandum

To: Area Manager, Albuquerque Area Office, U.S. Bureau of Reclamation, Albuquerque, New Mexico

From: Field Supervisor, U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office, Albuquerque, New Mexico

Subject: U.S. Fish and Wildlife Service's Biological Opinion on the Effects of Actions Associated with the Rio Grande Restoration Project at Santa Ana Pueblo

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion on the effects of the proposed Rio Grande Restoration Project at Santa Ana Pueblo (Santa Ana Restoration Project). This document replaces the Service's biological opinion (BO) dated October 29, 2007. The project site for this consultation is located on Santa Ana Pueblo in Sandoval County, New Mexico, north of the City of Albuquerque. The work area is located along the Rio Grande and Jemez rivers near their confluence. The Santa Ana Restoration Project has multiple phases, designed to protect the existing levees and associated infrastructure and using bioengineering and other techniques, to provide habitat for listed species. This consultation includes work under Phase II of this project. Reclamation proposes to install thirteen bendway weirs intended to protect a threatened bankline by moving the river westward and relocate sediment to the west bank of the river. This BO concerns the effects of the proposed action on the endangered Rio Grande silvery minnow (*Hybognathus amarus)* (silvery minnow), and southwestern willow flycatcher (*Empidonax traillii extimus)* (flycatcher). Designated critical habitat for the silvery minnow and flycatcher are not within the project area, therefore none would be affected. Your request for formal consultation, in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 531 *et seq.*) was received on June 7, 2007.

This BO is based on information submitted in the June 2007 Middle Rio Grande Project Santa Ana Phase II Biological Assessment (Biological Assessment), revisions to that assessment received on August 14, November 7, and December 4, 2007, 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).

You have determined that the proposed project "may affect, but is not likely to adversely affect," the flycatcher. We concur with this determination for the following reasons:

The flycatcher is a migrant through this portion of the Rio Grande and may be present between April and June, and again in August. Suitable nesting habitat does not currently exist within the project area. No suitable riparian habitat will be disturbed by the project, and the proposal includes the planting of riparian native plants in newly created wetland areas that could eventually mature and create potentially suitable flycatcher habitat. Construction will not occur during the flycatcher breeding or migration season to avoid noise impacts. No nesting occurs in the vicinity of the project area. The number of flycatcher territories in the Middle Rio Grande Management Unit has exceeded recovery goals (100 territories) for the past three years (Ahlers and Doster 2007). Additionally, flycatcher habitat restoration projects are occurring throughout the basin, improving conditions for the flycatcher. Given the small amount of disturbance expected from this project, the effects of this project on flycatcher are discountable.

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

Consultation History

The proposed action tiers off the Reclamation and U.S. Army Corp of Engineers' 2003 Programmatic Biological Assessment and the Service's Biological Opinion and Conference Report entitled, *Bureau of Reclamation's Water and River Maintenance Operations, Army Corps of Engineers' Flood Control Operation, and Related Non-Federal actions on the Middle Rio Grande, New Mexico* (2003 Middle Rio Grande Biological Opinion). The proposed Santa Ana Restoration Project emphasizes the use of bioengineering in conjunction with river maintenance projects whenever possible. Phase I of this project was evaluated under Consultation #2-22-98-I-168. A BO on Phase II was issued on October 29, 2007. Subsequently, Reclamation provided additional project information. This document replaces the October 29, 2007 BO.

BIOLOGICAL OPINION

DESCRIPTION OF PROPOSED ACTION

The Biological Assessment provided for this project by Reclamation, contains a comprehensive description of the purpose and need for the proposed action and the project area, details on construction of the bioengineering project, revegetation, adaptive management, a description of environmental commitments, and effects determination for listed species and critical habitat. The material contained in the Biological Assessment is herein incorporated by reference (U.S. Bureau of Reclamation 2007). The following description of the proposed action is a summary of the material in the biological assessment and should not be considered as the complete description.

Purpose and Objective

The Santa Ana Restoration Project is divided into three phases of construction. Phase 1, completed in April 2001 consisted of constructing a gradient restoration facility (GRF) and realigning the channel of the Rio Grande (Mosley and Boelman, 1999). Phase 2 began in 2001 with additional earthwork, berm and dike reinforcement, and vegetation planting (Bauer, 2001). Initial work on Phase 2 was completed in 2003, including modifications to the berm and backwater areas on the east side of the Rio Grande downstream of the Rio Jemez confluence (Nemeth, 2004). A primary component of Phase 2, is the iterative repositioning of spoil material to provide for riverine transport away from the project site. This work is not complete and will continue until all the spoil material has been removed. During the high spring runoff flows of 2005, personnel from Reclamation's Socorro Field Division were actively engaged in rearranging the sediment berms on the east side of the channel to maximize erosion potential and sediment removal. The volume of sediment on the east side of the river remains large, however, and requires more active management. The combination of logistical difficulties and uncertainty about when another high flow might occur led to a desire by both Reclamation and the Pueblo of Santa Ana to find a way to remove the sediment berm during lower flow conditions.

The river, upstream of the GRF is migrating westward to an extent that the GRF is vulnerable. The purpose of this project is to to prevent the bend from migrating further westward by installing bendway weirs on the west bankline in the bend upstream of the GRF.

Project Description

Reclamation proposes to install thirteen bendway weirs along 7 acres on the west bankline in the bend upstream of the GRF. Following construction, these weirs will be completely buried by earth fill material placed along the west bankline. Some of the fill material is expected to be mobilized in subsequent years. The intent of the bendway weir placement is to prevent the bend from migrating westward beyond its current location. Sediment in the east-side berm will be moved to areas of the west bankline where extensive erosion occurred in 2005.

Bendway weirs alter the secondary currents and velocities in a manner that controls excessive deepening and reduces adjacent riverbank erosion on the outer bank. They also produce a better current alignment through the bend and downstream crossing, in addition to improving the aquatic and stream corridor habitat. Bendway weirs will be used in this project to provide additional bank stability and reliability during high flows to protect the eastern levee against bank erosion. Scour is expected near the toe of each weir, and the development of a new thalweg approximately 25 feet away from the new bankline is expected. To reduce the probability that the new thalweg will migrate outward and undermine the weirs, weir stones will be placed in the old channel on the existing grade. This technique, although requiring burying more rock in the newly constructed bank, would significantly increase reliability. The weir rock will be placed extending out from the bankline using excavators. Fill will be placed between and on top of the weirs to create the new bankline and floodplain surface. Sediment will be moved using bulldozers pushing from the bankline outward and the bendway weirs in a downstream direction.

Construction will occur in the river working from the upstream end of the site in a downstream direction. The preferred construction period is November through March when winter river flow is 400-1000 cfs. The bendway weirs will be constructed of 12-inch riprap. Each weir will be angled 20 degrees upstream to promote pool development and locate scour away from the outer bankline. The weir length is consistent with recommendations by Biedenharn et al. (1997) that the maximum weir length should not exceed 15 percent of the bankfull channel width. In general, the active channel is greater than 200 feet, making a weir length of 25 feet less than 15 percent of the bankfull channel width. For this project, spacing of 50 feet (on centerline) was selected, which is 2 times the length of the buried weirs. Bank height on the west bank in the project area is approximately 11 feet; the surface at the top of the bank is so high that it is no longer part of the active floodplain. Based on the bank height, engineering judgment, and experience elsewhere on the Rio Grande, a weir height of 4 feet at the bankline was selected. Biedenharn et al. (1997) note that it is often desirable, especially in the case of impermeable weirs, for the weir to slope downward from the bank to the riverward end. To incorporate this consideration, the riverward toe height of the weirs was specified as 3 feet. A top width of 4 feet was selected for the project site. For this project, in which the weirs will be completely buried, the root length is essentially the entire length of the weir.

Approximately 62,000 cubic yards of fill material will be obtained from excavation of the east-side berm for fill between and above the bendway weirs. Sediment from the berm will be hauled using articulated dump trucks for 75 to 125 round trips across the Rio Grande per day for five months (except weekends and holidays). The location at which the river will be crossed will be selected at the time of construction, based on hydrologic and morphologic conditions; selection will emphasize finding a crossing point with a shallow depth and sufficiently solid bed to allow safe equipment access. Excavation of the berm will increase 8.5 acres of floodplain connectivity at flows of 3,000 cfs.

West side access will follow the existing dirt road from the Jemez Canyon Dam road (Tamaya Blvd.) to the project site. The existing access road ends near the GRF. This access road along with adjoining roads may be periodically bladed and/or gravel capped, and overhanging tree branches trimmed as necessary.

Water will be used for project construction for the following activities:

1) On access roads for dust abatement purposes.

2) When placing the sediment on the western bankline, material would be moistened to obtain optimal sediment fill compaction.

3) For dust control purposes when removing and moving the sediment fill material from the east side to the west side of the Rio Grande.

It is preferred that water necessary for construction activities be taken from the Rio Grande, since all of the irrigation facilities are on the eastern side of the river, a considerable distance from the project. Reclamation plans to pump permitted water out of the river for dust abatement during the project.

Two techniques have been identified for using river water without affecting silvery minnows and other fish in the immediate area;

1) From September 1 through April 15, Reclamation would use an exclusion cage with ¼" hardware cloth enclosing the sides to screen the pump intake. The ¼" hardware cloth would exclude small silvery minnows and other fish from the pump intake. The cage would be sized (larger than 2'L x 2'W x 2'D) to allow sufficient water for pumping and avoid pressure differential (suction) along the sides of the cage that could injury small fish.

2) From April 16 through August 31, Reclamation would dig a sump in the proximate floodplain for pumping. Preparation of a sump involves digging a hole in the floodplain, away from the edge of the river. The sump would be located a minimum of 50' from the nearest open water in the river and excavated to about 30-35 feet square and approximately 3 feet below groundwater level. The excavated material would be temporarily placed as a berm between the sump and the river. Water would be pumped out of the sump for dust abatement. The sump is less effective for pumping water, but would exclude fish eggs and larvae during the spawning season. The sump would be filled back in with the excavated materials when pumping is terminated.

Adaptive Management

The response of the riparian system to the planned project is inherently uncertain. Consequently, adaptive management principles should be used to ensure project purposes are fulfilled and undesirable conditions do not develop. Based on post-project monitoring, additional work may be done at the project site to address perceived deficiencies and unforeseeable developments.

Reclamation will use Best Management Practices (BMPs) for placement of rock and other fill for stabilizing the bankline and would continue to coordinate with the Service on construction techniques to avoid harm to silvery minnow in the work area (U.S. Bureau of Reclamation 2007). BMPs to be implemented are:

1. Place riprap and sediment from dumptruck starting from the bankline and extending placement out into the channel. Movement of the truck in the water will give fish the opportunity to swim away from the rock being placed.

2. Where possible, push sediment fill from the bankline using a bulldozer or use the excavator to gently place riprap (or sediment) in the proper location rather than dumping it directly into the water. This provides fish the opportunity to swim away from the sediment being moved.

3. Maintain an open water area for fish to retreat to during placement of riprap and sediment fill. This will be accomplished by maintaining a connection to the river from the construction area to prevent the formation of isolated pools or channels, where fish could become trapped. This BMP allows fish the opportunity to swim away from potential harm in the work area.

4. When crossing the wetted river channel with heavy equipment, the path will be placed in a shallow riffle hardened with gravel. This is preferable to the shortest distance across the river, which would have deeper water and a faster current. This BMP is intended to reduce the chances of a spill, allow the trucks to traverse the river quicker, and reduce turbidity.

Action Area

The action area is defined as the area from the Angostura Diversion Dam to the Isleta Diversion Dam and the entire width of the 100 year Rio Grande floodplain within that reach.

STATUS OF THE SPECIES

RIO GRANDE SILVERY MINNOW

The silvery minnow was federally listed as endangered under the ESA 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 are described below in the Reasons for Listing section.

Description

The silvery minnow currently occupies a 170-mile reach of the Middle Rio Grande, New Mexico, from Cochiti Dam, Sandoval County, to the headwaters of Elephant Butte Reservoir, Socorro 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 (in). The only readily apparent sexual dimorphism is the expanded body cavity of ripe females during spawning (Bestgen and Propst 1994).

In the past, the silvery minnow 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). It 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 (Bestgen and Platania 1991).

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 ft per second) areas over silt or sand substrate that are associated with shallow [< 15.8 inch (in)] 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 silvery minnow (Sublette *et al*. 1990, Bestgen and Platania 1991).

Adult silvery minnow 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. From this study Dudley and Platania (1997) reported that the silvery minnow was most commonly found in habitats with depths less than 19.7 in. Over 85 percent were collected from low-velocity habitats (<0.33 ft/sec) (Dudley and Platania 1997, Watts *et al*. 2002).

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 1998). The majority of 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. Artificial spikes have apparently induced silvery minnow to spawn (Platania and Hoagstrom 1996). It is unknown if individual silvery minnow spawn more than once a year or if some spawn earlier and some later in the year.

Platania (2000) found that development and hatching of eggs are correlated with water temperature. Eggs of the silvery minnow raised in 30ºC water hatched in approximately 24 hours while eggs reared in 20-24ºC water hatched within 50 hours. Eggs were 0.06 in in size upon fertilization, but quickly swelled to 0.12 in. Recently hatched larval fish are about 0.15 in in standard length and grow about 0.005 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 mi downstream depending on river flows (Platania 2000). Approximately three days after hatching the larvae move to low velocity habitats where food (mainly phytoplankton and zooplankton) is abundant and predators are scarce. YOY attain lengths of 1.5 to 1.6 in by late autumn (U.S. Fish and Wildlife Service 1999). Age-1 fish are 1.8 to 1.9 in by the start of the spawning season. Most growth occurs between June (post spawning) and October, but there is some growth in the winter months. In the wild, maximum longevity is about 25 months, but very few survive more than 13 months (U.S. Fish and Wildlife Service 1999). Captive fish have lived up to four years (C. Altenbach, City of Albuquerque, *pers. comm.* 2003).

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, but 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, U.S. Fish and Wildlife Service 1999).

Population Dynamics

Generally, a population of silvery minnow consists of only two age classes: YOY and Age-1 (U.S. Fish and Wildlife Service 1999). The majority of spawning silvery minnow is 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 (greater than 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 1998). In captivity, silvery minnow have been induced to spawn as many as four times in a year (C. Altenbach, City of Albuquerque, *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 dry reaches of the river (U.S. Fish and Wildlife Service 1999).

Distribution and Abundance

Historically, the silvery minnow occurred in 2,465 mi 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 between Cochiti Dam and Elephant Butte Reservoir, which amounts to approximately 5 percent of its historic range.

The construction of mainstem dams, such as 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 3 to 12 in 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 1999, 2001). The Rio Grande downstream of Rio Rancho 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 (U.S. Fish and Wildlife Service 1999). 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 declined two to three orders of magnitude between 1993 and 2004. Additionally, relative abundance of silvery minnow declined from approximately 50 percent of the total fish community in 1995 to about 5 percent in 2004. However, in 2004, the October density of silvery minnow was significantly higher ($p<0.05$) than in 2003 and autumnal catch rates increased by over an order of magnitude between those years. Silvery minnow catch rates in 2004 were comparable to those in 2001. Catch rates in 2005 were even higher. October catch rates in 2005 (3,899) increased nearly 50 times over catch rates for 2004 (78) (Dudley *et al*. 2005).

Augmentation, throughout this period, likely sustained the silvery minnow population. Approximately, 1,000,000 silvery minnow have been released (primarily in the Angostura Reach) since 2000 (see Environmental Baseline). Captively propagated and released fish supplemented the native adult population and most likely also took advantage of the good spawning conditions of 2004 and 2005.

Increased discharge in the Rio Grande during 2004 and 2005 contrasted with the extended low-flow conditions observed throughout the Middle Rio Grande during 2003 and 2002. Spring runoff in 2005 was significantly 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. The timing of the 2004 and 2005 runoff flow was typical of a flow increase that would normally occur at the onset of the spring runoff period. Elevated and extended flows during these years 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.

These flows improved conditions for both spawning and recruitment. October 2005 monitoring indicated a significant increase in silvery minnow in the Middle Rio Grande, increasing to 3,899 total silvery minnow captured from 2 and 78 in 2003 and 2004, respectively.

In 2006, however, spring runoff was extremely low and although there were several peaks in the natural hydrograph in June, July, August, and September, only a small number of silvery minnow eggs were documented in June and July. October samples yielded only 166 silvery minnow. None of the silvery minnow collected were YOY, indicating poor recruitment, likely due to channel drying in June and July, after the late and minimal spawn (Dudley et al. 2006a). Sampling in October 2006 yielded a total of 166 silvery minnow, a more than 23 fold decrease from 2005 (Dudley, et al. 2006).

<u>Middle Rio Grande Distribution</u>

Since the early 1990s, the density of silvery minnow generally increased from upstream (Angostura Reach) to downstream (San Acacia Reach). During surveys in 1999, over 98 percent of the silvery minnow 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.

However, in 2004 and 2005, Dudley *et al.* (2005 and 2006a) found that this pattern reversed. Catch rates were 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). Routine augmentation of silvery minnow in the Angostura Reach (nearly 900,000 since 2000), and the transplanting of silvery minnow rescued from drying reaches (approximately 770,000 since 2003) explains this change in pattern. Additionally, good spawning conditions (i.e., high and sustained spring runoff) throughout the Middle Rio Grande during April and May followed by wide-scale drying in the Isleta and San Acacia reaches from June-September exacerbated the skew. High spring runoff and perennial flow in the Angostura Reach appeared to result in relatively high survival and recruitment of larval and juvenile silvery minnow compared to previous drought years (2002-2003). In contrast, large portions of the Rio Grande south of Isleta Diversion Dam were dewatered in 2004 and young silvery minnow in these areas were either subjected to poor recruitment conditions (i.e., lack of nursery habitats during low-flows) or they were trapped in drying pools where they perished.

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 (U.S. Fish and Wildlife 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 (U.S. Fish and Wildlife Service 1999). The Recovery Plan has been updated and revised and a draft revised Recovery Plan (U.S. Fish and Wildlife Service 2007) was released for public comment on January 18, 2007 (72 FR 2301).

The draft revised Recovery Plan describes recovery goals for the silvery minnow and actions to complete these (U.S. Fish and Wildlife Service 2007). The three goals identified for the recovery and delisting of the silvery minnow are:

1. Prevent the extinction of the silvery minnow in the middle Rio Grande of New Mexico.

2. Recover the silvery minnow to an extent sufficient to change its status on the List of Endangered and Threatened Wildlife from endangered to threatened (downlisting).

3. Recover the silvery minnow to an extent sufficient to remove it from the List of Endangered and Threatened Wildlife (delisting).

Downlisting (Goal 2) for the silvery minnow may be considered when three populations (including at least two that are self-sustaining) of the species have been established within the historic range of the species and have been maintained for at least 5 years.

Delisting (Goal 3) of the species may be considered when three self-sustaining populations have been established within the historic range of the species and they have been maintained for at least ten years (U.S. Fish and Wildlife Service 2007).

DESIGNATED CRITICAL HABITAT

Designated critical habitat for the silvery minnow was designated on February 19, 2003 (68 FR 8088). The critical habitat designation extends approximately 157 miles 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 (ft) or riparian zone adjacent to each side of the bank full stage of the Middle Rio Grande. Some developed lands within the 300 ft lateral extent are not considered critical habitat because they do not contain the primary constituent elements of designated critical habitat and are not essential to the conservation of the silvery minnow. Lands located within the lateral 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, commercial, 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 Pueblo lands, the remaining portion of the silvery minnow's occupied range in the Middle Rio Grande in New Mexico is designated as critical habitat (68 FR 8088).

The Service has determined the primary constituent elements (PCEs) of silvery minnow critical habitat based on studies on silvery minnow habitat and population biology (68 FR 8088). They 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 1ºC (35ºF) and less than 30ºC (85ºF) and reduce degraded conditions (e.g., decreased dissolved oxygen, increased pH).

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

ENVIRONMENTAL BASELINE

Under section 7(a)(2) of the ESA, when considering the effects of the action on federally listed species, we are required to take into consideration the environmental baseline. Regulations implementing the ESA (50 FR 402.02) define the environmental baseline as the past and present impacts of all Federal, State, or private actions and other human activities in the action area; the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation; and the impacts of State and private actions that are contemporaneous with the consultation in progress. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

Drought, as an overriding condition of the last decade in the southwest, is an important factor in the environmental baseline. However, stream conditions in 2004 and 2005 improved over previous years. The United States Geological Survey (USGS) in Albuquerque, New Mexico reported that stream flow conditions in 2005 were well above average to significantly above average statewide leading to a peak of over 6,000 cfs at Albuquerque and sustained high flows (> 3,000 cfs) for more than 2 months. These flows improved conditions for both spawning and recruitment.

The 2006 spring runoff was well below average because of lower than normal snowpack. In May 2006, year to date precipitation was well below average with the snow pack at 20 percent of average in the Rio Grande Basin. Fortunately, a strong monsoon season led to the wettest period of record in July and August. Consequently, only 26.5 miles of river dried in the summer of 2006, the lowest amount since 2001. Despite this monsoonal precipitation, reservoir levels continued to be below average across the state. It is predicted that at least another year or two of well above average precipitation would be necessary to develop pre-drought reservoir conditions.

The 2007 runoff was above average. Additionally, a one time deviation in Cochiti operations (Corps 2007) allowed managed releases of native flow during the spawn. Flows below Cochiti exceeded 3,000 cfs for 10 days in May.

Since 1996, Reclamation has relied heavily on leases of San Juan-Chama (SJC) water to provide supplemental water by the Middle Rio Grande Endangered Species Act Collaborative Program to implement the 2003 Middle Rio Grande Water Operations Biological Opinion. Supplemental water has been used to create spawning pulses and recruitment flows for the silvery minnow and to meet minimum flow requirements for silvery minnow and flycatchers. From 1996-2003, Reclamation leased an average of 46,318 acre-feet/year (afy) of SJC water from willing leasers.

Status of the Species within the Action Area

The population of silvery minnow in the Action Area and throughout the Middle Rio Grande is highly variable over time (see Status of the Species). The most recent October sample reported silvery minnow in the action area at an estimated density of 30.26 per 100 meters squared (m^2) (Dudley et al. 2006). Major threats to silvery minnow within the Action Area include changes in hydrology, channel morphology and reduced water quality. Channel drying does not typically occur in the Angostura Reach.

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 minnow; silvery minnow rescue efforts, on-going research efforts, and past projects in the Middle Rio

Grande. Also of importance is the current drought, and how it may affect flow in the Rio Grande. Each of these topics is 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 extirpated areas, the fish had a much greater geographical distribution, and there were oxbow lakes, cienegas, and sloughs associated with the Rio Grande that supported fish until the river became connected again.

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 Conservation District (MRGCD) was 535,280 af for the period from 1975 to 1989 (U.S. Bureau of 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; U.S. Geological Survey 2002). 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).

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 altered timing of flows may inhibit reproduction. Since completion of Elephant Butte Dam in 1916, four additional dams have been constructed on the Middle Rio Grande, and two have been constructed on one of its major tributaries, the Rio Chama (Scurlock 1998). Construction and operation of these dams, which are either irrigation diversion dams (Angostura, Isleta, San Acacia) or flood control and water storage dams (Elephant Butte, Cochiti, Abiquiu, El Vado), have modified the natural flow of the river. Mainstem dams store spring runoff and summer inflow, which would normally cause flooding, and release this water back into the river channel over a prolonged period of time. These releases depart significantly from natural conditions, and can substantially alter the habitat. In spring and summer, artificially low-flows limit the amount of habitat available to the species and may also limit dispersal of the species (U.S. Fish and Wildlife Service 1999).

Mainstem dams and the altered flows they create can affect habitat by preventing overbank flooding, trapping nutrients, altering sediment transport regimes, prolonging summer base flows, modifying or eliminating native riparian vegetation, and creating reservoirs that favor non-native fish species. These changes may affect the silvery minnow by reducing its food supply; altering its preferred habitat, preventing dispersal, and providing a continual supply of non-native fish that may compete with or prey upon them. Altered flow regimes may also result in improved conditions for other native fish species that occupy the same habitat, causing those populations to expand at the expense of the silvery minnow (U.S. Fish and Wildlife Service 1999).

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 are discussed below.

Changes in Channel Morphology

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 lateral channel migration (i.e., jetty jacks) adversely affected the silvery minnow. These effects result directly from constraints placed on channel capacity by structures built in the floodplain. These anthropogenic changes have and continue to degrade and eliminate spawning, nursery, feeding, resting, and refugia areas required for species' survival and recovery (U.S. Fish and Wildlife Service 1993a).

The active river channel within occupied habitat 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 salt cedar and Russian olive to encroach on the river channel (U. S. Bureau of 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 and the ability to carry sediments is enhanced. 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 minnow, and narrower channels resulted in fewer fish captured. The availability of wide, shallow habitats that are important to the silvery minnow is decreasing. Narrow channels have few backwater habitats with low velocities that are important for silvery minnow fry and YOY.

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 mi 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 mi of river, only 1 mi, or 0.6 percent of the floodplain has remained undeveloped.

Development in the floodplain, 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. As a result, reduced releases have decreased available habitat for the silvery minnow and allowed encroachment of non-native species into the floodplain.

<u>Water Quality</u>

Many natural and anthropogenic factors affect the quality of the middle Rio Grande. The water quality of the Rio Grande varies spatially and temporally throughout its course primarily because of inflows of ground water and from surface water discharges and tributary delivery to the river. Both point sources (pollution discharged from a pipe) and non-point sources (diffuse sources of pollution) affect the Middle Rio Grande. Major point sources are wastewater treatment plants (WWTPs) and feedlots. Major non-point sources include urban storm water run off, agricultural activities (e.g., fertilizer and pesticide application, livestock grazing), and mining (Ellis *et al.* 1993).

Effluents from WWTPs contain contaminants that may affect the water quality of the river. In the project area, the largest WWTP discharges are from the City of Albuquerque, Rio Rancho WWTP #2, Los Lunas, and Socorro (design 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 or other aquatic life standards (see webpage search engine at the URL <http://www.epa-echo.gov/echo/>).

Records also show that the monthly maximum concentration of ammonia during July 2001 was 14 mg/L. At pH 8 and water temperature of 25 °C, ammonia concentrations as low of 3.1 mg/L can be harmful to larval fathead minnow (U.S. Environmental Protection Agency 1999). The fathead minnow has been suggested as a surrogate to evaluate the effects of various chemicals on the silvery minnow (Buhl 2002).

Although we do not have complete records for the Rio Rancho and Bernalillo WWTPs, in the summer of 2000, the Rio Rancho WWTP released approximately one million gallons of raw sewage into the Rio Grande. Chlorine treatment was maximized in an attempt to reduce the public health risk. Ammonia was reported at 37 mg/L on July 13, 2000, and at 17.1 mg/L on July 27, 2000 (City of Rio Rancho, *in litt.* 2000). Nonetheless, no violations of chlorine or ammonia effluent limits were recorded. This suggests that averaging measurements and/or the frequency of water quality measurements is insufficient to detect water quality situations that would be toxic to silvery minnow. The Rio Rancho WWTP now uses ultraviolet disinfection (Dee Fuerst, City of Rio Rancho, *pers. comm.* 2003). However, high concentrations of ammonia could still be discharged during an upset. Spills from the Rio Rancho City sewage system are treated with a chlorine-based disinfectant, which may lead to chlorine being flushed to the Rio Grande. Chlorine concentrations of 0.013 mg/L can be harmful to silvery minnow (Buhl 2002).

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 minnow when discharged in concentrations that exceed the protective water quality criteria (J. Lusk, Service, *in litt*. 2005). 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 minnow (Buhl 2002). The long-term effects and overall impacts of chemicals on silvery minnow populations are not known.

Large precipitation events wash sediment 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 (U.S. Geological Survey 2001).

Harwood (1995) studied the North Floodway Channel (Floodway) of Albuquerque, which drains an urban area of about 90 square miles and crosses the Pueblo of Sandia. He found that storm water contributions of dissolved lead, zinc, and aluminum were significant and posed a threat to the water quality of the Rio Grande. Because the Floodway crosses the Pueblo of Sandia and enters their portion of the Rio Grande, they requested that the Environmental Protection Agency conduct toxicity tests on water in the Rio Grande collected below the Floodway. Aquatic crustaceans exposed to this water were found to have significant reproductive impairment and mortality when compared with controls. Additionally, larval fish also experienced significant mortality and/or narcosis when exposed to water and bed sediment collected from this same area on April 22, 2002 (http://www.epa.gov/region6/6wq/ecopro/watershd/monitrng/toxnet/nm.pdf). This study indicates that storm water runoff can impact the water quality of the Rio Grande and the aquatic organisms that live in the river.

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 PEC provide an accurate basis for predicting sediment toxicity to aquatic life and a reliable basis for assessing sediment quality in freshwater ecosystems. Although the PEC 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.

Semi-volatile organic compounds are a large group of environmentally important organic compounds. Three groups of compounds, polycyclic aromatic hydrocarbons (PAHs), phenols, and phthalate esters, were included in the analysis of bed sediment collected by the USGS (Levings *et al.* 1998). These compounds were abundant in the environment, are toxic and often carcinogenic to organisms, and could represent a long-term source of contamination. The analysis of the PAH data by Levings *et al.* (1998) show one or more PAH compounds were detected at 14 sites along the Rio Grande with the highest concentrations found below Albuquerque and Santa Fe. Polycyclic aromatic hydrocarbons and other semi-volatile compounds affect the sediment quality of the Rio Grande and may affect silvery minnow behavior, habitat, feeding, and health.

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 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 minnow, the evidence suggests that the amount and variety of pollutants present in the Rio Grande, could compromise their health and fitness (Post 1987). Factors that are known to cause poor fish habitat include temperature changes, sedimentation, runoff, erosion, organic loading, reduced oxygen content, pesticides, and an array of other toxic and hazardous substance addition or alterations in the physical or biological integrity.

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. 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 minnow are currently housed at four facilities in New Mexico including: the Dexter Fish Hatchery; New Mexico State University Coop Unit (Las Cruces); 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 minnow. Silvery minnow are also held in South Dakota at USGS, Biological Resources Division Lab, but there is no active spawning program at this facility.

Since 2000, approximately 1,000,000 silvery minnow have been propagated and released. Wild gravid adults are successfully spawned in captivity at the City's propagation facilities. Wild caught eggs are raised and released as larval fish. Marked fish have been released by the NMFRO since 2002 under a formal augmentation effort funded by the Collaborative Program. Silvery minnow have been released primarily into the Angostura Reach of the river near Alameda Bridge to ensure downstream repopulation. This ensures that an adequate number of spawning adults are present to repopulate the river after drying. While hatcheries continue to successfully spawn silvery minnow, wild eggs are collected to ensure genetic diversity within the remaining population.

<u>Genetic Diversity</u>
Genetic data have been collected for the silvery minnow. The data set includes information from eight generations: one generation that preceded the precipitous decline that occurred in the last decade (1987), three generations that preceded the augmentation program (1999, 2000, 2001; Alò & Turner, 2005), and four generations that were supplemented with captively spawned and/or captively reared stocks (2002-2005; Turner et al. 2005). The following information was derived from studies of this data set.

Overall, mitochondrial (mt) DNA gene diversity declined nearly 18 percent between 1987 and 2005. In addition, researchers have identified other changes:

- There have been two sharp declines in mitochondrial haplotype diversity in the "wild" silvery minnow population. The first occurred in 1999, the second in 2001. Each loss of diversity followed a sharp decline in abundance of silvery minnow: between 1995 and 1997, and again between 1999 and 2000, catch rates declined by an order of magnitude (Dudley et al. 2004). These declines in diversity coincided with extensive river drying in the San Acacia Reach of the Rio Grande.
- Microsatellite allelic diversity was less in 1999, but detected diversity was greater from 1999 to 2002. Although numerical abundance of the wild population continued to decline drastically after 2001, reaching extremely low levels in 2003, there was no substantial loss of allelic diversity over that time period.
- Declines in heterozygosity were recorded for the silvery minnow from 1987 to 1999 and between 2000 and 2002. However, heterozygosity increased between 2002 and 2005. Supplemental stocking with captively-reared wild caught-eggs between 2001 and 2003 may have temporarily alleviated loss of alleles and heterozygosity in the wild (Turner et al. 2004).

<u>Permitted and/or Authorized Take</u>
Take is authorized by section 10 recovery permits when there is a net conservation benefit to the species. Incidental take is permitted under section 7 of the ESA. These permits and/or authorizations are issued by the Service. Applicants for section 10 recovery permits must also acquire a permit from the State to "take" or collect silvery minnow. Many of the permits issued

under section 10 allow take for the purpose of collection and salvage of silvery minnow 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. Because of the population decline from 2002-2004, the Service has reduced the amount of take permitted for voucher specimens in the wild.

Incidental take of silvery minnow is authorized through section 7 consultation associated with the 2003 BO, the City of Albuquerque Drinking Water Project (U.S. Fish and Wildlife Service 2004), the Isleta Island Removal Project, the Tiffany Plug Removal Project, and the Interstate Stream Commission's (ISC) Habitat Restoration Project. In 2005 the Service revised the incidental take statement for the 2003 BO using a formula that incorporates October monitoring data, habitat conditions during the spawn (spring runoff), and augmentation. Annual estimated take for the 2003 BO now fluctuates relative to the total number of silvery minnow found in October across 20 population monitoring locations.

Factors Affecting Species Environment 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 designated critical habitat:

1. Release of Carryover Storage from Abiquiu Reservoir to Elephant Butte Reservoir: The Army Corps of Engineers (Corps) consulted with the Service on the release of water during the winter of 1995. Ninety-eight thousand af of water was released from November 1, 1995, to March 31, 1996, at a rate of 325 cfs. 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.

2. Corrales, Albuquerque, and Belen Levees: These levees contribute to floodplain constriction and habitat degradation for the silvery minnow.

3. Santa Ana River Restoration Project: Santa Ana Pueblo is engaged in multiple elements of river restoration in an area where the river channel was incising and eroding into the levee system. The project includes two GRFs, channel re-alignment, bioengineering, riverside terrace lowering, and erodible bank lines. The GRFs are designed to: (1) store more sand sediments at a stable slope for the current sediment supply; (2) decrease the velocities and depths and increase the width in the river channel upstream; (3) be hydraulically submerged at higher flows while simultaneously increasing the frequency and duration of overbank flows upstream; (4) provide velocities and depths suitable for passage of the silvery minnow through the structure; and (5) halt or limit further channel degradation upstream of its location. The channel re-alignment involved moving the river away from the levee system and over the grade control structure, and excavation of a new river channel and floodplain. Another significant component of the Santa Ana Restoration project was riverside terrace lowering for the creation of a wider floodplain.

The bioengineering and deformable bank lines also assisted in establishing the new channel bank and regenerating native species vegetation in the floodplain.

4. 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.

5. Programmatic Biological Opinions 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: In 2001 and 2003, the Service issued jeopardy biological opinions on the effects of water operations and management activities in the Middle Rio Grande on the silvery minnow and flycatcher. In 2002, the Service issued a jeopardy biological opinion for the silvery minnow. The opinion analyzing current water operations was issued on March 17, 2003, and contains one RPA with multiple elements. These elements set forth a flow regime in the Middle Rio Grande and describe habitat improvements necessary to alleviate jeopardy to both the silvery minnow and flycatcher. For example, the elements require augmentation in the Rio Grande of an additional million silvery minnow over the life of the project and 1,600 acres of habitat restoration. Approximately 484 acres have been constructed to date.

6. Albuquerque Drinking Water Project: The Drinking Water Project, involves the construction and operation of: (1) A new surface diversion dam north of Paseo del Norte Bridge, (2), conveyance of raw water from the point of diversion to the new water treatment plant, (3) a new water treatment plant on Chappell Road NE, (4) transmission of treated (potable) water to residential and commercial customers throughout the Albuquerque metropolitan area, and (5) aquifer storage and recovery. This consultation covers through 2060. During typical operations, the project will divert a total of 94,000 afy of raw water from the Rio Grande (47,000 afy of City SJC water and 47,000 afy of Rio Grande native water) at a near constant rate of about 130 cfs. Diversions of native water would be reduced if flows above the new diversion site were less than 260 cfs and all diversions would cease at levels below 195 cfs. Peak diversion operations will consist of up to 103,000 afy being diverted at a rate of up to 142 cfs. Consultation on this project was completed in 2004. Construction is currently underway with operations likely to begin in 2010.

7. Silvery minnow salvage and relocation: During river drying, the Service's silvery minnow salvage crew captures and relocates silvery minnow. Since 1996, approximately

770,000 silvery minnow have been rescued and relocated to wet reaches, the majority of which were released in the Angostura Reach. Studies are being conducted to determine survival rates for salvaged fish and their contribution to the population.

8. Habitat Restoration Projects: Several habitat restoration projects have been completed in the Albuquerque reach through the Collaborative Program. These projects include woody debris installation projects to encourage the development of pools and wintering habitat, and a river bar modification project south of the I-40 Bridge designed to create side and backwater channels on an existing bar as well as modify the top surface of the bar to create habitat over a range of flows. In 2005, the ISC started a multi-year habitat restoration program that implements several island, bar, and bank line modification techniques throughout the Albuquerque Reach.

9. Bernalillo and Sandia Priority Site Projects: The Bernalillo and Sandia Priority Site Projects proposed by Bureau of Reclamation (Reclamation) are intended to protect the integrity of the east levee and canal system along the Albuquerque Reach of the Middle Rio Grande between the U.S. Highway 550 bridge and the northern boundary of the Pueblo of Sandia. The banks of the river were close to the east levee and posed a potentially serious threat to project facilities and public health and safety. The Project created a secondary high flow channel, realigned the main river channel, and installed bendway weirs to reduce bank erosion threatening the levee.

10. Middle Rio Grande Conservation District: Improvements to physical and operational components of the irrigation system since 2001 have contributed to a reduction in the total diversion of water from the Rio Grande by the MRGCD. Prior to 2001, average yearly diversions were 630,000 af. They now average 370,000 af. The change was possible because of the considerable efforts of MRGCD to install new gages, automated gates at diversions, and scheduling and rotation of diversions among water users. The new operations reduce the amount of water diverted; however, this also reduces return flows that previously supported flow in the river. The river below Isleta Diversion Dam may be drier than in the past, but small inflows may contribute to maintaining flows.

11. Pilot Water Leasing Project: The City of Albuquerque and Albuquerque Bernalillo County Water Utility Authority, with six conservation groups, established a fund in February 2007 that will provide the opportunity to lease water from Rio Grande farmers and have that water remain in the river channel to support the silvery minnow. This program supports the need for reliable sources of water to support conservation programs as identified by the MRGESACP (2004).

Summary

The remaining population of the silvery minnow is restricted to approximately 5 percent of its historic range. The Angostura Reach represents less than 27% of the remaining occupied range. While river drying does not occur regularly in this reach, channelization, water withdrawals from the river and water releases from dams severely limit the survival of silvery minnow in this area.

Augmentation of silvery minnow with captive-reared fish will continue to support the population within the Angostura Reach; however, continued monitoring and evaluation of these fish is necessary to obtain information regarding the survival and movement of these individuals.

The consumption of shallow groundwater and surface water for municipal, industrial, and irrigation uses, in the Angostura Reach, continues to reduce the amount of flow in the Rio Grande and eliminate habitat for the silvery minnow (U.S. Bureau of Reclamation 2003). Under state law, the municipal and industrial users are required to offset the effects of groundwater pumping on the surface water system. The City of Albuquerque, for example, has been offsetting their surface water depletions with 60,000 afy returning to the river from the WWTP (U.S. Bureau of Reclamation 2003). The effect of water withdrawals means 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 contribute to the overall degradation of water quality.

Various conservation efforts have been undertaken in the past and others are currently being carried out in the middle Rio Grande. Silvery minnow abundance has increased over 2002-2003 population levels. However, the threat of extinction for the silvery minnow continues because of increased reliance on captive propagation, the fragmented and isolated nature of currently occupied habitat, and the absence of silvery minnow in other parts of the historic range. The increased abundance of silvery minnow from 2004-2005 is a positive sign. Nevertheless, as the sharp population decline of 2006 demonstrates, the threats that endanger this species are still present.

EFFECTS OF THE ACTION

Effects of the action refer to the direct and indirect effects of an action on the species or designated 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.

Data from the long-term silvery minnow monitoring sites, located upstream and downstream of the project area indicates that silvery minnow are extremely likely to be present in the project area. Monitoring from October 2007 indicates that the approximate density of silvery minnow at Hwy 550 and Angostura monitoring sites (River Miles 203.8 and 209.7) is 30.26 silvery minnow per 100 meters square (m^2) (Dudley *et al.* 2006).

Direct Adverse Effects

There are potential direct adverse effects to silvery minnow that may occur in the immediate project area during construction. Silvery minnow may be present when construction equipment is working along the bankline or crossing the river channel and/or when fill material is placed in the wetted channel.

The proposed action is likely to have direct adverse effects on silvery minnow during construction. Heavy equipment will need to work in the river during bendway weir construction and cross the active channel to haul fill across the river. As the heavy equipment displaces water, any silvery minnow in the area would flee. Fleeing from the disturbance represents an expenditure of energy that the fish would not have without the project.

Equipment working in the river, placement of fill material in the wetted channel, and equipment crossing wetted portions of the river channel may also potentially affect water quality. During construction, localized increases in turbidity and suspended sediments will likely occur. Direct effects from excess suspended sediments to a variety of fish include: alarm reaction, abandonment of cover, avoidance response, reduction in feeding rates, increase in coughing rate, increased respiration, physiological stress, poor condition, reduced growth, delayed hatching, and mortality (Newcombe and Jensen 1996).

The effects of sediment mobilization due to the use of heavy equipment in the channel, placement of fill material into the wetted channel, and crossing the river include the potential smothering and mortality of algae and aquatic invertebrates, depressed rates of growth, reproduction, and recruitment or reduced physiological function of invertebrates. Decreases in primary production are associated with increases in sedimentation and turbidity and produce negative cascading effects through depleted food availability to zooplankton, insects, mollusks, and fish.

Beneficial Effects

Approximately, 8.5 acres of habitat that can inundate at flows of 3,000 cfs will be created once the sediment berm is excavated. This area is expected to provide nursery habitat for silvery minnow eggs and larvae. The increased frequency and timeframe during which the floodplain would be inundated would also benefit native vegetation, potentially increasing flycatcher habitat.

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 draft 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 Act. Cumulative effects include:

- 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 quantities of water that would overbank and create low velocity habitats that silvery minnow prefer.

- 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.

- 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 reduced habitat availability for the silvery minnow.

- 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.

- Wildfires and wildfire suppression in the riparian areas along the Rio Grande may have an adverse affect on silvery minnow. Wildfires are a fairly common occurrence in the bosque (riparian area) along the Rio Grande. Although fire retardant, which is toxic to aquatic species, is generally not used in close proximity to the Rio Grande, other fire suppression techniques, such as scooping water from the Rio Grande in large buckets, may harm silvery minnow. Silvery minnow could potentially be scooped up along with the water and dropped onto burning areas.

- The effect global warming may have on the silvery minnow is still unpredictable. However, mean annual temperature in Arizona increased by 1 degree per decade beginning in 1970 and 0.6 degrees per decade in New Mexico (Lenart 2005). In both New Mexico and Arizona the warming is greatest in the spring (Lenart 2005). Higher temperatures lead to higher evaporation rates which may reduce the amount of runoff, groundwater recharge, and consequently spring discharge. Increased temperatures may also increase the extent of area influenced by drought (Lenart 2003). The warming trend appears to have led to insect outbreaks in the Southwest with 1.9 million acres damaged in 2003 in Arizona and 860,000 acres affected in New Mexico (Lenart 2003). Increased numbers of dead trees can increase the risk and intensity of forest fires which could lead to increased impacts to watersheds, streams, and springs.

The Service anticipates that these conditions and types of activities will continue to threaten the survival and recovery of the silvery minnow by reducing the quantity and quality of habitat through the continuation and expansion of habitat degrading 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 Santa Ana Restoration Project, as proposed in the August 2007, Biological Assessment is not likely to jeopardize the continued existence of the silvery minnow or result in adverse modification of designated critical habitat. The Santa Ana Restoration Project will create adverse effects to silvery minnow and its food base, which are assumed to be present in the main channel construction zone, through the use of heavy equipment within the active channel, and placement of fill material in the wetted channel of the Rio Grande.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and federal regulation pursuant to section 4(d) of the Act 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, breeding, feeding or sheltering. Incidental take is defined as take that is incidental 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 Act 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 Reclamation so that they become binding conditions of any grant or permit issued, as appropriate, for the exemption in section 7(o)(2) to apply. The action agency has a continuing duty to regulate the activity covered by this incidental take statement. If Reclamation (1) fails to assume and implement the terms and conditions or (2) fails to require adherence to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, Reclamation 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 has developed the following incidental take statement based on the premise that the Santa Ana Restoration Project will be implemented as proposed. Take is expected in the form of harm and harass during: (1) the use of heavy equipment within the channel and crossing the active channel of the Rio Grande; and (2) placement of fill materials directly into the wetted channel of the Rio Grande.

The Service anticipates that take in the form of harassment may affect up to 36,688 silvery minnow during project construction. We base this figure on the following assumptions. According to the BA, disturbed wetted area will be approximately 7 acres. In addition, the distance across which equipment will travel to transport sediment will be approximately 200 ft long and the swath of disturbance 50 ft wide (30 ft for equipment and 10 ft on either side that silvery minnows would avoid). We estimate that this area would be newly disturbed at the start of each work day for up to 100 days (5 months excluding weekends). Any silvery minnows present would be harassed but able to escape equipment. We anticipate that due to the level of noise and activity, silvery minnows would avoid the work area until activity ceases at the end of each day. River crossings would add an additional 22.96 acres of disturbed area. Consequently a total of 29.96 ac of wetted area will be disturbed. The average density of silvery minnow in the project area has been reported as 30.26/100 m^2, therefore, approximately 36,688 silvery minnow will be harassed by construction, fill placement in the river, and movement of equipment through the water. The Service does not expect any direct mortality to occur due to construction activities.

The Service notes that this number is only a best estimate of the amount of take that is likely under the proposed action. Thus, estimated incidental take may be modified from the above number should population monitoring information, data from silvery minnow rescue operations, or other research indicate substantial deviations from estimated values. In this case, further consultation, may be necessary.

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.

Reasonable and Prudent Measures
The Service believes the following Reasonable and Prudent Measures (RPMs) are necessary and appropriate to minimize impacts of incidental take of the silvery minnow due to activities associated with the proposed project.

1. Minimize take of silvery minnow due to construction and river crossing activities.

2. Manage for the protection of water quality from activities associated with the project.

Terms and Conditions
Compliance with the following terms and conditions must be achieved in order to be exempt from the prohibitions of section 9 of the ESA. These terms and conditions implement the Santa Ana Restoration Project described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

To implement RPM 1, Reclamation shall:

1.1 For the first three river crossings per day, limit driving speeds to approximately 5 miles per hour.
1.2 To the extent feasible, minimize driving speeds for all in channel equipment to approximately 5 mph.
1.3 Report any findings of injured silvery minnow to the Service.
1.4 If dead silvery minnows are found in the project area, cease construction activity until the Service has determined that it is safe to resume.
1.5 Use information collected from Terms and Conditions 1.1 – 1.2 to develop new or modify existing BMPs to minimize the adverse effects of this project and future river maintenance projects on the silvery minnow.

To implement RPM 2, Reclamation shall:

2.1 Transport fill materials with heavy equipment across the Rio Grande as few times as possible to minimize disturbance of sediments.
2.2 Avoid, to the extent practicable, crossing the wetted channel of the river with heavy equipment during flows greater than 900 cfs.
2.3 Monitor water quality, including turbidity and dissolved oxygen before, during, and after equipment operates in the river channel.
2.4 Use information collected from Term and Condition 2.3 to develop new or modify existing BMPs to minimize the adverse effects of this project and future river maintenance projects

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. Encourage adaptive management of flows and conservation of water to benefit listed species.
2. Work to further conduct habitat/ecosystem restoration projects in the Middle Rio Grande to benefit the silvery minnow.
3. Continue to use bio-engineering methods whenever possible in conjunction with river maintenance projects.

RE-INITIATION NOTICE

This concludes formal consultation on the action(s) described in the August 2007 biological assessment. 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 designated critical habitat in a manner or to an extent not considered in this draft biological opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or designated critical habitat not considered in this draft biological opinion; (4) adaptive management that includes additional earth work is needed to repair or maintain the project after the initial construction phase; or (5) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending re-initiation.

In future correspondence on this project, please refer to consultation number 22420-1998-F-0168-R002. 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.

//s//
Wally Murphy

cc:
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