



United States Department of the Interior

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Memorandum

To: Area Manager, Albuquerque Area Office, 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 the Drain Unit 7 Extension River Maintenance Priority Site Project

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion (BO) on the effects of the action described in the 2008 Biological Assessment (BA) for the Drain Unit 7 River Maintenance Priority Site Project in Socorro County, New Mexico. This BO concerns the effects of the action on the endangered Rio Grande silvery minnow, *Hybognathus amarus*, (silvery minnow) and its designated critical habitat. The project site is located just north of the San Acacia Diversion Dam on the west bank. Request for reinitiation of 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 13, 2008.

This BO is based on information submitted in the BA dated June 2008; conversations and communications between the Bureau of Reclamation (BOR) and the Service; 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.

Consultation History

The Drain Unit 7 Priority Site previously underwent formal consultation and the Service issued a

BO on April 6, 2007, describing the effects of the project on listed species. This 2007 BO tiered off the 2003 *Biological and Conference Opinions on the Effects of the Bureau's Water and River Maintenance Operations, Army Corps of Engineers' Flood Control Operation, and Related Non-Federal Actions on the Middle Rio Grande* (March 2003 BO). On June 13, 2008, BOR requested reinitiation of formal consultation based on modifications to the Drain Unit 7 Project, and submitted a final BA to the Service describing the modified project. This BO addresses the modified project and is also tiered off the March 2003 BO.

BIOLOGICAL OPINION

I. DESCRIPTION OF THE PROPOSED ACTION

Background

The Drain Unit 7 Priority Site is located approximately 500 feet upstream of the San Acacia Diversion Dam, on the right bank of the Rio Grande, and adjacent to the Drain Unit 7 Extension irrigation structure. The approximate River Mile is 116.3. Riprap is in place to protect the adjacent road and irrigation structure from river flows. This riprap is currently being displaced and continued erosion could result in loss of the access road that parallels the drain, and eventually compromise the Drain Unit 7 Extension structure.

To stabilize the eroding bankline, temporary emergency action maintenance work was performed at this same location during the 2005 spring runoff. This action resulted in the placement of 550 cubic yards of 16-inch nominal size riprap along 200 feet of bankline. Erosion along approximately 350 feet of bankline and bend migration upstream of the site indicate that bend migration may soon begin at the site, exposing more of the levee to active erosion.

High river flows during the 2006 monsoon season displaced the riprap placed in 2005 in several areas along the bankline. This raised concerns about the ability of remaining riprap to protect the access road and drain during the 2007 spring runoff, and an additional 100 cubic yards of riprap were placed along 200 feet of the bankline as addressed in the 2007 BO on this project. BOR has since determined that much larger riprap is required at this location instead of repairs made with smaller riprap, and the agency requested reinitiation of formal consultation due to proposed modifications in the proposed action, including (1) use of larger (30-inch) nominal size riprap, (2) use of larger (66-inch) maximum size riprap, and (3) extension of the affected bankline from 200 linear feet to 500 linear feet. A description of the modified proposed action, as addressed in this biological opinion, is provided below.

Proposed Action

BOR proposes to reinforce the bankline by installing additional riprap along the river side of the eastern levee for a length of 650 feet, of which approximately 500 linear feet will be within the active river channel and 150 linear feet on the dry terrace. Placement of the entire 650 feet of riprap is expected to require approximately 5.5 months to complete, anticipated to occur from November 1, 2008 to April 15, 2009. However, limitations on availability of riprap may require the work to be completed in two phases as follows: (1) Phase 1 would address the most severely eroded portions of bankline, totaling 250 linear feet, and be completed over two months between November 1, 2008 and April 15, 2009; and (2) Phase 2 would address the remaining area of

concern (i.e., 400 linear feet, of which 250 feet are within the active river channel), and be completed over two months between July 1, 2009 and April 15, 2010.

In water work will involve creation of a toe trench and placement of riprap. Nominal riprap size to be used will be 30 inches, with a maximum size of approximately 66 inches, and is designed to accommodate predicted velocities based on the 10-year return period flow (listed as 16,450 cfs at San Acacia; see Bullard and Lane 1993); riprap height is designed based on the 20-year period flow (interpolated from 10- and 25-year return period flows as 18,025 cfs; Bullard and Lane 1993). BOR used hydraulic modeling (e.g., HEC-RAS, GSTAR-2D) to determine riprap size and height, as well as scour depth for the project design.

The placement of riprap will be performed from the bank. Riprap placed in the active river channel will be placed in two layers – (1) a 60-inch thick primary layer for bankline protection, which will be keyed into the river channel at a depth of up to five feet to provide scour protection, and (2) an additional layer of self-launching riprap placed against the primary layer, which will provide additional scour protection and fall into the scour hole as needed. Excavated bankline material will be placed over the riprap to reconstruct the levee embankment to its original lines and grades. Use of self-launching riprap minimizes construction costs and alleviates the need for diversion of the river to excavate a trench to the full 15-foot scour depth. Riprap will also be placed in the dry terrace and designed to fall into place and provide bankline protection in the event of active river channel migration toward the levee.

Access to the project area would be by the existing roads, including the Low Flow Conveyance Channel (LFCC) Operations and Maintenance (O&M) road, the San Acacia Diversion Dam access road, and the eastern Drain Unit 7 Extension levee road. For heavy riprap dump trucks to access the site, the existing levee roads may need to be modified by blading and placement of a gravel cap. Trimming of vegetation along existing roads may also be necessary to ensure vehicle clearance and safety, as well as wetting of roads using water pumped from the drain in the event dust becomes a safety concern. In addition, four previously-used staging areas will be used during the project, all of which are clear or sparsely vegetated. Staging areas would be used for sorting, mixing, or reduction of oversize riprap materials.

Work at the site would be performed by an excavator, which would rest of the levee road or on a riprap pad within the channel. Tracks of the excavator will not enter the water; only the bucket and boom of the excavator will be in the water. Given the large size of rock used for this project and the distance from the river channel to the levee road, two potential strategies will be used to allow equipment to work closer to the river channel without entering the water. The preferred strategy would involve working platforms created on riprap placed in the channel, allowing the excavator to work from the platform with tracks above the water surface. Alternatively, if high water precludes the first strategy, partial excavation of the levee road may be conducted to allow the excavator to rest of the lowered road surface while placing riprap in the river.

In addition to riprap placement, two existing corrugated metal pipe (CMP) culverts will be extended to accommodate the additional riprap thickness. Culverts are four feet in diameter and located above the water river surface. BOR expects that culverts will need to be cut between 10 and 20 feet from the existing bankline, with extension pipe of the same material as the existing pipes placed at the current slope. The culvert extension work will be performed during the non-

irrigation season, when the water surface in Drain Unit 7 Extension is very low. BOR does not anticipate that dewatering of the drain will be required to perform this work.

In total, BOR estimates the area of disturbance due to the proposed action to include 2.9 acres of staging area, up to 0.75 acres below the water surface for riprap placement (including a 20-foot potential disturbance zone beyond the planned riprap footprint to account for rocks settling in the river channel), and 0.3 acres above the water surface. As part of the proposed project, BOR also intends to continue fish community surveys annually for monitoring silvery minnow population trends in the vicinity of the project.

Conservation Measures

BOR will implement several conservation measures during the proposed activities to help minimize or avoid adverse effects of the project work:

Construction BMPs. BOR will utilize construction best management practices (BMPs) during the proposed activities, for example cleaning all equipment before entering the channel. In addition the following BMPs will be implemented: (1) equipment will be inspected several times daily for leaks, (2) spill protection kits will be kept on site, and operators will be trained in use of the kits, (3) equipment will be moved away from the water for fueling, (4) fuel will not be stored at the site overnight, (5) equipment will be moved to the levee, or other safe location away from the water, at night and on weekends, (6) to allow fish time to leave the area before excavation begins, the bucket will initially enter the water slowly when beginning excavation of the toe trench in the river channel, (7) the in-water work (i.e., toe trench excavation and riprap placement) will be fairly continuous during work days, so that fish are unlikely to return to the area once work has begun, (8) riprap will be placed in a manner such that no isolated pools of water are formed where fish could become trapped, (9) riprap to be placed in the water will be reasonably clean, and (10) if there are large clumps of soil within the riprap, those clumps will be set aside during the loading or placing operations.

Dust Abatement. If water is needed for dust abatement on roads, water will be pumped from the drain, not the river.

Revegetation. As part of the proposed action, BOR intends to complete several environmental enhancements. Willow poles will be planted in the reconstructed embankment along the river edge. The willow root system is expected to help stabilize the bankline and maintain a smooth transition between the riprap and natural banklines. Poles will also be planted between the levee and the self-launching riprap, with the expectation that the root system will protect the levee in the event the self-launching riprap is ineffective. Poles may be coyote willow, Goodding's willow, or Rio Grande cottonwood. In addition, vegetation will be planted in the soil zone of the riprap, using drought resistant grasses or shrubs. And staging area number 4 near the project area, which had been cleared earlier of vegetation to accommodate subsurface drilling, will be replanted with native species. BOR will conduct monitoring of the revegetated areas.

Action Area

The action area includes all areas to be affected directly or indirectly by the proposed action (see 50 CFR §402.02). The proposed action would be conducted upstream of the San Acacia Diversion Dam, on the right bank of the Rio Grande, and is expected to disturb an area of 0.75 acres underwater, 0.3 acres above the water surface due to riprap placement, and 2.9 acres of

staging area on land. For this consultation, the action area is defined as the entire width of the 100-year floodplain of the Rio Grande from the San Acacia Diversion Dam to the upstream boundary of the anticipated disturbance zone.

II. STATUS OF THE SPECIES

The proposed action considered in this biological opinion may affect the Rio Grande silvery minnow (*Hybognathus amarus*) provided protection as an endangered species under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*; ESA). In addition, the proposed action area overlaps designated critical habitat for the Rio Grande silvery minnow. A description of this species, its status, and designated critical habitat are provided below and inform the effects analysis for this biological opinion.

RIO GRANDE SILVERY MINNOW

Description

The silvery minnow currently occupies a 170-mile (275-kilometer) reach of the Middle Rio Grande, New Mexico, from Cochiti Dam in Sandoval County, to the headwaters of Elephant Butte Reservoir in 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 (90 millimeters). 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 in the genus *Hybognathus* due to morphological similarities. Phenetic and phylogenetic analyses corroborate the hypothesis that it is a valid taxon, distinct 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).

Legal Status

The silvery minnow was federally listed as endangered under the ESA on July 20, 1994 (58 FR 36988; see 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. The Service designated critical habitat for the silvery minnow on February 19, 2003 (68 FR 8088). See description of designated critical habitat below.

Habitat

The silvery minnow travels in schools and tolerates a wide range of habitats (Sublette *et al.* 1990), yet generally prefers low velocity ($< 0.33 \text{ ft}\cdot\text{s}^{-1}$ or $10 \text{ cm}\cdot\text{s}^{-1}$) areas over silt or sand substrate that are associated with shallow ($< 15.8 \text{ in}$, 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 silvery minnows are most commonly found in backwaters, pools, and habitats associated with debris piles; whereas, young of year (YOY) fish 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 – one at Rio Rancho and the other at 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 (50 cm). Over 85 percent were collected from low-velocity habitats ($< 0.33 \text{ ft}\cdot\text{s}^{-1}$ or $10 \text{ cm}\cdot\text{s}^{-1}$) (Dudley and Platania 1997, Watts *et al.* 2002).

Designated Critical Habitat

The Service designated critical habitat for the silvery minnow on February 19, 2003 (68 FR 8088). The critical habitat designation extends approximately 157 mi (252 km) from Cochiti Dam in Sandoval County, New Mexico, downstream to the utility line crossing the Rio Grande, which is 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 ft (91.4 m) of riparian zone adjacent to each side of the bankfull 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 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.

The Service determined the primary constituent elements (PCEs) of silvery minnow critical habitat based on studies on silvery minnow habitat and population biology. These PCEs 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°C (35°F) and less than 30°C (85°F) 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.

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 minnows to spawn (Platania and Hoagstrom 1996). It is unknown if individual silvery minnows in the wild 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 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 about 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 (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 silvery minnows 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 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 minnows consists of only two age classes: YOY and Age 1 fish (U.S. Fish and Wildlife Service 1999). The majority of spawning silvery minnows are one year in age, with 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 (i.e., 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 minnows 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 (3,967 km) of rivers in New Mexico and Texas. The species was known to have occurred upstream to Española, New Mexico (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

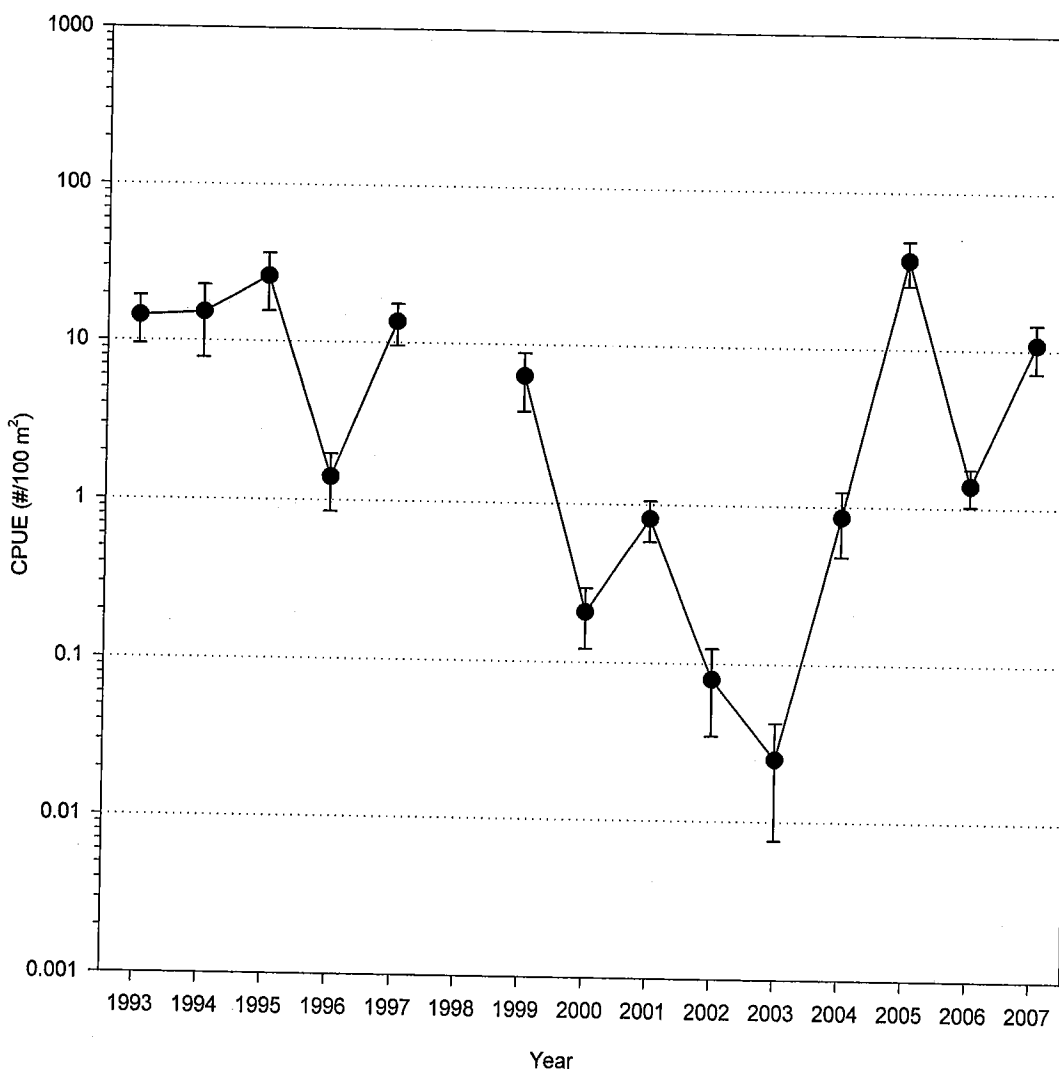
Reservoir downstream to the confluence with the Rio Grande (Sublette *et al.* 1990, Bestgen and Platania 1991). The current distribution of the silvery minnow is limited to the Rio Grande between Cochiti Dam and Elephant Butte Reservoir, which amounts to approximately five percent of its historic range.

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 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. River outflow from 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 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 2001, 1999). The Rio Grande below Angostura Dam 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; Torres *et al.* 2008).

Long-term monitoring for the Rio Grande silvery minnow and fish communities in the Middle Rio Grande began in 1993 and has continued annually, with the exception of 1998. This monitoring has recorded substantial (order of magnitude increases and decreases) fluctuations in the population. Rio Grande silvery minnow catch rates declined two to three orders of magnitude between 1993 and 2004, but then increased three to four orders of magnitude in 2005 (Figure 1, next page). Population size is highly correlated with hydrologic conditions, particularly the magnitude and duration of the spring runoff (Dudley and Platania 2007). The capacity of the species to respond to good hydrologic years (e.g. 2005) is dependent on a variety of factors including the previous year's survivorship and number of adults available to reproduce.

Augmentation, throughout this period, likely sustained the silvery minnow population. Over 1,126,000 silvery minnows 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 prevented extinction during the extremely low water years of 2002 and 2003.

Figure 1. Rio Grande Silvery Minnow Population Trends 1993-2007 based on October CPUE data.



Middle Rio Grande Distribution

During the early 1990s, the density of silvery minnows 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 can be attributed to downstream drift of eggs and larvae and the inability of adults to repopulate upstream reaches because of diversion dams.

This pattern has changed in recent years. In 2004, 2005, and 2007, catch rates were highest in the Angostura Reach and lower the Isleta and San Acacia reaches. Routine augmentation of silvery minnows in the Angostura Reach (nearly 1,000,000 since 2000) and the transplanting of silvery minnows rescued from drying reaches (approximately 770,000 since 2003) may partially explain this pattern. Good recruitment 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 in these years, may also explain the shift. High spring runoff (>3,000 cfs for 7-10 days) and perennial flow, leads to increased availability of nursery habitat and increased survivorship in the Angostura Reach. In contrast, south of Isleta and San Acacia Diversion Dams, large stretches of river (30+ miles) have been routinely dewatered and young silvery minnows in these areas were either subjected to poor recruitment conditions (i.e., lack of nursery habitats during low-flows) or were trapped in drying pools where they perished.

In 2006, the largest numbers of silvery minnows were again highest downstream of San Acacia. Spring runoff volumes were exceedingly low in 2006. Flows at the Albuquerque gage never exceeded 3,000 cfs in 2006 (Porter, pers com.) and likely very little nursery habitat was inundated during critical recruitment times.

Based on available reports for 2008, silvery minnows occurred at all 20 sampling sites along the Middle Rio Grande in August, with flow conditions leading to elevated numbers of this species. The highest densities were noted in the San Acacia Reach, and the lack of extensive river drying this year was likely an important factor in this distribution shift compared to 2007 (i.e., from Angostura to San Acacia Reaches). With continuation of favorable flow conditions, silvery minnow recruitment in 2008 is expected to be high (Dudley and Platania 2008b).

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 (U.S. Fish and Wildlife Service 1993, 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) and is currently undergoing revision, with a draft revised plan released in January 2007 (U.S. Fish and Wildlife Service 2007). The primary objectives for recovery are to increase numbers of the silvery minnow; maintain a captive population sufficient to prevent extinction and support augmentation needs; enhance minnow habitat in the Middle Rio Grande valley; and reestablish the species in at least three other areas of its historic range, with habitat and water quality that are sufficient to support the species in those areas (U.S. Fish and Wildlife Service 2007). Conservation efforts targeting the Rio Grande silvery minnow are summarized in draft revised recovery plan (see U.S. Fish and Wildlife Service 2007). These efforts include habitat restoration activities; research and monitoring of the status of the silvery minnow, its habitat, and the associated fish community in the Middle Rio Grande; and programs to stabilize and enhance the species, such as tagging fish and egg monitoring studies, salvage operations, captive propagation, and augmentation efforts. In addition, specific water management actions in the Middle Rio Grande valley over the past several years have been used to meet river flow targets and requirements for silvery minnows.

III. 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 already undergone formal or early section 7 consultation; and the impact of State and private actions that are contemporaneous with the consultation in process. The environmental baseline defines the effects of these activities in the action area on the current status of the species and its habitat to provide a platform to assess the effects of the action now under consultation.

Several activities have contributed to the current status of the silvery minnow and its habitat in the action area, and are believed to potentially affect the survival and recovery of silvery minnows in the wild. These include the current weather patterns, changes to the natural hydrology of the Rio Grande, changes to the morphology of the channel and floodplain, water quality, storage of water and release of spike flows, captive propagation and augmentation, silvery minnow salvage and relocation, ongoing research, and past projects in the Middle Rio Grande. Each of these topics is discussed below.

Weather Patterns

Drought, as an overriding condition of the last decade in the Southwest, is an important component of 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 two months. These flows improved conditions for both spawning and recruitment. Despite good runoff, reservoir levels in recent years have been below average across the state. The August 2008 drought report for New Mexico indicated that reservoirs along the Middle Rio Grande are all well below capacity, but that storage is currently above normal at Abiquiu and El Vado. Water levels are close to normal at Heron, and well below normal storage persists at Elephant Butte and Cochiti Lakes (New Mexico Drought Monitoring Work Group 2008).

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. River conditions in 2007 were considered average, with about 30 miles of river drying, mainly in the San Acacia Reach. In contrast, 2008 has been a wet year with above average runoff and at least an average monsoon season. As a result, to date there has been no river intermittency and no minnow salvage this year, which is the first time there has been no river drying since at least 1996.

Changes in Natural Hydrology

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: (1) loss of water and (2) 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 greater 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 broader 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 MRGCD was 535,280 af (65,839 hectare-meters) 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 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. Papadopoulos & Associates, Inc. 2000; U.S. Geologic Survey 2002). A portion of the water diverted by the MRGCD returns to the river and may be re-diverted, sometimes more than once (Bullard and Wells 1992; MRGCD, *in litt.* 2003).

River reaches particularly susceptible to drying occur 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 each year, mostly in the San Acacia Reach. The most extensive drying occurred in 2003 and 2004 when 60 and 68.7 miles, respectively, were dewatered. Most documented drying events lasted an average of two weeks before flows returned.

Predatory birds have been observed hunting and consuming fish from isolated pools during river intermittence (J. Smith, NMESFO, *pers. comm.* 2003). Although 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.

Changes to Magnitude and Duration of Peak Flows

Water management has also resulted in a loss of peak flows that historically triggered the initiation of silvery minnow spawning. The reproductive cycle of the silvery minnow is tied to the natural river hydrograph. A reduction in peak flows 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 are often made during the winter months, when low-flows would normally occur. For example, release of carryover storage from Abiquiu Reservoir to Elephant Butte Reservoir

during the winter of 1995-96 represented a substantial change in the flow regime. The Army Corps of Engineers (Corps) consulted with the Service on the release of water from November 1, 1995 to March 31, 1996, during which time 98,000 af (12,054 hectare-meters) of water was released at a rate of 325 cfs (9.8 cm). Such releases depart significantly from natural, historic winter flow rates, and can substantially alter the habitat for silvery minnows. In spring and summer, artificially low-flows may limit the amount of habitat available to the species and may also limit dispersal of the species (U.S. Fish and Wildlife Service 1999).

In the spring of 2002 and 2003, an extended drought raised concerns that silvery minnows would not spawn because of a lack of spring runoff. River discharge was artificially elevated through short duration reservoir releases during May to induce silvery minnow spawning. In response to the releases, significant silvery minnow spawning occurred and was documented in all reaches except the Cochiti Reach (S. Gottlieb, UNM, *in litt.* 2002; Dudley *et al.* 2005). Fall populations in 2003 and 2004 continued to decrease despite large spawning events, indicating a lack of recruitment.

By contrast, spring runoff in 2005 was 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 improved conditions for both spawning and recruitment. October 2005 monitoring indicated a significant increase in silvery minnows in the Middle Rio Grande compared to 2003 and 2004. In 2006, however, October numbers declined again after an extremely low runoff period and channel drying in June and July (Dudley *et al.* 2006). October samples that year yielded no small silvery minnows, indicating poor recruitment in the spring. Runoff conditions in 2007 and 2008 were average or above average.

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 silvery minnows. 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 and Floodplain 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 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 1993).

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 channel narrowing and a subsequent increases in water velocity. Higher velocities result in fine sediment such as silt and sand being 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 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 (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 mi (290 km) of river, only 1 mi (1.6 km), 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.

Water Quality

Both point source pollution (e.g., pollution discharges from a pipe) and non-point source pollution (i.e., diffuse sources) affect the Middle Rio Grande. Major point sources include 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. It is anticipated that WWTP effluent may be the primary source of perennial flow in the lower portion of the Angostura Reach during extended periods of intermittency. For that reason the water quality of the effluent is extremely important. In the project area, the largest WWTP discharges are from Albuquerque, followed by two WWTPs in Rio Rancho, and then 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.

Albuquerque WWTP effluent discharge records show that during November 1999, the monthly maximum chlorine concentration in the outfall was 0.49 milligrams per liter (mg/L). Additionally, on February 23, 2003, the concentration of chlorine in the outfall was reported to be 0.70 mg/L (C. Abeyta, Service, *in litt.* 2003; D.S. Dailey, City of Albuquerque, *in litt.* 2003). These exceed chlorine concentrations of 0.013 mg/L that can be harmful to the silvery minnow. 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 as 3.1 mg/L can be harmful to larval fathead minnow (U. S. Environmental Protection Agency 1999), which has been suggested as a surrogate species to evaluate the effects of various chemicals on the silvery minnow (Buhl 2002).

Although we do not have complete records for the other 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 the frequency of water quality measurements and the average of those measurements is insufficient to detect water quality situations that would be toxic to the 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 chlorine, which may lead to chlorine being flushed to the Rio Grande.

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 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 tetrachloroethene (TCE); and the gasoline additive methyl tert-butyl ether (U.S. Geologic Survey 2001).

Harwood (1995) studied the North Floodway Channel (Floodway) of Albuquerque, which drains an urban area of about 90 square miles and crosses Pueblo of Sandia lands. The author 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 lands of the Pueblo of Sandia and enters their portion of the Rio Grande, the Pueblo 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 or narcosis when exposed to water and bed sediment collected from this same area on April 22, 2002 (http://oaspub.epa.gov/enviro/pcs_det_reports_detail_report?npdesid=NM0022250). 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, such as the endangered silvery minnow.

In a cooperative study, the New Mexico Environment Department (NMED) detected elevated polychlorinated biphenyl (PCBs) contamination of the San Jose Drain (NMED DOE Oversight Bureau Correspondence and Transmittal Letter, signed S. Yanicak, to G. Turner, DOE, Subject: 2002 – 2003 Cooperative Polychlorinated Biphenyl (PCB) Study Data, Dated June 6, 2006). The San Jose Drain empties into an area near the confluence of the Tijeras Arroyo (and SDC) with the Rio Grande. The PCB pollution was detected in sediment and storm water runoff and in fish tissue collected downstream. Concentrations of PCBs in fish tissues were elevated above the threshold at which fish consumption advisories would recommend no fish be eaten by people (R. Ford-Schmid, NMED, electronic communication, June 24, 2004). The San Jose Drain empties into the Rio Grande in close proximity of the SDC Island Site increasing the probability that sediment forming the island may be contaminated with PCBs as well.

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. PAHs 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 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).

Storage of Native Water and Release of Spike Flow to Benefit Silvery Minnows

The City of Albuquerque 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.

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 minnows 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 minnows are also held in South Dakota at the U.S. Geological Survey, Biological Resources Division Lab, but there is no active spawning program at this facility.

Since 2000, over 1,126,000 silvery minnows have been propagated and then released into the wild (J. Remshardt, Service, *pers. comm.* 2008). Wild gravid adults are successfully spawned in captivity at the City's propagation facilities. 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 Middle Rio Grande ESA Collaborative Program (Collaborative Program). 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 minnow, wild eggs are collected to ensure genetic diversity within the remaining population.

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 minnows 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.

Ongoing Research

There is ongoing research by the NMFRO and University of New Mexico (UNM) to examine the movement of silvery minnows. Augmented 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. Preliminary results indicate that the majority of silvery minnows disperse a few miles downstream. One individual was captured 15.7 mi (25.3 km) upstream from its release site (Platania *et al.* 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. The farthest downstream point of recapture was 9.4 mi (15.1 km).

In 2002, a hybridization study involving the plains minnow and silvery minnow was conducted to determine the genetic viability of hybrids. Plains minnow are found in the Pecos River where reintroduction of the silvery minnow is being considered. 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).

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 (N_e) (the number of individuals that contribute to maintaining the genetic variation of a population) of the silvery minnow in the wild is a fraction of the census size (Alò & Turner 2002, *cited in* U.S. Fish and Wildlife Service 2007). For example, Alò and Turner (2005) found that genetic data from 1999 to 2001 indicated the current effective population size of the largest extant population of silvery minnows is 78. Other estimates have ranged as low as 50 (for 2004 and 2005; *cited in* U.S. Fish and Wildlife Service 2007). It has been suggested that a N_e 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. For example, estimates of the effective population size for stocks that were reared from wild-caught eggs were consistently lower than for wild counterparts. This indicates that samples collected and reared in captivity do not accurately reflect the allelic frequencies or diversity seen in the wild population (U.S. Fish and Wildlife Service 2007). Silvery minnow propagation efforts 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 minnows 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, making it 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 minnows should be kept in propagation facilities to maintain sufficient genetic variability for propagation efforts (T. Turner, UNM, *pers. comm.* 2003). Approximately 150,000 silvery minnows are currently being maintained in captivity (M. Ulibarri, Service, *pers. comm.* 2007).

Past Projects in the Middle Rio Grande

"Take" of ESA-listed species is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct" (see ESA section 3(18)). Take of silvery minnows has been permitted or authorized during prior projects conducted in the Middle Rio Grande. The Service has issued permits authorizing take for scientific research and enhancement purposes under ESA section 10(a)(1)(A), and incidental take under section 7 for actions authorized, funded, or carried out by Federal agencies. Applicants for ESA section 10(a)(1)(A) permits must also acquire a permit from the State of New Mexico to "take" or collect silvery minnows. Many of the section 10 permits issued by the Service 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. Because of the population decline from 2002-2004, the Service has reduced the amount of take permitted for voucher specimens in the wild.

In 2001 and 2003, the Service issued jeopardy biological opinions resulting from programmatic section 7 consultation with Reclamation and the Corps, which addressed water operations and management on the Middle Rio Grande and the effects on the silvery minnow and the southwestern willow flycatcher. Incidental take of listed species was authorized associated with the 2001 programmatic biological opinion (2001 BO), as well as consultations that tiered off this opinion. For example, the Los Lunas Habitat Restoration Project tiered off the 2001 biological opinion, and was intended to partially fulfill RPA requirements associated with the 2001 BO to benefit the silvery minnow and southwestern willow flycatcher. Approximately 37 acres of native riparian and 40 acres of aquatic habitat have been created by this project. This project included side-channels with increased inundation frequency to cause the inundation of the area at flows greater than or equal to 2,500 cfs. A variety of substrate elevations were intended to allow inundation of some areas during flows less than 2,500 cfs.

The 2003 jeopardy biological opinion (2003 BO) was issued on March 17, 2003, is the current programmatic biological opinion on Middle Rio Grande water operations, 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 southwestern willow flycatcher. Incidental take of silvery minnows is authorized with the 2003 BO, as well as consultations tiered off this programmatic BO such as the previous biological opinion (issued 2007) on this Drain Unit 7 Project. In addition, incidental take of silvery minnows is currently authorized through section 7 consultations associated with several activities including the City of Albuquerque Drinking Water project, the Isleta Island Removal Project, the Tiffany Plug Removal Project, and several Albuquerque Reach habitat restoration projects.

Summary of the Environmental Baseline

The remaining population of the silvery minnow is restricted to approximately five percent of its historic range. With the exception of the current year (2008), every year since 1996 has exhibited at least one drying event in the river that has negatively affected the silvery minnow population. The species is unable to expand its distribution because poor habitat quality and Cochiti Dam prevent upstream movement and Elephant Butte Reservoir blocks downstream movement (U.S. Fish and Wildlife Service 1999). Augmentation of silvery minnows with captive-reared fish has been ongoing, and monitoring and evaluation of these fish provides 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 (U.S. Bureau of Reclamation 2003). However, under New Mexico 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 its surface water depletions with 60,000 af per year (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 compared to 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 minnows in other parts of their historic range.

IV. EFFECTS OF THE ACTION

Regulations implementing the ESA (50 FR 402.02) define the *effects of the action* as the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or 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. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification; interdependent actions are those that have no independent utility apart from the action under consideration.

Effects on Silvery Minnow

As described earlier, the action area for this consultation is defined as the entire width of the 100-year floodplain of the Rio Grande from the San Acacia Diversion Dam to the upstream boundary of the anticipated disturbance zone as described in the 2008 Biological Assessment. Silvery minnows are present in the Isleta Reach, defined as Rio Grande waters between the San Acacia Diversion Dam and the Isleta Diversion Dam (Dudley *et al.* 2006). Monitoring data are available from river mile 116.8, located in the vicinity of the action area, and indicate that silvery minnows are likely to occur during river maintenance activities and may be affected by the proposed action. Data for the most recent average year (i.e., 2007) indicate a density of 0.73 silvery minnows per 100 m² in this area; the latest monitoring data for 2008 (a wet year) provide an estimated density of 2.81 minnows per 100 m².

The primary adverse effects of the proposed action on the silvery minnow are expected to result from four different activities: (1) the removal or movement of existing riprap, (2) the placement of riprap below the waterline, (3) toe trench excavation in the river channel, and (4) the construction of temporary working platforms on riprap. No mortalities are expected to result from the proposed action, but silvery minnows may be harassed as a direct effect of these activities. The Service has defined take by harassment as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding, or sheltering (see 50 CFR 17.3). Avoidance behavior, or fleeing from the disturbance, represents a disruption in normal behaviors and an expenditure of energy that an individual silvery minnow would not have experienced in the absence of the proposed action. However, this form of harassment is expected to be short in duration, with pre-exposure behaviors to resume after fleeing the disturbance. In addition, best management practices to be used during the proposed action include allowing fish time to leave the area before excavation begins (i.e., by starting excavator work slowly) and conducting in-water work fairly continuously so that fish are unlikely to return to the area once work has begun. Thus, the potential number of individuals affected within the immediate vicinity of the equipment is likely to be relatively low, as we expect an initial flight response at the onset of activities, and sustained avoidance during in-water construction work. Given the mobility of silvery minnows, the small area affected over a limited duration, and the proposed work window, we do not expect the avoidance response to lead to any long-term significant effects on silvery minnow behaviors such as breeding, feeding, or sheltering.

Effects on Critical Habitat

Some of the primary constituent elements of silvery minnow critical habitat will be adversely affected by the proposed action. Specifically, the proposed action maintains a riprap bankline which has confined the channel, increased water velocities and prevented the formation of backwaters, embayments and other slow velocity habitat in the project 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. In addition, the proposed action may temporarily affect water quality within the anticipated disturbance zone.

However, we find that the effects of the proposed action on the function and conservation role of silvery minnow critical habitat relative to the entire designation are not significant because the effects will be temporary and occur over 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 continue to serve the intended conservation role for silvery minnows with implementation of the proposed action.

V. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local or private actions that are reasonably certain to occur within the action area considered in this biological opinion (50 FR 402.02). 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.

The Service expects the natural phenomena in the action area will continue to influence silvery minnows as described in the *Environmental Baseline*. The Service also expects the continuation of habitat restoration projects and research to benefit silvery minnows, for example projects funded and carried out by the State of New Mexico, City of Albuquerque, the Pueblos, and other groups. In addition, we expect cumulative effects to include the following:

- 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 minnows prefer. Development also reduces overbank flooding favorable for the silvery minnow.
- 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 urban areas, 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 (e.g., saltcedar), as well as riparian clearing and chemical use for vegetation control and crops 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 will result in a reduction of habitat available 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.

The Service anticipates the continued and expanded degradation of silvery minnow habitat as a result of these types of activities. Effects from these activities will continue to threaten the survival and recovery of the species by reducing the quality and quantity of minnow habitat.

V. CONCLUSION

After reviewing the current status of the silvery minnow, the environmental baseline for the action area, the anticipated effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the Drain Unit 7 Extension River Maintenance Priority Site project, as proposed in the June 2008 BA, is not likely to jeopardize the continued existence of the silvery minnow. We expect the level and type of take associated with this project is unlikely to appreciably diminish the population in the Isleta Reach, or the species as a whole. We expect harassment of minnows may occur, but the duration and intensity of this effect would be short-term and minimal. No mortalities are expected to result from the proposed project, which is likely to have only a short-term adverse effect on individual silvery minnows present in the action area.

We found that the proposed action has the potential to cause adverse effects to approximately 0.75 acres (3,035 m²) of designated critical habitat, representing the in-water disturbance zone. However, we anticipate that these effects on critical habitat will be short-term and will not affect the conservation role of critical habitat for silvery minnows relative to the overall designation. The conservation measures included in the BA (e.g., construction BMPs, dust abatement procedures, and revegetation) are expected to help minimize adverse effects to the silvery minnow and its designated critical habitat. 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.

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, 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 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 BOR so that they become binding conditions of any grant or permit issued, as appropriate, for the exemption in section 7(o)(2) to apply. BOR has a continuing duty to regulate the activity covered by this incidental take statement. If BOR (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, BOR 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 Drain Unit 7 Extension River Maintenance Priority Site project will be implemented as proposed. Take of silvery minnows is expected in the form of harassment during river maintenance activities, and is restricted to the action as proposed. If actual incidental take meets or exceeds the predicted level, BOR must reinitiate consultation.

The Service anticipates that take in the form of harassment may affect up to 85 silvery minnows during the proposed river maintenance activities, if the activities are completed in one phase. Alternatively, if the two-phase approach is required, as described in this opinion, the Service anticipates the take by harassment of up to 107 silvery minnows. We base these figures on the best available information on minnow density in the area disturbed by the proposed activities. Proposed activities including placement of riprap will result in an estimated disturbance of up to 0.75 acres in-water where silvery minnows are anticipated to be affected. Currently, the density of silvery minnows in the project area for 2008 is estimated at 2.81 minnows per 100 m², based on the latest monitoring data from 2008 (a wet year). If two phases are required, we anticipate

the take of additional minnows affected during the 2009 work window, based on available data from the most recent average year (i.e., 2007) indicating a density of 0.73 minnows per 100 m².

Effect of Take

The Service has determined that this level of anticipated take is not likely to result in jeopardy to the silvery minnow. The river maintenance project is likely to have adverse effects on individual silvery minnows but those effects are not anticipated to result in any long-term consequences on the population. Incidental take would result from harassment of minnows during maintenance activities and is not expected to result in the death of any individuals.

Reasonable and Prudent Measures

The Service believes the following reasonable and prudent measures are necessary and appropriate to minimize impacts of incidental take of the silvery minnow resulting from the proposed action:

1. Minimize take of silvery minnows due to the proposed river maintenance activities.
2. Continue to work collaboratively with the Service on the Middle Rio Grande Endangered Species Act Collaborative Program.

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 Reasonable and Prudent Measures described above. These terms and conditions are non-discretionary.

To implement RPM 1, BOR shall:

1. Ensure that all in-channel maintenance work is conducted prior to the initiation of silvery minnow spawning, i.e., within the timeframes described in this biological opinion (November 1 to April 15 if conducted in one phase; or from November 1, 2008 to April 15, 2009 and between July 1, 2009 and April 15, 2010 if conducted in two phases).
2. Ensure that conservation measures described in this biological opinion are implemented, including construction BMPs, dust abatement, and revegetation activities.
3. Monitor the implementation of RPM1 and associated Terms and Conditions

To Implement RPM 2, BOR shall:

1. Work to further conduct habitat/ecosystem restoration projects in the Middle Rio Grande to benefit the silvery minnow.

CONSERVATION RECOMMENDATIONS

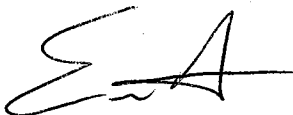
Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse 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.

RE-INITIATION NOTICE

This concludes formal consultation on the actions described in the June 2008 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 critical habitat in a manner or to an extent not considered in this BO; (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 BO; or (4) 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 22420-2009-F-0001. If you have any questions or would like to discuss any part of this biological opinion, please contact Jen Bachus of my staff at (505) 761-4714.


for Wally Murphy

cc:

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