



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 Pueblo of Santa Ana Bar 3 Modification 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 May 2012 Biological Assessment (BA) for the Pueblo of Santa Ana Bar 3 Modification Project in the Middle Rio Grande (Project), which will be funded by the Middle Rio Grande Endangered Species Collaborative Program (Collaborative Program) through the Bureau of Reclamation (Reclamation). This BO analyzes the effects of the action on the endangered Rio Grande silvery minnow, *Hybognathus amarus*, (silvery minnow), as well as on the endangered southwestern willow flycatcher, *Empidonax traillii extimus*, (flycatcher). The restoration Project will be located in Sandoval County, within the Angostura (or Albuquerque) Reach, which extends from the Angostura Diversion Dam south to the Isleta Diversion Dam. Request for formal consultation, in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*), was received on May 22, 2012.

This BO is based on information submitted in the May 2012 BA; conversations and communications between Reclamation, the Pueblo of Santa Ana, 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).

Southwestern Willow Flycatcher

Reclamation has determined the proposed action "may affect, but is not likely to adversely affect," the flycatcher. We concur with this determination for the reasons described below.

The flycatcher is a migrant through this portion of the Rio Grande and may be present from April through August. Suitable nesting habitat does not currently exist within the Project area; however, the adjacent "avoidance area" on Bar 3 (not part of action area) does provide migratory

habitat for flycatchers. Migrating flycatchers adjacent to the action area could, therefore, be disturbed by construction activities; however, these activities will not occur during the timeframe when migrating flycatchers could be present (April 15 to August 15). Thus, we expect direct effects on flycatchers are discountable.

Although long-term goals of the proposed action include restoring native riparian habitat and migratory or breeding habitat for the flycatcher in the long term (5-10 years), short-term indirect effects on flycatchers are possible from the removal of any vegetation that currently represents suitable migratory-stopover habitat. This includes both the river bar where the Project would be constructed, as well as areas for harvesting willows nearby along the Rio Grande and Rio Jemez (for planting in the Project area). However, because the river bar where the proposed action will occur is almost completely void of any vegetation within the construction area, no vegetation removal will occur prior to vegetation planting in this location. The proposed action will intentionally avoid and will not otherwise affect nearby flycatcher existing habitat. For willow harvesting, harvest areas include the shoreline along both the Rio Grande and Rio Jemez where habitat is currently not suitable for flycatchers. Therefore, no existing flycatcher migratory-stopover habitat or suitable vegetation will be removed during the proposed action. New vegetation will be monitored as it establishes in the restoration treatment area, to determine the effectiveness of the methods implemented as part of the Project. Additional vegetation management may occur in the action area, including salt cedar and Russian olive seedling removal by hand extraction, supplemental woody species planting, and native herbaceous plant seeding. The need for these activities will be evaluated on a yearly basis and will intentionally avoid nearby existing flycatcher habitat. The proposed action is intended to add vegetated bosque acres in general and create flycatcher habitat specifically by creating a mixed structure flooded woodland community. We expect this potential future development of dense native vegetation may benefit the flycatcher in the future. In addition, conservation measures will be implemented to minimize potential effects on vegetation in the action area. These include using existing roads, trails, and cleared staging areas to minimize damage to any vegetation. Therefore, indirect effects on flycatchers from the proposed action through effects on vegetation are considered discountable with beneficial effects anticipated in the long-term.

There is no designated critical habitat for the flycatcher within the action area. Reclamation has determined there will be no effect of the Project on critical habitat. The remainder of this biological opinion will deal with the effects of implementation of the proposed action on the silvery minnow.

Consultation History

The Service received a preliminary draft BA on December 21, 2011, for early review and provided comments on that draft BA to Reclamation and the Pueblo of Santa Ana on January 24, 2012. The Service conducted a site visit of the Project location with representatives from the Pueblo of Santa Ana on January 31, 2012. The Service received a final BA and request for formal consultation on May 22, 2012. The Service requested additional information on the proposed action and received that information on June 27 and July 3, 2012. On July 19, 2012, the Service provided a draft BO to Reclamation for review and also to the Pueblo of Santa Ana

for review pursuant to our obligations in Secretarial Order 3206 (U.S. Department of the Interior 1997). This BO is 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).

BIOLOGICAL OPINION

I. DESCRIPTION OF THE PROPOSED ACTION

Overview

The Pueblo of Santa Ana Bar 3 Modification Project would apply habitat restoration techniques within the Angostura Reach (also referred to as the Albuquerque Reach) and create ephemeral channels within an existing river bar. The goal of the Project is to create aquatic habitat at target inundations for larval development and refugia for young silvery minnow, as well as to help promote riparian function and interconnectedness. This includes the purposes of accelerating vegetation growth which mimics a natural bosque woodland community, providing early life history wetted habitat for the silvery minnow, and providing migratory or breeding habitat for the flycatcher in the long term (5-10 years). The Project is in support of Element S of the Reasonable and Prudent Alternative (RPA) in the March 2003 BO. Information contained in this section comes from the May 2012 BA (Pueblo of Santa Ana and U. S. Bureau of Reclamation 2012) and subsequent information received from Reclamation.

The Pueblo of Santa Ana plans to implement the habitat restoration work, which is funded through Reclamation as a contribution to the Collaborative Program's goal for habitat restoration in the Middle Rio Grande. Construction is expected to begin in November of 2012 and continue through completion by April 2013, with a possible extension to April 2014 if any delays in construction occur. Monitoring by the Pueblo of Santa Ana is expected for two years after construction. The proposed activities will not be conducted between April 15 and August 15 of any year.

Project Location

The proposed action will occur in the Angostura Reach, within the boundaries of the Pueblo of Santa Ana in Sandoval County, north-central New Mexico (see Figure 1). The existing river bar comprises approximately 22 acres and is located on the east side of the Rio Grande in the Angostura Reach between river mile (RM) 205.8 and RM 206.3. It is bound on the north, west, and south sides by the Rio Grande. The east side of the Project area is delineated by the upper terrace of the river where a parallel line of jetty jacks is located. The upper terrace adjacent to the Project site is approximately 250 feet in width from the Project site boundary to levee base.

Current conditions within the Project boundary are typical of a dry river bar. Soils are generally coarser with sparse patches of drought tolerant grasses characterizing the herbaceous layer. A mix of cottonwood (*Populus deltoides* ssp. *wizlizenii*), Russian olive (*Elaeagnus angustifolia*), and salt cedar (*Tamarix ramosissima*) are located in a thin diagonal band through the southern portion of the bar. Vegetated areas are outside current Project boundaries and will be left untouched.

Figure 1: Project location at the Pueblo of Santa Ana along the east bank of the Rio Grande (from May 2012 BA)



Sixty years of flood control and channelization projects within New Mexico's rivers have significantly altered the character of the floodplain and river channel at the Pueblo of Santa Ana. The Rio Grande has changed from broad, braided, and shallow to narrow and incised, resulting in negative impacts to the bosque and riparian ecosystems (Pueblo of Santa Ana and U. S. Bureau of Reclamation 2012). Spring flooding inundates less area and has reduced the historic floodplain to a series of terraces (Pueblo of Santa Ana and U. S. Bureau of Reclamation 2012).

Until 2009, the Project site was a dry river bar that did not inundate during spring runoff. Following a previous U.S. Army Corps of Engineers' project that lowered 55 acres of this river bar throughout the Pueblo of Santa Ana's portion of the Rio Grande, the lower outer edge of the bar currently inundates at approximately 4,500 cfs. The bar remains dry in the higher areas. Despite the moderate inundation near 5,000 cfs, the bar does not appear to retain sufficient moisture to germinate or grow cottonwood and willow (*Salix* spp.) (Pueblo of Santa Ana and U. S. Bureau of Reclamation 2012).

Proposed Restoration Treatments

The Pueblo of Santa Ana is proposing to create two ephemeral channels (one with multiple branches, see Figure 1) within an existing river bar whose lower edge currently inundates at river flows of approximately 4,500 cfs. The low-velocity, flow-through channels will be connected to the main river channel with both inlets and outlets providing access back to the river for silvery minnows, and designed to inundate with flows at approximately 2,000 cfs. The goal is to provide a wetted network on the bar during lower spring peak flow conditions. The constructed ephemeral channels would dry during lower flows and are not designed to provide habitat for adult silvery minnow. Channels will be constructed with a slight slope toward the river to allow water to drain back and minimize risk of entrapment for fish. Native woody species will be planted and large woody debris piles will be located above and adjacent to the created channels to increase habitat within the bar.

The river bar is 22 acres (0.09 km²) in size, with the Project to occur on 16.1 acres (0.07 km²), which includes 4.3 acres (0.02 km²) for ephemeral channels, and 11.8 acres (0.05 km²) for construction impacts and treatments including native woody species planting. The Pueblo of Santa Ana has designated a 5.9-acre (0.024-km²) vegetated area of the bar an "avoidance area" (see Figure 1), which is clearly defined by the presence of tall woody vegetation including cottonwood, Russian olive, and salt cedar. This area is migratory flycatcher habitat and will be left unaltered and will not be affected by Project activities. No Project work will be performed in the wet. No river crossings with equipment will occur as part of the Project.

Ephemeral Channel Creation (4.3 acres or 0.02 km² - dry)

Ephemeral channels will be created to allow flows of 2,000 cfs to inundate the channels. Channels are designed to provide multiple habitat features for the silvery minnow. The total length of these channels will be approximately 4,000 linear feet (1,219 meters). The bottom width of all the channels would be 20 ft (6.1 m), with a side slope of 5:1. The total excavation for the channels shown is about 12,000 yd³ (9,175 m³). Spoils will be removed and stockpiled for transport to a location at the Pueblo of Santa Ana. Approximately 440 total round trips using

a 25-28 cy (19-21.3 m³) capacity end dump will be required. Channel openings to the main stem of the river will be located above normal, non-runoff water levels and will therefore be constructed completely in the dry. The goal of this action is to create low velocity habitat during spring run-off, in years when peak flows are less than 4,500 cfs. In addition, these channels would help increase upper soil strata saturation for longer duration, which will help establish and maintain planted material.

Native Woody Species Planting (11.8 acres or 0.05 km² - dry)

Areas adjacent to the ephemeral channels will be pole-planted with woody riparian species, coyote willow (*Salix exigua* Nutt.) and cottonwoods, harvested at the Pueblo of Santa Ana. Cottonwood poles will be caged to prevent beaver damage, but willows will be left open. Harvest areas for willows include the shoreline along both the Rio Grande and Rio Jemez where habitat is currently not suitable for flycatchers; this includes one of three backwaters near the Project location. Cottonwood poles will be harvested at the Pueblo of Santa Ana's cottonwood pole farm. Cottonwood poles will be spaced approximately 50 feet apart and willows every 10 feet. Plants will be clustered in three to four individuals of the same species. Poles will be planted using a tractor and 10-ft (3.05-m) hydraulic auger. Rooted riparian species will be planted to provide additional vegetation structure and cover in the drier sections of the bar. Species may include buffaloberry (*Shepherdia argentea*), seepwillow (*Baccharis salicina*), boxelder (*Acer negundo*), peach leaf and Goodding's willow (*Salix amygdaloides*, *S. gooddingii*). Live material will be installed by hand or by using a power hand auger. Material will be initially watered-in to help settle backfill, but will not be hand watered afterwards. Pole planting will be completed during the months of February and March, before bud break. Rooted material can be planted anytime during the growing season, but will be most successful and least stressful to the plant during September to November. Since the river bar is almost completely void of any vegetation within the construction areas, there is no need to remove vegetation prior to planting. The goal of this action is to add vegetated bosque acres, in general, and create flycatcher habitat, specifically. The Pueblo has very few areas where water inundates below mature cottonwoods and willows. This action focuses on flycatcher breeding habitat by creating a mixed structure flooded woodland community. Flycatcher habitat is not expected to develop in less than five years and may become suitable in closer to ten years.

Large Woody Debris Placement (0.014 acres or 56.7 m² - dry)

Six large woody debris (LWD) piles will be constructed on the upper portions of the bar and near ephemeral channels to diversify habitat at target flows. The placement of debris piles will be accomplished in the dry. Dead and downed cottonwood trees from the Pueblo of Santa Ana's east side bosque will be relocated to the river bar using a tractor with hydraulic grapppler. Piles will range in size but should be less than six feet tall. Individual pile pieces will not be connected nor anchored using a "deadman" because if the pile lifts and floats, the Pueblo of Santa Ana would prefer that the pile move in pieces rather than as a cabled mass. Past experience has indicated that piles stacked approximately five feet tall and up to 10 feet long will remain in place during river bar inundation (Pueblo of Santa Ana and U. S. Bureau of Reclamation 2012). The goal of this action is to provide overhead cover for the silvery minnow and create a community component that mimics a more natural river system.

Monitoring and Post-construction Management

Monitoring of all habitat restoration treatments will occur for two years to determine the effectiveness of the methods implemented in the Project. In addition, due to the potential for entrapment of silvery minnow following spring run-off post construction, the Pueblo of Santa Ana will conduct minnow entrapment surveys each year for two years (see specific protocol below). Based on the hydrograph, as water recedes below 2,500 cfs at the San Felipe gage station, the Pueblo of Santa Ana will visually inspect each ephemeral channel on Bar 3 for impoundment twice a week. If isolated pools are found, all fish will be removed using nets and placed in a bucket of river water. The bucket will be carried and gently dumped into the Rio Grande. After two years, it will be determined in coordination with the Service if further monitoring following spring run-off is necessary. Additionally, monitoring is not expected to be necessary during summer monsoonal rains because entrapment is unlikely to occur as water levels typically do not exceed 2,000 cfs at this location during that period (Pueblo of Santa Ana and U. S. Bureau of Reclamation 2012). The specific protocol below addresses if inundation does occur during rainfall/monsoons.

The Project site will be managed as a natural area with restoration management activities being performed after construction. These activities may include salt cedar and Russian olive seedling removal by hand extraction, supplemental woody species planting, or native herbaceous plant seeding. The need for these activities will be evaluated on a yearly basis and will be dependent on the availability of supplemental funding. The Pueblo of Santa Ana will continue to exclude these activities from the “avoidance area” and will concentrate on the active construction locations.

Entrapment Monitoring Protocol

1. Monitoring for silvery minnow entrapment in restored features will occur following peak/secondary runoff. While entrapment is unlikely to occur during summer monsoonal rains as water levels typically do not exceed 2,000 cfs at this location during that period, the Pueblo will monitor the restored features when flows at the San Felipe gage station exceed 2,000 cfs during the summer to determine if inundation has occurred. If inundation does occur during rainfall/monsoons and any other high flow events, the Pueblo will conduct monitoring for silvery minnow entrapment.
2. Following peak/secondary runoff, the Pueblo will conduct monitoring at restored features when discharge at the San Felipe gage station drops below 2,500 cfs (within 25% of the site-specific target inundation).
3. Monitoring at restored features will be done a minimum of twice weekly. Best judgment will be used to determine the appropriate frequency above this minimum, as well as the appropriate time of day to conduct monitoring based on conditions at the restored feature.
4. Monitoring will be conducted until such time as (a) the site is dry, (b) all silvery minnows are removed from the isolated pool, or (c) flows increase such that the isolated pool becomes reconnected to the main channel.

5. If isolated pools occur at restored features that may contain silvery minnows, a permitted biologist will lead the effort to seine these pools and determine (a) the presence or absence of silvery minnows, and (b) the potential number present. Seining will only be conducted in these isolated pools, and not in areas that have the potential to become isolated but are not yet disconnected from the river. Silvery minnows collected during seining of isolated pools will then be released into continuous parts of the river.
6. Species identification, standard length, reproductive condition, and health condition of fish; and pool depth, dimensions and water quality information will be recorded to the extent possible. Health information includes whether fish exhibit signs of compromised health due to disease (e.g., fungus, Lernia, hemorrhagic lesions), anemia (i.e., emaciation), or physical deformity. Species counts will be maintained for all collections separately for each pool. A handheld global positioning system (GPS) unit with sub-meter accuracy will be used to record pool locations.
7. Any dead silvery minnows will be initially preserved in 10% formalin and then transferred to a 5% buffered solution for eventual museum accession.
8. The findings of injured or dead silvery minnow will be reported to Reclamation within three months of the final yearly monitoring event, and will then be submitted to the Service once a year. The Pueblo will maintain the other minnow data with their other minnow data, as the Pueblo has done in the past. The Service may contact the Pueblo to visit the Pueblo office and review the data.
9. If silvery minnow take is met or exceeded (based on the Incidental Take Statement) in these isolated pools at the restored features, the Service will be contacted before continuing with further silvery minnow monitoring activities.

Equipment, Staging and Access

Equipment proposed for construction includes dump trucks, backhoes, graders, and a tractor-mounted auger and grappler. Additional equipment may include hand tools for planting.

All access to the Project site will be through the eastern boundary. Access will be through the Middle Rio Grande Conservancy District gate north of US Highway 550 and along the lower levee road to the Project site. Equipment will be staged on high ground within the Project site boundaries at least 500 feet from the bankline. All access and work will occur on dry land due to construction timing and the Project site location. There is no need for equipment to cross, stage, nor excavate in water at any time. The Project will use existing roads, trails, and cleared staging areas. No vegetation will be removed during construction.

Dust abatement during the Project may be necessary. If water is needed for dust abatement on roads, no water will be pumped directly from the Rio Grande during irrigation season. Water will be pumped from the irrigation drains. During the non-irrigation season, if the water levels in

the irrigation drains are sufficient for pumping, then the drains will be the source of water for dust abatement. If the water levels in the drains are not sufficient, the Pueblo's contractor will bring a water truck and fill it using the Pueblo's hydrants. As a last option, during non-irrigation season, a minimal amount of water from the Rio Grande may be used, and will be pumped using a 0.25-in (0.64-cm) mesh screen at the opening to the intake hose to minimize entrainment of aquatic organisms. This water would likely be pumped at a rate between 1.8 and 2.2 cfs for four to eight minutes to fill a water truck. This equates to a decrease in flows of approximately 0.2% for river flows of 1,000 cfs and approximately 0.1% for river flows of 1,500 cfs for four to eight minutes. A typical project may use four to six truckloads per day and, at a maximum, 18 truckloads per day. This Project is expected to use the typical amount (four to six truckloads) or less.

Conservation Measures

Measures will be implemented during the proposed action to help minimize or avoid adverse effects of the river bar work and to successfully and safely implement all habitat restoration activities. These include the following:

Timing of the Proposed Action

- The proposed activities (including construction and vegetation work) will not be conducted between April 15 and August 15 to avoid impacts to listed species and migratory birds.
- All work will be performed during daylight hours between 7:00 am and 5:00 pm.

Equipment and Operations

- Vegetated areas are outside current Project boundaries and will be left untouched.
- The designated "avoidance area" with tall woody vegetation will be left unaltered and will be unaffected by Project activities.
- To minimize potential for spills into or contamination of aquatic habitat, hydraulic lines will be checked each morning for leaks and periodically throughout each work day.
- All fueling will take place outside the active floodplain. Fuel may be stored on site overnight, but not near the river or any location where a spill could affect the river.
- All equipment will undergo high-pressure spray cleaning and inspection prior to initial operation in the Project area.
- Equipment will be parked on pre-determined locations on high ground away from the Project area overnight, on weekends, and holidays.
- Steel-mesh guards will cover all external hydraulic lines.
- Spill protection kits will be on site, and operators will be trained in the correct deployment of the kits.
- No work will be performed in the wet. No river crossings with equipment will occur.
- Vegetation trimming, if necessary, will be completed after September 1st and before April 1st.

Water Quality

- All applicable permits will be obtained prior to implementation of the Project. Clean Water Act (CWA) Section 404 and 401 permit compliance will be required. Applications will be

submitted to the Corps and U.S. Environmental Protection Agency. The Pueblo of Santa Ana will comply with conditions of these permits and implement Best Management Practices in accordance with CWA permits and regulations, as applicable.

- Each individual operator will be briefed on and will sign off on local environmental considerations specific to the Project tasks, including specific Stormwater Pollution Prevention Plans (SWPPPs).

Staging and Access

- No impacts to existing conditions will occur because the Project will use existing roads, trails, and cleared staging areas.
- No vegetation will be removed in the Project area prior to construction and vegetation planting.

Dust Abatement

- If water is needed for dust abatement on roads, no water will be pumped directly from the Rio Grande during irrigation season. Water will be pumped from the irrigation drains.
- During the non-irrigation season, if the water levels in the irrigation drains are sufficient for pumping, then the drains will be the source of water for dust abatement. If the water levels in the drains are not sufficient, the Pueblo's contractor will bring a water truck and fill it using the Pueblo's hydrants. As a last option, during non-irrigation season, a minimal amount of water from the Rio Grande may be used, and will be pumped using a 0.25-in (0.64-cm) mesh screen at the opening to the intake hose to minimize entrainment of aquatic organisms (see earlier description of pumping from the river).

Other Measures

- Vegetation work that is necessary during the proposed action will be done using mechanical or hand techniques. No herbicide or chemicals are planned for use during the Project. If a future need arises, Reclamation and the Pueblo of Santa Ana will work with the Service to identify appropriate buffer zones and application conditions.
- Ephemeral channels will be constructed with a slight slope toward the river to allow water the drain back to the river and minimize risk of entrapment for silvery minnows.

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 will be conducted within the Angostura Reach of the Middle Rio Grande. Bar 3 modification activities will be conducted specifically in within the boundaries of the Pueblo of Santa Ana in Sandoval County, and extending from river mile (RM) 205.8 to RM 206.3. For this consultation, the action area is defined as the entire width of the 100-year floodplain of the Rio Grande from RM 205.8 to RM 206.3.

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). A description of this species, its status, and its habitat are provided below and inform the effects analysis for this biological opinion.

RIO GRANDE SILVERY MINNOW

Description

The Rio Grande silvery minnow is one of seven species in the genus *Hybognathus* that is found in the United States (Pflieger 1980). The silvery minnow currently occupies a 280 km (174 mi) stretch 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). This includes a small section of the lower Jemez River, a tributary to the Rio Grande north of Albuquerque. The silvery minnow's current habitat is limited to approximately seven percent of its former range, and is split into four discrete reaches by three river-wide dams (Angostura, Isleta, and San Acacia diversion dams). The silvery minnow was also introduced into the Rio Grande near Big Bend, Texas, in December 2008 as an experimental, non-essential population under section 10(j) of the ESA.

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). Live specimens are light greenish-yellow dorsally and light cream to white ventrally. The fins are moderate in length and variable in shape, with the dorsal and pectoral fins rounded at the tips. The body is fully scaled, with breast scales slightly embedded and smaller. The scales about the lateral line are sometimes outlined by melanophores, suggesting a diamond grid pattern. The eye is small and orbit diameter is much less than gape width or snout length (Bestgen and Propst 1996). Maximum length attained is about 90 mm (3.5 in) in standard length (SL)¹. The only readily apparent sexual dimorphism is the expanded body cavity of ripe females during spawning (Bestgen and Propst 1996).

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 1996). 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

¹ Standard length, or SL, is measured from the tip of the snout to the base of the tail whereas total length or TL, is measured from the tip of the snout to the end of the tail

(*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 (19 NMAC 33.1), the state of Texas (sections 65.171 – 65.184 of Title 31 T.A.C), and the Republic of Mexico (Secretaria de Desarrollo Social 1994). Primary reasons for listing the silvery minnow are described below in the *Reasons for Listing/Threats to Survival* 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 ($< 10 \text{ cm}\cdot\text{s}^{-1}$ or $0.33 \text{ ft}\cdot\text{s}^{-1}$) areas over silt or sand substrate that are associated with shallow ($< 40 \text{ cm}$ or 15.8 in) braided runs, backwaters, embayments, eddies formed by debris piles, or pools (Dudley and Platania 1997, Watts et al. 2002, Remshardt 2007). 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).

Passively drifting eggs and larvae are found throughout all habitat types, whereas adult silvery minnows are most commonly found in backwaters, pools, and habitats associated with debris piles, and 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 50 cm (19.7 in). Over 85 percent were collected from low-velocity habitats ($< 10 \text{ cm}\cdot\text{s}^{-1}$ or $0.33 \text{ ft}\cdot\text{s}^{-1}$) (Dudley and Platania 1997, Watts et al. 2002). Habitat use also varies seasonally, with preferred summer habitat including pools and backwaters, while preferred winter habitat is found in or adjacent to instream debris piles and associated with deeper water (Dudley and Platania 1996, 1997).

Designated Critical Habitat

The action area for this consultation is located on Pueblo of Santa Ana lands and, therefore, does not occur within designated critical habitat for the silvery minnow. However, a description of critical habitat is included here as it informs the overall status of the silvery minnow. The Service designated critical habitat for the silvery minnow on February 19, 2003 (68 FR 8088; see U.S. Fish and Wildlife Service 2003). The critical habitat designation extends approximately 252 km (157 mi) from Cochiti Dam in Sandoval County, New Mexico, downstream to the utility

line crossing the Rio Grande, a permanent identified landmark in Socorro County, New Mexico just north of Elephant Butte Reservoir and River Mile 62.1. The critical habitat designation defines the lateral extent (width) as those areas bounded by existing levees or, in areas without levees, 91.4 m (300 ft) 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 Santa Ana, Santo Domingo, Sandia, and Isleta within this area are not included in the critical habitat designation because specific management plans for the Rio Grande silvery minnow were developed for these Pueblos prior to critical habitat designation (68 FR 8088; February 19, 2003). 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

Prior to Federal listing little was known of the life history and ecology of the silvery minnow (Sublette et al. 1990). Most of the following information has been derived from studies undertaken since the mid-1990s and in the Middle Rio Grande where habitat degradation and loss has occurred.

The species is a pelagic spawner that produces 3,000 to 6,000 semi-buoyant, non-adhesive eggs during a spawning event that passively drift while developing (Platania 1995b, Platania and Altenbach 1998). The majority of adults in the wild 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). In captivity, silvery minnow have been induced to spawn as many as four times a year (C. Altenbach, City of Albuquerque, *pers. comm.* 2000); however, it is unknown if individual silvery minnow spawn more than once per year in the wild or if multiple spawning events suggested during spring and summer represent the same or different individuals.

The spawning strategy of releasing semi-buoyant eggs can result in the downstream displacement of eggs, especially in years or locations where overbank opportunities are limited. The presence of diversion dams (Angostura, Isleta, and San Acacia diversion dams) prevents the recolonization of upstream habitats (Platania 1995b) and has reduced the species' effective population size (N_e) to critically low levels (Alò and Turner 2005, Osborne et al. 2005). Adults, eggs and larvae may also be 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).

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 1.6 mm (0.06 in) in size upon fertilization, but quickly swelled to 3.0 mm (0.12 in). Recently hatched larval fish are about 3.7 mm (0.15 in) in standard length and grow about 0.013 mm (0.005 in) per day during the larval stages. Eggs and larvae have been estimated to remain in the drift for three to five days, and could be transported from 216 to 359 km (134 to 223 mi) downstream depending on river flows and availability of nursery habitat (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 (Age-0) attain lengths of 38.1 to 40.64 mm (1.5 to 1.6 in) by late autumn (U.S. Fish and Wildlife Service 2010). Age-1 fish are 45.72 to 48.26 mm (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, the maximum longevity documented is about three years based on a study of otolith and scale examinations (Horwitz et al. 2011). In comparison to longevity in the wild, it is not uncommon for captive silvery minnows to live beyond two years, especially at lower water temperatures (U.S. Fish and Wildlife Service 1999). The U.S. Geological Survey's (USGS) Columbia Environmental Research Center in Yankton, South Dakota has documented several silvery minnows in captivity with a maximum age of 11 years, ranging in size from 46 to 73 (± 8.1) mm SL (Buhl, pers. comm. as cited in U.S. Fish and Wildlife Service 2010).

The silvery minnow is primarily herbivorous, feeding mainly on algae, which is indicated indirectly by the elongated and coiled gastrointestinal tract (Sublette et al. 1990). Silvery minnow are also opportunistic feeders, filtering detritus, including sand and silt, from the bottom (Sublette et al. 1990, U.S. Fish and Wildlife Service 1999, Magaña 2007), and the presence of sand and silt in the gut of wild-captured minnows suggest that epepsammic algae (algae growing on the surface of sand) is an important food source. Silvery minnow reared in the laboratory have also been directly observed to graze on algae in the aquaria (Platania 1995a, Magaña 2007).

Population Dynamics

Generally, a population of silvery minnows consists of mainly two age classes: YOY (Age-0) 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 and older estimated to comprise less than 10 percent of the spawning population (U.S. Fish and Wildlife Service 2010). 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. 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. A recent study by Horwitz et al. (2011) examined both scales and otoliths taken from 158 specimens of wild Rio Grande silvery minnow (83 collected fall 2009 and 75 collected spring 2010) to assign ages to fish. The authors found that the size and age structure of the Rio Grande silvery minnow is similar to that of other *Hybognathus* species (Horwitz et al. 2011). Horwitz et al. (2011) demonstrated Rio Grande silvery minnow live up to 3 years in the wild, with Age 3 fish being extremely rare and not appearing in every sample. The study found that 82% of the fish in the fall sampling were Age 0 and 1, and 96% of the fish were Age 1 and 2 in the spring (Horwitz et al. 2011).

Platania (1995b) 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 3,862 river km (2,400 mi) of rivers in New Mexico and Texas and was one of the most abundant and widespread species in the Rio Grande basin. (Bestgen and Platania 1991, U.S. Fish and Wildlife Service 2010). 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 seven percent of its historic range. In December 2008, silvery minnows were introduced into the Rio Grande near Big Bend, Texas as a nonessential, experimental population under section 10(j) of the ESA (73 FR 74357). Monitoring of this reintroduced population, including genetics and reproduction, began in May 2009 and is ongoing. In 2010, the Service found evidence of successful reproduction with the detection of silvery minnow eggs, larvae and juvenile fish. Success of the Big Bend 10(j) population will continue to be evaluated and relevant information incorporated into the assessment for potential reintroductions in additional locations.

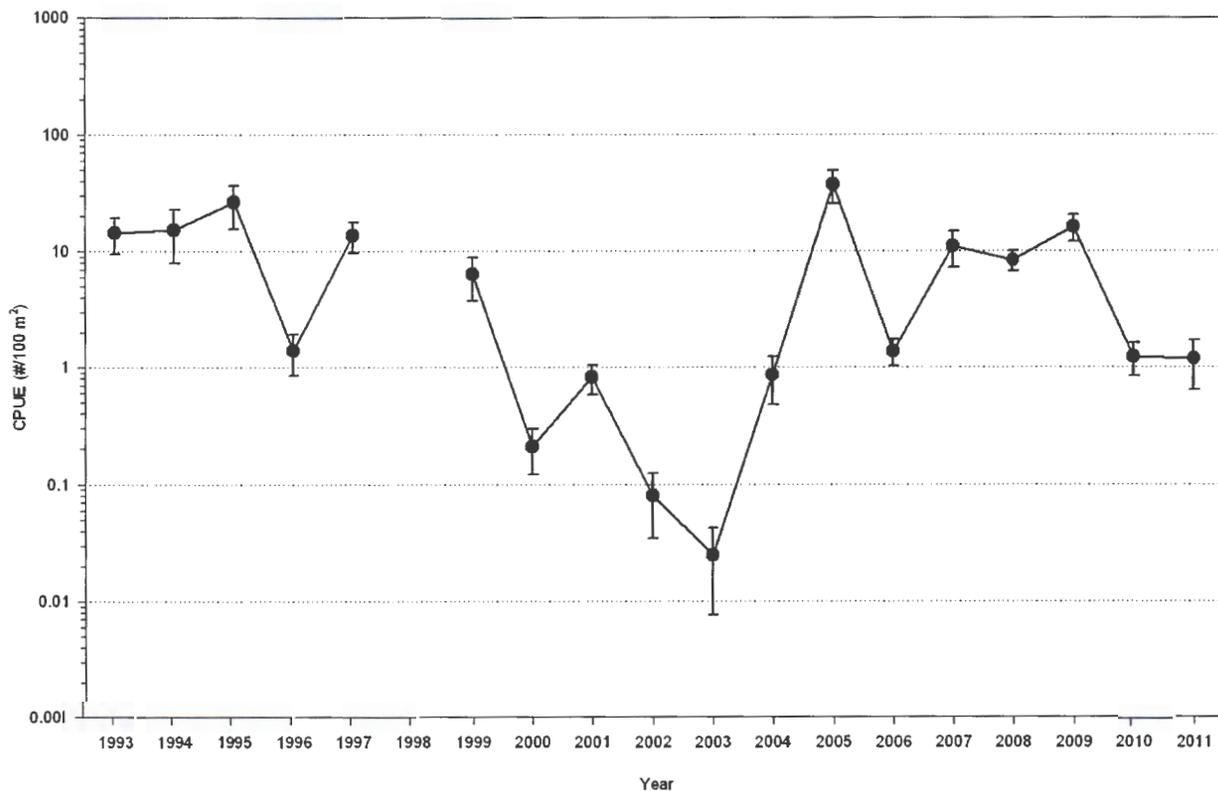
The Rio Grande, prior to widespread human influence, was a wide, perennially flowing, aggrading river characterized by a shifting sand substrate. The river freely migrated across a wide floodplain and was limited only by valley terraces and bedrock outcroppings. Throughout much of its historic range, the decline of the Rio Grande silvery minnow can be attributed in part to destruction and modification of its habitat due to dewatering and diversion of water, water impoundment, and modification of the river (channelization). The construction of mainstem dams (Cochiti, Angostura, Isleta, and San Acacia) have fragmented the Rio Grande, isolating the population and making it vulnerable to natural and human-caused threats which further increase the risk of extinction. The construction of Cochiti Dam in particular, negatively 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 1999, 2001). The Rio Grande below Angostura diversion 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 that area (U.S. Fish and Wildlife Service 1999, Torres et al. 2008).

Long-term Population Monitoring

Long-term monitoring for the Rio Grande silvery minnow began in 1993 and has continued annually, with the exception of 1998 and the majority of 2009. The area monitored for silvery minnows is the Middle Rio Grande from Cochiti Dam downstream to Elephant Butte Reservoir. Currently, 20 sites are sampled monthly (with the exception of January, March, and November). The long-term monitoring of silvery minnows has recorded substantial fluctuations (order of magnitude increases and decreases) 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 (see Figure 2). Population size is highly correlated with hydrologic conditions, particularly the magnitude and duration of the spring runoff (Dudley and Platania 2007a). 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.

Figure 2. Rio Grande Silvery Minnow Catch Rate Trends 1993-2011 based on October CPUE data



The 20 sampling sites for long-term population monitoring include monitoring at river mile 209.7 (below Angostura Diversion Dam, Algodones, site #0), which is approximately 3.4 upstream from the action area, and also at river mile 203.8 (at US Highway 550 bridge crossing, Bernalillo, site #1), which is 2 miles downstream from the action area. The most recent data

from these sites indicate silvery minnow densities have been variable over the past five years (e.g., 2007-2011 for fall sampling represented here by October data, and 2008-2012 for spring sampling represented here by April, May, and June data). These years encompass a range of flow conditions from dry to wet years. Table 1 shows the maximum and minimum monthly catch rates recorded at each site over this time frame, as well as the average catch rate at these two sites for the past five years combined (Dudley and Platania 2007b, 2008d, 2008a, c, b, 2009, 2010d, 2010a, c, b, 2011e, 2011b, d, c, Dudley et al. 2012a, b).

Table 1. Catch rates at Silvery Minnow Population Monitoring Sites 0 and 1 during fall (2007-2011 combined) and spring (2008-2012 combined)

Site	Month	Max CPUE (per 100 m ²)	Min CPUE (per 100 m ²)	Monthly Average CPUE (per 100 m ²)
Site 0	October	9.48	0	1.99
	April	0.21	0	0.05
	May	0	0	0
	June	0	0	0
Site 1	October	66.14	0	23.6
	April	2.34	0	0.81
	May	0.3	0	0.07
	June	1.73	0	0.64

Distribution and Abundance in the Action Area

Monitoring for silvery minnows has been carried out on the Pueblo of Santa Ana since 2006, and the waters adjacent to the Project site have been monitored since November 2008. Silvery minnows have been present during each monitoring event except spring 2009, spring 2011, and summer 2011 (Pueblo of Santa Ana and U. S. Bureau of Reclamation 2012). Prior to 2009, the Pueblo monitored during the summer and fall only. Currently, the Pueblo monitors during March, July, and November for fish and during May for eggs. Silvery minnows around the Project area are found in greater abundance during the summer and fall monitoring, while spring counts are relatively low (Pueblo of Santa Ana and U. S. Bureau of Reclamation 2012).

Augmentation of the Silvery Minnow Population

Augmentation has likely sustained the silvery minnow population throughout its range. Almost 1.3 million silvery minnows have been released in the Middle Rio Grande since 2002 (U.S. Fish and Wildlife Service 2012). Captively propagated and released fish supplement the native adult population, most likely prevented extinction during the extremely low water years of 2002 and 2003, and allowed for quicker and more robust population responses in all reaches due to improved water conditions observed in recent years. Since 2001, the Angostura Reach has been the focus of augmentation efforts; however, beginning in 2008, augmentation shifted focus to the Isleta and San Acacia Reaches only (J. Remshardt, Service, *pers. comm.* 2010). To accurately determine the success of these efforts and the continued effects of these releases, a period of five

years (2008-2012) without intensive stocking is being evaluated. If the overall catch rate for the Angostura Reach drops to below 0.1 silvery minnows per 100 m² during October population monitoring, then augmentation will be re-initiated for this reach the following year (Remshardt 2008).

Middle Rio Grande Distribution Patterns

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 in the Isleta and San Acacia Reaches. Routine augmentation of silvery minnows in the Angostura Reach (the focus of augmentation efforts starting in 2001) may partially explain this pattern. Transplanting of silvery minnows rescued from drying reaches (approximately 821,567 individuals through 2011) has also occurred since 2003; however, it is not possible to quantify the effects of those efforts on silvery minnow distribution patterns (J. Remshardt, Service, *pers. comm.* 2010). 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 lead to increased availability of nursery habitat and increased survivorship in the Angostura Reach. In contrast, south of the 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, densities 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 (U.S. Geological Survey 2010) and likely very little nursery habitat was inundated during critical recruitment times.

Distribution patterns for silvery minnows shifted again in 2007 and again in the recent years of 2008 and 2009. In 2007, population monitoring of silvery minnow densities indicated the highest densities occurred in the Angostura Reach. Available reports for 2008 indicated high recruitment, with silvery minnows occurring at all 20 sampling sites along the Middle Rio Grande, and flow conditions (i.e., strong runoff over an extended duration from May to July, no summer river drying) leading to elevated numbers of this species. Sampling in October 2009 also indicated high recruitment, with silvery minnows present at 19 of the 20 sampling sites. The highest densities were noted to persist in the San Acacia Reach during the population monitoring census in October of both 2008 and 2009, and the lack of extensive river drying these years, combined with favorable spring flows, was likely an important factor in this distribution shift

compared to 2007 (i.e., from highest densities in the Angostura Reach in 2007 to highest densities in the San Acacia Reach in 2008 and 2009) (Dudley and Platania 2008d, 2009).

During October 2010, Rio Grande silvery minnow were collected in low numbers at the 20 sampling sites, with densities that were significantly lower than in recent years (e.g., 2007, 2008, and 2009). And in 2011, silvery minnow were collected at only eight of the 20 sampling sites in October; catch rates were generally low at all sites, with a few exceptions in the southern portion of the San Acacia Reach (Dudley and Platania 2011e). Recruitment success throughout the Middle Rio Grande was fairly low in 2011 given the poor spring runoff and low flows during the remainder of the summer (Dudley and Platania 2011e). The pattern of highest densities occurring in the San Acacia Reach and the lowest in the Angostura Reach continued in both 2010 and 2011 (Dudley and Platania 2011a, e).

Reasons for Listing/Threats to Survival

The 1994 listing package (59 FR 36988) described numerous threats to the Rio Grande silvery minnow. Originally identified threats to the species, along with additional threats identified since the silvery minnow was federally listed as endangered are presented here:

Listing Factor A. The present or threatened destruction, modification, or curtailment of its habitat or range.

Dewatering and Diversion

- Annual dewatering of a large percentage of the species' habitat
- Risk of two consecutive below-average flow years, which can affect short-lived species
- Increase in non-native and exotic fish species
- Increase in contamination concentrations during flow years, which may exacerbate other stresses
- Entrainment of eggs and young-of-year in diversion structures
- Fragmented habitat

Water Impoundment

- Altered flow regimes
- Prevention of overbank flooding
- Trapped nutrients
- Altered sediment transport regimes
- Prolonged summer base flows
- Reduced food supply
- Altered preferred habitat
- Prevention of species' dispersal
- Creation of reservoirs and altered flow regimes that favor non-native fish species that may compete with or prey upon the species
- Stored spring runoff and summer inflow, which would normally cause flooding
- Reduced flows, which may limit the amount of preferred habitat and limit dispersal of the species
- Lack of suitable habitat for young-of-year

- Fragmented habitat

River Modification

- Confined flood flows
- Trapped sediment
- Establishment of stabilizing vegetation
- Elimination of meanders, oxbows, and other components of historic aquatic habitat
- Replacement of preferred sand and silt substrate with gravel and cobble
- Reduction of floodplain areas where young can develop
- Geomorphological changes to the river channel

Water Pollutants

- Poor water quality caused by agriculture and urbanization in the Rio Grande River basin, especially during low flows and storm events

Listing Factor B. Overutilization for commercial, recreational, scientific, or educational purposes.

- Possible over-utilization through scientific collection
- Licensed commercial bait dealers possibly selling bait minnows
- Incidental utilization of species during legal collection of bait minnows for personal use

Listing Factor C. Disease or predation.

Disease

- Risk of stress and disease when Rio Grande silvery minnow are confined to pools during periods of low flow
- Increased risk of stress-induced disease outbreaks possibly exacerbated when high levels of pollutants or other stresses are present

Predation

- Predation by non-native fishes, as well as by birds and mammals
- Competition for space and food with non-native fish during low flows

Listing Factor D. The inadequacy of existing regulatory mechanisms.

- No protection of habitat under State law
- Inability to acquire instream water rights for the benefit of fish and wildlife
- Inadequate regulations to restrict the use of bait fish, illegal use of bait fish, introduction of non-natives via bait bucket, and introduction of disease or parasites by importation of bait fish

Listing Factor E. Other natural or manmade factors affecting its continued existence.

- Reduced population numbers and potential loss of genetic diversity
- Introduction and subsequent competition from non-native fish
- Climate change

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 was updated and revised, and the First Revision of the Rio Grande Silvery Minnow Recovery Plan was finalized and issued on February 22, 2010 (75 FR 7625). The revised Recovery Plan describes recovery goals for the Rio Grande silvery minnow and actions to complete these (U.S. Fish and Wildlife Service 2010). The three goals identified for the recovery and delisting of the Rio Grande silvery minnow are:

1. Prevent the extinction of the Rio Grande silvery minnow in the Middle Rio Grande of New Mexico.
2. Recover the Rio Grande 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 Rio Grande silvery minnow to an extent sufficient to remove it from the List of Endangered and Threatened Wildlife (delisting).

Downlisting (Goal 2) for the Rio Grande silvery minnow may be considered when the criteria have been met resulting in three populations (including at least two that are self-sustaining) that have been established within the historical range of the species and have been maintained for at least five years.

Delisting (Goal 3) of the species may be considered when the criteria have been met resulting in three self-sustaining populations that have been established within the historical range of the species and have been maintained for at least ten years (U.S. Fish and Wildlife Service 2010).

Conservation efforts targeting the Rio Grande silvery minnow are also summarized in the revised Recovery Plan. 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 March 2003 BO 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 affect the survival and recovery of silvery minnows in the wild. Many of these activities are broader than the action area but have effects that extend into the action area. These include changes to the natural hydrology of the Rio Grande, changes to the morphology of the channel and floodplain, current weather patterns including climate change, 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.

Changes in 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 in minnow habitat and (2) changes to the magnitude and duration of peak flows.

Loss of Water in Minnow Habitat

Prior to the large-scale influence of humans on the watershed, the Rio Grande ecosystem was a highly dynamic fluvial system with channel dimension, planform and profile reflective of the natural basin hydrology, sediment regime, and site-specific geological and local controls (U.S. Fish and Wildlife Service 2010). It is believed that a significant portion of the river was a wide, braided, sand-bedded system with an extensive active floodplain composed of numerous secondary channels, floodplain lakes and marshes, and woody debris. The Rio Grande River has undergone considerable change in the last 150 years and is no longer the highly dynamic system it once was. Several large dams and irrigation diversions have been built on the river, and the entire system (U.S. Fish and Wildlife Service 2010). 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 at that time 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 Middle Rio Grande Conservancy District (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. Papadopulos & Associates Inc. 2000, Bartolino and Cole 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). Although the river below Isleta Diversion Dam may be drier than in the past, small inflows may contribute to maintaining flows. Since 2001, improvements to physical and operational components of the irrigation system have contributed to a reduction in the total diversion of water from the Middle Rio Grande by the MRGCD. Prior to 2001, average diversions were 630,000 afy and now average 370,000 afy. The change was possible because of the considerable efforts of MRGCD to install new gages, automated gates at diversions, and the 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. In February 2007, the City of Albuquerque and Albuquerque Bernalillo County Water Utility Authority with six conservation groups established a fund 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. The Pilot Water Leasing Project supports the need for reliable sources of water to support conservation programs as identified by the Collaborative Program (Middle Rio Grande Endangered Species Act Collaborative Program 2004).

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 (U.S. Fish and Wildlife Service 2010). Extensive fish kills, including tens of thousands of silvery minnows, have occurred in these lower reaches when the river has dried. It is assumed that mortalities during river intermittence are likely greater than documented levels, for example due to predation by birds in isolated pools (J. Smith, NMESFO, *pers. comm.* 2003). From 1996 to 2007, 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. In contrast, 2008 was considered a wet year, with above average runoff and at least an average monsoon season. As a result, there was no river intermittency and no minnow salvage that year, which is the first time there has been no river drying since at least 1996.

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, 2008, and 2009 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, reducing and dewatering main channel habitat, 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 also 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 and U.S. Army Corps of Engineers 2001). These non-native plants are very resistant to erosion, resulting in channel narrowing and a subsequent increase 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 (5,526 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.

Climate Change

“Climate” refers to an area's long-term average weather statistics (typically for at least 20- or 30-year periods), including the mean and variation of surface variables such as temperature, precipitation, and wind. “Climate change” refers to a change in the mean and variability of climate properties that persists for an extended period (typically decades or longer), whether due to natural processes or human activity (IPCC 2007a). Although changes in climate occur continuously over geological time, changes are now occurring at an accelerated rate. For example, at continental, regional, and ocean basin scales, recent observed changes in long-term trends include: a substantial increase in precipitation in eastern parts of North American and South America, northern Europe, and northern and central Asia, and an increase in intense tropical cyclone activity in the North Atlantic since about 1970 (IPCC 2007a); and an increase in annual average temperature of more than 1.1 °C (2 °F) across U.S. since 1960 (Karl et al. 2009).

The IPCC used Atmosphere-Ocean General Circulation Models and various greenhouse gas emissions scenarios to make projections of climate change globally and for broad regions through the 21st century (Meehl et al. 2007, Randall et al. 2007), and reported these projections using a framework for characterizing certainty (Solomon et al. 2007). Examples include: 1) it is virtually certain there will be warmer and more frequent hot days and nights over most of the earth's land areas; 2) it is very likely there will be increased frequency of warm spells and heat waves over most land areas, and the frequency of heavy precipitation events will increase over most areas; and 3) it is likely that increases will occur in the incidence of extreme high sea level (excluding tsunamis), intense tropical cyclone activity, and the area affected by droughts (IPCC 2007b, Table SPM.2). More recent analyses using a different global model and comparing other emissions scenarios resulted in similar projections of global temperature change across the different approaches (Prinn et al. 2011).

All models (not just those involving climate change) have some uncertainty associated with projections due to assumptions used, data available, and features of the models; with regard to climate change this includes factors such as assumptions related to emissions scenarios, internal climate variability and differences among models. Despite this, however, under all global models and emissions scenarios, the overall projected trajectory of surface air temperature is one of increased warming compared to current conditions (Meehl et al. 2007, Prinn et al. 2011). Climate models, emissions scenarios, and associated assumptions, data, and analytical techniques will continue to be refined, as will interpretations of projections, as more information becomes available. For instance, some changes in conditions are occurring more rapidly than initially projected, such as melting of Arctic sea ice (Comiso et al. 2008, Polyak et al. 2010), and since 2000 the observed emissions of greenhouse gases, which are a key influence on climate change, have been occurring at the mid- to higher levels of the various emissions scenarios developed in the late 1990's and used by the IPCC for making projections (Raupach et al. 2007, Figure 1, Pielke et al. 2008, Manning et al. 2010, Figure 1). The best scientific and commercial data available indicates that average global surface air temperature is increasing and several climate-related changes are occurring and will continue for many decades even if emissions are stabilized soon (Meehl et al. 2007, Gillett et al. 2011, Church et al. 2010).

Changes in climate can have a variety of direct and indirect impacts on species, and can exacerbate the effects of other threats. Rather than assessing “climate change” as a single threat in and of itself, we examine the potential consequences to species and their habitats that arise from changes in environmental conditions associated with various aspects of climate change. For example, climate-related changes to habitats, the quality, availability, and timing of prey to developing fish and wildlife, predator-prey relationships, disease and disease vectors, or conditions that exceed the physiological tolerances of a species, or that alter the rate of metabolic and biochemical processes within organisms, the occurring individually or in combination, may affect the status of a species. Vulnerability to climate change impacts is a function of sensitivity to those changes, exposure to those changes, and adaptive capacity (IPCC 2007a, Glick et al. 2011).

While projections from global climate model simulations are informative and in some cases are the only or the best scientific information available, various downscaling methods are being used to provide higher-resolution projections that are more relevant to the spatial scales used to assess impacts to a given species (see Glick et al. 2011). With regard to the area of analysis for the silvery minnow, the following downscaled projections are available.

The New Mexico Office of the State Engineer (2006) made the following observations about the impact of climate change in New Mexico:

1. warming trends in the Southwest exceed global averages by about 50 percent;
2. modeling suggests that even moderate increases in precipitation would not offset the negative impacts to the water supply caused by increased temperature;
3. temperature increases in the Southwest are predicted to continue to be greater than the global average;
4. there will be a delay in the arrival of snow and acceleration of spring snow melt, leading to a rapid and earlier seasonal runoff; and
5. the intensity, frequency, and duration of drought may increase.

Most of the upper Rio Grande basin is arid or semiarid, generally receiving less than 25 cm (10 in) of precipitation per year (Reclamation 2011). In contrast, some of the high mountain headwater areas receive on average over 100 cm (40 in) of precipitation per year. Most of the total annual flow in the Rio Grande basin results, ultimately, from runoff from mountain snowmelt (Reclamation 2011). In the Middle Rio Grande, there is expected earlier peak streamflows, reduced total streamflows, and more water lost to evaporation (Hurd and Coonrod 2007).

Climate change predicts four major impacts on silvery minnow habitat: 1) increased water temperature; 2) decreased streamflow; 3) a change in the hydrograph; and 4) an increased occurrence of extreme events (fire, drought, and floods). These impacts may reduce the amount and quality of silvery minnow habitat, may affect silvery minnow physiology and phenology (the timing and availability of resources necessary for silvery minnow growth to maturity), may affect the density, type and seasonal availability of prey available to developing larvae and

maturing silvery minnow, as well as the amount of primary productivity and oxygen saturation, and may affect biological interactions with other aquatic and terrestrial species. Decreased streamflow may result in the river becoming more intermittent, and fish isolated in pools may be subject to increased stress and predation. And changes to the hydrograph during spring runoff would affect the reproductive success of the silvery minnow that is dependent on river flow pulses to spawn. As such, the silvery minnow may be adversely affected by impacts due to climate change. Overall, the predicted effects of climate change are expected to result in degradation of the remaining silvery minnow habitat, with potential adverse consequences on species viability.

Water Quality

Many natural and anthropogenic factors affect water quality in the Middle Rio Grande, including the action area. Water quality in the Middle Rio Grande varies spatially and temporally throughout its course primarily due to inflows of groundwater, as well as surface water discharges and tributary delivery to the river. 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 substances. 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), urban storm water run-off, and mining activities (Ellis et al. 1993).

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 during extended periods of intermittency in the lower portion of the Angostura Reach. For that reason, the water quality of the effluent is extremely important. Near the Project area, the largest WWTP discharges are from Albuquerque, followed by two WWTPs in Rio Rancho, and Bernalillo (mean annual discharge flows are 80.4, 2.5, 0.9, and 0.7 cfs, respectively) (Bartolino and Cole 2002). Since 1998, total residual chlorine (chlorine) and ammonia, as nitrogen (ammonia), have been discharged unintentionally at concentrations that exceed protective levels for the silvery minnow. In addition to chlorine and ammonia, WWTP effluents may also include cyanide, chloroform, organophosphate pesticides, semi-volatile compounds, volatile compounds, heavy metals, and pharmaceuticals and their derivatives, which can pose a health risk to silvery minnows when discharged in concentrations that exceed the protective water quality criteria (J. Lusk, Service, *in litt.* 2003). Even if the concentration of a single element or compound is not harmful by itself, chemical mixtures may be more than additive in their toxicity to silvery minnows (Buhl 2002). The long-term effects and overall impacts of chemicals on the silvery minnow are not known.

Large precipitation events wash sediment and pollutants into the river from surrounding lands through storm drains and intermittent tributaries. Constituents of concern that are commonly found in stormwater include petroleum hydrocarbons (from oil spills, parking lot runoff, illicit dumping, roadways); the metals aluminum, cadmium, lead, nickel, copper, chromium, mercury,

and zinc; nutrient runoff (phosphates, nitrogen compounds, potassium, trace elements); pesticide runoff (herbicides, insecticides, fungicides, termiticides); solid waste; sedimentation, erosion, and salts (which reduce oxygen content in water and alter habitat); toxics such as PCBs and controlled substances; the industrial solvents trichloroethene and tetracholoroethene (TCE); and the gasoline additive methyl tert-butyl ether (U.S. Geological Survey 2001, NMED 2010; J. Lusk, Service, pers. comm. 2010). 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. 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 lands of 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 (EPA 2003). 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. The authors 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).

Preliminary results from a recent Rio Grande silvery minnow health study (Lusk et al. 2012) have indicated that temperature and dissolved oxygen (DO) may also be factors affecting the health of the silvery minnow. Water temperature is thought to be responsible for the elevated frequency of physical anomalies seen in silvery minnows, and there is a positive relationship between water temperature and the number of silvery minnows infected with bacteria. Reduced DO in the Middle Rio Grande is associated with storm events, which may result in chronic or behavioral effects on silvery minnows and the avoidance of low DO environments.

Pipelines

Based on information reported in the National Response Center (NRC) database (<http://www.nrc.uscg.mil>), nine incidents involving pipelines have occurred in Sandoval county – three releases to air, two to water, and three to soil or land. Substances released or spilled included natural gas, propane, demethonizer, diesel, jet fuel, and crude oil. Of these, most were either in the downstream direction from the action area or at a substantial distance from the action area such that effects in the action area for this consultation would not be expected. There is concern about the potential adverse effects of spills from these pipelines for the silvery minnow and its critical habitat. Fuels such as diesel that are carried by pipelines have documented toxicity due to polycyclic aromatic hydrocarbons (PAHs), which are known to persist after spills, pass readily into tissues, are potent carcinogens, and are toxic to fish (Eisler 1987, Schein et al. 2009; Lee and Grant 1981 as cited in Eisler 1987). A break in a pipeline if it were to release fuel into the river has the potential for lethal effects on minnows as well as adverse effects downstream on critical habitat (e.g., water quality; J. Lusk, Service, *pers. comm.* 2010). However, no incidents are known of such releases to the river from these pipelines that would have affected the action area for this consultation. No available information indicates any past adverse effects to silvery minnows or their critical habitat from spills at these pipelines.

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 three facilities in New Mexico that conduct captive propagation of the species, including the Dexter Fish Hatchery and Technology Center, the City of Albuquerque's BioPark propagation facility, and the New Mexico Interstate Stream Commission (ISC) Refugium in Los Lunas, New Mexico. These facilities are actively propagating and rearing silvery minnow. Silvery minnows are also held at the Service's New Mexico Fish and Wildlife Conservation Office (FWCO) and at the U.S. Geological Survey Biological Resources Division Lab in Yankton, South Dakota; however, there are no active spawning programs at these facilities.

Since 2002, almost 1.3 million silvery minnows have been released in the Middle Rio Grande (U.S. Fish and Wildlife Service 2012). Wild-caught silvery minnows are successfully spawned in captivity at the City of Albuquerque's propagation facilities. Eggs are raised and released as larval fish. Marked fish have been released into the Middle Rio Grande by the FWCO since 2002 under a formal augmentation effort funded by the Collaborative Program. Eggs left in the wild have a very low survivorship and this helps ensure 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 and larvae are collected to maximize genetic diversity within the remaining population (Turner and Osborne 2004).

Silvery Minnow Salvage and Relocation

During river drying, the Service's silvery minnow salvage crew captures and relocates silvery minnow. Through 2009, approximately 802,700 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. Caldwell et al. (2010) reported on studies that assessed the physiological responses of wild silvery minnows subjected to collection and transport associated with salvage. The authors examined primary (plasma cortisol), secondary (plasma glucose and osmolality), and tertiary indices (parasite and incidence of disease) and concluded that the effects of stressors associated with river intermittency and salvage resulted in a cumulative stress response in wild silvery minnows. Caldwell et al. also concluded that fish in isolated pools experienced a greater risk of exposure and vulnerability to pathogens (parasites and bacteria), and that the stress response and subsequent disease effects were reduced through a modified salvage protocol that applied specific criteria to determine which wild fish are to be rescued from pools during river intermittency (Caldwell et al. 2010).

Ongoing Research

There is ongoing research by the New Mexico FWCO 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). Studies are also currently underway by New Mexico FWCO using Passive Integrated Transponder (PIT) tags to examine silvery minnow movement and use of the fishway at the Albuquerque Bernalillo County Water Utility Authority's drinking water diversion site near the

Alameda Bridge in Albuquerque. Preliminary results indicate use of the fishway and both upstream and downstream movement of minnows in that location.

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. Several studies since 2003 have documented a significant decline in overall mitochondrial (mt)DNA and gene diversity in the silvery minnow (e.g., Osborne et al. 2005, Turner et al. 2006), which may correspond to an increased extinction risk. 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 and Turner 2005, Turner et al. 2005, U.S. Fish and Wildlife Service 2007). In addition, estimates of the current genetic effective size for silvery minnow have consistently fallen well below the values recommended to maintain the adaptive potential of the species. 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). 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; in addition, stocks produced by captive spawning consistently show lower levels of allelic diversity than those reared from wild-caught eggs (Osborne et al. 2006). 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). Results indicate that while captive propagation can be important for reducing the loss of some genetic markers (including microsatellite allelic diversity and heterozygosity) as seen in recent years, it cannot be relied upon to fully address declines in genetic diversity in the silvery minnow population.

10(j) Experimental Population

In December 2008, silvery minnows were introduced into the Rio Grande near Big Bend, Texas as a nonessential, experimental population under section 10(j) of the ESA (73 FR 74357). The Service released approximately 445,000 silvery minnows in 2008, approximately 509,000 in 2009 and approximately 488,000 in 2010. In 2011, over 304,000 silvery minnows were released in Big Bend, bringing the total to over 1.7 million silvery minnows released in this portion of the species' historic range in Texas (U.S. Fish and Wildlife Service 2012). The four release sites are distributed across Federal, state, and private lands: one in Big Bend Ranch State Park; two within Big Bend National Park; and one on the Adams Ranch del Carmen, a privately-owned and managed conservation area. The silvery minnows came from the Service's Dexter National Fish Hatchery and Technology Center and the City of Albuquerque's Rio Grande Silvery Minnow Rearing and Breeding Facility.

Monitoring has been conducted since 2009 to determine the success of the Big Bend reintroduction effort, and the results have been positive. It is expected to take years of monitoring to fully evaluate if the species is established and will remain viable in this river reach. However, post-release monitoring of silvery minnows in proximity to the four release sites has found silvery minnows. In 2010, the Service detected successful breeding of silvery minnows in the Big Bend reach for the first time since releases began, including documentation of eggs, larval fish, and juvenile fish. This indicates that silvery minnows are successfully breeding in Big Bend and that wild born silvery minnows are surviving to be recruited into the population and hopefully will contribute to future reproduction. In 2011, silvery minnows were detected up to 70 miles downstream and 15 miles upstream from the nearest release sites. These are significant milestones in working toward the recovery of the silvery minnow.

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(19)). 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.

The Service has conducted numerous section 7 consultations on past projects in the Middle Rio Grande. In 2001 and 2003, the Service issued jeopardy biological opinions resulting from programmatic section 7 consultation with Reclamation and the U.S. Army Corps of Engineers (Corps), which addressed water operations and management on the Middle Rio Grande and the

effects on the silvery minnow and the southwestern willow flycatcher (U.S. Fish and Wildlife Service 2001, 2003a). Incidental take of listed species was authorized associated with the 2001 programmatic biological opinion (2001 BO), as well as consultations that tiered off that opinion.

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. In 2005, the Service revised the Incidental Take Statement (ITS) for the 2003 BO using a formula that incorporates October monitoring data, habitat conditions during the spawn (spring runoff), and augmentation. Incidental take of silvery minnows is authorized with the 2003 BO (with 2005 revised ITS), and now fluctuates on an annual basis relative to the total number of silvery minnows found in October across the 20 population monitoring locations. Incidental take is authorized through consultations tiered off this programmatic BO and on projects throughout the Middle Rio Grande.

Within the Albuquerque Reach of the Middle Rio Grande, the Service has conducted numerous section 7 consultations on past projects, including the following:

- In 1999, the Service consulted with Reclamation on a restoration project on the Santa Ana Pueblo in an area where the river channel was incising and eroding into the levee system. The second phase of this Rio Grande Restoration Project at Santa Ana Pueblo underwent consultation in 2008, and the Service anticipated that up to 36,688 silvery minnow would be harassed by construction, fill placement in the river, and movement of equipment; no mortality was expected.
- In 2003, the Service completed consultation with the City of Albuquerque on its Drinking Water Project, which involved the construction and operation of a new surface diversion north of the Paseo del Norte bridge, conveyance of raw water to a new treatment plant, transmission of treated water to customers throughout the Albuquerque metropolitan area, and aquifer storage and recovery. The Service anticipated that up to 20 silvery minnows would be killed or harmed during construction, up to 25,000 eggs would be entrained each year at the diversion, and up to 7,000 larval fish would be harmed, wounded, or killed during operational activities.
- The Service consulted on habitat restoration projects on the Rio Grande near Albuquerque, including the 2005 Phase I, the 2007 Phase II, and the 2009 Phase IIa projects. Biological opinions addressing this prior habitat restoration work (see U.S. Fish and Wildlife Service 2005, 2007b, 2009) reviewed the effects on silvery minnows. Incidental take authorized included 190 silvery minnows in 2005 due to harm or harassment, in 2007 the harassment of up to 3,365 minnows and mortality of up to 341 minnows, and in 2009 the harassment of up to 4,094 minnows and mortality of up to 187 silvery minnows.
- In 2006 and 2007, the Service consulted with Reclamation on the Bernalillo Priority Site Project and the Sandia Priority Site Project for river maintenance activities. The Bernalillo project was anticipated to kill no more than 42 silvery minnows due to channel modification, berm removal, dewatering, and sediment deposition in the river. The most

recent consultation on the Sandia Priority Site River Maintenance project concluded that direct take of up to 539 silvery minnows, and harassment of 53,853 silvery minnows would occur due to construction activities.

- In 2007, the Service determined through consultation with the Corps on the Rio Grande Nature Center Habitat Restoration Project, that up to 10 silvery minnows would be harassed during construction and that up to 154 silvery minnows would be killed due to entrapment in constructed channels.
- In 2007, consultation on the Corrales Siphon River Maintenance Project concluded that the harassment of up to 244 silvery minnows would occur during construction, fill placement in the river, and movement of equipment.
- In 2008, the Service concluded an intra-Service consultation on the Pueblo of Sandia Management of Exotics for the Recovery of Endangered Species (MERES) Habitat Restoration Project. The Service anticipated that up to 2,449 silvery minnows would be harassed due to construction, and up to 770 killed due to potential entrapment in channels.
- In 2009, the Service concluded a consultation with the Bureau of Reclamation on the Pueblo of Sandia Bosque Rehabilitation Project, which concluded that up to 85 silvery minnows would be harassed during the proposed restoration activities, and up to 269 would be killed due to potential entrapment in a restored channel.
- In 2010, the Service consulted with the Bureau of Reclamation for a habitat restoration project located on the Pueblo of Sandia. The Service anticipated that take in the form of harassment may affect up to 36,318 silvery minnow due to proposed construction and river crossings, as well as the harassment and mortality of up to 6 silvery minnows due to potential stranding in restored features after peak flows recede.
- In 2011, the Service consulted with the Army Corps of Engineers on the Middle Rio Grande Bosque Restoration Project located in Bernalillo and Sandoval Counties. The Service anticipated that up to 6,988 silvery minnows would be harassed due to the proposed construction, and up to 8,471 silvery minnow would be harassed or killed due to potential stranding in restored habitat features.
- In 2011, the Service consulted with the U.S. Environmental Protection Agency (EPA) on its issuance of an NPDES Permit for the City of Albuquerque urbanized area stormwater discharge (MS4 NPDES Permit NMS000101). The Service expected that no more than 195 (15 mortalities and 180 harassment) silvery minnows would be taken due to the discharge of stormwater pushing low dissolved oxygen (DO) into the Rio Grande. In addition, the Service anticipated low DO events from stormwater would result in a total take due to harm of 1,528 silvery minnows.
- In 2011, the Service consulted with the USDA Forest Service on a New Mexico State Land Office Albuquerque Reach riverine restoration project. The Service anticipated that up to 96 silvery minnows would be taken due to harassment during construction, and up to 9 silvery minnows would be harassed and killed due to potential stranding in restored features. Stranding of eggs and larvae in restored features was also expected, but was not quantifiable.
- In 2012, the Service consulted with the Army Corps of Engineers on its authorization of the Albuquerque Metropolitan Arroyo Flood Control Authority's (AMAFCA's) plan to

widen the North Diversion Channel embayment outfall into the Rio Grande. The Service anticipated that no more than 5,670 silvery minnows would be adversely affected by entrapment and confinement during dewatering activities, with mortalities of no more than 847 of those silvery minnows prior to their rescue due to confinement stress and water quality degradation.

Summary of the Environmental Baseline

The remaining population of the silvery minnow is restricted to approximately seven percent of its historic range. With the exception of 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 provide information regarding the survival and movement of individuals.

Water withdrawals from the river and water regulation 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 and U.S. Army Corps of Engineers 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 afy returning to the river from the WWTP (U.S. Bureau of Reclamation and U.S. Army Corps of Engineers 2003). The effect of water withdrawals means that discharges 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. And the overall predicted effects of climate change are expected to result in degradation of the remaining silvery minnow habitat, with potential adverse consequences on species viability.

Various conservation efforts have been undertaken in the past and others are currently being carried out in the Middle Rio Grande for the benefit of the silvery minnow. Population monitoring indicates that densities of this species have increased compared to extremely low levels seen in 2002–2003. However, current data show catch rates are currently lower than levels at the time of its listing as an endangered species in 1994. The threat of extinction for the silvery minnow continues because of increased reliance on captive propagation to supplement the wild population, the fragmented and isolated nature of currently occupied habitat, and the absence of the silvery minnow throughout most of its 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 encompassing the disturbance zone boundaries from RM 205.8 to RM 206.3. Monitoring data are available from river mile 209.7 (below Angostura Diversion Dam, Algodones, site #0), which is approximately 3.4 upstream from the action area, and also at river mile 203.8 (at US Highway 550 bridge crossing, Bernalillo, site #1), which is 2 miles downstream from the action area. These data indicate that silvery minnows are likely to occur during habitat restoration activities and afterward during inundation of the restored features (i.e., during the spring peak), and therefore the species may be affected by the proposed action. Monitoring data (catch-per-unit-effort or CPUE) at these two closest silvery minnow monitoring sites in spring months (April, May, June; when entrapment would occur) over the past five years of data collected indicate a range of 0 to 2.34 minnows per 100 m² (see compilation in Table 1 earlier). Spring counts of silvery minnow are noted to be relatively low compared to other times of the year (Pueblo of Santa Ana and U. S. Bureau of Reclamation 2012).

The Service reviewed the proposed action, including measures implemented to reduce risk to listed species. The action area occurs outside of designated critical habitat for the silvery minnow, and Reclamation has determined there will be no effect on silvery minnow critical habitat (for critical habitat designation see 68 FR 8088; February 19, 2003).

The proposed action is expected to have beneficial effects on silvery minnows in the long-term by creating an increase in wetted areas during low run-off years and contributing to available nursery habitat. Such habitat is expected to benefit silvery minnows through improved egg and larval retention, increased recruitment rates, and increased survival of young of year (YOY). In the long-term, the Project is anticipated to contribute to improving the status of this species into the future through improved habitat availability and function.

However, the proposed action also has the potential for adverse effects on silvery minnows as a result of (1) direct effects during construction, (2) indirect effects due to sediment disturbance within the restored ephemeral channels once inundated, and (3) indirect effects beyond the construction period due to potential stranding of silvery minnows in restored ephemeral channels. Take by trapping, capturing and collecting silvery minnows for the purposes of

removing them from isolated pools (should they become stranded in those pools) is intentional take that is covered through ESA section 10(a)(1)(A) permits held by both Reclamation and the Pueblo of Santa Ana staff (or other permitted biologists, as applicable). The proposed entrapment monitoring protocol will help identify any minnows that are entrapped, and it will also serve to relocate surviving fish to the main river, giving them a chance to avoid mortality and thus minimize the adverse effects of the proposed action.

Construction of the restoration treatments could potentially affect the silvery minnow; however, given that all construction will occur in the dry and the conservation measures that will be implemented (i.e., timing of the project, equipment and operations measures, water quality protective measures, staging and access, no river crossings), we find the risk of adverse effects from construction equipment and operations to be discountable. Water use for dust abatement during the irrigation season will not use any water from the river channel, so we do not expect risk of adverse effects. However, water use during the non-irrigation season has the potential to use river water and therefore remove water from silvery minnow habitat. During non-irrigation season, water use for dust abatement will prioritize using water from drains where it has already been diverted, or using water from the Pueblo (hydrant). In the event dust abatement during the proposed action would remove water from the river during the non-irrigation season, it therefore has the potential to cause adverse effects on the silvery minnow through reduction in available habitat. However, given the time of year (non-irrigation season when demands on the river are reduced), the minimal amount of water that would be used (0.1 to 0.2 percent of river flows), and the short duration of each episode where the river would be affected (four to eight minutes), the available information indicates that such water use would exhibit insignificant effects on minnow habitat and we do not expect adverse effects resulting in take would occur. Any risk of direct effects on silvery minnow through uptake in the pumps is minimized, given the mesh size to be used on the pumps and the size of silvery minnow at the time of year this activity could occur. We expect this mesh would exclude silvery minnows and, therefore, adverse effects on silvery minnow directly from pumping are discountable.

Indirect adverse effects on silvery minnows may also be possible due to sediment disturbance within the restored ephemeral channels, resulting in increased sedimentation into the river. This may affect water quality, causing localized increases in turbidity and suspended sediments. Direct effects from excess suspended sediments on a variety of fish species have included alarm reactions, abandonment of cover, avoidance responses, reduction in feeding rates, increased respiration, physiological stress, poor condition, reduced growth, delayed hatching, and mortality (Newcombe and Jensen 1996). In addition, indirect effects from sediment mobilization in the channel are possible, including 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 also associated with increased sedimentation and turbidity and can produce negative cascading effects through depleted food availability for zooplankton, insects, mollusks, and fish. For the proposed action, sedimentation into the river after construction is dependent on flow levels, root systems, and debris piles; however, we do not expect the sediment released from the newly constructed channels once inundated will have any impact as it will be within naturally occurring levels for the river

channel in this location (Pueblo of Santa Ana and U. S. Bureau of Reclamation 2012). Therefore, we do not expect any suspended sediment coming off the new channels would result in any significant direct effects on silvery minnow, nor any significant indirect effects on their prey species. We find the risk of effects from sediment in these channels to be insignificant.

Indirect effects on silvery minnows may also result from the proposed ephemeral channels beyond the construction period. Harassment and mortality of silvery minnows may occur due to potential stranding of fish in these restored features. For example, high flows may deposit sediment in or at the openings of constructed ephemeral channels or other features resulting in isolated pools containing silvery minnows. We expect silvery minnows may become stranded in these isolated pools and die. Minnows may also be harassed by entrapment and behavioral responses to escape potential entrapment. 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). The proposed action is implementing several measures to minimize this risk to the silvery minnow, including constructing channels with a slight slope toward the river to allow water to drain back, connecting channels to the main river through both inlets and outlets providing access back to the river for silvery minnows, and monitoring for minnow entrapment at restored features a minimum of twice weekly and relocating fish to the main channel (take from that seining and relocation is covered by section 10(a)(1)(A) permit as mentioned above). However, we still expect that silvery minnow is likely to be adversely affected by potential entrapment, resulting in take through harassment and mortality.

We expect the risk for entrapment of silvery minnows as flows recede will occur in the ephemeral channels to be constructed on Bar 3. The total area for where there is a risk of stranding in pools is 80,000 ft² (7,432 m²) – which is derived from the 4,000 linear feet (1,219 m) of channels with a 20-ft (6.1-m) width at the bottom. Using the minnow density information from Table 1, catch rates (CPUE) at the two closest silvery minnow monitoring sites in any given spring month (April, May, June; when entrapment would occur) over the past five years of data collected indicate a range of 0 to 2.34 minnows per 100 m². Using that upper density estimate, we would expect entrapment-related take would occur resulting in 174 silvery minnows (juveniles and adults) being harassed and killed due to indirect effects from stranding. Any minnows that are located alive in isolated pools, seined, and relocated to the main river channel as part of the entrapment monitoring protocol would serve to minimize the adverse effects on silvery minnows by the proposed action. We also expect mortality of silvery minnow eggs and larvae that may become stranded in restoration features after flows recede; however, it is not possible to estimate the number of eggs and larvae that would be taken. We expect the extent of this take would encompass the Project area over the same footprint that applies to stranding of juvenile and adult silvery minnow. We expect any take of eggs and larvae would be small in relation to the natural mortality of these life stages.

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 in the Middle Rio Grande and research that will benefit silvery minnows in the Angostura Reach, which overlaps with the action area for this consultation – 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.
- Increased urban use of water, including municipal and private uses. Further use of surface water or further groundwater withdrawals that reduce surface water from the Rio Grande will reduce river flow and decrease available habitat for the silvery minnow.
- Contamination of 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., salt cedar), 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 point and 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.

VI. 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 Pueblo of Santa Ana Bar 3 Modification Project, as proposed in the May 2012 BA and subsequent correspondence with the Service during this consultation, is not likely to jeopardize the continued existence of the silvery minnow. We expect the level and type of take associated with the Project is unlikely to appreciably diminish the population in the Angostura Reach, or the species as a whole. We expect harassment and mortalities of minnows may occur due to stranding in restored features as peak flows recede; however, we do not expect this to result in any significant long-term effects on the population in the Angostura Reach or for the species as a whole.

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 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. Reclamation 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 Pueblo of Santa Ana Bar 3 Modification Project will be implemented as proposed. Take of silvery minnows is expected in the form of harassment and mortality due to the proposed habitat restoration activities, and is restricted to the action as proposed. If actual incidental take meets or exceeds the predicted level, Reclamation must reinitiate consultation.

The Service anticipates take in the form of harassment and mortality of up to 174 silvery minnows (juveniles and adults) due to potential stranding in restored features after spring peak flows recede. We base these figures on the best available information on minnow density in the area to be disturbed by the proposed activities during the next two years of project implementation and monitoring. We also expect mortality of silvery minnow eggs and larvae that may become stranded in restoration features after flows recede; however, it is not possible to estimate the number of eggs and larvae that would be taken. We expect the extent of this take would encompass the Project area over the same footprint that applies to stranding of juvenile and adult silvery minnow. We expect any take of eggs and larvae would be small in relation to the natural mortality of these life stages.

Any adverse effects to silvery minnow associated with the entrapment monitoring protocol, including those from seining and relocating silvery minnow to the main river channel, are the intended purpose of those activities, and this take is attributed to the applicable ESA section 10(a)(1)(A) permit. Therefore, this aspect of the proposed action is not considered incidental take and is not covered by Reclamation's incidental take statement for the Santa Ana Pueblo Bar 3 Project.

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 restoration 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 will result from harassment and mortality of any individuals that may become stranded in restoration features (i.e., ephemeral channels) after peak flows recede.

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 habitat restoration activities.
2. Manage for the protection of water quality from activities associated with the restoration Project.
3. Work collaboratively with the Service on the Middle Rio Grande Endangered Species 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, Reclamation shall:

1. Ensure that all Project work in the action area is conducted within the timeframes described in this biological opinion (not between April 15 and August 15).
2. Ensure that conservation measures described in this biological opinion are implemented, including those pertaining to the avoidance area, equipment and operations, staging and access, water quality, dust abatement during the irrigation season, and others.
3. Implement the Project-specific monitoring plan described for this consultation.
4. As appropriate, report to the Service the results and effectiveness of restoration treatments.
5. Report to the Service findings of injured or dead silvery minnows.
6. Monitor the implementation of RPM 1 and its associated Terms and Conditions.

To implement RPM 2, Reclamation shall:

1. Ensure that conservation measures described in this biological opinion are implemented, including those pertaining to equipment and operations, and staging and access.
2. Report to the Service any significant spills of fuels, hydraulic fluids, and other hazardous materials.
3. Monitor the implementation of RPM 2 and its associated Terms and Conditions.

To implement RPM 3, Reclamation shall:

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.

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. Evaluate the effectiveness of habitat restoration techniques implemented in the Middle Rio Grande for ESA-listed species, including an evaluation of site longevity and benefits provided to species.
2. Evaluate entrapment risk in restored features (for the silvery minnow), including compilation of data available from prior projects. Work to develop guidelines or requirements for construction of features that minimize that risk.

3. Implement recovery actions identified in the southwestern willow flycatcher and Rio Grande silvery minnow recovery plans.

RE-INITIATION NOTICE

This concludes formal consultation on the action described in the May 2012 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 02ENNM00-2012-F-0062. 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.



Wally Murphy

cc:

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