Biological Assessment

EFFECTS OF LFCC EXPERIMENTAL OPERATIONS:

WATER DIVERSIONS FROM THE RIO GRANDE AND PARROT FEATHER REMOVAL

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Background

On December 12, 1994 the Bureau of Reclamation (Reclamation) submitted a biological assessment (BA) addressing the diversion of water from the Rio Grande at San Acacia Diversion Dam (SADD) into the Low Flow Conveyance Channel (LFCC) for experimental purposes. The federal action included installing a temporary outfall to the river and diverting water during spring runoff for three consecutive years. On January 24, 1995 the U.S. Fish and Wildlife Service (Service) New Mexico Ecological Services Field Office issued a biological opinion (opinion) concurring with Reclamation's finding that the project may affect, but would not likely adversely affect the Rio Grande silvery minnow (silvery minnow). During spring runoff of 1995, construction of the outfall to the river was not completed, and experimental operations could not proceed. During spring of 1996, there was essentially no "runoff" and flows never approached the minimum required at San Acacia for diversions to proceed. On November 1, 1996 Reclamation submitted an updated BA to the Service that included an assessment of effects on the Southwestern willow flycatcher (flycatcher) and an expanded analysis of effects of LFCC experimental operations during all seasons on the silvery minnow using new habitat information. On February 21, 1997, the Service transmitted a letter to Reclamation concurring with the finding of "may affect, not likely to adversely affect" for the silvery minnow and flycatcher and no adverse modification or destruction of proposed ciritical habitat for the silvery minnow. Re-initiation of consultation occurred through a letter dated February 5, 1999 and concurrence was received from the Service through a Memorandum dated March 3, 1999, for an extension through the spring runoff of 2001, with a determination of "may affect, not likely to adversely affect" the silvery minnow and flycatcher and no adverse modification or destruction of critical habitat for the silvery minnow. By Memorandum dated April 20, 2001, Reclamation provided an update to the proposed experimental operations, including biological monitoring, for the spring of 2001. Reclamation also reiterated its determination of "may affect, but not likely to adversely affect" the silvery minnow and flycatcher, and "no adverse modification or destruction of critical habitat for the silvery minnow".

The Bureau of Reclamation (Reclamation) is continuing a sediment investigation for the potential future operations of the Low Flow Conveyance Channel (LFCC). Future operation of the LFCC is being considered under the Upper Rio Grande Water Operations Review-EIS. Reclamation's sediment investigation study involves experimental diversion operation of the LFCC headworks canal between San Acacia and Escondida. Flows are diverted at the SADD and returned to the river through an outfall constructed above Escondida. An intensive data collection program to evaluate sediment transport and channel hydraulics has been on-going since 1997. Reclamation desires to pursue the experimental test operations for an additional 5 years, through the spring runoff of 2006.

A HEC-RAS (USACE,2001) analysis characterizing the river channel condition between San Acacia and Escondida is presented to assist in evaluating potential impacts to aquatic habitats during potential experimental operations. This analysis is necessary to provide assistance in meeting all Endangered Species Act (ESA) requirements. Reclamation staff biologists identified 4 representative cross sections in the study reach for detailed analysis in support of the biological assessment. These cross sections represent the range of channel geometries experienced in the affected reach. Trend analysis of instream velocity, depth, flow area, wetted perimeter, and wetted river width is presented at the four cross sections for a varying range of discharges.

Federal Action

This assessment addresses two requirements of LFCC experimental operations: water diversions from the Rio Grande and parrot feather removal. Water from the main channel of the Rio Grande will be diverted into the LFCC only when there is sufficient flow for diversions and for maintaining a minimum flow of 50 cfs at the gage below San Acacia Diversion Dam (SADD), simultaneously. Diversions may be made at any time during the year when there are sufficient flows in the Rio Grande. This means that excess flows above 50 cfs may be diverted from the river up to the LFCC capacity of 1,500 cfs. For example, if discharge at SADD is 600 cfs, then Reclamation may divert up to 550 cfs provided 550 cfs is the total of all diversions (see Cumulative Effects section). If discharge at SADD is 6400 cfs, for example, then Reclamation may divert up to 2,000 cfs. Water will be diverted into the LFCC at the LFCC headworks at SADD and returned to the river via the temporary outfall, approximately 9.5 miles downstream (Figure 1). These operations will begin as soon as practical and may continue for 5 years through 2006 (years with adequate river flows for LFCC diversions to occur).

Collection of one complete data set typically requires 14-17 days of constant discharge in the LFCC. During experimental operations, flow in the LFCC ranges from 300 to 2,000 cfs. Selection of the LFCC discharge for a particular data set is governed by the expected availability of water during the data collection period; successful data collection requires that the discharge be continuously maintained throughout the collection period. Water from the main channel of the Rio Grande will be diverted into the LFCC only when there is sufficient flow for diversions and for maintaining a minimum flow of 50 cfs at the gage below San Acacia Diversion Dam (SADD), simultaneously. Diversions may be made at any time during the year when the above parameters (flow volume and duration) exist. Sufficient water to conduct experimental operations at the higher range of flow (above 900 cfs) is usually only available during the spring runoff peak. River flow is typically insufficient to conduct experimental operations during the remainder of the irrigation season, but enough water is often available during the winter months to collect data sets at lower LFCC discharges (900 cfs and below). Experimental operations would likely occur for two or three 14-17 day periods during the spring runoff period and again for several 14-17 day periods during the winter. Experimental operations are not conducted constantly throughout the year. For example, summer monsoon floods that may be of high flow volume, but short duration, would not be diverted into the LFCC for experimental operations. Overbank flooding events below SADD will still occur in any given year that they would have normally occurred, given the proposed experimental operations parameters described above. Water will be diverted into the LFCC at the LFCC headworks at SADD and returned to the river via the temporary outfall, approximately 9.5 miles downstream (Figure 1). These operations will begin as soon as practical and may continue for 5 "runoff" years (years with adequate river flows for LFCC diversions to occur).

Experimental operations of the LFCC would be conducted under the flow guidelines agreed upon in the Programmatic Biological Opinion on the Effects of Actions Associated with the U.S. Bureau of Reclamation's, U. S. Army Corps of Engineers', and Non-Federal Entities' Discretionary Actions Related to Water Management on the Middle Rio Grande, New Mexico, dated June 29, 2001. Experimental operations may be conducted from May 26 to May 9 the following year, 1) with a minimum flow of 50 cfs over San Acacia Diversion Dam and 2) when a minimum flow of 50 cfs at the San Marcial Floodway gage can be safely maintained. No operations will occur during the peak spawning period for the Rio Grande silvery minnow from May 10 to May 25.

Parrot feather will be mechanically removed from several sections (totaling 7-8 miles) of the 9.5-mile reach of the LFCC to facilitate data collection during experimental operations. If the parrot feather is not removed from the specified reaches, then accurate velocity and sediment load data cannot be collected. Within the Study reach (9.5-mile reach of LFCC) there are three data collection reaches, each defined by a series of cross sections upstream of a grade control structure, and two sediment sampling structures independent of the other data collection reaches (Figure 2). The purpose of the grade control structures is to create a backwater effect upstream. These structures (Figure 3) will induce upstream sediment deposition which will vary for each reach because of physical differences (LFCC width and depth) between the reaches. Some details specific to each sampling reach are given in Table 1.

Upstream of each grade control structure, cross sections (total of 43 among all three reaches) have been established for collection of hydrologic data (elevations, depths, and velocities). The rate of aggradation and degradation will be monitored at these cross sections. This analysis will aid in defining sediment transport properties of the LFCC based on discharge, width, and slope. The purpose of the two sediment sampling structures (Figure 4) is to measure the total sediment load being transported. Measurements of suspended sediment will determine the amount of sediment being delivered in suspension and bed material sampling will determine what is being transported as bed load. One structure is located in a control section upstream of Reaches 2 and 3, and the other in a downstream control section to monitor inflow and outflow. This will allow for the determination of a mass balance to quantify sediment deposition within the experimental area.

Figure 1. Project area: approx. 9-mile experimental reach of the Low Flow Conveyance Channel below San Acacia Diversion Dam.

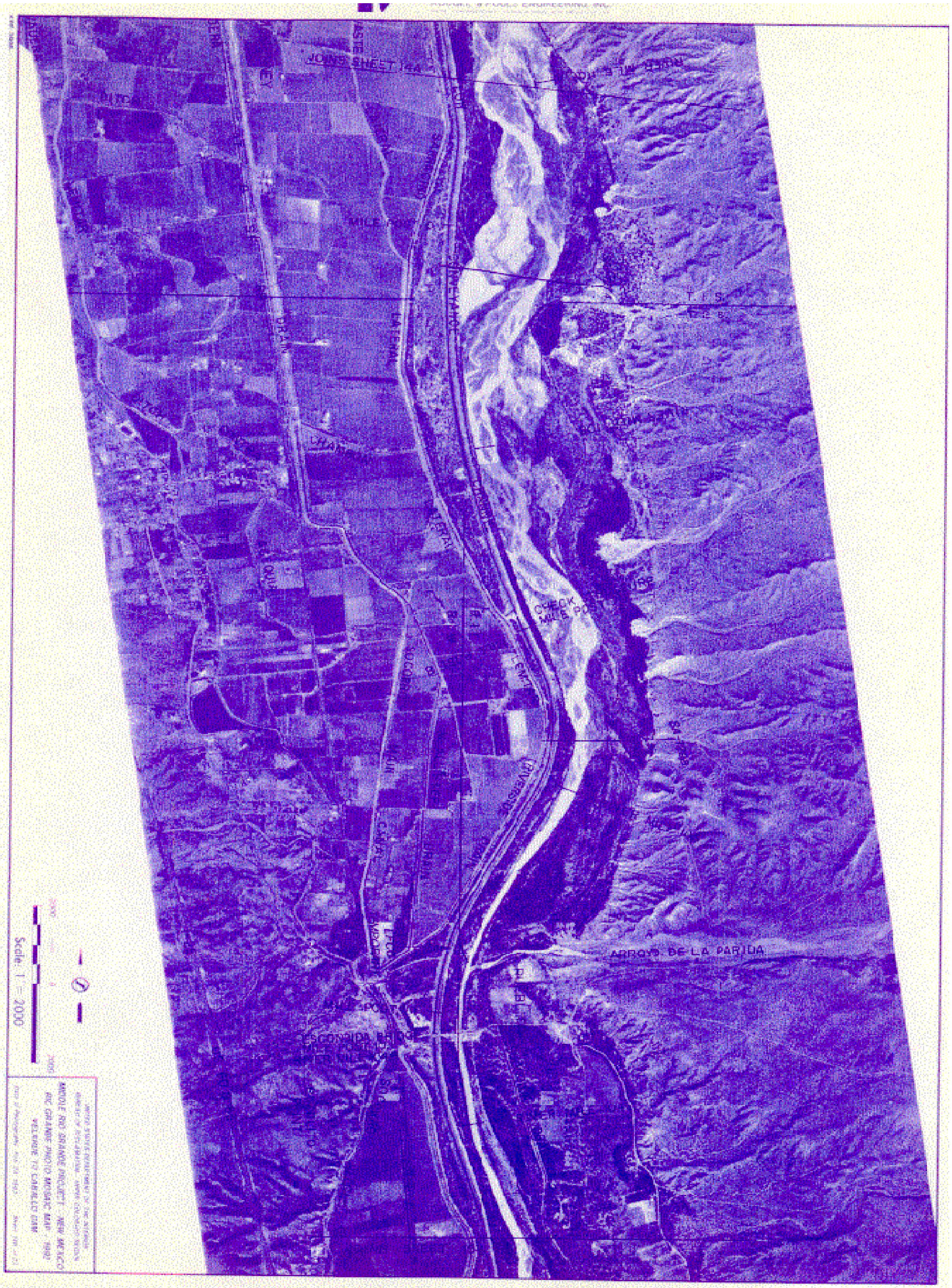

Figure 1. Continued.

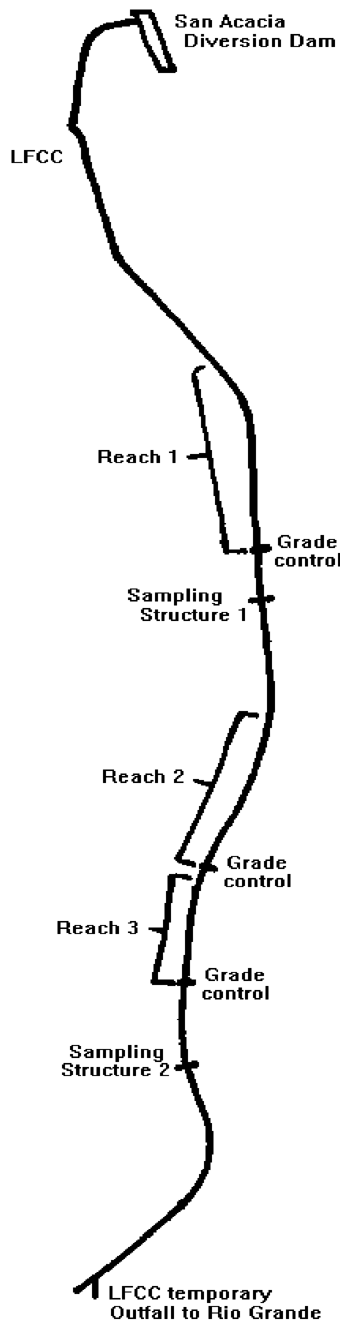

Figure 2. Nine and one-half-mile experimental reach of the Low Flow Conveyance Channel below San Acacia Diversion Dam showing the data collection reaches and sampling structures.

Using a dragline with bucket dredge (Figure 5), the parrot feather will be removed from the three data collection reaches upstream of each grade control structure and from two reaches at each sediment sampling structure. The total length of all these sections combined and the maximum distance to be dredged is 7-8 miles. A dragline can remove parrot feather from 0.2 to 0.4 miles of the LFCC per day. Initial estimates indicate it will require 4-8 weeks to remove parrot feather prior to LFCC experimental operations. Regular removal will reduce the time spent on vegetation removal and impacts on any minnows present in the LFCC. The vegetation removed will be placed on adjacent levees next to the respective roads. The material will be allowed to decay on-site. Control of parrot feather to a level that will allow proper data collection will require maintenance. Removal procedures will be undertaken at least once/year and may be undertaken twice/year as long as experimental operations are scheduled (maximum of five years).

The temporary outfall of the LFCC to the Rio Grande approx. 9.5 miles downstream of SADD was opened during spring/summer 1996 to provide flows for the silvery minnow during the drought crisis. This reach of the Rio Grande is important to the species, with the majority of the population found here and isolated from upstream reaches by SADD. As previously prescribed by the 1994/95 consultation, the LFCC outfall to the river was temporary, to be dismantled when experimental operations were completed. Reclamation recommends that the LFCC outfall be maintained following experimental operations to retain flexibility in water delivery capabilities.

Additional Site Information

General Fish Habitat

The Rio Grande from San Acacia Diversion Dam (SADD) to the headwaters of Elephant Butte Reservoir is an alluvial channel; the river bed is sand (mean particle size . 0.25 mm) and it slopes approximately 5 feet per mile. The reach is relatively sediment-rich due to inputs from the Rio Salado and the Rio Puerco. Backwater effects of Elephant Butte Reservoir influence sediment transport, particularly when the reservoir pool is high. The channel is relatively straight, but it varies in width from over 1,000 feet to less than 200 feet (U.S. Bureau of Reclamation, 1993).

Aquatic conditions in the Rio Grande from SADD to Elephant Butte are more representative of native conditions than elsewhere in the middle Rio Grande. Runs, flats, shorelines, and islands are all common (Platania 1993). Debris piles are an additional habitat type that creates low velocity water and provides critical cover habitat for many species of fish. This reach is also characterized by dramatic variations in discharge because of thunderstorm events and it also becomes seasonally ephemeral with periods of habitat intermittency and fragmentation. This aquatic environment supports many native fishes, including the federally endangered silvery minnow. Cobble and gravel runs and riffles that occur immediately below SADD were created by channel downcutting exposing an underlying gravel layer and some riprap to protect the dam (Massong et al. 2001; Platania, 1993; U.S. Bureau of Reclamation, 1993).

Figure 3. Grade control structure in the upper 9-mile experimental reach of the Low Flow Conveyance Channel.

GRADE CONTROL STRUCTURE

BRIDGE ABOVE SEDIMENT SAMPLING STATION

Figure 4. Grade control structure and bridge over sediment sampling structure in the upper 9-mile experimental reach of the Low Flow Conveyance Channel.

Figure 5. Dragline bucket dredge for proposed mechanical removal of parrot feather in Low Flow Conveyance Channel.

DENSE INFESTATION OF PARROT FEATHER

SPARSE TO MODERATE INFESTATION OF PARROT FEATHER

Figure 6. Parrot feather in the upper 9-mile experimental reach of the Low Flow Conveyance Channel.

Table 1. Physical characteristics and other details of each data collection reach in the LFCC.

Reach 1
- Overall Length = 5900 feet
- Number of cross sections = 15
- Number of grade control structures = 1
- Channel slope = 0.000970
- Channel bottom width = 32 feet
- Channel side slopes = 2:1
- Channel depth = 7.97 feet
- Substrate = Layers of clay and sand
- Discharge capacity = 2000 cfs

Reach 2
- Overall Length = 5800 feet
- Number of cross sections = 16
- Number of grade control structures = 1
- Channel slope = 0.000970
- Channel bottom width = 28 feet
- Channel side slopes = 2:1
- Channel depth = 8.42 feet
- Substrate = Layers of clay and sand
- Discharge capacity = 2000 cfs

Reach 3
- Overall Length = 2920 feet
- Number of cross sections = 12
- Number of grade control structures = 1
- Channel slope = 0.000970
- Channel bottom width = 24 feet
- Channel side slopes = 2:1
- Channel depth = 8.93 feet
- Substrate = Layers of clay and sand
- Discharge capacity = 2000 cfs

The 9.5-mile experimental reach of the LFCC begins at SADD, continues downstream west of the Rio Grande, and outfalls just upstream of Escondida Bridge near where the Arroyo de la Parida enters the Rio Grande on the east (Figure 1). The Rio Grande from SADD to the LFCC temporary outfall is measured as 10.9 river miles, and this reach of river adjacent to the 9.5-mile LFCC reach will be referred to as an 11-mile reach. Parrot feather is abundant in this reach of the LFCC (Figure 6). Silvery minnow are concentrated in the Rio Grande in the reach between San Acacia and San Marcial, and have occasionally been collected in this reach of the LFCC.

Riparian Habitat Characteristics and the Southwestern Willow Flycatcher

Riparian vegetation for the Study reach has been delineated and classified in habitat categories representing different levels of suitability for breeding willow flycatchers. These categories are based on locations of known breeding territories, proximity to water, plant species composition, vegetation density and height. Willow flycatcher habitat categories for riparian habitats within and near the Study reach are indicated in Figure 7 and 8. The majority of the riparian habitat within this reach of the river and LFCC that occurs within 100 m of surface water is comprised of young sparse riparian plants that currently do not have the characteristics to provide suitable breeding flycatcher habitat. A few of these areas could develop into stands of adequate structure and/or density with growth or additional plant recruitment (Ahlers et al. 2001). Approximately 0.5 miles of riparian habitat has been mapped as highly suitable native riparian within 100 meters of surface water (Ahlers et al. 2001). This area occurs on the west side of the river designated in green (Figure 7). This area has been recently ground-truthed by Reclamation biologists in October of 2001. The vegetation was described as sparse and young and determined to be more appropriately characterized as potential flycatcher habitat. This area does occur on a 2-3 foot terrace, and is one of several low terraces occurring within this reach of the river that would become inundated under various river discharges (Figure 9). Riparian habitat on these 2-3 foot terraces would have the most potential to develop into suitable flycatcher habitat.

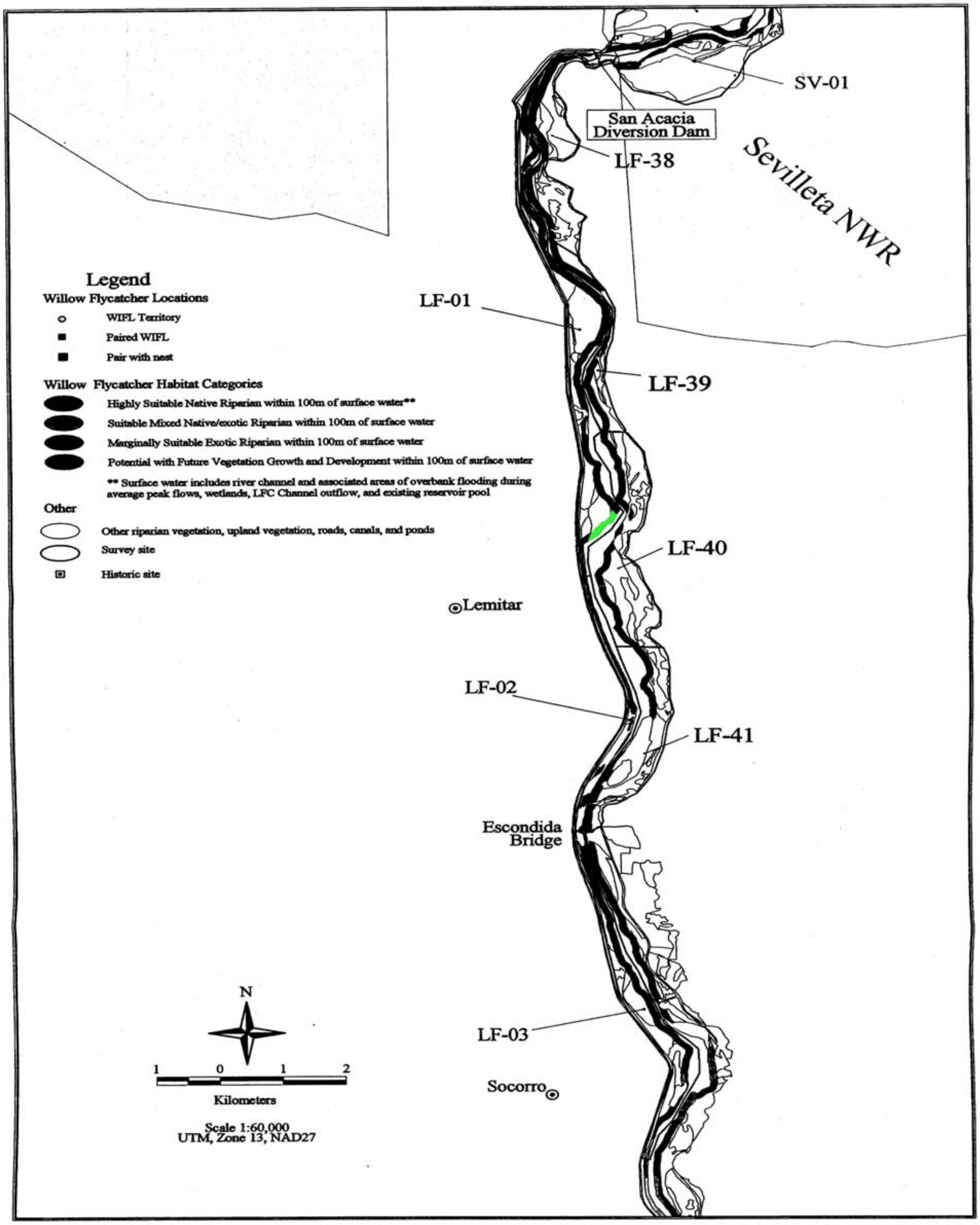

Figure 7. Willow flycatcher habitat categories and flycatcher survey study sites in Study reach.

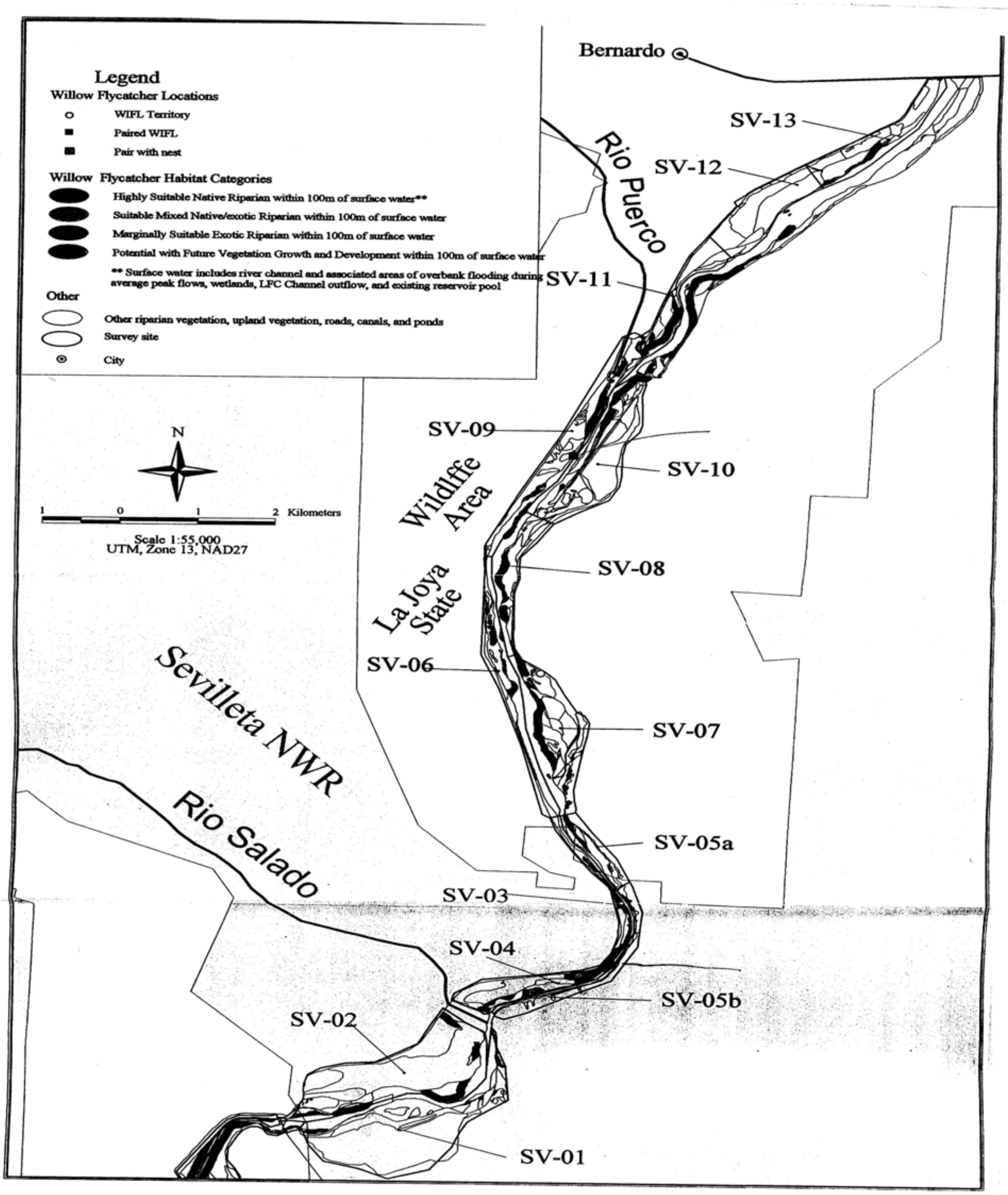

Figure 8. Willow flycatcher habitat categories and flycatcher survey study sites near Study reach.

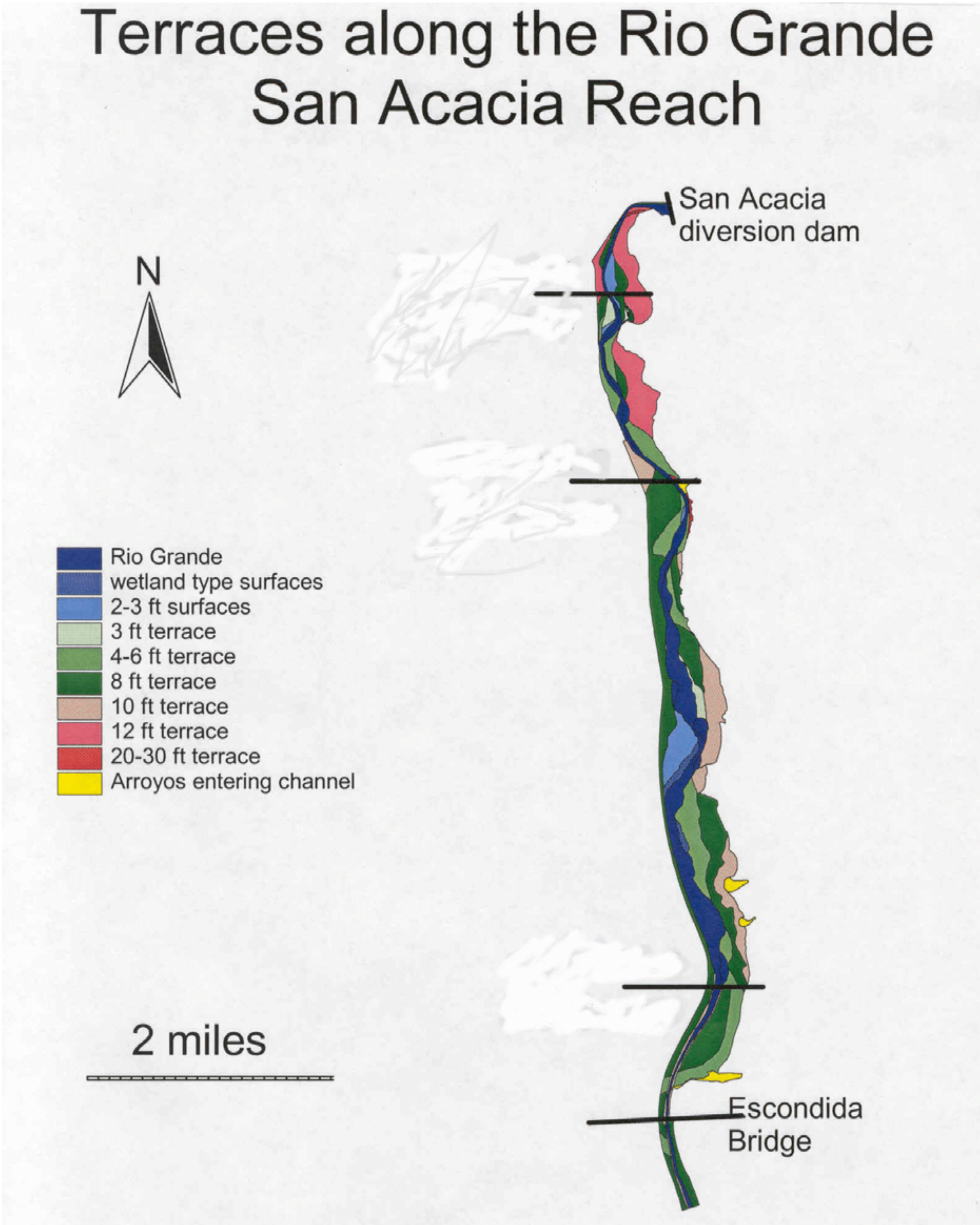

Figure 9. River bank terraces between San Acacia and Escondida Bridge.

Parrot feather

This information was compiled from Gibbons et al. (1994), Guillarmod (1979), Hotchkiss (1972), and Sytsma and Anderson (1989). *Myriophyllum aquaticum* gets its name from its feather-like leaves which are arranged around the stem in whorls of four to six. Parrot feather has both submersed and emergent leaves, with the submersed form being easily mistaken for Eurasian watermilfoil (*Myriophyllum spicatum*), a close relative. The submersed leaves are 1.5 to 3.5 cm long and have 20 to 30 divisions per leaf. The emergent leaves are 2 to 5 cm long and have 6 to 18 divisions per leaf. The emergent stems and leaves are the most distinctive trait of parrot feather. Submersed leaves are limp and often appear to be decaying but the stems are very robust. Stems can be five feet long. Adventitious roots form at the nodes. Flowers are inconspicuous (approx. 1/16" long) and are borne in axils of the emergent leaves. Parrot feather is a native of the Amazon River in South America but has naturalized worldwide, especially in warmer climates. In the U.S., it is found throughout the southern U.S. and northward along both coasts. It is found in freshwater lakes, ponds, streams, and canals and appears to be adapted to high nutrient environments. It tends to colonize slow moving or still water rather than areas with higher flow rates. While it grows best when rooted in shallow water, it has been known to occur as a floating plant in the deep water of nutrient-enriched lakes. The emergent stems can survive on wet banks of river and lake shores, so it is well adapted to moderate water level fluctuations. Parrot feather is a rhizomenous perennial. Shoots grow rapidly from overwintering rhizomes as water temperatures rise in the spring. Underwater leaves tend to senesce as the season advances, and the plant may die back to the rhizomes. However, in many cases parrot feather maintains considerable biomass throughout the winter. All of the parrot feather plants in North America are female. Since it lacks tubers, turions, and winterbuds, it spreads exclusively by fragments outside of its native range. It does not autofragment, but fragments can be formed mechanically. Parrot feather populations can be successfully harvested, but the dense tough rhizomes are very heavy and the plant can regrow rapidly. Rhizomes buried in sediment can survive overwinter without surface water.

Species Information

Rio Grande silvery minnow

Status and Reasons for Decline

Currently, the silvery minnow occupies less than 10 percent of its historic range and is restricted to the reach from Cochiti Dam to the headwaters of Elephant Butte. Within its current range, the silvery minnow has experienced wide fluctuations in abundance. The Federal Register (1993a) proposal to list the silvery minnow as an endangered species discusses many factors affecting the species. Development in the Rio Grande valley during the last century has adversely affected the middle Rio Grande riparian and aquatic ecosystem. Construction of mainstream dams and diversion structures have modified the natural flow of the river. These same structures also limit the upstream movement of fish. The diversion of water from the river channel, degradation of water quality, water resource development and management actions, and the introduction of non-native species are likely responsible for the decline or extinction of native fish, including the silvery minnow

(Crawford et al. 1993). Miller (1961) noted that human disturbances to the aquatic environment over the past century have probably had the most significant impact on the Rio Grande fish community.

The silvery minnow is listed as endangered (Group II) on the New Mexico state list of endangered species, having first been listed May 25, 1979 as an endangered endemic population of the Mississippi silvery minnow (*Hybognathus nuchalis*) (New Mexico Department of Game and Fish, 1988). On July 20, 1994, the Service published a final rule to list the silvery minnow as an endangered species with proposed critical habitat (Federal Register, 1994). Proposed critical habitat was identified as approximately 163 miles of the Rio Grande from the downstream side of State Highway 22 bridge crossing just below Cochiti Dam to the Atchison Topeka and Santa Fe Railroad bridge crossing near San Marcial.

Recent fish sampling efforts have been concentrated in the reach downstream of Angostura Diversion Dam due to access difficulties in the Cochiti reach. Population monitoring was conducted quarterly in 1993-1997 at 16-17 sites distributed in the Albuquerque (Angostura to Isleta Diversion Dam), Belen (Isleta to San Acacia Diversion Dam), and Socorro Reaches (San Acacia to Elephant Butte headwaters). Since 1998, population surveys have been conducted on a bimonthly or more frequent basis at 17-21 sites. The majority of silvery minnow (over 80 percent) were collected in the Socorro Reach. The Albuquerque and Belen Reaches each yielded about 10 percent of the total silvery minnow sampled. Over 80 percent of the total silvery minnow were young-of-year and were collected in July.

Life History and Ecology

Silvery minnow spawn in May or June (Platania, 1995). The silvery minnow is a broadcast spawner with semibuoyant, non-adhesive eggs. The eggs are carried in the drift for approximately 24-48 hours. Silvery minnow larvae move out of the main river flow about 3 days after hatching and seek low velocity habitat (Dudley and Platania, 1997). Silvery minnow exhibit rapid growth rates during their first year. Young-of-year (Age 0) individuals may attain lengths of up to 40-50 mm by December. Silvery minnow are able to reproduce as Age I fish. The maximum age for silvery minnow may be only 3 years. Food habits are thought to be similar to other species from the genus *Hybognathus*, i.e., bottom sediment containing plant and animal material (Sublette et al. 1990, Pflieger, 1980). Ongoing research should help quantify many of these issues.

Recent monitoring efforts (1997-2001) by the Service and American Southwest Ichthyological Research Foundation (ASIRF) indicate that spawning occurs in early May (Figure 10) in the San Acacia reach. Silvery minnows appear to prefer to spawn over silt or sandy-silt substrate (Sublette et al. 1990).

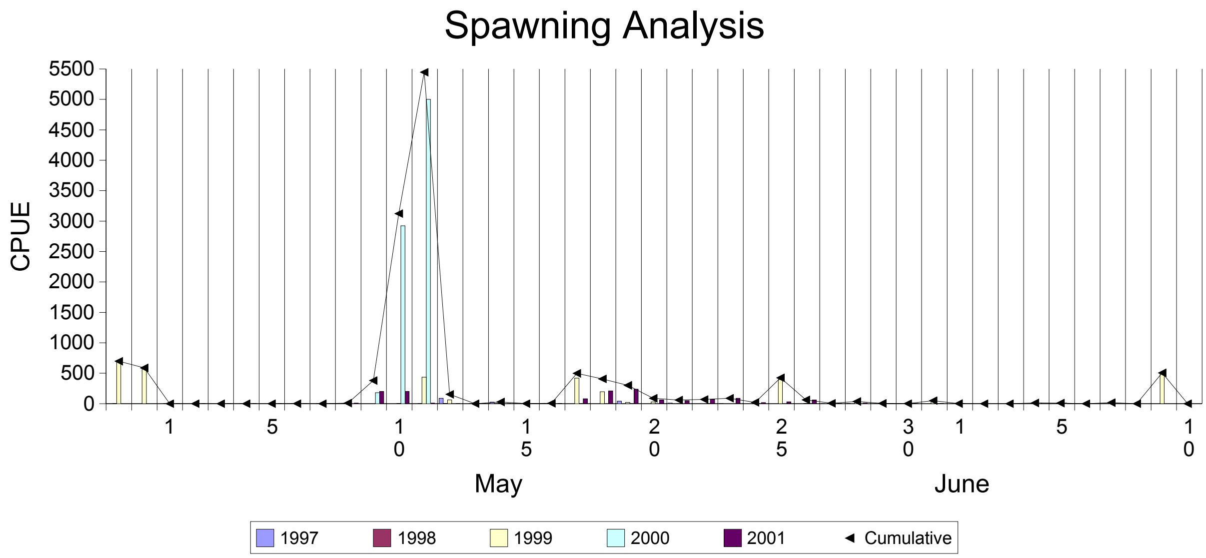

Figure 10. Silvery minnow egg collections in the vicinity of San Marcial (1997-2001).

Silvery minnow tend to prefer habitats composed of shallow to moderate depths with slow to moderate velocities over sand substrate. Adult silvery minnow are often encountered in shallow and braided runs over sand substrate (Bestgen and Platania, 1991). Backwaters and isolated pools, usually greater than 1m in depth, also support silvery minnow (Bestgen and Platania 1991). The use of overbank habitat by the silvery minnow during periods of seasonal flooding has been observed but not yet quantified. Young-of-year silvery minnow occupy primarily shallow, low velocity backwaters with sand-silt substrates. Young-of-year and adult silvery minnow are seldom found in the same local habitat type.

It appears that silvery minnow regularly seek refuge in response to localized changes in habitat conditions. Silvery minnow generally do not tolerate cool water temperatures, gravel or cobble substrates, strong currents, high salinity, highly channelized areas, or extended periods of channel drying. These fish appear to redistribute during periods of higher flow. Bestgen and Platania (1991) report that silvery minnow may move upstream during periods of low flow to escape areas where the channel is dry.

Key habitat components for the silvery minnow appear to be flow and substrate. Post runoff low velocity habitat appears to be important. Also low velocity habitat with vegetative cover is important in the winter. In most cases, zero velocity or high velocity main channel habitat is not used by the silvery minnow (Dudley and Platania, 1997). Main channel habitat may only be important during spawning (Dudley and Platania, 1997). An important substrate issue for the silvery minnow is the availability of sand versus gravel substrate.

Abundance in 11-Mile Reach of Rio Grande

Within the 11-mile reach of the Rio Grande below SADD, 5 sites were surveyed for fish during 1990-1993, and 2 sites were surveyed in 1999-2001. The data from these collections is summarized in Table 2. Red shiner (*Cyprinella lutrensis*), silvery minnow, flathead chub (*Platygobio gracilis)*, fathead minnow (*Pimephales promelas*), and river carpsucker (*Carpiodes carpio*) are the most abundant native species. Channel catfish (*Ictalurus punctatus*), common carp *(Cyprinus carpio*), and western mosquitofish (*Gambusia affinis*) are the most abundant non-native species. The importance of this reach to silvery minnow and native species overall is evident.

Abundance in 9.5-mile Reach of LFCC

Within the 9.5-mile reach of the LFCC below SADD, silvery minnow egg and fish sampling have been ongoing since 1995. Fish are sampled by electrofishing, large specimens were tagged for several years, and all fish are counted. Silvery minnow eggs are sampled using a Moore egg catcher (Altenbach et al. 2000).

Smith (1998) documented the entrainment of silvery minnow eggs (0.05-0.8 eggs / m^3) during experimental operations in May and June. Egg catch rates for 1998 ranged from 0.05 eggs / m^3 to 2.4 eggs / m^3. Egg sampling during experimental operations in 2001 collected a single silvery minnow egg (Platania pers comm) in 25 days of sampling. Experimental operations in 2001 did not coincide with peak silvery minnow spawning in the Rio Grande. No evidence of silvery minnow reproduction has been observed in the LFCC.

Species collected since the initiation of the study and their relative abundances is given in Table 3. Fathead minnow, common carp, white sucker, western mosquitofish, and channel catfish were the most common of the 16 species collected. Eight silvery minnow were collected in 1995-1996; they ranged in size from 54 to 76 mm standard length. The electrofishing catch rate of silvery minnows in the LFCC following experimental operations in 1997 ranged from 140 fish / hour (August) to 20 fish / hour (December). No silvery minnows were collected in 2001 prior to or following experimental operations. Smith (1999) noted a positive correlation between egg entrainment and subsequent numbers of silvery minnows in the LFCC following experimental operations.

Table 2. Summary of fish collections from sites within the 11-mile reach of the Rio Grande below San Acacia Diversion Dam made during 1990-1993,1999-2000, and 2001.

Species	5 sites 1990-1993	2 sites 1999-2000	2 sites 2001
black bullhead	1	2	0
channel catfish	124	495	13
common carp	30	148	8
fathead minnow	231	1583	16
flathead chub	599	2185	104
gizzard shad	1	0	0
green sunfish	0	0	0
largemouth bass	1	0	1
longnose dace	4	175	52
rainbow trout	0	0	0
red shiner	3303	2858	3402
Rio Grande silvery minnow	1198	493	323
river carpsucker	106	0	40
smallmouth buffalo	0	0	8
walleye	0	115	6
western mosquitofish	51	180	162
white sucker	5	3040	7
yellow perch	0	77	0

Table 3. Summary of fish collections from the 9.5-mile reach of the Low Flow Conveyance Channel made during 1995-1996 and 2001.

Species	1995-1996	2001
black bullhead	55	0
bluegill	0	2
channel catfish	128	16
common carp	931	86
fathead minnow	998	~1300
flathead chub	15	0
gizzard shad	15	3
green sunfish	1	0
largemouth bass	23	2
longnose dace	19	1
rainbow trout	10	0
red shiner	13	83
Rio Grande silvery minnow	8	0
river carpsucker	12	25
smallmouth buffalo	1	33
western mosquitofish	150	2
white sucker	495	9
yellow bullhead	0	4

Southwestern willow flycatcher

Status, Distribution, and Reasons for Decline

The Southwestern willow flycatcher (flycatcher) is federally listed as endangered (Federal Register, 1995). The final rule designating critical habitat for the species did not include any of the Rio Grande (Federal Register 1997). The flycatcher occurs in southern California, Arizona, New Mexico, southern portions of Nevada and Utah, western Texas, and possibly southwestern Colorado (Federal Register, 1995). In New Mexico, the flycatcher has been observed in the Rio Grande, Rio Chama, Zuni, San Francisco, and Gila River drainages. Available habitat and overall numbers of flycatchers have declined statewide. In recent years, breeding pairs have been found within the Middle Rio Grande Study Reach from Elephant Butte Reservoir upstream to the vicinity of Espanola.

During the last two centuries, human induced hydrological and ecological changes have heavily influenced the composition and extent of floodplain riparian vegetation along the middle Rio Grande (Bullard and Wells, 1992; Peddie, 1993). Introduction of exotic species, such as salt cedar, has decreased the availability of dense willow and associated desirable vegetation and habitat important to flycatchers. Fragmentation of forested breeding habitat may also play a role in population reduction of migratory birds (Lynch and Whigham, 1984; Wilcove, 1988). In addition, the rapid rate of deforestation in tropical areas has been cited as a possible reason for population declines in forest-dwelling landbird migrants (Lovejoy, 1983; Rappole and McDonald, 1994: Robbins et al. 1989). In addition, brood parasitism by brown headed cowbirds (*Molothrus ater*), has been implicated in the decline of songbirds including those found in the western riparian habitats (Gaines 1974, 1977, Goldwasser et al. 1980, Laymon 1987). Brown-headed cowbirds have increased their range with the clearing of forests and the spread of intensive grazing and agriculture. The declining flycatcher population continues to be placed in a precarious situation as a result of on-going habitat fragmentation which allows brown-headed cowbirds greater accessibility to host nests and the open-cup design which renders flycatcher nests available to parasitism (Mayfield 1977, Rothstein et al. 1980, Brittingham and Temple 1983, Laymon 1987).

Life History and Ecology

The flycatcher is an obligate riparian species occurring in habitats adjacent to rivers, streams, or other wetlands characterized by dense growths of willows (*Salix* sp.), *Baccharis*, arrowweed (*Pluchea* sp.), salt cedar (*Tamarix* sp.), or other species (Federal Register 1995). This habitat is often associated with a scattered overstory of cottonwood (*Populus* sp.) (Federal Register 1995).

The flycatcher is a late spring/summer breeder that builds nests and lays eggs in late May and early June and fledges young in late June or early July (Sogge et al. 1993; Tibbitts et al. 1994). In New Mexico, the flycatcher may be present in breeding territories as early as the beginning of May and as late as August. Nesting habitat for the willow flycatcher varies greatly by site and includes species such as willow, tamarisk, box elder, and Russian olive. Species composition, however, appears less important than plant and twig structure (Sogge, pers. comm.). Slender stems and twigs are important for nest attachment. Nest placement is highly variable. Nests have been observed at heights ranging from 0.5 m to 10 m and generally occur adjacent to or over water (Sogge, pers. comm.).

Summary of Recent Flycatcher Surveys

The Study reach, 9.5 miles of the LFCC and the adjacent river corridor, has been divided into the following study areas for flycatcher surveys: LF-01, LF-02, LF-38,LF-39, LF-40 and LF-41 (Figure 7). All six of these study areas were surveyed for the presence/absence of flycatchers in 1996, and 2000. The LF-01 study area was additionally surveyed in 1999 and 2001. The presence/absence of flycatchers was determined with a minimum of three surveys conducted from May to mid July during 1996, 1999 and 2000. In 2001, flycatcher surveys were conducted according to the current protocol of 5 surveys during the breeding season. Other riparian areas upstream and downstream of the Project were divided into study areas for flycatcher surveys. Study areas above San Acacia Diversion Dam (SADD) include SV-01 through SV13 (Figure 8). LF-03 is located below Escondida Bridge (Figure 7).

Monitoring Summary for Potential Flycatcher Breeding Habitat in the 9.5 mile Study Reach

In 1996, all six study areas within the Study reach were surveyed for flycatchers and none were detected on the surveys conducted from June 13 through July 6, 1996. Although a few small pockets of suitable habitat occurred near the levee, the habitat lacked sufficient density and structure and was considered unsuitable for breeding flycatchers (Ahlers and White,1996).

During 1999, LF-01 was surveyed 4 times for willow flycatchers between May 24 and July 8 and none were detected in the 6 miles of river reach within this study area.

During the 2000 breeding season, all six study sites within the Study reach was surveyed for the presence or absence of flycatchers. Two male flycatchers were observed in LF-01 on the west side of the river approximately 1.5 miles below the SADD on June 1.

In 2001, LF-01 was surveyed, five times between May 24 through July 27, and no flycatchers were detected (Ahlers et al. 2001). Description of the habitats and bird observations within the study sites of the study reach for each year are included in Appendix IV. Habitat descriptions are detailed on these forms.

Flycatchers Breeding Adjacent to the Study Reach

In 1999, following the detection of willow flycatchers during a series of neotropical migrant point counts, presence /absence surveys were conducted within a small reach of the riparian habitat on the Sevilleta NWR (Ahlers and White 2000). Four willow flycatcher pairs were discovered within the Sevilleta NWR, however only three nests were located. One was abandoned and the remaining two were successful. Three of the five young were believed to have successfully fledged from the nests. The outcome of the fourth pair is unknown. The LF-03 study site, below Escondida Bridge was also surveyed four times between May 24 and July 7, and 2 flycatcher migrants were detected.

In the 2000 season, presence/absence surveys and nest monitoring for flycatchers were again conducted within the Sevilleta NWR/LaJoya State Wildlife Area (SV-3,SV-4,SV-7, SV-9, SV-10 and SV-13) and at LF 03 below Escondida Bridge (Ahlers et al. 2001). Two males were detected at LF 03 on June 5. One nest was discovered approximately 4 miles upstream from SADD at study site SV-04 and four nests were discovered approximately 5 miles north of SADD at study site SV-03. Both of these study sites are just north of the Rio Salado on the Sevilleta NWR. Of the five nesting attempts, three were successful and two were assumed to have failed. Another nest was located approximately 13 miles north of SADD at study site SV-09 on the La Joya State Wildlife Area but was assumed unsuccessful. Of the three successful nesting attempts, the earliest estimated hatch date was June 23 and the latest estimated fledge date was August.

In 2001, presence/absence surveys and nest monitoring for flycatchers were conducted on the following study sites only SV03 and SV04 (Sevilleta NWR), SV 09 (La Joya State Wildlife Area), and LF-03 (near Escondida Bridge) (Ahlers et. al 2001). Site SV 03 had a total of six adults (3 pairs, 3 territories and 4 nests) and site SV 04 had two adults (1 pair, 1 territory and 1 nest). SV 09, which previously had one pair of flycatchers in 2000, had 13 willow flycatchers (6 pairs, 7 territories and 5 nests) in the 2001 breeding season (Ahlers et. al 2001). No flycatchers were detected at LF-03.

Other flycatcher breeding territories that the Bureau of Reclamation biologists are aware of to date are located approximately 50 miles upstream near Isleta Marsh and approximately 44 miles downstream near San Marcial.

Modeling River Channel Morphology

For the 11-mile study reach approximately 37 field cross sections were utilized for the HEC-RAS model. The modeling results (Appendix I) of four representative cross sections, two narrow (SA-1218, 1252), and two wide (SA-1274, 1298), demonstrate trends for the reach in terms of aquatic habitat for different hydraulic parameters. For the calculated hydraulic parameters trend analysis of water surface elevation, flow area, wetted perimeter, wetted river width, instream velocity, and channel depth show a general increase in these parameters as discharge is increased.

<u>Narrow Cross Section Hydraulic Parameter Trend Analysis (SA-1218 and SA-1252)</u>

Figures I.A and I.B show the water surface profiles of the narrow width cross sections SA -1218 and SA-1252 for 100-8,000 cfs. As shown the river channel width and wetted perimeter remains relatively the same for the range of flows evaluated. The river channel in this reach is incised and has abandoned the surrounding floodplain. Figure I.F demonstrates the minimal change in wetted channel width with increasing discharge. For SA-1252 there is a slight increase in the river channel wetted perimeter and width for the change in discharge between 3,500-6,000 cfs. The channel flow area shown in Figures I.E increases steadily for the different discharges without any significant changes between discharges.

<u>Wide Cross Section Hydraulic Parameter Trend Analysis(SA-1274 and SA-1298)</u>

Figures I.C and I.D show the water surface profiles of the wide cross sections SA-1274 and SA-1298 for 100-8,000 cfs. As shown in these figures for discharges in the range of 1,200-1,800 cfs, flows exceed the inner channel and start flooding more of the active floodplain. Figure I.F shows the incremental change in width for the different discharges. The channel width trend for flows between 100-1,800 cfs, indicates a large increase in width between 200-400 cfs at SA-1274. The width then stays relatively constant until the flows reach 1,200 cfs. The width increases steadily until the flow reaches 3,500 cfs. For flows above 3,500 cfs the width appears to remain relatively constant. For river cross section SA-1298, the channel width increases rapidly until about 1,800 cfs. Between 1,800-8,000 cfs the channel width continues to increase at a more gradual rate. The channel flow area (Figure I.E) increases steadily for the different discharges without any significant changes between discharges.

Depth and Velocity Trend Analysis (SA-1218, 1252, 1274, and 1298)

Appendix II shows the cumulative distribution plots for both the velocity and depth values for the 4 representative river cross sections. For low discharges in the range of 100-400cfs (Figures II.A-II.C), the depths are distributed between 0.5-3.0 ft with velocities distributed between 0.5-2.5 ft/s. For low discharges the depth is generally less than 1 ft, with velocities less than 1.5 ft/s. For discharges in the intermediate low range of 600-1,200cfs (Figures II.D-II.F), the depths are distributed between 0.5-4.0 ft. with the velocities are distributed between 0.5-3.0 ft/s. Depth is generally less than 2.5 ft. and velocities still less than 1.5 ft/s. For discharges in the intermediate high range of 1,800-3,500cfs (Figures II.G-II.I), the depths are distributed between 0.5-7.0 ft. with velocities distributed between 0.5-4.5 ft/s. Depths are less than 4.0 ft. though velocities have increased to 2.5 ft/s or less. For higher discharges in the range of 6,000-8,000 cfs (Figures II.J-II.K), the depths are distributed between 0.5-10.0 ft. and velocities are between 0.5-6.5 ft/s. Most depths are less than 6.0 ft, with velocities less than 4.0 ft/s.

HEC-RAS Modeling Results Considerations

A consideration for the HEC-RAS model analysis is that the model is a fixed bed model and does not account for scour in the main channel bed. Bed scour in the active channel will lower the water surface elevation and increase the velocities and depths in the river channel during the higher flows. Bed scour is primarily dependant on the stability of bed material particles and the momentum force of the flows. During the higher flows, greater shear stresses on the bed are experienced. The velocities and depths in the main channel increase due to the confining effects of bed scour on the channel width. A greater percentage of the flow is concentrated over the main channel width. Furthermore, based on the analysis by Massong et. al (2001), the river channel's sand bed should become completely mobilized at an effective discharge of 3,200 cfs. Massong et. al (2001) also indicates there is a discontinuous gravel layer underlying the sand layer in this reach ranging in depth from 1.8 feet to 3.2 feet below the sand layer. A discharge of 5,000 cfs was estimated to mobilize the gravel layer in this reach.

Other considerations for the modeling results is that the cross sectional data utilized is approximately 2 years old and the river channel due to its dynamic nature will change its form in response to hydrologic events. The model data was collected after the spring runoff of 1999 in the month of July and reflects the channel bed at that time. In August of 1999, a thunderstorm runoff event with an instantaneous peak of 7,000 cfs (Massong et. al, 2001) passed through the study reach. This event deposited sediments and altered the river channel geometry in the lower reaches below Alamillo Arroyo. Massong et. al.(2001) indicate that the upper reaches have adjusted their channel geometry to the current sediment and flow regimes. The lower reaches are still in a state of adjustment in terms of the width/depth ratio, slope, bed material size, and planform geometry. Since this flood event, no significant flood events have been experienced with the exception of the annual spring runoffs. Since this flood event was of such short duration (less than 24 hrs) the river condition eventually returned to its original state(s). Therefore, the assumption for a more representative channel geometry condition utilizing the July 1999 is considered appropriate for the general habitat characterization.

Based on the calibration information presented in Table 1 and Appendix I, the model's accuracy in predicting water surface elevations and depth is fairly accurate. The estimated average error in the water surface and depth estimates is approximately 0.25 ft. The maximum error is estimated to be 0.5 ft. based on backwater modeling experience and Manning's "n" calibration analysis.

Due to data limitations, comparison of velocity results was not possible. Previous analysis (Reclamation, 1996) for the LFCC Experimental Operations Biological Assessment demonstrated an accurate representation of the measured velocity values with the modeling results. Given the good match between the computed and measured water surface profiles and depth, it can be assumed that the computed velocities would be consistent with the actual instream channel velocities.

Analysis of the Effects of the Action

This analysis will addresses the effects of 1) parrot feather mechanical removal and 2) diversions of water from the Rio Grande into the LFCC on the silvery minnow and the flycatcher.

Rio Grande silvery minnow

<u>Parrot feather removal</u>
Reclamation funded studies have documented the presence of silvery minnow in the upper 9.5 miles of the LFCC. However, the species is not abundant in the reach. Silvery minnows in the LFCC ranged from 8 individuals in 1995-96, to a density of 140 / hour in 1997. During the 1996-1997 collecting trips, a total of 998 fathead minnow and 931 common carp, for example, were collected (Table 3). The number of silvery minnows in the LFCC appears related to egg entrainment (Smith 1999).

Although there is no evidence that removal of parrot feather with a dragline bucket dredge would remove any silvery minnow, it is conceivable that an individual may seek refuge among the vegetation and be incidentally collected in the bucket if it could not escape. If the individual is not tangled in vegetation within the bucket, it could possibly return to the LFCC as excess water drains from the bucket. In all likelihood, however, any silvery minnow actually collected in the bucket will perish.

A total of 7-8 miles of the total 9.5-mile reach are proposed to be dredged to remove parrot feather. The disturbances of heavy equipment in the area and the actual removal of vegetation will probably cause much of the fish community to flee from the immediate work area to undisturbed areas upstream and downstream. It can probably be assumed that not all silvery minnow will flee the area and that not all silvery minnow can evade the bucket. Actual take of silvery minnow cannot be quantified since there has been no population estimate derived from fishery research conducted in the LFCC. However, given the low numbers of silvery minnow encountered within the 9.5-mile reach the level of incidental take could be insignificant.

Water diversions into LFCC

It is generally accepted that the silvery minnow existing in the entire length of the LFCC do not comprise a viable population. There has been no evidence of reproduction occurring in the LFCC. Any individuals moving out at the downstream end of the LFCC near Elephant Butte Lake would enter into a lacustrine environment that is not suitable silvery minnow habitat. Any individuals exiting at the 9.5-mile outfall connection to the Rio Grande, would be reintroduced into proposed critical habitat where silvery minnow thrive.

The action of diverting water into the LFCC may influence 1) aquatic habitat in the river channel, 2) reproduction of the Rio Grande silvery minnow within the 11-mile reach, and 3) entrainment of Rio Grande silvery minnow. The effects of diversions on riverine habitat could potentially be the most important outcome of the proposed action. Thus, the core of this biological assessment lies within the determination of a river flow that has no deleterious effects on habitat suitable for native fishes, particularly the silvery minnow. Any entrainment and reproduction effects that may occur within the 11 miles are considered relatively minor. Smith (1999) suggested establishing a two-week period in mid-May to minimize entrainment of silvery minnow eggs.

Entrainment

As water is diverted from the Rio Grande into the LFCC, silvery minnow embryos and/or larvae have been entrained into the LFCC during May-June. An increase in adult flathead chub was observed within the 9.5 mile reach after cessation of emergency diversions during 1996. It is possible that adult silvery minnow may also be entrained. This potential effect was addressed in the previous BA/opinion concerning diversions and construction of the 9.5-mile outfall. Since then, drift net efforts were conducted on the Rio Grande near Socorro. Only two silvery minnow eggs were collected in the LFCC during 2001 experimental operations. Entrainment of silvery minnow eggs in the LFCC has been a continuing concern. Data collected during 2001 experimental operations using passively drifting particles shows rapid transport downstream at 300 and 600 cfs (Dudley and Platania, 2001). Calculated velocities for these particles ranges from 2-4 ft/s, resulting in a retention time in the LFCC of 12-24 hours. A small number of particles (<5%) apparently become trapped in eddies and debris, persisting in the LFCC for over a week. Entrainment of silvery minnow eggs in the LFCC experimental operations appears small, and because of the temporary outfall, many of the larvae that hatch in the channel will return to the river.

Reproduction

During the periods of time when water is being diverted into the LFCC, maximum discharge in the

11-mile reach of the river channel will be diminished. Below the outfall, river discharge should be similar to the natural discharge if LFCC diversions were not occurring. During May reduced discharge could potentially impact recruitment of silvery minnow within the 11-mile reach of the river.

During the spawning peak at San Acacia (Figure 8) the middle two weeks of May, flooded overbank areas provide habitat for incubating silvery minnow eggs and rearing the larvae. Reduced flows in mid May could potentially restrict rearing habitat within the 11-mile reach. Maintaining adequate overbank flooding during the middle two weeks of May should provide sufficient habitat for rearing larval silvery minnows.

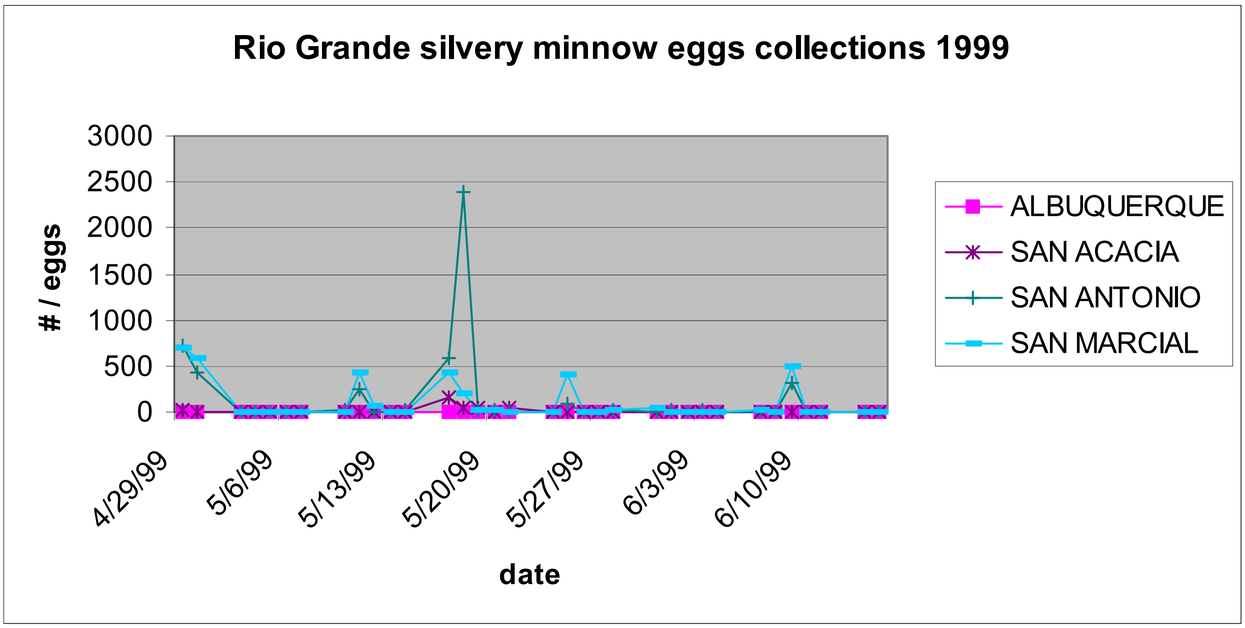

Figure 11. Silvery minnow egg collections at four sites in 1999.

<u>Aquatic Habitat</u>

Diversions into the LFCC will reduce the magnitude of discharge in the Rio Grande and could potentially impact the quality and quantity of aquatic habitat within the 11-mile reach. In determining the magnitude of diversions, there is a need to examine the relationship between river discharge and aquatic habitat. The Service has determined that a discharge of 50 cfs below SADD, provides the minimum habitat for silvery minnow.

Until 1996, there was no cross sectional data within the 11-mile reach that included depths, velocities, and discharge measurements. Downstream in the Socorro reach, there is a significant amount of such data collected over time at established cross sections. To determine the effects of a range of river discharges on aquatic habitat within the 11-mile reach below SADD, a model was applied to existing cross sections or rangelines within the reach (Appendix III).

Summary of aquatic habitat analyses

Aquatic habitat at various discharges has been characterized via computer modeling and analysis of actual field data. Flow guidelines agreed upon in the Programmatic Biological Opinion issued by the Service dated June 29, 2001 will be used in determining operational flows in the LFCC. These guidelines provide for minimum flows of 50 cfs at San Acacia during the irrigation season, and 50 cfs at San Marcial during the rest of the year. Combined with special precautions during the spawning season, these flows minimize the adverse impacts to the silvery minnow from this action.
Best available information indicates that silvery minnow tend to prefer slow to moderate velocities, shallow depths, and sand to sand-silt substrates. Silvery minnow would tend to avoid deep, high velocity, and zero velocity habitats and gravel substrates. Main channel runs may be used by silvery minnow only during spawning. Habitats suitable to silvery minnow are more commonly found in wide braided reaches rather than in narrow, incised reaches.

The first approximately 1.3 miles of the Rio Grande below SADD is characterized by a narrow channel and has a high proportion of gravel substrate. The remainder of the 11-mile reach is characterized by sand substrate. From approximately 1.3 to 10.5 miles below SADD, the river channel is moderately to highly broad, and approx. 4.5 miles of this section is considered highly braided. The river channel in the lower 0.5 mile of the 11-mile reach becomes narrow again.

At discharges of 350-400 cfs , computed wetted river widths in the 11-mile reach were within the range of 60-170 ft, and computed flow areas were within the range of 65-125 ft^2. At 400 cfs, computed data shows that 5 depth classes are available, with depths ranging from 0 to 2.5 ft. Over one-half of all depths represented are less than 1 ft. At 400 cfs, computed data shows that 8 velocity classes are available, with velocities ranging from 1.5 to 7 ft/sec. Approximately 30% of the habitat has velocities less than 2.5 ft/sec. Knowing that generated data tends to under-represent low velocity habitat, it is likely that additional low velocities would actually be available.

SA-1256 and SA-1268 represent a reach of the Rio Grande that is considered important for silvery minnow. This reach is wide and braided and composed primarily of sand substrate. The reach has a large diversity of habitat types at a range of discharges. At SA-1256 and SA-1268 measured availability of aquatic macrohabitats suitable to silvery minnow was sufficient in composition at all discharges monitored (56-1199 cfs). At 183 and 364 cfs, five macrohabitat classes were available: runs, flats, shoreline habitats, backwaters, and debris piles. The measured availability of depths and velocities suitable to silvery minnow was also sufficient at all discharges monitored. At 183 and 364 cfs, 4-6 depth classes were available with depths ranging from 0 to 3 ft. Depths less than 1 ft. were more common than deeper areas. This provides maximal habitat for silvery minnows, since all size classes prefer depths of 15-40 cm (Dudley and Platania, 1997). At 183 and 364 cfs, five velocity classes were available with velocities ranging from 0 to 2.5 ft/sec. Lower velocities were more common at SA-1268 than at SA-1256. Wetted river width decreased as discharge declined so the quantity of aquatic habitat is reduced with falling discharge. At SA- 1256 the decrease in wetted width was linear and steady. At SA-1268, wetted width decreased rather abruptly between 728 and 183 cfs. At a discharge of 350 cfs at this rangeline, wetted width would be approx. 380 ft. At a discharge of 385 at SA-1209 in the gravel-bottom narrow reach below SADD, wetted width was 86 ft. At a discharge of 364 cfs at SA-1256, wetted width was 220 ft.

Southwestern willow flycatcher

Surveys for flycatchers were conducted in 1996, 1999, 2000 and 2001. Only two male flycatchers were detected in study site LF-01 approximately 1.5 miles below SADD on June 1, 2000. No other flycatchers were detected in the study reach during other surveys performed in the area.

The habitat between the river and the LFCC in the 11-mile reach below SADD with the most potential to develop into suitable flycatcher habitat is characterized by 2-3 foot terraces which would become inundated with higher river flows (Figure 9). A small area of habitat (Figure 7) previously designated as highly suitable native riparian within 100 meter of surface water (green) was ground truthed in October 2001. Janik (pers. comm.) re-classified the site as potential habitat indicating the area has the plant species composition and is located within 100 meters of surface water (the river channel, or zone of peak flow inundation) but does not currently have the density or height to be suitable habitat. A few of these areas could develop into stands of adequate structure and/or density with growth or additional plant recruitment (Ahlers et al. 2001). The LFCC was not classified as a suitable indicator of surface water because it is usually isolated from suitable riparian vegetation by levees and roads on both sides. The study reach is not located within designated critical habitat for the flycatcher.

Removal of parrot feather will involve the use of heavy machinery along the LFCC. This activity along the LFCC will produce noise and general presence disturbances. Since flycatchers are not known to occupy the area, these disturbances will not directly or indirectly impact the flycatcher.

Diversion of water from the river channel into the LFCC will affect the magnitude of discharge in the river channel by various quantities throughout the 11-mile reach during test operations. A reduction of discharge in the river through diversion into the LFCC could reduce the acreage of riparian habitat that receives moisture or incipient flooding along the 11-mile reach of the river. Test operations could indirectly affect the riparian vegetation and potential willow flycatcher habitat in the study reach.

During May, experimental operations will not occur from May 10-25 to allow a two week period of non-LFCC diverted flows in the Rio Grande. During this period, river flows in excess of 1,500 are anticipated to provide overbank flooding in the 11 mile reach below San Acacia for silvery minnow and willow flycatcher habitat. Overbank flooding during this period would benefit potentially suitable flycatcher habitat. If overbank flows (above 1,500 cfs) are not anticipated during the May 10-25 period when experimental operations are not scheduled, the proposed action includes provisions for an extension of non-LFCC diversion for a 7-day period during runoff to allow for overbank flooding in the river floodplain below San Acacia. Additionally, during test operations, river discharges above 1,500 cfs could occur during the period from April to mid- June that would allow additional incipient flooding of river bars and low terraces. Inundation of these areas, would enhance potentially suitable flycatcher habitat within this reach.

Table 4. Estimated overbank wetted acres of riparian habitat from overbank flooding at specific controlled river discharge levels.

	Estimated Overbank Wetted Acreage				
River Discharge (cfs)	Sub-reach 1 and 2	Sub-reach 3	Sub-reach 4	Sub-reach 5	Sub-reaches 1-5
400	0	0	0	0	0
600	.61	0	0	0	.61
800	2.72	0	0	0	2.72
1000	10.16	0	0	0	10.16
1500	24.49	0	0	<1	25
2000	36.56	0	0	1	37.6
2500	45.92	2.9	0	4.7	50.6
3000	50.4	4.6	0	6.8	60.1
3500	53.74	4.7	<0.1	9.2	67.6
4000	54.02	4.7	<0.2	10.7	69.6
4500	54.07	4.7	<0.4	12.2	71.3
5000	54.13	4.7	<0.4	20.8	80.1
5500	54.18	4.8	<0.4	22.9	82.2
6000	54.21	4.8	<0.4	24.7	84.1
6500	54.26	4.5	<0.4	26.7	86.2
7000	54.31	4.5	<0.4	27.3	86.9

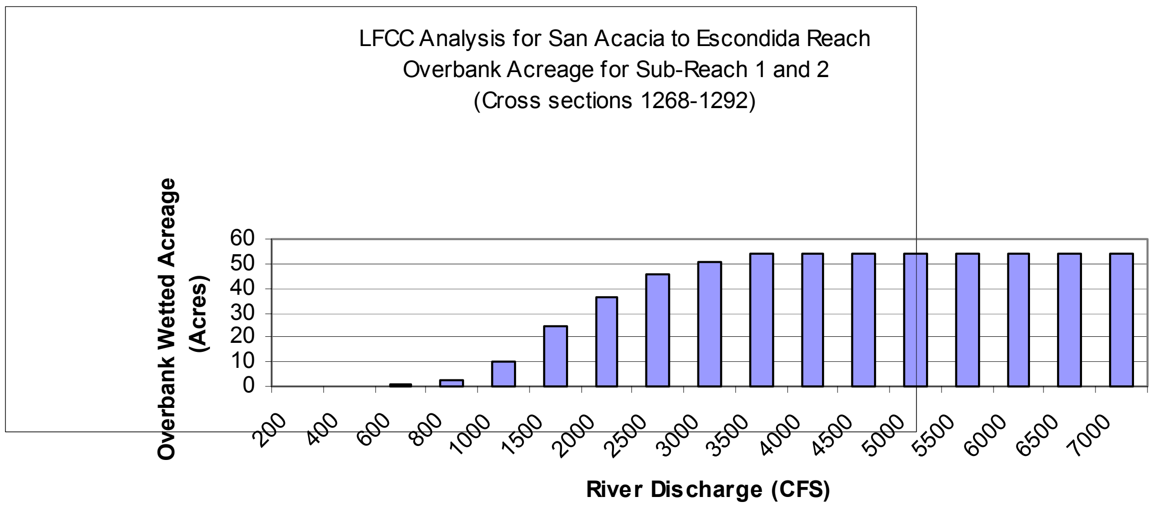

Figure 12. Total Overbank Acreage With Discharge for Sub-reach 1 and 2.

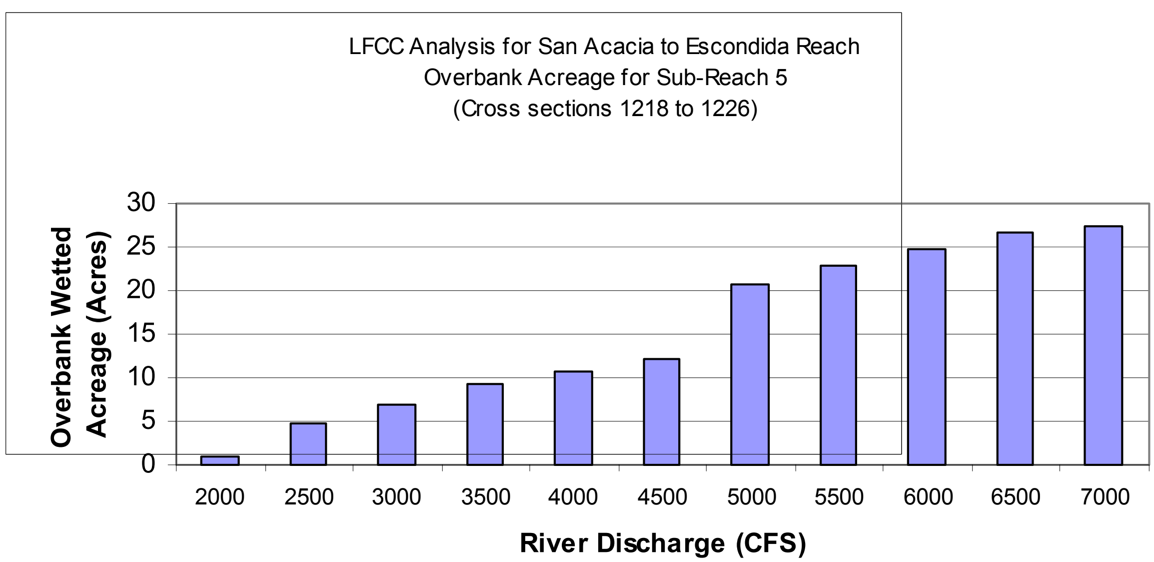

Figure 13. Total Overbank Acreage With Discharge for Sub-reaches 5.

Overbank Flooding in Riparian Areas

The potential impacts to riparian habitat has been evaluated by characterizing the extent of overbank flooding under various discharges for the river channel. A quantitative analysis of overbank wetted acreage with various river discharges derived from a one-dimensional backwater model HEC-RAS Version 3.0 (USACE 2001) was initiated. The modeling utilized approximately 37 river cross sections located in the 11 mile reach for representative channel cross sectional geometry. Aerial photography for each reach was used to estimate (to the nearest ten feet) the downstream overbank and channel distance for input into the model. The maximum overbank flooding and wetted acreage occurs when discharges are high enough to inundate the 2-3 foot terraces (Figure 9). Table 4 indicates the estimated wetted acreage for each sub-reach by river discharge determined from the model analysis. Detailed sub-reach analysis of overbank acreage for sub-reach 1 and 2, and 5 are shown in Figures 12 and 13, with the sub-reach map in Appendix III. Using the model analysis, a discharge of 1,500 cfs would inundate approximately 25 acres of riparian habitat in all 5 sub-reaches, 2,000 cfs would inundate 38 acres of riparian habitat and 5,000 cfs would inundate approximately 80 acres of riparian habitat.

Key Potential Habitat Areas Within the Study Reach

Although the model analyzes the acreage of 2-3 foot terraces that would be inundated under various discharge scenerios, not all these areas have the components of species, age, and structure to become suitable flycatcher habitat. During October 2001, riparian habitat was ground truthed to evaluate the vegetative components of these 2-3 foot terraces and the potential for these areas to development into suitable flycatcher habitat with future growth. Based on these field reviews, approximately
80 acres of riparian habitat on these terraces within all sub-reaches have the potential to actually develop into suitable flycatcher habitat with inundations at 5,000 cfs. Approximately 25 acres have the potential to develop into suitable flycatcher habitat with inundations at 1,500 cfs. Aerial photographs delineating riparian habitat within 2-3' terraces that have the most potential to develop suitable flycatcher habitat are shown by sub-reach in Appendix III.

Cumulative Effects

Future state or private activities, not involving Federal activities, that are reasonably certain to occur within the proposed Study reach include the return of irrigation water from the Middle Rio Grande Conservancy District (MRGCD) to the LFCC. These returns would not affect listed species, but would interfere with experimental LFCC operations. Discharge will be carefully controlled during operations, and returns from MRGCD will be taken into consideration and coordination with MRGCD regarding modifications to these returns may be critical. Diversions by MRGCD from the Rio Grande into the Socorro Main Canal at SADD do not directly impact the LFCC, but they do impact the river and Reclamation's ability to divert additional water into the LFCC. Experimental operations of the LFCC must be closely coordinated with MRGCD. Reclamation's responsibility with the action of diverting water into the LFCC and ensuring that at least 50 cfs remain in the river channel below SADD during diversions into LFCC includes all diversions.

Effect Determinations

Rio Grande silvery minnow

The 9.5-mile reach of the LFCC is not located in proposed critical habitat; however, this reach of the Rio Grande is part of proposed critical habitat. Diversion of water from the river may alter aquatic habitat in the Rio Grande during the times diversions are made. As proposed, aquatic habitat will not be reduced to a level that would limit availability nor quality of habitats suitable to the silvery minnow. Though environmental commitments are designed to minimize the number of minnows in the LFCC, removal of parrot feather could conceivably disturb and/or incidentally collect individual silvery minnow present in the LFCC. Thus, the proposed diversions may affect, likely to adversely affect the silvery minnow and will not result in an adverse modification or destruction of proposed critical habitat, and parrot feather removal procedures may adversely affect the silvery minnow.

Incidental take of silvery minnow could potentially occur as a result of methods used to remove the parrot feather. The number of individuals that may be taken as a result of the proposed action is indeterminable since the silvery minnow population within the 9.5 mile reach of the LFCC is extremely low and highly variable . Nonetheless, the level of take can be presumed to be low and insignificant based on previous surveys (1995-2001).

The potential for incidental take of silvery minnows during parrot feather removal is low due to changes in conducting experimental operations. Conservation measures have been specifically designed to minimize entrainment of the eggs and larvae, the life stages most vulnerable to entrainment during diversions into the LFCC. Monitoring for egg drift during experimental operations provides data for evaluating entrainment of eggs or larvae in the LFCC. Fish surveys before and after experimental operations provide estimates of minnows present in the LFCC. Recent surveys (2001) of the LFCC have not found any silvery minnows. Furthermore, the outfall provides a route for any entrained minnows to escape back to the river. Since the viability of a silvery minnow population within the LFCC is doubtful, conservation measures which minimize entrainment provide the greatest benefits for the silvery minnow. The proposed magnitude and timing of diversions described in this assessment were developed to ensure that habitat in the river channel would be maintained in quality and quantity to promote recovery of the species.

Southwestern willow flycatcher
The proposed study reach has been surveyed for breeding flycatchers and no territories or nests were detected. Currently, there is one area of suitable breeding habitat present within sub reach 1 and 2, however, it has been surveyed and no flycatchers were present during the breeding season or during spring migration during surveys conducted in the year 2000. The area is not located within designated critical habitat for the flycatcher. Some habitat along the river channel and LFCC may be used by migrating flycatchers. Thus, the proposed diversions may affect, but are not likely to adversely affect the flycatcher.

Environmental Commitments

1) Maintain the LFCC outfall following experimental operations of the 9.5-mile reach.

2) Experimental operations of the LFCC will be conducted under the flow guidelines agreed upon in the Programmatic Biological Opinion. Experimental operations may be conducted from May 26 to May 9 the following year when 1) a minimum flow of 50 cfs over San Acacia Diversion Dam and 2) a minimum flow of 50 cfs at the San Marcial Floodway gage can be safely maintained.

3) In addition, Reclamation water managers will maintain a daily average flow of 150 cfs over San Acacia Diversion Dam during experimental operations for maintaining the minimum flow requirements from the Programmatic Biological Opinion.

4) During experimental operations startup, when flows are above 500 cfs in the main channel, flows may be adjusted in 360 cfs increments (1 ft elevation change in the LFCC) every hour. When flows in the main channel are less than 500 cfs, flows in the LFCC will be adjusted in 50 cfs increments every hour.

5) No experimental operations will occur during the peak spawning period at San Acacia for the Rio Grande silvery minnow from May 10 to May 25.

6) During the May 10-25 period, normal flows over San Acacia Diversion Dam should provide overbank flooding in the 11 mile reach below San Acacia for willow flycatcher and silvery minnow habitat.

7) If overbank flows above 1500 cfs are not anticipated during the May 10-25 period when experimental operations are scheduled to be shut down, the proposed action includes provisions to schedule another experimental operations shut down period to allow up to an additional seven days of undiverted flows during the spring runoff to allow for overbank flooding in the river floodplain below San Acacia.

8) Reclamation will electrofish areas of the LFCC scheduled for parrot feather removal within

6 days prior to removal of the vegetation. Silvery minnows will be collected and relocated to adjacent sections of the Rio Grande. Parrot feather removal in the LFCC will move from the upstream end in a downstream direction. Reclamation will notify the Service one week prior to sampling and communicate results with 48 hours after sampling.

9) Continue funding fish community surveys in the LFCC and in the Rio Grande. Quarterly fish community surveys will be conducted in LFCC by Reclamation or a Service approved contractor.

10) Reclamation will survey the upper LFCC pools for stranded silvery minnows within 48 hours following termination of experimental operations. At the conclusion of experimental operations, a sustaining flow of about 50 cfs will be maintained in the LFCC until biologists can initiate the fish survey.

11) Continue funding silvery minnow egg surveys in the Rio Grande during May. Silvery minnow egg surveys will be conducted in the LFCC during May and June experimental operations.

12) Continue funding flycatcher presence/absence surveys and nest monitoring along the middle Rio Grande. Potentially suitable habitat identified during previous mapping surveys will be monitored to determine if it has developed components to become suitable habitat.

13) Continue funding habitat (depth, velocity, macrohabitat) data collection in San Acacia reach.

14) Develop a database and analysis tools to study aquatic habitat and fish communities in the San Acacia reach.

15) Reclamation (150, 240, 420) will schedule a coordination meeting (January or February) with the Service each calendar year to review proposed experimental operations, scheduling, and river flows in the area.

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APPENDIX I

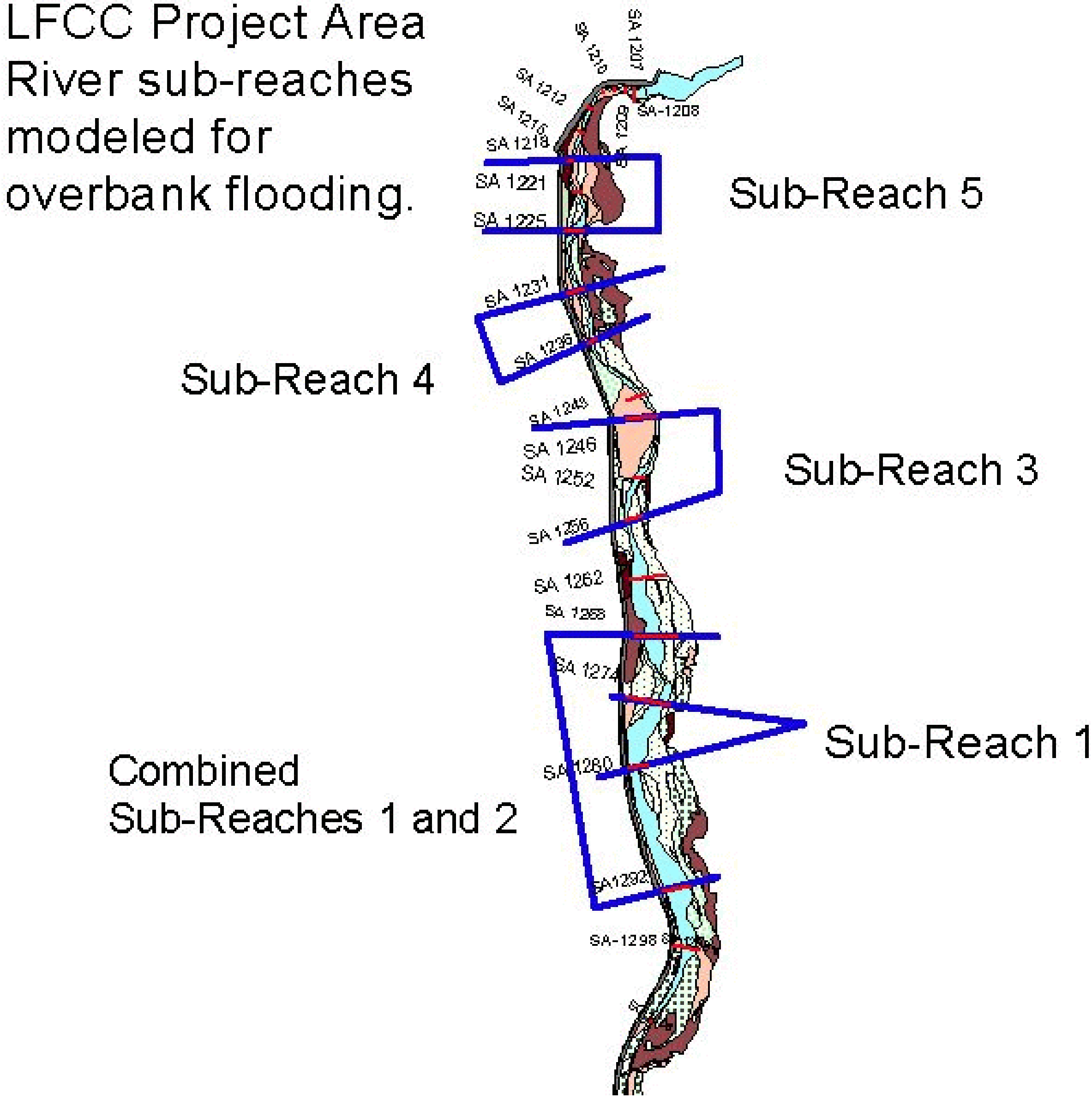
COMPARISON PLOTS OF COMPUTED VS. MEASURED WATER SURFACE ELEVATIONS AND INSTREAM CHANNEL DEPTHS - 1218, 1252, 1274, 1298

APPENDIX II

CUMULATIVE DISTRIBUTIONS PLOTS
OF
INSTREAM DEPTHS AND VELOCITIES
FOR DISCHARGES 100-8000CFS

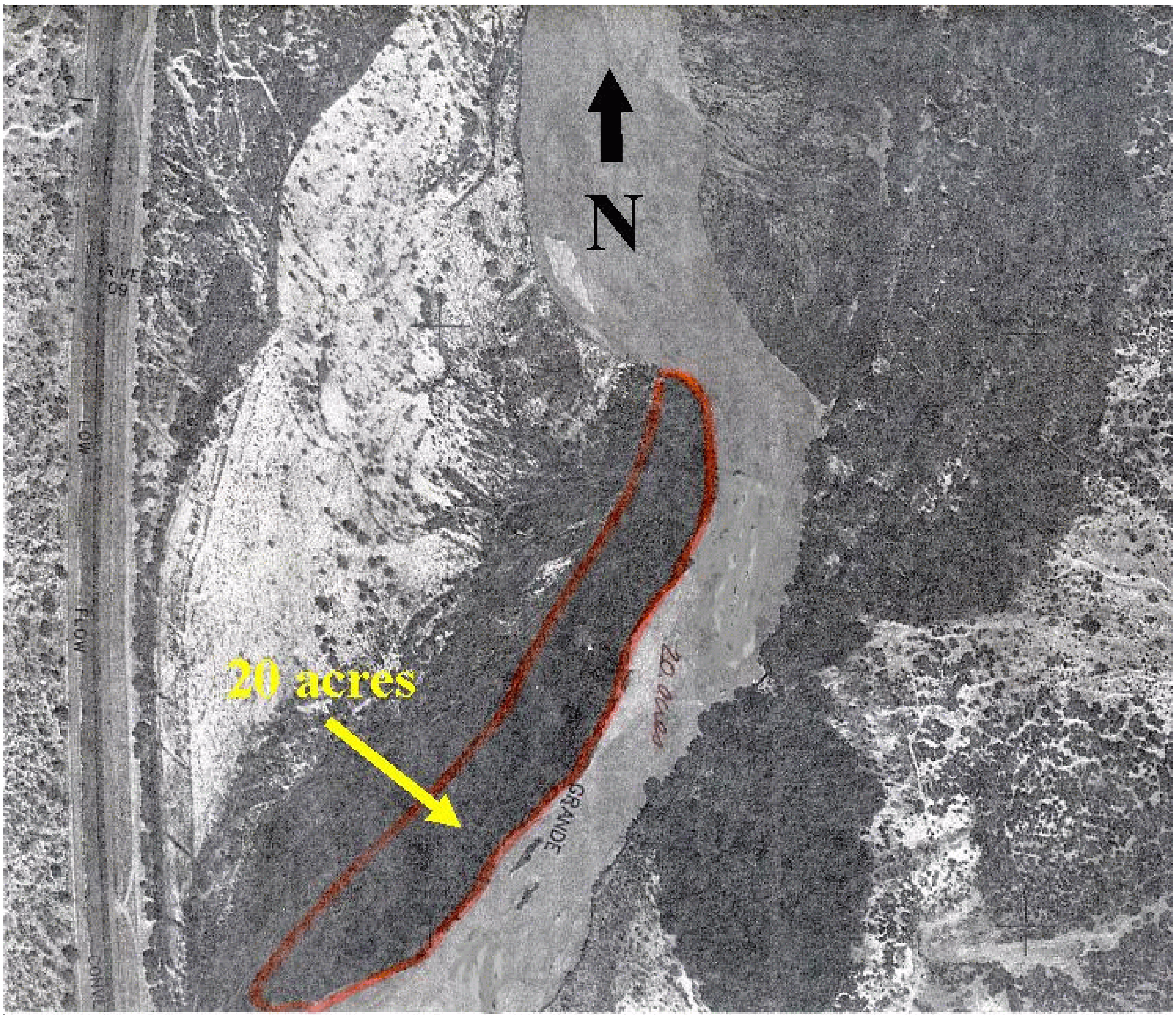
APPENDIX III

AERIAL PHOTOGRAPHS OF RIPARIAN HABITAT DELINEATED AS KEY AREAS FOR POTENTIAL WILLOW FLYCATCHER HABITAT



Study reaches below San Acacia Diversion Dam for flycatcher surveys.

Potential flycatcher habitat in San Acacia subreach 5 (3 foot terrace).



Flycatcher habitat in San Acacia subreach 1, cross-section 1274-1280 (2-3 foot terrace).

APPENDIX IV

SOUTHWESTERN WILLOW FLYCATCHER SURVEY FORMS FOR SURVEYS CONDUCTED ALONG 11-MILE REACH OF THE RIO GRANDE AND LOW FLOW CONVEYANCE CHANNEL BELOW SAN ACACIA DIVERSION DAM
1996, 1999 and 2000