MIDDLE RIO GRANDE
ISLETA REACH RIVERINE RESTORATION PROJECT
DRAFT ENVIRONMENTAL ASSESSMENT

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ACRONYMS

ARMS	Archaeological Records Management Section
BiOp	Biological Opinion
BMPs	Best Management Practices
CFR	Code of Federal Regulations
CFRP	Collaborative Forest Restoration Program
cfs	cubic feet per second
CWA	Clean Water Act
dBA	decibel A-weighted
DEM	digital elevation model
DO	dissolved oxygen
EA	Environmental Assessment
ESA	Endangered Species Act
FR	Federal Register
ITA	Indian Trust Assets
LiDAR	Light Detection and Ranging
LP1DR	Lower Peralta #1 Riverside Drain
LWD	large woody debris
MBTA	Migratory Bird Treaty Act
MEI	Mussetter Engineering, Inc.
MRG	Middle Rio Grande
MRGCD	Middle Rio Grande Conservancy District
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMAC	New Mexico Administrative Code
NMDGF	New Mexico Department of Game and Fish
NMISC	New Mexico Interstate Stream Commission
NMOSE	New Mexico Office of the State Engineer
NMSU	New Mexico State University
NMWQ	New Mexico Water Quality
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NTU	nephelometric turbidity unit
RPA	Reasonable and Prudent Alternatives
SHPO	State Historic Preservation Officer
SSED	suspended sediments
SSPA	S.S. Papadopulos and Associates, Inc.
SWCA	SWCA Environmental Consultants
TCP	traditional cultural property
TDS	total dissolved solids
USACE	U.S. Army Corps of Engineers
USC	United States Code
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
v/v	volume/volume

1.0 PURPOSE AND NEED FOR ACTION

1.1 INTRODUCTION

The New Mexico Interstate Stream Commission (NMISC) is proposing to implement the *Isleta Reach Riverine Restoration and Habitat Improvements for the Rio Grande Silvery Minnow and Bosque Ecosystem* (project), a river restoration project in sections of the Isleta Reach of the Middle Rio Grande (MRG) from the southern Isleta Pueblo border to the San Acacia Diversion Dam (Figure 1.1). The NMISC is working in collaboration with the Middle Rio Grande Conservancy District (MRGCD) in implementing the *Post-fire Bosque Restoration in the Middle Rio Grande: A Landscape-Scale Approach Towards Revitalization of an Ecosystem*, an ecosystem restoration project funded through a grant proposal submitted to the U.S. Forest Service Collaborative Forest Restoration Program (CFRP). The combined projects will provide benefit for the federally listed Rio Grande silvery minnow (*Hybognathus amarus*; silvery minnow), Southwestern Willow Flycatcher (*Empidonax traillii extimus*; flycatcher), and the Rio Grande ecosystem as a whole. The combined projects, when implemented, will contribute to the Middle Rio Grande Endangered Species Collaborative Program's (Collaborative Program's) goal of meeting the habitat restoration requirements as stated in Element S of the Reasonable and Prudent Alternatives (RPA) in the March 2003 Biological Opinion (2003 BiOp: U.S. Fish and Wildlife Service [USFWS] 2003). This document covers the two separate but collaborative projects between the NMISC and the MRGCD listed above.

The project will build upon the NMISC's previous habitat restoration work in the MRG between 550 Bridge and I-25 Bridge in the Albuquerque Reach. The NMISC's habitat restoration goals for the Isleta Reach include 1) diversifying mesohabitat types, focusing on spawning, egg retention, larval fish, and young-of-year habitat; 2) creating refugial habitat for silvery minnow during prolonged dewatering/no-flow periods in locations that are adjacent to perennial water sources; 3) designing strategic inundation of disconnected bosque habitat to encourage and increase the extent of overbank inundation; and 4) encouraging fluvial processes and river dynamics (SWCA Environmental Consultants [SWCA] 2008a). The project will apply restoration techniques identified in the MRG Habitat Restoration Plan (Tetra Tech 2004) and the Restoration Analysis and Recommendations for the Isleta Reach of the Middle Rio Grande, New Mexico (Parametrix 2008). The project will complement any existing or planned projects in the Isleta Reach to create suitable habitat for the silvery minnow. Lessons learned from the monitoring of previous projects (SWCA 2007a, 2008b, 2008c) were applied to the site selection and the final design of specific habitat restoration projects proposed here.

The CFRP project intends to implement an ecological restoration project in the riparian area adjacent to what was Willie Chavez State Park. A fire in February 2007 burned the approximately 100-acre (40.5-hectare) site and destroyed a large portion of the Rio Grande cottonwood (*Populus deltoides* spp. *wislizeni*) dominated bosque on the west bank of the project area. This area has been identified by the MRGCD as an important restoration area, particularly as it is now subject to invasion by non-native saltcedar (*Tamarix ramosissima*) and Russian olive (*Elaeagnus angustifolia*). The goal of the CFRP project is to restore landscape diversity and ecological integrity of a post-fire riparian forest, provide efficient and effective tools for measuring success of this project and other bosque restoration efforts, demonstrate ecologically sound forest restoration techniques, and communicate those results to a larger public through

educational programs. The CFRP project will enhance work implemented by the NMISC through active vegetation management and ongoing monitoring. Vegetation management will include controlling non-native phreatophytes, restoring native cottonwood riparian gallery forests, and restoring habitat for the benefit of the flycatcher.

This Environmental Assessment (EA), completed in accordance with provisions of the National Environmental Policy Act (NEPA), evaluates potential direct, indirect, and cumulative impacts of the combined NMISC and MRGCD projects to all resources within the project area during project implementation. The project is anticipated to be implemented in early 2009. Further consultation and acquisition of permits would take place, as required, when specific detailed plans for subsequent phases become available.

Figure 1.1. Project location map.

1.2 PROPOSED ACTION LOCATIONS

1.2.1 ISLETA REACH

The Isleta Reach of the MRG stretches from the Isleta Diversion Dam south of Albuquerque to the San Acacia Diversion Dam (see Figure 1.1). Here, the Rio Grande is a predominantly sand-bedded channel that has experienced significant channel degradation since the closure of Cochiti Dam. Flood control activities have caused the river to be significantly channelized through the Isleta Reach. The reduced magnitude of peak flows and the presence of non-native phreatophytes have resulted in stabilization of the river planform and disconnection of the channel from its historic floodplain (Mussetter Engineering, Inc. [MEI] 2008). Channel degradation has resulted in a reduced frequency and duration of inundation of bosque lands outside the floodway and the bank-attached and mid-channel bars within the floodway. The resulting changes have caused a loss of habitat required to meet the life stages of the silvery minnow.

A detailed understanding of the specific responses of the river to these changes at each of the identified sites is necessary for successful implementation of habitat restoration measures. Site-specific information on river conditions is developed from a number of investigations of the Rio Grande performed over the past several years, including:

- NMISC's study of MRG bar morphology and dynamics (MEI 2005a).
- Geomorphic and Sedimentologic Investigation of the Middle Rio Grande (MEI 2002).
- Sediment continuity analysis of the MRG funded by the NMISC and the Upper Rio Grande Basin Water Operations Review (MEI 2004).
- U.S. Army Corps of Engineers (USACE) Spring 2005 Inundation Mapping of the Middle Rio Grande (USACE 2007a).
- USACE FLO-2D Modeling (calibrated to the 2005 peak flows) of the Middle Rio Grande (MEI 2005b).
- NMISC Riparian Groundwater Modeling of the Middle Rio Grande Corridor (S.S. Papadopulos and Associates [SSPA] 2003).
- NMISC river flow monitoring in support of fish rescue and biological flow requirements (River Eyes) (SSPA 2005).
- Characterization of silvery minnow egg and larval drift and retention study (SWCA 2007b).
- U.S. Bureau of Reclamation (Reclamation) experimental activities on the MRG (SWCA 2008d)
- Technical Memorandum: Isleta Reach Riverine Restoration Hydrological Analysis and Hydraulic Modeling (MEI 2008).

Designs based on updated hydrological analysis and hydraulic modeling (MEI 2008) were developed for each site restoration treatment. Hydrological analysis included mean daily flow analysis using gage records from the Rio Grande Floodway near Bernardo (U.S. Geological Survey [USGS] Gage No. 08330010) and flood-frequency analysis using flood-frequency values developed by the USACE (2007a). HEC-RAS modeling was used to determine the water-surface

profiles over a range of steady state discharges to determine inundation discharge for islands and bank-attached bars. FLO-2D modeling was conducted using the 250-foot grid to assess the channel capacity, overbank flows, and overbank flow paths at discharges greater than channel capacity. Both models used topographic data, a digital elevation model (DEM), and contour shapefiles obtained from Light Detection and Ranging (LiDAR) topographic data acquired in March 2008. Modeling outputs show a topographical representation of the site before restoration and cross sections of the river channel. These engineering designs take into account potential increased sediment retention in the modified sections of the river as well as potential flow-through velocities and depths.

As shown in Figure 1.2 and Figure 1.3, the two subreaches of the Isleta Reach proposed for restoration/rehabilitation techniques in Isleta Reach Habitat Restoration Phase 1 are the Peralta and Lower Peralta #1 Riverside Drain (LP1DR) subreaches. These subreaches lie within the Los Lunas Subreach and the Belen Subreach, respectively, as defined in the Restoration Analysis and Recommendations for the Isleta Reach (Parametrix 2008). Figure 1.4 shows the burn area MRGCD proposes to remediate. Brief descriptions of the existing conditions in the Peralta and LP1DR subreaches are contained in Sections 1.2.2 and 1.2.3.

1.2.2 PERALTA SUBREACH

The Peralta Subreach (Figure 1.2) is demarcated by the Peralta wasteway outfall at River Mile 152.5 (River Kilometer 245.4) to the north and the LP1DR wasteway outfall at River Mile 149.6 (River Kilometer 240.8) to the south. The approximate subreach length is 2.9 miles (4.7 km). Overbank inundation occurs at approximately 5,000 cubic feet per second (cfs). Level-1 (low-relief bars formed during recessional flows) and Level-2 bank-attached bars (bars formed by additional deposition onto Level-1 bars) give the appearance of a meandering, single-thread channel within a well-defined channel. Islands appear to be primarily Level-1 (formed from linguoid bars during recessional flows) and Level-2 braid bars (formed from vertical accretion of sand onto Level-1 braid bars) with a few stabilized mid-channel bars. The river channel throughout this subreach has a nominal 600-foot (183-m) channel width as designed under Reclamation's Middle Rio Grande Project. This subreach has intermittent flow during irrigation season due to influx from the Peralta wasteway (SSPA 2005). The bosque through this subreach has been affected recently by fire and has also had forest clearing activities to minimize future fire potential. This subreach also includes a small wetland area on the west side of the river called "Boys Pond," which is managed by the MRGCD. Within this subreach, the following modifications are being proposed:

- Increase mesohabitat diversity, focusing on egg retention, larval fish, and young-of-year (e.g., backwater, embayments, and bankline terrace creation).
- Create low-flow refugia by creating in-channel pools (created and maintained with large woody debris [LWD] or other physical structures) to provide dewatering/no-flow habitat.

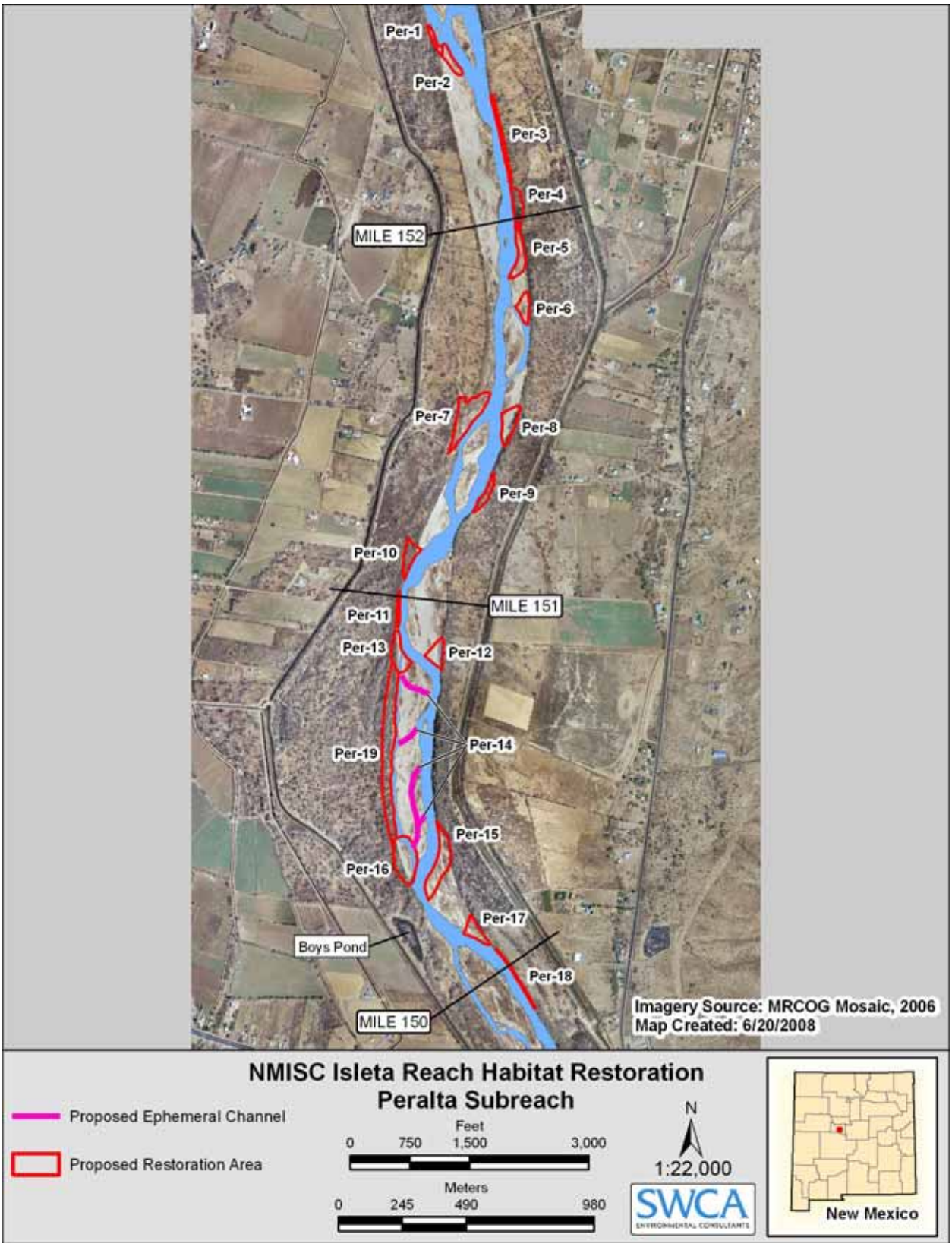

Figure 1.2. Peralta Subreach restoration sites.

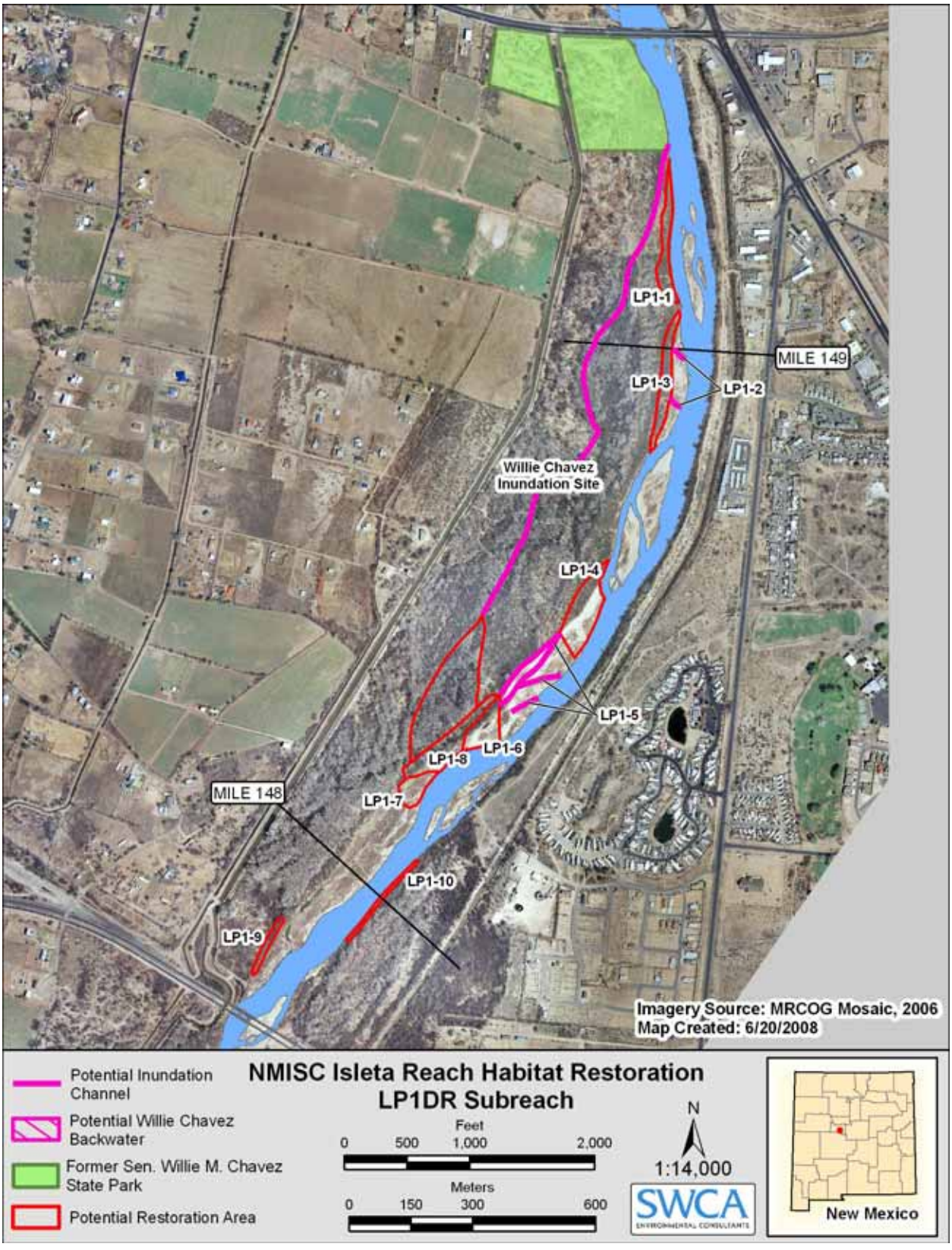

Figure 1.3. LP1DR Subreach restoration sites.

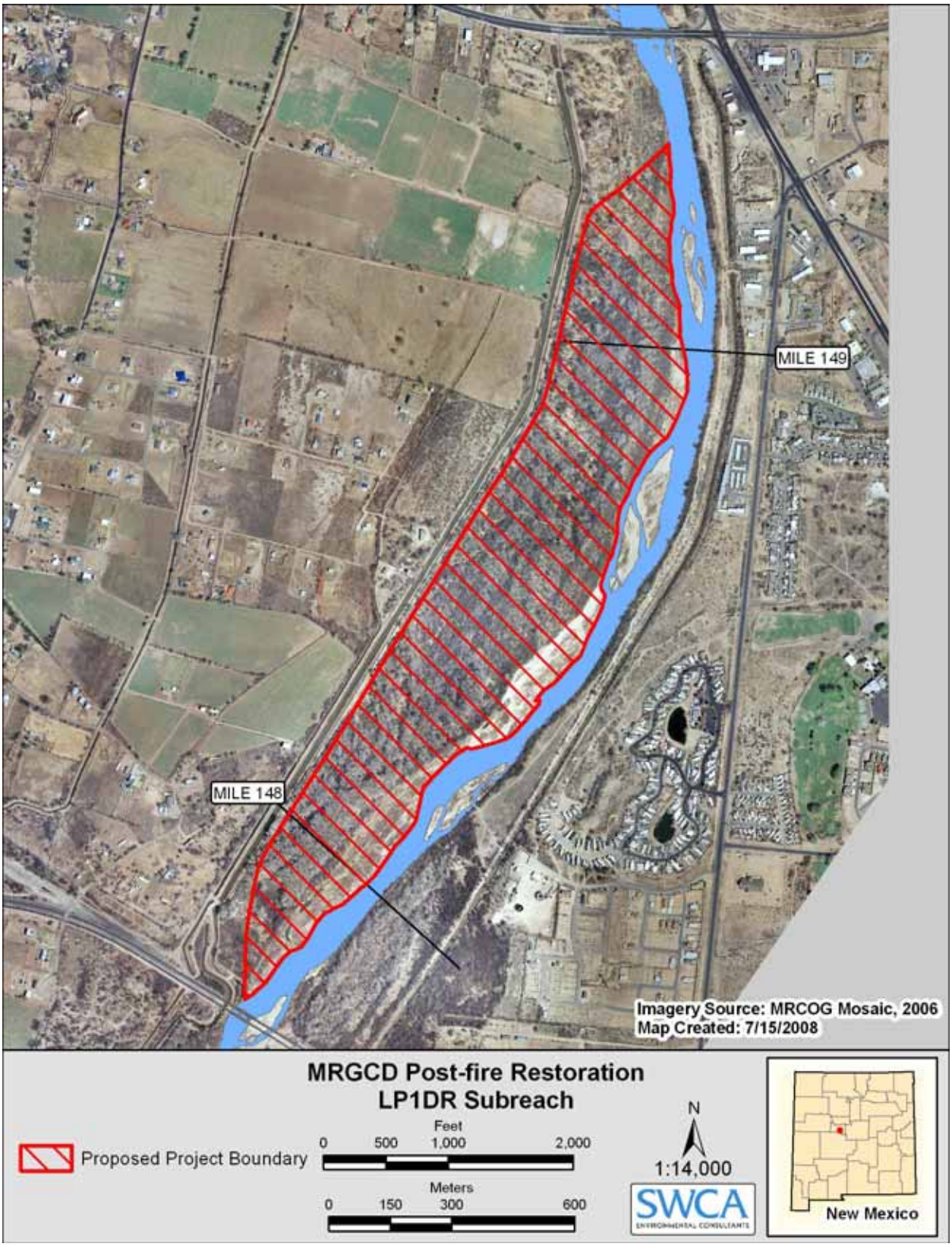

Figure 1.4. Boundary of MRGCD's proposed project and burn area.

1.2.3 LP1DR SUBREACH

The Lower Peralta #1 Riverside Drain Subreach (see Figure 1.3) of the MRG valley is demarcated by the LP1DR outfall at River Mile 149.6 (River Kilometer 240.8) to the north and the Belen Riverside Drain outfall at River Mile 147.7 (River Kilometer 237.7) to the south, a distance of 1.9 miles (3.1 km). This subreach is generally a braided channel at flows less than 400 cfs. Overbank inundation occurs at approximately 5,000 cfs. The active river channel has migrated to the east bank levee as the channel bends from the east to the southwest. There is a significant point bar along the west side river bank for over half of the subreach length (a Burlington Northern Santa Fe railroad bridge demarcates the southern boundary of this subreach). The large west side bosque area, including the aforementioned point bar, experienced a wildfire in 2007 and has undergone subsequent vegetation management by local agencies as a response. Within this subreach, the following modifications are being considered:

- Alleviate stresses on east river bank through the modification of the migrating point bar and associated banklines.
- Increase inundation of floodplain west of the Rio Grande and east of the flood control levee.
- Increase mesohabitat diversity, focusing on egg retention, larval fish, and young-of-year (e.g., backwater, embayments, and bankline terrace creation).
- Create low-flow refugia by creating in-channel pools (created and maintained with LWD or other physical structures) to provide dewatering/no-flow habitat.
- Restore the burned portions of the bosque in the LP1DR Subreach with native tree and shrub plantings, especially willow (*Salix* spp.) and willow baccharis (*Baccharis* spp.) species.
- Restore riparian habitat for the benefit of the flycatcher.

1.3 PURPOSE AND NEED

The Proposed Action is needed to satisfy federal requirements under the 2003 BiOp. The 2003 BiOp requires the funding and collaborative execution of habitat restoration projects on the MRG that will improve survival of all life stages of the endangered silvery minnow, as specified in RPA Element S:

> In consultation with the [U.S. Fish and Wildlife] Service and appropriate Pueblos and in coordination with parties to the consultation, action agencies shall conduct habitat/ecosystem restoration projects in the Middle Rio Grande to increase backwaters and oxbows, widen the river channel, and/or lower river banks to produce shallow water habitats, overbank flooding, and regeneration stands of willows and cottonwood to benefit the silvery minnow, the flycatcher, or their habitats. Projects should be examined for depletions. It is the Service's understanding that the objective of the action agencies and parties to the consultation is to develop projects that are depletion neutral. By 2013, additional restoration totaling 1,600 acres (648 hectares) will be completed in the action area. In the short term (5 years or less), the emphasis for silvery minnow habitat restoration projects shall be placed on river reaches north of the San Acacia

> Diversion Dam. Projects should result in the restoration/creation of blocks of habitat 24 hectares (60 acres) or larger. (USFWS 2003:95–96)

The project consists of the application of several alternative restoration/rehabilitation techniques designed to create aquatic habitat in the two subreaches: Peralta Subreach and LP1DR Subreach (see Figure 1.1). The goal of the project is to enhance the availability and condition of spawning and egg retention, larval rearing, young-of-year, and over-wintering habitat for silvery minnow in support of RPA Element S. The objective of the restoration process is to increase measurable habitat complexity in support of various life stages of silvery minnow by providing slackwater habitat and facilitating lateral migration of the river across bars and riverbanks during various mid-level and high-flow stages. The project would be implemented with construction starting in late fall 2008 and continuing through spring 2009. Specific restoration treatments would be implemented, monitored, and evaluated to inform the restoration plans of future phases. Phase 1 of the Isleta Reach Habitat Restoration Project will be implemented in the Peralta and LP1DR subreaches (see Figure 1.2–Figure 1.4). Additional phases would be implemented in downstream subreaches.

Evidence derived from habitat remediation work conducted by the NMISC in the Albuquerque Reach of the MRG suggests that silvery minnow habitat goals can be met by 25 days of inundation based on conservative estimates for egg and larval maturation (MEI 2006). Accomplishing these goals will require: 1) the creation of backwaters and embayments to create slackwater areas; 2) the reduction in height of banklines, bank-attached bars, and islands; and 3) the creation of ephemeral high-flow channels to carry water into hydrologically disconnected overbank areas and bank-attached bars and islands. These actions will result in redistribution of river sediments into geomorphic units (mesohabitats). Further, the jetty jack lines that are so predominant throughout the project area have contributed to the disconnection of overbank areas from the active channel. Natural levees have built up around the jetty jack lines as the river drops sediment during the receding limb of the hydrograph. Natural levees result from overbank flood sedimentation and develop where there is an abrupt reduction in flow velocity, such as around jetty jacks, resulting in immediate deposition of coarser sand and silt (Hudson 2005). These natural levees reduce the connectivity between the river channel and the floodplain. The deposition of nutrient-rich sediments around the jetty jacks, as well as the accretion of similar sediments on the river banks adjacent to the jetty jacks, provide ideal conditions for the colonization of these areas by non-native vegetation, particularly Russian olive. The colonization of these areas by dense vegetation causes additional decreases in flow velocities, further increasing the deposition of sediment along the channel margins. This positive feedback loop relationship further decreases the connectivity between the channel and adjacent floodplain through increasing the bank elevation. Therefore, it is unlikely that flows under the current hydrological conditions will provide the shear stress required to remove vegetation and permit lateral reworking of the existing in-channel and channel-margin bars and islands. Mechanical intervention is required to initially form and maintain desirable silvery minnow spawning and refugia habitat supporting the life cycle of the species.

1.4 ISSUES

1.4.1 ECOLOGICAL VALUES

The Rio Grande floodplain, including the riparian corridor (bosque) and river channel, is highly valued by the residents of Belen and all of New Mexico for its natural beauty, recreational opportunities, importance as a refuge for birds and other wildlife, and the presence of rare and protected species. The floodplain provides numerous ecosystem services to all citizens of New Mexico (Costanza et al. 1997). The project areas are located within the boundaries of the MRGCD.

1.4.2 ECONOMIC COMMITMENTS FOR ENDANGERED SPECIES RECOVERY

The 2003 BiOp requires the funding and collaborative execution of habitat restoration projects to improve survival of all life stages of the silvery minnow and the flycatcher to aid in their recovery. Reclamation has been the primary source of federal funding for the Collaborative Program, which has approved federal funding for this project through its proposal process. The State of New Mexico is managing the project and is contributing funding as part of a non-federal cost share for the Collaborative Program. Additionally, the MRGCD and their project partners are contributing non-federal funds. A summary of funding is presented in Table 1.1.

Table 1.1. Funding Allocation Table

Funding Source	Non-Federal	Federal
NMISC	$350,000	–
Collaborative Program	–	$550,000
MRGCD	$174,100	–
CFRP	–	$360,000
Total	$524,100	$910,000

1.4.3 NET WATER DEPLETIONS

The 2003 BiOp, the Collaborative Program, and/or the New Mexico Office of the State Engineer (NMOSE) require that proposed projects demonstrate that they will not result in any increases in net water depletions or that any increases are offset by releases of stored water or purchased or leased water rights, and that the Collaborative Program comply with state water laws (see NMOSE Restoration Offset Policy presented in Appendix A). In-stream formations within the nominal 600-foot (183-m) channel width (the original river channel design width for this reach to maintain flow delivery efficiency and reduce flood risk) are considered by the NMOSE to be dynamic aspects of the channel. Therefore, no depletion offsets are required for riverine restoration work within the nominal channel width. Restoration work in the floodplain that is outside the nominal channel width would be subject to the depletions offset requirement.

1.4.4 BURNED AREA RESTORATION

A large bosque wildfire in 2007 burned a 700-acre (283-hectare) area of the bosque south of the Belen Bridge (Figure 1.5). Approximately 100 acres (40.5 hectares) of the project area controlled by the MRGCD were severely affected. This fire removed large areas of the overstory and understory vegetation, with some of the most severely burned areas now characterized by standing dead Rio Grande cottonwood and limited herbaceous understory. This poses an extreme erosion risk for the bosque area and reduces native biodiversity of plants and animals. The substrate has also been exposed to invasion by non-native species. Rapid colonization by saltcedar and Russian olive has already begun throughout the site, most particularly in the areas that are adjacent to unburned portions. The MRGCD and New Mexico State Forestry are implementing reduction of hazardous snags and fuels in the area that pose a risk to the public; such fuels reduction efforts will also lower potential fire risk. The MRGCD is also engaging in forest restoration in this area funded through a U.S. Forest Service CFRP grant. MRGCD plans to reduce hazardous fuels, including non-native trees and dead wood, and restore key natural processes on the site, such as seasonal flooding and soil wetting, to increase biodiversity with a goal of making the site a self-sustaining native ecosystem. The projected outcome will be a reduction in the intensity of future fires by creating a diverse mosaic of vegetation patches across the site, which will result in 80% native species plant cover and increased habitat diversity. The project area has also been the focus of four Bosque Ecosystem Monitoring Program monitoring sites.

Figure 1.5. Impact of the fire in the bosque just south of the former Willie Chavez State Park.

1.5 RELEVANT STATUTES, REGULATIONS, AND OTHER PLANS

The Proposed Action does not conflict with any known state or local planning or zoning ordinances. The Proposed Action would also be required to conform to the provisions of Section 7 of the Endangered Species Act (ESA) and the Migratory Bird Treaty Act (MBTA) as administered by the USFWS, and Section 106 of the National Historic Preservation Act (NHPA) as administered by the New Mexico State Historic Preservation Office (SHPO). Compliance with Sections 401, 402 and 404 of the Clean Water Act (CWA) will also be required.

2.0 ALTERNATIVES

2.1 INTRODUCTION

The MRG Habitat Restoration Plan (Tetra Tech 2004) and the Restoration Analysis and Recommendations for the Isleta Reach of the Middle Rio Grande (Parametrix 2008) contain a toolbox of habitat restoration treatments that may be selectively applied to site-specific restoration plans. Conditions at a specific site, combined with the ever-evolving understanding of silvery minnow, require the restoration practitioner to be creative and adapt techniques appropriate to the goals of the project. Table 2.1 summarizes the specific restoration treatments, which were derived from TetraTech (2004) and Parametrix (2008) that will be applied to restoring silvery minnow habitat in the Isleta Reach.

The project aims to implement river restoration activities that will create, enhance, and maintain egg retention, larval and young-of-year rearing habitat, low-flow habitat, and over-wintering habitat for the silvery minnow. Approximately 44 acres (18 hectares) of islands and riverbank would be modified to create slackwater mesohabitat features to increase potential spawning, larval fish habitats, and refugial pools within the Peralta and LP1DR subreaches of the Isleta Reach. Additionally, the creation of the bosque inundation channel within the LP1DR Subreach will be designed to increase the frequency of inundation of historic floodplains. The project will implement active bosque inundation on approximately 12 acres (5 hectares) within the floodplain of the LP1DR subreach. In addition, expected benefits to native riverine vegetation would potentially increase habitat for the flycatcher.

2.2 ALTERNATIVES CONSIDERED BUT ELIMINATED

Five restoration treatments—island/bar destabilization, arroyo connectivity, gradient control structures, sediment management, and fish passage (Table 2.2)—were eliminated from consideration during the evaluation process. Although these techniques may have positive habitat implications, they have been eliminated from the Proposed Action Alternative because of lack of feasibility or because these techniques would not meet the desired project objectives.

Table 2.1. Restoration Treatments and Potential Benefits of Proposed Treatment

Treatment	Description	Benefits of Treatment
Creation of backwaters and embayments	Areas cut into banks and bars to allow water to enter to create slackwater habitat, primarily during mid- to high-flow events, including spring runoff and floods.	Increases habitat diversity by increasing backwaters, pools, eddies at various depths and velocities. Intended to retain drifting silvery minnow eggs and to provide rearing habitat and enhance food supplies for developing silvery minnow larvae.
Creation of bankline benches	Removal of vegetation and excavation of soils adjacent to the main channel to create benches that would be inundated at a range of discharges.	Provides shallow water habitat at a range of discharges that could provide spawning habitat and increased retention of silvery minnow eggs and larvae. Increased inundation would benefit native vegetation, potentially increasing habitat for the flycatcher.
High-flow ephemeral channels	Construction of ephemeral channels on islands to carry flow from the main river channel during high-flow events.	Normally dry, but creates shallow, ephemeral, low-velocity aquatic habitats important for silvery minnow egg and larval development during medium and high-flow events.
Island/Bar modification	Creation of shelves on islands and bars to increase inundation frequency. This technique is targeted for islands and bars that have an overtopping discharge greater than 3,500 cfs and exceedance days per year less than 21 days.	Increases habitat availability by increasing the inundated area at lower flows. May also destabilize bars and islands, slowing the rate of vegetation stabilization and/or armoring.
Large woody debris (LWD)	Placement of trees, root wads, stumps, or branches in the main river channel or along its banks to create pools.	Creates low-flow refugial habitat (pools and slow-water habitats), provides shelter from predators and winter habitat, and provides structure for periphyton growth to improve food availability for silvery minnow.
Removal of lateral confinements	Elimination or reduction of structural features and maintenance practices that decrease bank erosion potential	Could increase floodplain width with more diverse channel and floodplain features, resulting in increased net-zero and low-velocity habitat for silvery minnow
Floodplain vegetation management	Managing vegetation within the floodplain through actively planting desired native vegetation and controlling non-native vegetation to restore riparian habitat.	Increases habitat availability and diversifies habitat structure for the flycatcher in heavily disturbed sites. Combined with passive restoration techniques to promote natural revegetation, actively planting has the potential to increase flycatcher habitat availability.
Bosque inundation channels	Construction of ephemeral channels in the floodplain to carry flow from the main river channel during high-flow events.	Creates shallow, ephemeral, low-velocity aquatic habitats in the bosque during high-flow events. Provides silvery minnow egg retention and larval habitat associated with silvery minnow spawning. Enhances hydrologic connectivity with the floodplain. Could improve flycatcher habitat.
Passive restoration	Allows for higher magnitude peak flows to accelerate natural channel-forming process and improve floodplain habitat.	Increases sinuosity and allows for development of complex and diverse habitat, including bars, islands, side channels, sloughs, and braided channels.

Information adapted from Tetra Tech 2004.

Table 2.2. Treatments Eliminated from Further Study

Treatment	Description	Benefits of Treatment	Reason for Elimination
Island/Bar destabilization	Clearing vegetation on stabilized islands and bank-attached bars to encourage the redistribution of sediments.	Could encourage the redistribution of sediment and natural fluvial geomorphic processes.	Out of scope. The feasibility of accomplishing sediment mobilization in an environment with reduced flow regimes is unlikely. Given the budget, other techniques to provide habitat for the silvery minnow are favored.
Arroyo connectivity	Clearing of vegetation and/or excavation of pilot channels to bring stranded arroyos to grade with the mainstem Rio Grande.	Could re-establish eddies associated with the mouths of arroyos, which may help to retain silvery minnow eggs and larvae, and increase the supply of sediment to the river.	Out of scope. Technique does not meet project objectives. Based on an analysis of existing conditions, restoration treatments were selected to enhance critical habitat needs in the project reach.
Gradient-control structures	Low head weirs constructed perpendicular to the channel with aprons to simulate natural riffles.	Creates aquatic habitat diversity by producing variable flow velocities and depths.	Out of scope. Technique does not meet project objectives. Technique is not appropriate in this reach as extensive channel incision has not yet occurred.
Sediment management	Increased sediment supply through mobilization behind dams, arroyo reconnection, or introduction of spoils.	Silvery minnow is most commonly observed in areas where the bed is predominantly silt and sand.	Out of scope. Technique does not meet project objectives. Managing accumulated sediment behind dams or diversion structures is not feasible as there are no such structures within the project area.
Fish passage	Installation of fish passage structures at impoundments to improve longitudinal connectivity of river.	Allows upstream movement of silvery minnow and reduces habitat fragmentation.	Out of scope. Fish passages are not feasible in the proposed locations, which are 20.3 miles (33.7 km) south of Isleta Diversion Dam and 33 miles (53.1 km) north of San Acacia Diversion Dam.

2.3 ACTION AND NO ACTION ALTERNATIVES

Two alternatives, an Action Alternative and a No Action Alternative, are analyzed in detail below.

2.3.1 ACTION ALTERNATIVE

Habitat restoration in the Isleta Reach will involve a combination of passive and active restoration practices. Passive restoration results when the key ecological and geomorphological processes are restored. Active restoration practices are engineered approaches to artificially replace some aspect of lost ecosystem structure or function. Active restoration techniques depend more on human intervention and less on natural riverine processes to repair habitat function (Tetra Tech 2004). Though active restoration strategies rely on mechanical means to achieve the desired habitat restoration results, most of these techniques will also incorporate components of passive restoration. Active restoration will be implemented both in the channel and along the river's banks.

Each active restoration method presented involves the physical manipulation of a predetermined portion of the surface area of selected features with an amphibious excavator or land-based equipment, such as a dozer, a belly scraper, an excavator, or a backhoe. Treatments may involve the removal of vegetation and jetty jacks, the excavation to desired cut-depths, and the distribution of sediment spoils. These treatments would generate woody debris and sediments that must be utilized on site or disposed of in accordance with the 404 permit. Deposition of sediment spoils within the riparian areas, but specifically on islands and bank-attached bars is not desirable because it would further disturb vegetation and raise the elevation of the island or bank-attached bar, which would reduce opportunities for saturation and inundation and create sites for non-native, weedy, herbaceous species establishment (such as Russian thistle [*Salsosa kali*], field bindweed [*Convolvulus arvensis*], Canada thistle [*Cirsium arvense*], etc). Therefore, new low-elevation habitat would be created adjacent to the islands and bank-attached bars within the active river channel using evenly distributed excess sediment and woody debris. Sediments and woody debris would be placed within silt barriers 2 feet (0.6 m) from the wetted perimeter of the bank to prevent any sediments from falling into the channel. Woody debris may be used for the creation of in-channel debris piles adjacent to the treatment area. Sediment spoils on bankline features will be spread evenly over the land surface to an uncompacted depth not to exceed 2 feet (0.6 m) and seeded with native grasses and forbs.

All treatment and control areas would be monitored for two years to determine the effectiveness of the methods implemented and identify any project-related hydrologic and geomorphic alterations. Long-term monitoring (up to 10 years) and adaptive management would be coordinated with the Collaborative Program and would incorporate interagency objectives. After monitoring and natural reshaping, any restoration areas that remain void of native vegetation may be replanted with appropriate native species to stabilize the contours to the extent possible. Following restoration, the treated features are expected to have a surface elevation suitable for inundation at a range of river flows, representing dry, moderate to high water years. Revegetation, whether natural or planted, would also provide suitable roughness to decrease flow velocities and increase egg and larvae retention.

2.3.2 RESTORATION TREATMENTS

Treatment 1: Backwater / Embayment

The creation of moderate- to high-flow backwater and embayment areas would involve the removal of riverbank and island vegetation and the excavation of soils to prescribed depths. Backwater areas (e.g., no upstream inlet) would be constructed on the downstream end of large point bars, which are already low-velocity areas, at a range of elevations. This allows for inundation at a range of river flows (Figure 2.1 and Figure 2.2). Backwater areas would be constructed such that at their target discharge, would be inundated at a depth of approximately 1 to 2 feet (0.30–0.61 m) and slope slightly, with the downstream end lower in elevation than the upstream end, increasing the amount of habitat opportunities at a range of river flows and avoiding possible silvery minnow entrapment. Backwaters can also be terraced to create a range of distinct target inundation discharges.

This treatment is being used to increase the amount of shallow, low-velocity habitat available during spring snow pack runoff events. The creation of backwaters and embayments are intended to support spawning, retain drifting silvery minnow eggs, and provide habitat for developing silvery minnow larvae.

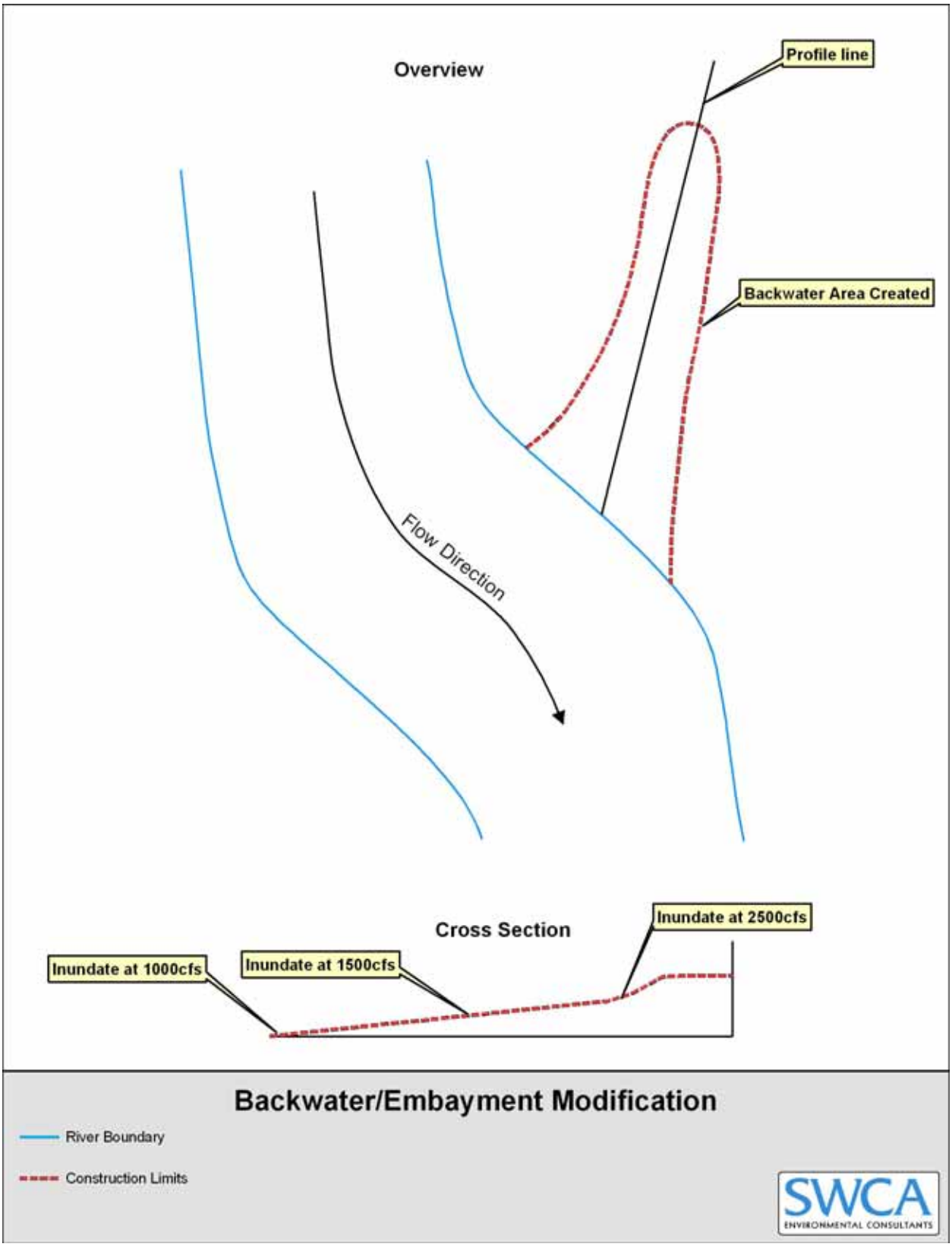

Figure 2.1. Backwater/Embayment schematic design.

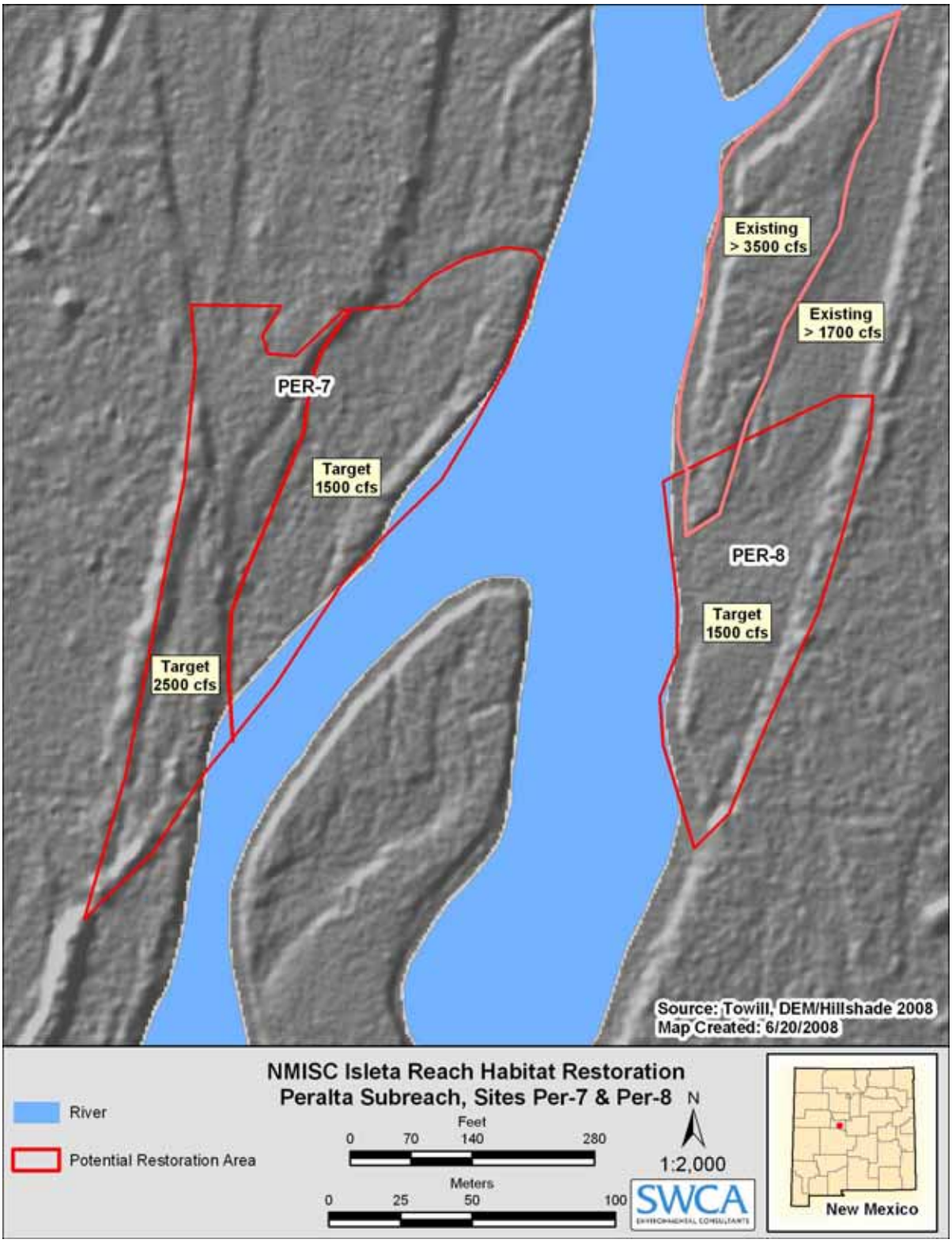

Figure 2.2. Example of backwater modification in sites PER-7 and PER-8. These sites will be modified to allow for additional backwater and overbank flooding during lower-flow periods, starting at target flows of 1,500 cfs.

Treatment 2: Bankline Benches

The creation of bankline benches involves lowering the bank through the removal of bankline vegetation and through the excavation of soils to increase the potential for overbank flooding (Figure 2.3 and Figure 2.4). The target elevation for excavated and terraced banks varies depending on the height of the bank, the bank-full level, and the target inundation discharge frequency and duration. Bankline benches would be created in areas where the removal of the naturally formed levees that often exist along the banks could increase inundation in the overbank areas.

Bankline benches would be inundated during different stages of moderate to high flows and would increase the frequency and duration of inundation. However, the overbank areas would not remain flooded for significant periods of time and would not be intended to provide mesohabitat for adult silvery minnow. Conversely, bankline benches are expected to provide additional low-velocity habitat, resulting in improved egg retention and larval fish development during periods of high river-flow.

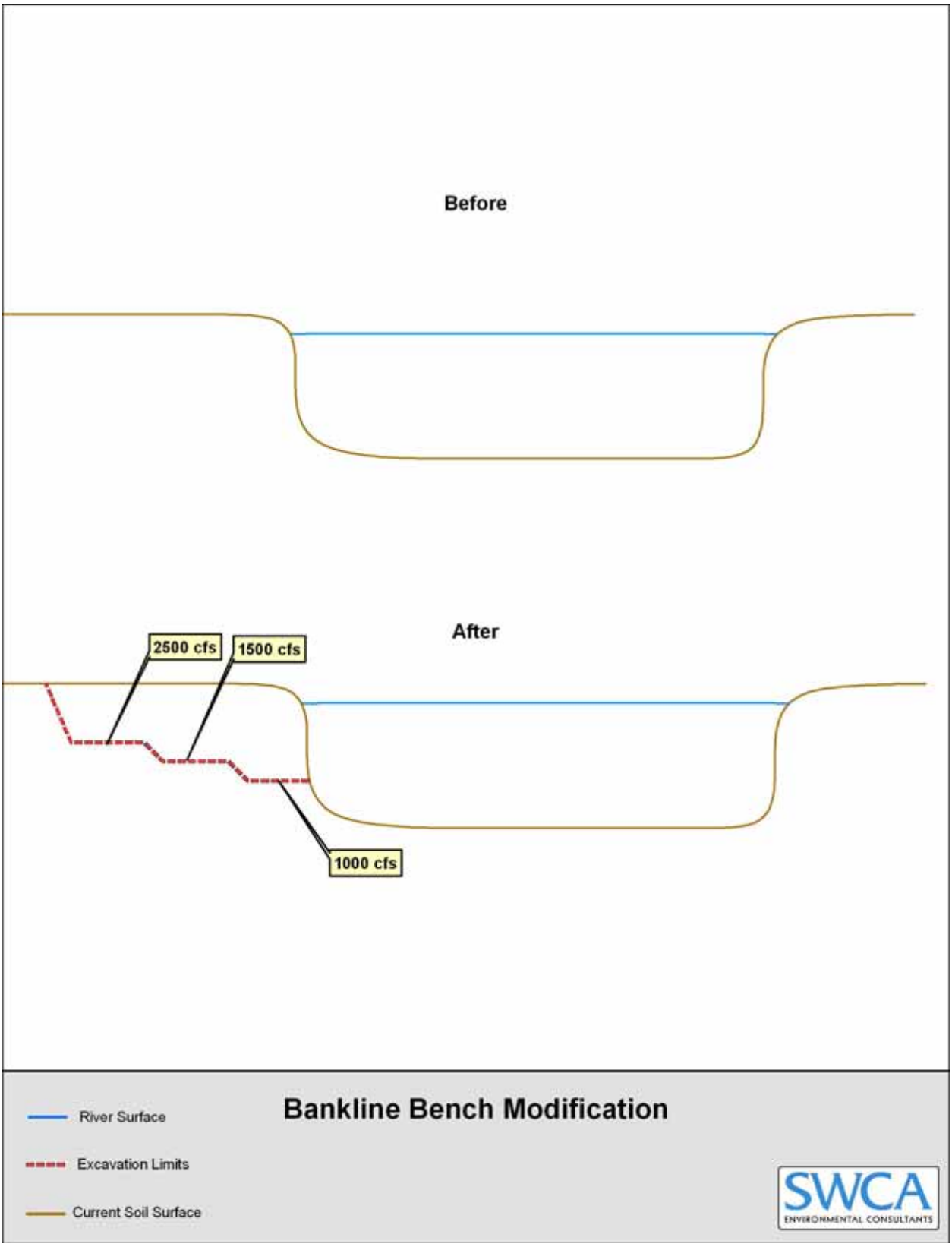

Figure 2.3. Bankline bench schematic design.

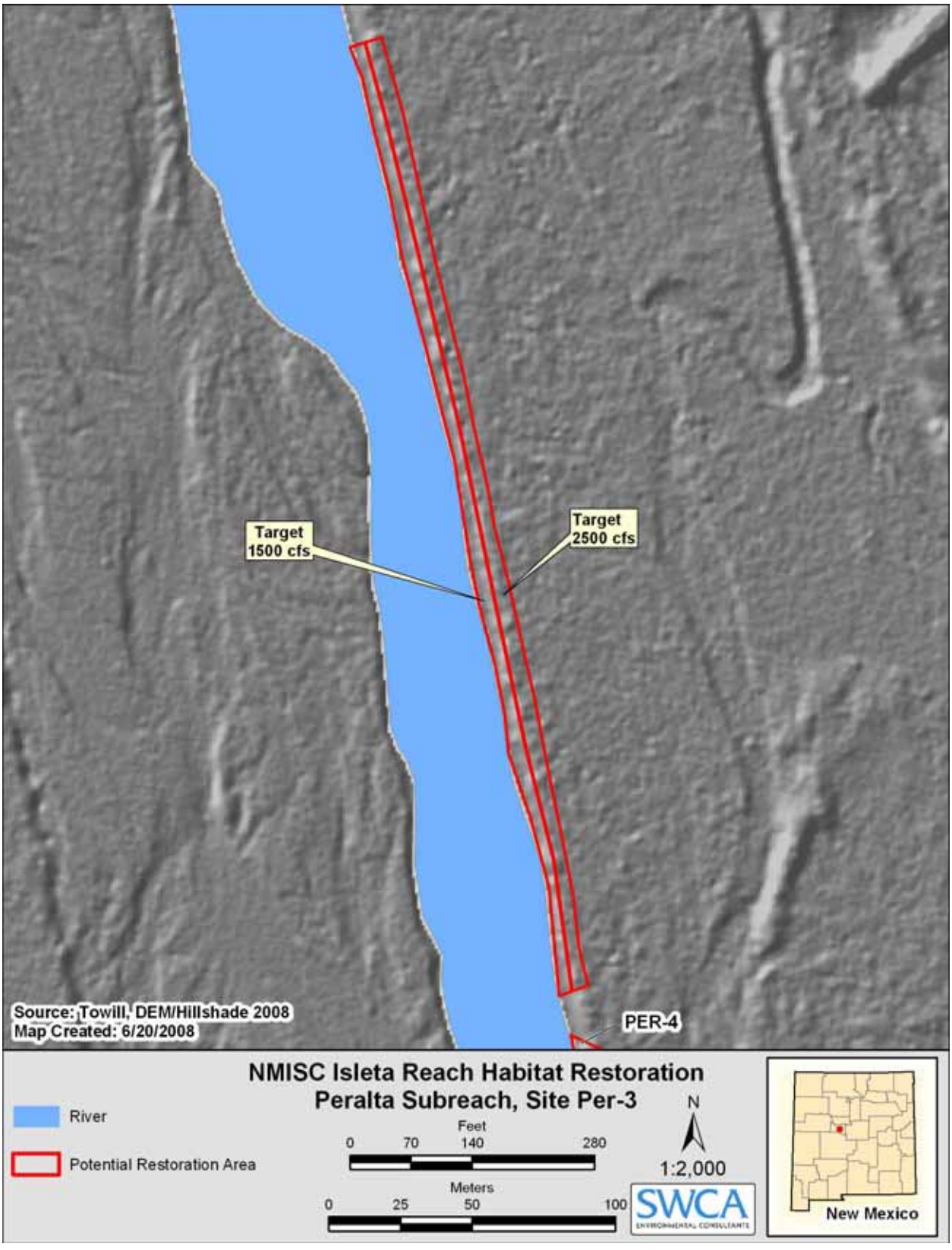

Figure 2.4. Example of bankline benches.

Treatment 3: Ephemeral Channels

Ephemeral channels are low-velocity, flow-through channels that are connected to the main river channel across bars and islands. These channels are normally dry but carry high-discharge flow from the main channel during spring snowmelt and summer monsoon events. The channels carry water at lower velocities than the main channel and may include mesohabitats such as pools and backwaters with little to no flow. Ephemeral channels are not intended to provide for overbank flooding. Construction of an ephemeral channel requires removal of existing vegetation and would cause the disturbance of some sediment or soil. The channels would be cut through islands, banks, and bars to a depth that would allow water to flow at moderate to high river flows (Figure 2.5 and Figure 2.6). The design of the ephemeral channels would consider the river channel geometry, resulting velocity profiles and distribution, and subsequent water retention times.

Ephemeral channels create aquatic habitat beneficial to the silvery minnow. The target inundation elevations and duration would accommodate flows to encourage silvery minnow recruitment each year. Ephemeral channels could provide sufficient periods of inundation for larval development and refugia for young silvery minnow depending on target elevations and individual runoff characteristics. These channels would dry during lower flows and would not be designed to provide habitat for adult silvery minnow. While channels of this kind are proposed primarily to enhance silvery minnow habitat, they also promote riparian functionality and interconnectedness.

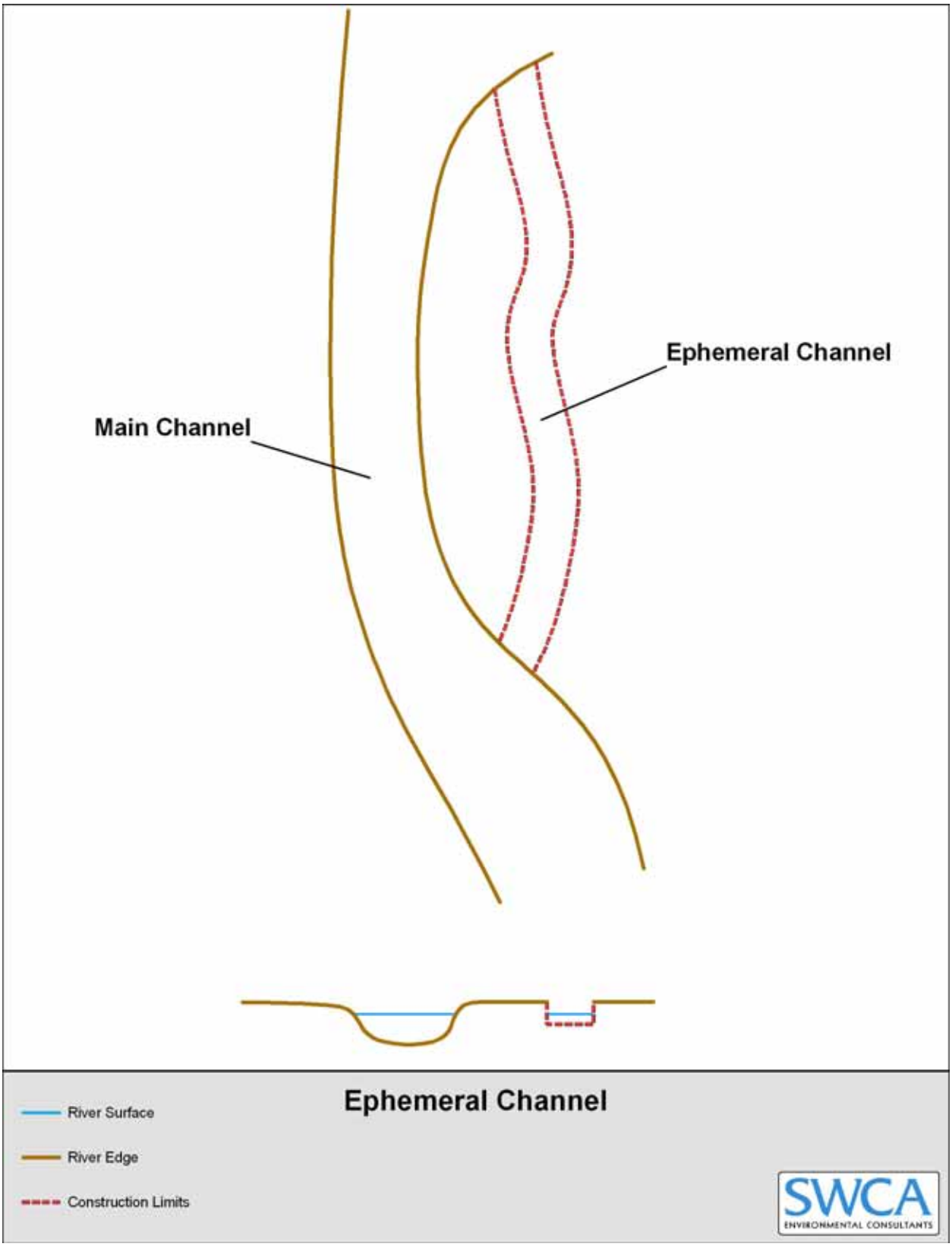

Figure 2.5. Ephemeral channel schematic design.

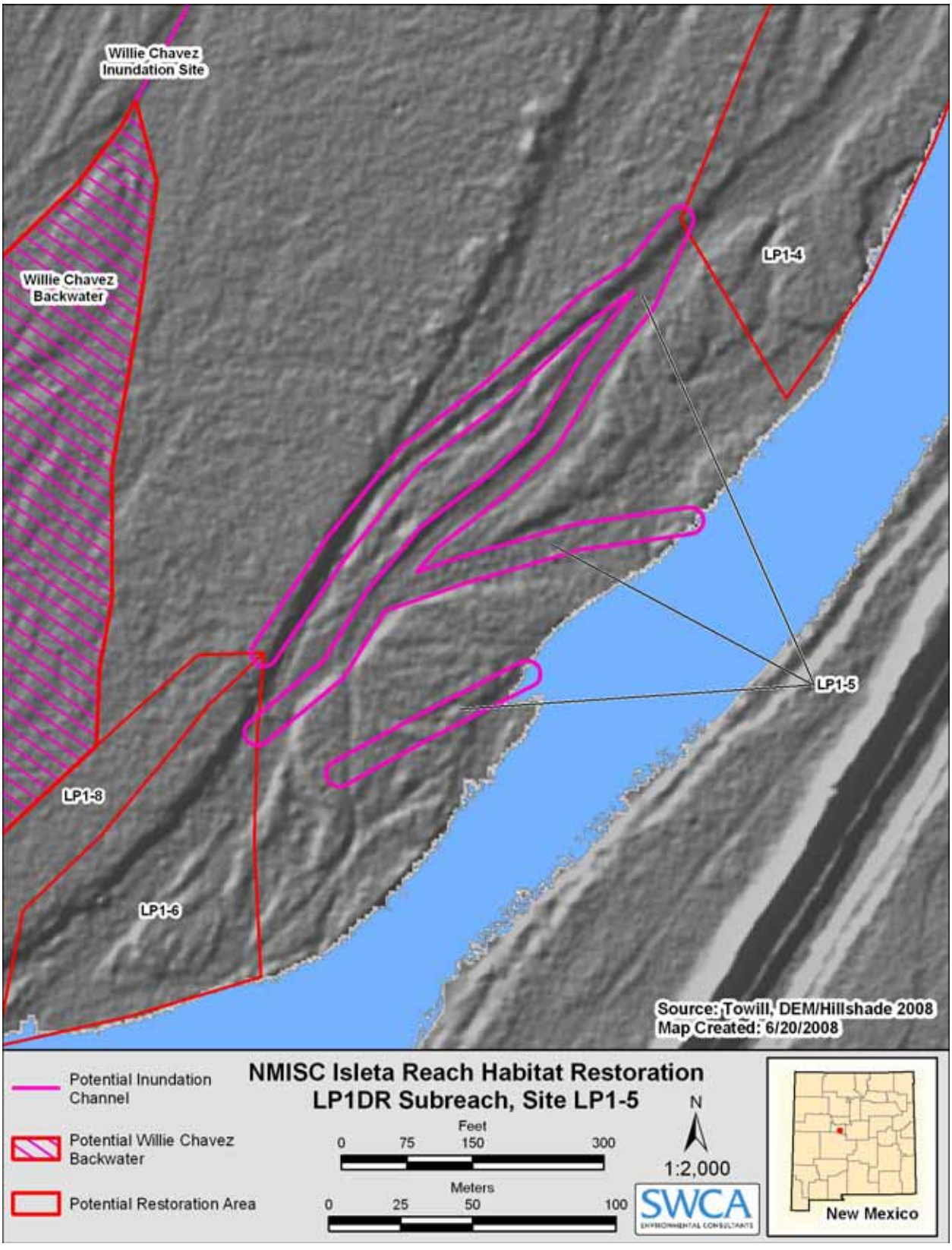

Figure 2.6. Ephemeral channel.

Treatment 4: Island Modification

The island modification technique would be targeted to those features that are infrequently inundated, stabilized by vegetation, or otherwise are armoring and thus are resistant to sediment mobilization. These bank-attached bars and islands have the potential to become or have become permanent channel features. Modifying these features would assist in alleviating adverse changes to silvery minnow critical habitat and improving the quality and quantity of available habitat (USFWS 2003). Islands can be modified by planned physical disturbance, such as removing vegetation and destabilizing soil and sediment, mowing vegetation, root-plowing vegetation and sediment, and raking vegetation and surface sediment (Tetra Tech 2004), or through creating shelves that are inundated at a lower discharge. Island modification should result in re-establishing channel function, through increasing the frequency and duration of inundation and increasing the redeposition of sediment, all of which should result in enhanced silvery minnow habitat. Treated islands would be allowed to naturally expand or contract in response to flows and available sediment load. Island modification would also increase the potential for redeposition of sediment in downstream subreaches of the Rio Grande. Sediment removed as a result of the modification would be placed in the river behind silt fences (Figure 2.7 and Figure 2.8). The NMISC would collaborate with the USACE for island modifications to ensure all 401 and 404 permits are obtained and the proposed actions comply with all elements of the CWA.

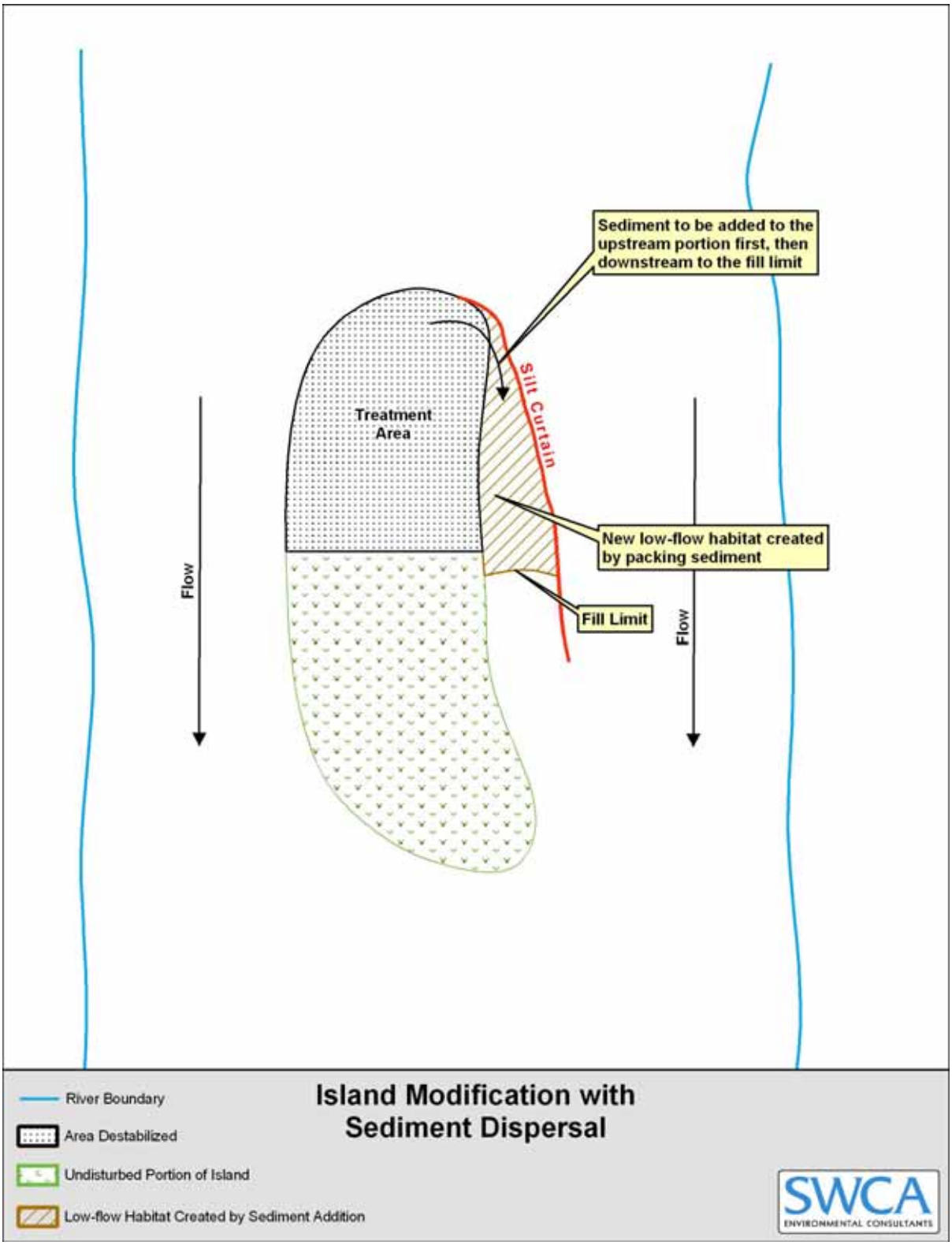

Figure 2.7. Island/Bar modification illustrating sediment dispersal through the creation of low-flow shelves.

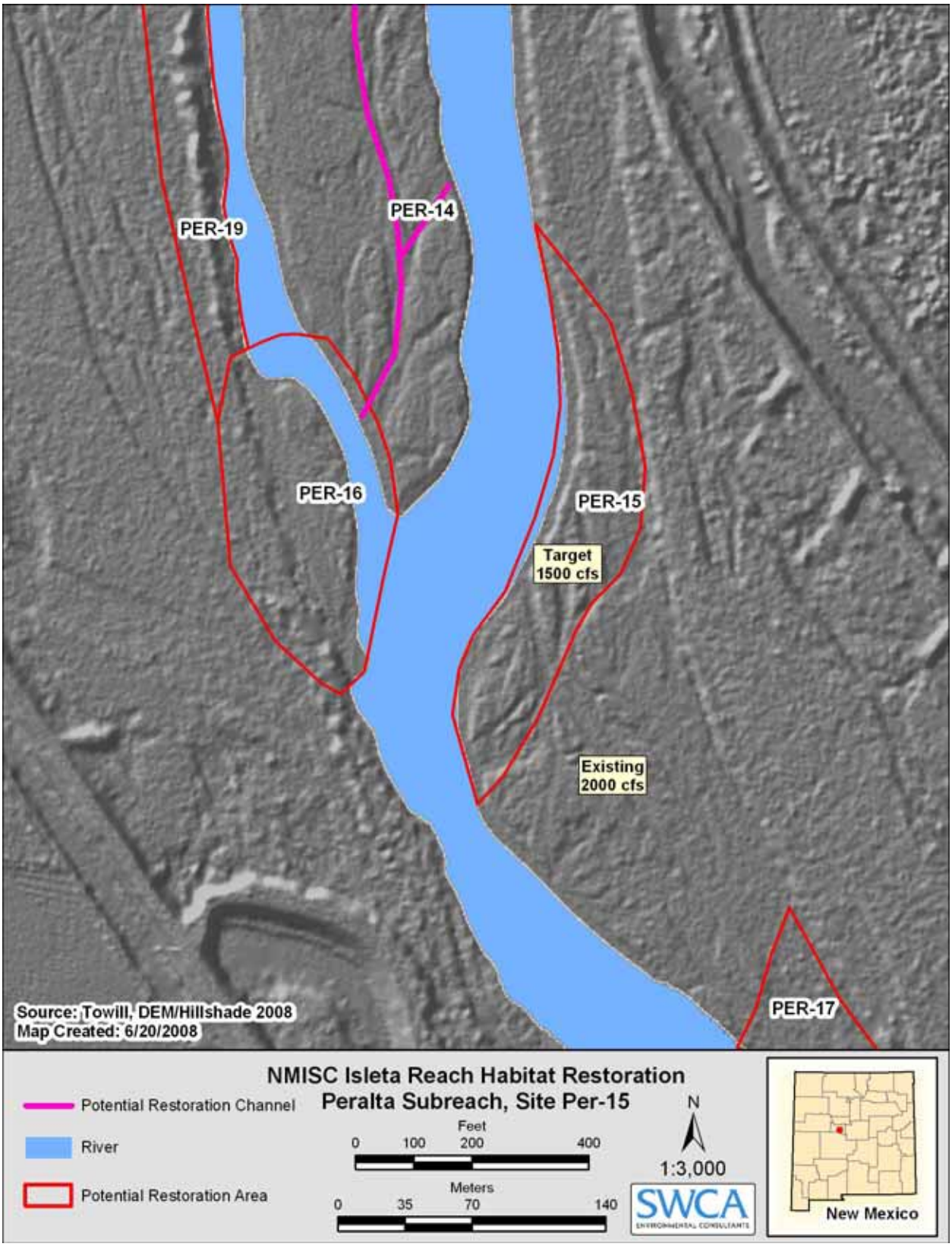

Figure 2.8. Island/Bar modification example.

Treatment 5: Large Woody Debris

Large woody debris (LWD) has been identified as suitable habitat for the silvery minnow (USFWS 2003). Prior to the 1930s, conditions in the MRG naturally provided large quantities of LWD to the channel as stream banks eroded and the river routinely migrated laterally across the floodplain, removing and transporting LWD from the riparian zone. River channel stabilization and the reduction in overbank flow have effectively reduced the amount of LWD available in the river channel.

The placement of LWD is a technique that involves setting root wads, trees, and large branches in the main river channel or near the banks to create diverse aquatic habitats (Figure 2.9). LWD will be unanchored and placed on or near the riverbank or on islands and bars likely to be transported as flows increase. LWD may be placed in high-density, location-specific areas associated with backwaters and embayments to create scour flows, which could help prevent sedimentation on these features and increase project longevity. The NMISC is coordinating with the MRGCD to obtain large cottonwoods that were killed as a result of the Belen fire.

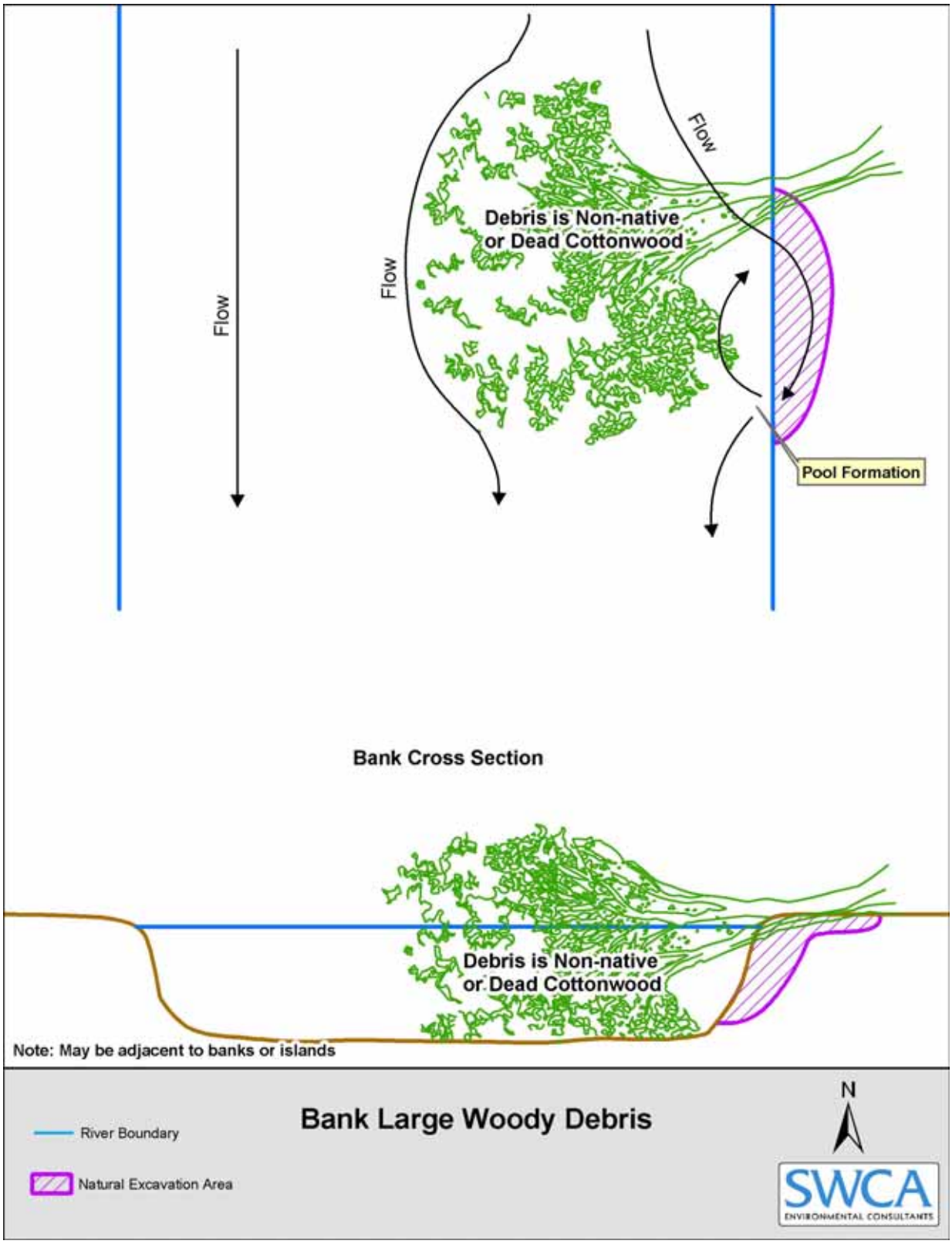

Figure 2.9. Large woody debris schematic.

Treatment 6: Remove Lateral Constraints

Lateral constraints, such as jetty jacks and the densely vegetated natural levees that form around them, decrease the potential for lateral migration of the channel and natural bank erosion processes, ultimately creating a narrower, more linear, and deeper river channel. Removal of jetty jacks would allow for the subsequent removal of the associated natural levees, thus increasing the connectivity between the river channel and floodplain. This, in turn, may allow for natural river processes to create wider and more diverse channel and floodplain features, yielding increased low-velocity habitat for all life stages of the silvery minnow.

Removal of bankline jetty jacks running parallel to the channel are proposed in select locations associated with the creation of bankline benches and embayments cut into the bank and adjacent floodplain. Jetty jack removal is proposed only in areas where levees would not be put at risk or where river control activities would not be affected. Tie-back jetty jacks or those that run perpendicular to the river channel are not proposed for removal as part of the project.

The bankline jetty jacks would be removed by an amphibious excavator and placed on the adjacent floodplain or bosque, then appropriately removed from the bosque shortly thereafter via designated access routes. Remaining jetty jacks would be tied together with cable looped through the end jetty jacks and secured with cable clamps. Approval from the USACE, Reclamation, and the MRGCD would be obtained prior to removal of jetty jacks. The NMISC has initiated a conversation with the three action agencies concerning jetty jack removal as part of the project, and a consensus agreement would be reached before any action is taken concerning this treatment.

Treatment 7: Floodplain Vegetation Management

The MRGCD has developed a site restoration design for the post-burn riparian site of approximately 100 acres (40 hectares) that would incorporate ecologically based passive and active restoration techniques to create a more resilient, sustainable, and fire-resistant landscape. The goal is for native trees, shrubs, and herbaceous vegetation to cover 80% of the site in a patchwork mosaic of differing ages and sizes to increase overall habitat diversity and availability for wildlife, including endangered and sensitive species, such as the flycatcher**.** Proposed activities include active revegetation, management and control of non-native species, preservation of mature native trees and dead snags, and the creation and maintenance of fuel breaks. All vegetative treatments and plantings would be performed in the dry. Active revegetation involves planting species representative of riparian gallery forests in the MRG. Dominant species include cottonwood, Goodding's willow (*Salix gooddingii*), and coyote willow (*Salix exigua*). A number of riparian shrubs, such as New Mexico olive (*Forestiera pubescens*), skunkbush sumac (*Rhus trilobata*), false indigobush (*Amorpha fruticosa*), and seepwillow (*Baccharis salicifolia*) may be planted to increase diversity. Ground layer plantings may be focused on restoring and enhancing existing wetlands. Control of non-native species (e.g., saltcedar, Russian olive) would be accomplished through herbicide treatments. All herbicides would be applied according to the label and would be mixed within contained system to minimize spills and flows onto the ground. Application of herbicides would be conducted in such a manner to minimize runoff from the stem and flows onto the ground. Herbicides would not be

applied when winds exceed 15 miles per hour or when rain is forecasted for the local area within 12 hours of application.

Mature cottonwood and tree willow species would be preserved as well as a number of dead snags to create structural diversity and wildlife habitat. Finally, open areas with native grasses and yerba mansa (*Anemopsis californica*) would be maintained as open areas to create and maintain fuel breaks. Existing depressions would be enhanced (5–10 acres [2–4 hectares]) to support the natural regeneration of cottonwoods, willow species, and herbaceous wetlands. A minimum of 5 of the 10 acres (2 of the 4 hectares) would be planted as willow swales. Swales would be excavated with rows approximately 8 feet (2.4 m) apart with one willow stem planted every 4 feet (1.2 m). Swales would have roughly 1,000 willow stems per acre and would be located in areas with a maximum depth to groundwater of less than 4 feet (1.2 m) and located in proximity to the river channel. All floodplain vegetation management activities would be scheduled between September 1 and April 15 to avoid impacts to nesting birds. A summary of proposed treatments follows:

1. Plant approximately 15 acres (6 hectares) of native trees and shrubs per the restoration plan. Ten acres (4 hectares) would be planted at a density of 50 shrubs/trees per acre, and 5 acres (2 hectares) would be planted at 100 shrubs/trees per acre.
2. Remove and control non-native plants to achieve goals for native plant cover, leaving selected non-native trees and shrubs for habitat until native trees provide adequate structure for wildlife (100 acres [40 hectares]). The proposed treatment is a continuation of a program implemented by the MRGCD to control non-native phreatophytes following the Belen fire. The MRGCD would use tryclopyr (Garlon 4) applied as basal bark or cut stump treatments. Treatment involves treating cut stems (3–8 inches [8–20 cm] in height) with an herbicide solution consisting of 35% Garlon 4 and 65% vegetable oil with a blue marker dye. Herbicide application would not take place when winds exceed 15 miles per hour or when rain is forecasted for the local area within 12 hours of application. Care would be taken when mixing or applying to avoid runoff onto the ground; careful application is required due to the high toxicity to fish.

   The herbicide application protocols were developed in collaboration with the New Mexico non-native phreatophyte control program and are based on the MRGCD's and others' experience and research within the MRG. The recommendations are consistent with New Mexico State University (NMSU) Saltcedar Information recommendations (NMSU 2008). These recommendations include a 50:50 volume/volume (v/v) ratio for basal bark treatments and ratios from 33:67 v/v to 50:50 v/v ratios for cut stump treatments using Garlon 4.

   Cut stump and basal bark application treatments are applied at low pressures and typically close to the ground. The low pressure applications result in larger droplet sizes that are less likely to present safety concerns for applicators and are less susceptible to drift to non-target species. Therefore, applications at the recommended wind speeds are warranted to enable completion of the project within the time frames allowed.

3. Preserve mature native trees, remove dead trees and excess dead-and-downed wood, and retain at least three snags and dead-and-downed logs >12 inches (30.5 cm) in diameter per acre for wildlife (100 acres [40 hectares]).
4. Create and maintain fuel breaks with more open and sparse canopies in existing stands of native grasses and forbs (currently dominated by yerba mansa and saltgrass [*distichlis spicata*]) on the site per the restoration plan (25–30 acres [10–12 hectares]).

Treatment 8: Bosque Inundation

The goals of the bosque inundation technique are to maintain or restore the hydrologic connectivity of the floodplain to the river and provide additional low-flow habitat for the silvery minnow during peak runoff events associated with the spring runoff pulse. Based on the 25-day exceedance goal, the target discharge is 3,000 to 3,500 cfs.

Inundation would be achieved through creating an inlet channel. The inlet channel would be cut through the natural bankline levee, directing water into the floodplain. Abandoned flow channels and other paths of least resistance located in the floodplain would be utilized in bringing the water to the desired location. The inundation channel would be graded to direct the flow of water away from the levee and to minimize the entrapment of silvery minnow. A backwater in the Willie Chavez site would be graded from the river channel to the inundation channel and serve as the desired location for bosque inundation. The backwater is intended to drain the area and minimize silvery minnow entrapment, while serving as slackwater habitat.

Treatment 9: Passive Restoration

Passive restoration can include both curtailing human actions that have a negative impact on the river and removing installations that were part of earlier efforts to stabilize the channel and that have interfered with the river's natural flow. It is anticipated that passive restoration would be accomplished throughout the entire project area. Passive restoration encourages the river to shape itself through natural riverine processes, such as the transport of sediment during flood events or the scouring of riverbanks, without human intervention. The passive restoration techniques considered herein would not cause a major shift in present river management practices, but would instead utilize current management trends to help restore natural riverine processes within the MRG.

2.3.3 NO ACTION ALTERNATIVE

The No Action Alternative assumes that no anthropogenic changes would be made to islands, bars, riparian environments, or the riverine habitats available to the silvery minnow in the Isleta Reach at the proposed project locations. Current river operations, as well as trends in riverine habitat quality and quantity, with the exception of other habitat restoration projects in the reach, would remain dominant under the No Action Alternative.

2.4 PREFERRED ALTERNATIVE

The Preferred Alternative is the Action Alternative, which implements the restoration techniques summarized in Table 2.3 and Table 2.4 with the goal of enhancing, restoring, and/or creating riparian and riverine areas. These areas would provide aquatic habitat for the benefit of the silvery minnow in the Isleta Reach of the MRG. Approximately 44 acres (18 hectares) of islands and riverbank would be modified to create slackwater mesohabitat features to increase the spawning and larval fish habitat and refugial pools within the Peralta and LP1DR subreaches. Additionally, the creation of the bosque inundation channel within the LP1DR Subreach would be designed to increase the frequency of overbank inundation on 11.59 acres (4.7 hectares) of floodplain. While many of the proposed restoration treatments are designed primarily to enhance silvery minnow habitat, it is expected that the bosque inundation channels would also promote riparian functionality and interconnectedness and provide the conditions that would encourage the development of flycatcher habitat. The frequency of overbank inundation would occur during periods of above base-flow discharge. The overbank areas would not remain flooded for significant periods of time but would result in residual habitat improvements and nursery habitat. Maps indicating proposed restoration sites and the results of the HEC-RAS and FLO-2D modeling can be found in Appendix B. Photographs of some of the Proposed Action areas within the two selected subreaches are provided in Appendix C. The NMISC and MRGCD would conduct post-construction monitoring, including geomorphic, fisheries, bird, and vegetation monitoring as part of an adaptive management plan. As part of that plan, a course of action would be created for any site that is at risk of no longer meeting the project's objective. Monitoring results would also be used to inform future habitat restoration project in the Isleta Reach.

Floodplain vegetation management, implemented by the MRGCD, would enhance the habitat riparian communities, including flycatcher habitat within the floodplain in the LP1DR Subreach. Restored willow-dominated riparian communities would enhance existing wetlands and the proposed bosque inundation channel. Native riparian trees, such as cottonwood and Goodding's willow, would be planted to restore areas of the bosque that were damaged by the fire. Non-native phreatophytes, such as saltcedar and Russian olive, would be removed. Floodplain management restoration treatments (Table 2.5) would treat approximately 100 acres (40 hectares) of riparian habitat within the LP1DR Subreach. Table 2.3 through Table 2.6 summarize the proposed restoration treatments.

Table 2.3. Peralta Subreach Proposed Sites and Treatment

Restoration Site	Location	Existing Inundation Discharge (cfs)	Restoration Treatment	Target Inundation Discharge (cfs)	Area (acres)
Per-04		4000	Backwater / Embayment	1500 – 2500	1.16
Per-06	Peralta B2	5286	Backwater / Embayment	2500	0.94
Per-07	Peralta B3	2715	Backwater / Embayment	1500	3.29
Per-08	Peralta I5	3948	Backwater / Embayment	1500 – 2500	1.61
Per-10	Peralta I7	2694	Backwater / Embayment	1500	1.12
Per-12	Peralta B4	2231	Backwater / Embayment	1500	1.15
Per-16	Peralta I10	2456	Backwater / Embayment	1500	3.17
Per-17	Peralta B5	2084	Backwater / Embayment	1500	1.04
Per-13	Peralta I9	2517	Backwater / Embayment	1500	0.69
				Backwater / Embayment Total	**14.17**
Per-01	Peralta I2	4500	Bankline Benches	2500 – 3500	0.43
Per-03		4000	Bankline Benches	1500 – 2500	0.87
Per-09		4000 – 4500	Bankline Benches	2500 – 3500	0.73
Per-11		4500	Bankline Benches	1500 – 2500	0.31
Per-18		4000 – 4500	Bankline Benches	1500 – 2500	0.36
Per-19	Peralta I9	4500	Bankline Benches	1500 – 2500	6.03
				Bankline Benches Total	**8.73**
Per-14	Peralta I9	2517	Ephemeral Channels	1500	1.40
				Ephemeral Channels Total	**1.40**
Per-02	Peralta I2	3726	Island Modification	2500	0.82
Per-05	Peralta B2	5286	Island Modification	2500	1.30
Per-15	Peralta B5	2084	Island Modification	1500	2.87
				Island Modification Total	**4.99**
				PERALTA SUBREACH TOTAL	**29.29**

Table 2.4. LP1DR Subreach and Willie Chavez Proposed Sites and Treatment

Restoration Site	Location	Existing Inundation Discharge (cfs)	Restoration Treatment	Target Inundation Discharge (cfs)	Area (acres)
LP1-06	LP1 I7	3796	Backwater / Embayment	1500 – 2500	1.64
LP1-08	LP1 B5	2084 – 4500	Backwater / Embayment	2000 – 2500	2.69
LP1-04	LP1 I7	3796	Backwater / Embayment	1500 – 2500	2.99
LP1-07	LP1 B5	2084	Backwater / Embayment	1500	1.13
				Backwater / Embayment Total	**8.45**
LP1-01		4500	Bankline Benches	2500 – 3000	1.79
LP1-03	LP1 B2	3926	Bankline Benches	2500	1.82
LP1-09	LP1 B5	2084	Bankline Benches	2000	0.54
LP1-10		>5000	Bankline Benches	3500	0.55
				Bankline Benches Total	**4.70**
LP1-02	LP1 B2	3926	Ephemeral Channels	1500 – 2500	0.21
LP1-05	LP1 I7	3796	Ephemeral Channels	1500 – 2500	1.42
				Ephemeral Channels Total	**1.63**
Bosque Inundation	LP1DR Subreach	4500	Inundation Channel	3000 – 3500	4.41
Bosque Inundation	LP1DR Subreach	4000	Backwater	2500 – 3500	7.18
				Willie Chavez Total	**11.59**
				LP1DR SUBREACH TOTAL	**26.37**
				GRAND TOTAL – PERALTA AND LP1DR SUBREACHES	**55.66**

Table 2.5. Floodplain Vegetation Management Treatments

Restoration Site	Location	Restoration Treatment	Area (acres)	Description
Willie Chavez	LP1DR Subreach	Willow swales	5	Constructed in burned area, minimal native vegetation
Willie Chavez	LP1DR Subreach	Native shrub revegetation	15	Revegetate burned area
Willie Chavez	LP1DR Subreach	Cottonwood	15	Revegetate burned area
Willie Chavez	LP1DR Subreach	Non-native control	100	Ongoing, annual maintenance
Willie Chavez	LP1DR Subreach	Preserve mature trees/snags	50	Ongoing, annual maintenance
Willie Chavez	LP1DR Subreach	Fuel breaks	25–30	Maintain open areas with native grasses and yerba mansa through control of woody vegetation

Table 2.6. Isleta Restoration Technique Treatment Areas, by Subreach

Restoration Treatment	Isleta Reach Phase 1				Total Acres by Restoration Treatment
	Peralta		LP1DR		
	Area (acres)	# Sites	Area (acres)	# Sites	
Riverine Treatments					
Bankline Benches	8.72	6	4.70	4	13.42
Ephemeral Channels	1.40	1	1.63	2	3.03
Backwater/Embayments	14.18	9	8.44	4	22.62
Island/Bar Modification	5.00	3	0.00	0	5.00
Large Woody Debris	TBD	0	TBD	0	TBD
Removal of Lateral Confinements	TBD	0	TBD	0	TBD
Estimated Subtotal Riverine	**29.30**	**19**	**14.77**	**10**	**44.07**
Bosque Inundation					
Bosque Inundation Channels	0.00	0	4.41	1	4.41
Bosque Inundation Backwater	0.00	0	7.18	1	7.18
Estimated Subtotal Bosque Inundation	0.00	**0**	11.59	**2**	**11.59**
Estimated Total by Subreach	**29.30**	**19**	**26.36**	**12**	**55.66**
Floodplain Vegetation Management					
Willow Swales	NA	NA	5.00	TBD	5.00
Native Shrub Revegetation	NA	NA	15.00	TBD	5.00
Native Tree Replanting	NA	NA	15.00	TBD	15.00
Non-Native Species Control	NA	NA	100.00	Entire Area	100.00
Preserve Mature Trees/Snags	NA	NA	50.00	TBD	50.00
Maintain Fuel Breaks	NA	NA	25.00	TBD	25.00
Estimated Total Vegetation Mgmt			**100.00**		**100.00**

3.0 AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This section describes the current condition of resources in the study area that may be affected by the Proposed Action. Resources and related topics include geomorphology and soils, hydrology and hydraulics, water quality, cultural resources, air quality and noise, fish and wildlife, vegetation and wetlands, threatened and endangered species, socioeconomics, visual and aesthetic resources, net water depletions, environmental justice, and Indian Trust Assets (ITAs).

The Isleta Reach of the MRG, which extends from the Isleta Diversion Dam to the San Acacia Diversion Dam (see Figure 1.1), has been identified by Reclamation and the NMISC, as well as the Collaborative Program, as a segment of the river where habitat/ecosystem restoration projects would be highly beneficial to all life stages of the silvery minnow.

3.2 GEOMORPHOLOGY AND SOILS

The MRG lies in an asymmetric, elongated valley along the Rio Grande Rift (Hawley 1978; Chapin 1988). Connected alluvium-filled sub-basins defined by normal faulted mountain ranges dominate the rift valley. The land flanking the Rio Grande Basin on the east is predominantly mountainous with the western face of the Manzano Mountains merging colluvial-alluvial fans and stream terraces sloping down and westward toward the Rio Grande (Bartolino and Cole 2002; MEI 2002). The geologic surface west of the river is ancestral Rio Grande alluvial deposits. The river channel flows in a wide valley with a fertile but narrow (2–3 miles [3–5 km] wide) floodplain that has been cultivated for centuries. The soil associations in this area are classified as Torrifluvents-Calciorthids-Torriorthents, deep and highly stratified mixed alluvial soils that encompass the sloping floodplain, steep terraces, and alluvial fans adjacent to and above the Rio Grande (NMISC 2002; National Resource Conservation Service [NRCS] 2006; Reclamation 2007). A detailed description of this soil association is provided in the NRCS (2006) Custom Soil Resource Report for Valencia County, New Mexico.

Historically, the Rio Grande has continuously reworked valley deposits on the active floodplain. However, in the twentieth and twenty-first centuries, floodway constriction and channel stabilization projects have confined the natural course of the river. For example, dams, levees, and jetty jacks have been used to create channel banks that control the location of the river, preventing flow from reaching the historic floodplain and causing sediment to accumulate within the levees (MEI 2003). Reclamation reports that, since 2001, the channel in the Isleta Reach has narrowed drastically, which can be attributed to vegetation encroachment into the active channel (Massong et al. 2007). The channel narrowing process has been accelerated by the accretion and attachment of bars to the river bank (MEI 2006). The historical floodplain in the reach has become disconnected from the river in all but the wettest years. This bar and island accretion has contributed to decreasing habitat heterogeneity and limited channel habitat diversity for the silvery minnow (Remshardt and Tashjian 2005).

Geomorphology plays an important role in describing the evolution of the Rio Grande and in influencing the spatial extent and species diversity of vegetation in riparian areas. The present-day Isleta Reach channel is composed of several varieties of loamy soils, including Gila and

Vinton loam, Brazito sandy clay, silt, and sand, similar to the composition of ancestral river deposits. The surface layers are brown loamy fine sand overlying a pale brown and light yellow loamy sand (NRCS 2006). The soil is slightly calcareous and mild-moderately alkaline (NRCS 2006). In addition to the erosion and transport of sediment through the mainstem channel, tributary streams can contribute large volumes of sediment to the system.

Existing channel and channel-margin conditions in the Isleta Reach are the result of channelization of the river, hydrologic modifications that have reduced the magnitude of the frequently occurring peak flows and the degradational response of the river to reduced upstream sediment supply and the presence of non-native vegetation species (MEI 2008). In combination, these drivers have resulted in stabilization of the river planform and disconnection of the channel from its floodplain, which together have caused loss of habitat for the various life stages of the silvery minnow. Restoration of silvery minnow habitat essentially requires redistribution of the sediment mass that is stored within mid-channel and bank-attached bars that are currently disconnected hydrologically.

3.3 HYDROLOGY AND HYDRAULICS

3.3.1 HYDROLOGY

The MRG, as defined in the Collaborative Program, is the portion of the Rio Grande from the Colorado/New Mexico state line southward to the headwaters of Elephant Butte Reservoir and includes the Rio Chama watershed. Most of the annual flow and discharge of the Rio Grande that reaches the MRG is generated in the headwaters of the river basin in Colorado and in the Rio Chama in northern New Mexico.

Most of the discharge volume of the Rio Grande is derived from late spring snowmelt runoff events, which in some years produce large volumes of water that briefly alter the hydrograph of the river. The moderate and high flows associated with the seasonal snowmelt, as well as other channel altering events, such as monsoonal rains, have the capacity to carry high sediment loads. However, human activities have produced significant changes in the hydrology of the Rio Grande during the past century. The operation of numerous upstream dams (Heron, El Vado, and Abiquiu Reservoirs on the Rio Chama, Jemez Canyon Dam on the Jemez River, and Cochiti Dam on the Rio Grande) have significantly affected flows in the river by storing and releasing water in a manner that generally decreases the spring flood peaks and alters the timing of the annual hydrograph. Of the 100 greatest daily discharges since 1942 at the Central gage (08330000), all have occurred prior to the construction of Abiquiu (1963) and Cochiti (1975) Dams (USGS 2003). However, these operations have not caused significant changes in the average annual flow volumes, but seem only to affect the magnitude, timing, and duration of peak flows. According to USGS gage data, average daily flow for the Central gage for the pre-reservoir period from 1942 to 1974 was 1042.70 cfs, while average daily flow for the post-reservoir period from 1975 to 2002 was 1395.75 cfs.

An analysis of gage records from the Rio Grande Floodway near Bernardo (USGS Gage No. 08330010) were used to develop mean daily flow duration and flood frequency curves (MEI 2008). The Bernardo gage provides the best representative flow record for the study reach following cessation of flows in the low-flow conveyance channel period. MEI (2008) used the

flood-frequency values developed by the USACE (2007b). Based on the volume of flow, the hydrological record was divided into wet, normal, and dry years (Figure 3.1) Wet years represent the top third percentile (67 through 100 percentile) of flow volumes; normal years represent the 34 through 66 percentile of flow volumes; and dry years represent the bottom third (less than 33 percentile) of flow volumes (MEI 2008). Flow duration curves were developed for wet, normal, and dry water years (Figure 3.2). Based on the design objective of 25 days inundation the 6.8% exceedance value is approximately 3,440 cfs. However, an exceedance value can be determined for wet, normal, and dry years. From the individual wet, normal, and dry flow duration curves (Figure 3.2), the 6.8% exceedance values are 4,550 cfs, 2,990 cfs, and 2,290 cfs, respectively (MEI 2008).

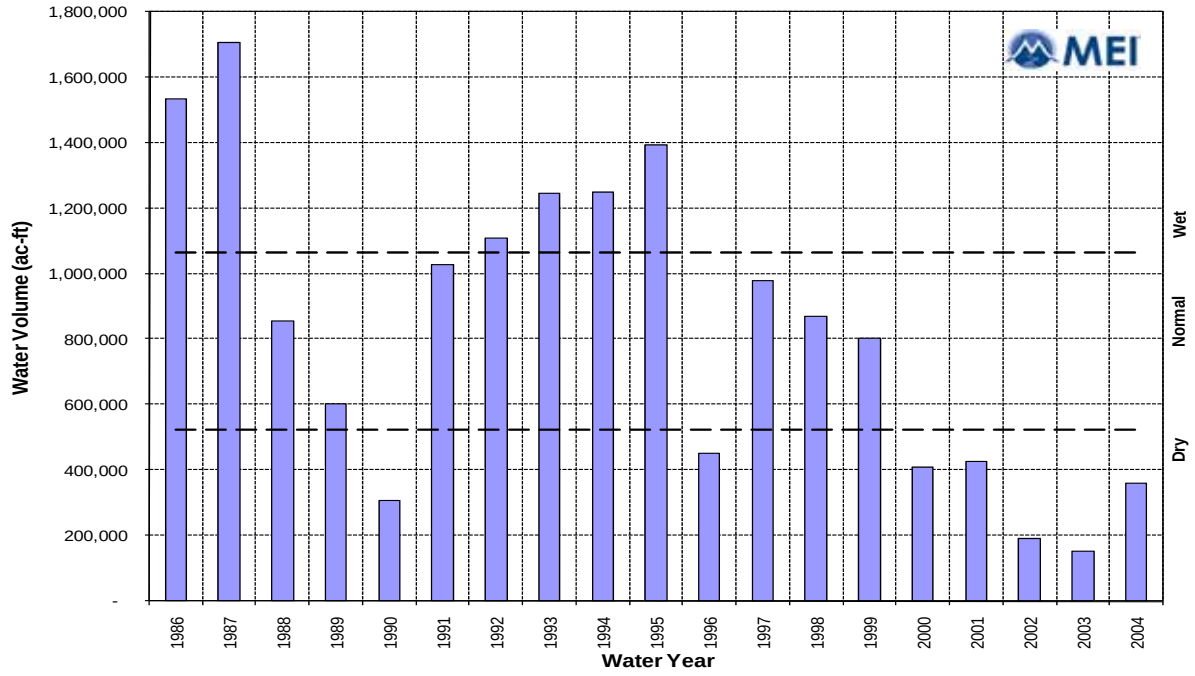

Figure 3.1. Annual flow volume at the Rio Grande at Bernardo, NM gage (USGS Gage No. 08330010) for the post–low-flow conveyance channel period (WY1986 – WY2004).

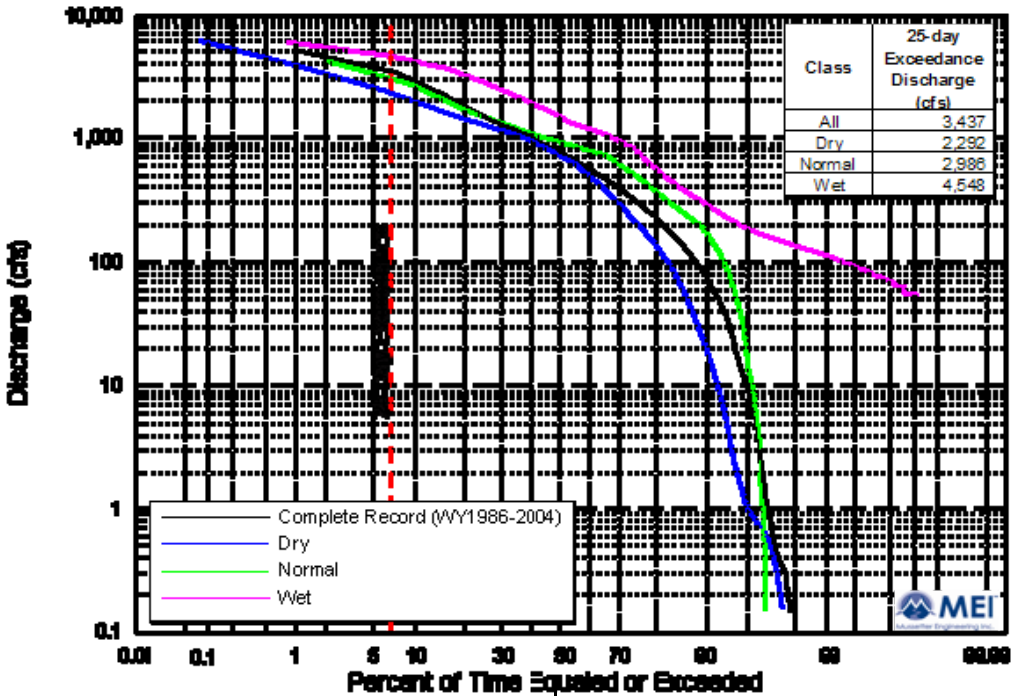

Figure 3.2. Computed mean daily flow-duration curves for the complete record and dry, wet, and normal years in the post-Cochiti Dam period at the Bernardo gage.

Peak flood discharges in the Isleta Reach have been moderated (Figure 3.3) since the closure of Cochiti Dam. Since 1986, and no releases from Cochiti Dam have exceeded 8,000 cfs (MEI 2008). The result is a reduction in flood frequency and a subsequent reduction in larger fluvial geomorphology events in the reach. The inflows into the Isleta Reach are a function of the water releases out of Cochiti Reservoir, the withdrawal of Rio Grande water at the Angostura and the Isleta Diversion Dams for agricultural purposes, and numerous ephemeral tributaries, including municipal stormwater diversion channels, both within the Isleta Reach and immediately upstream. Some of the diverted agricultural water is returned to the Rio Grande at the many ditch outfalls in the Isleta Reach, including the Peralta Wasteway and the LP1DR return flows.

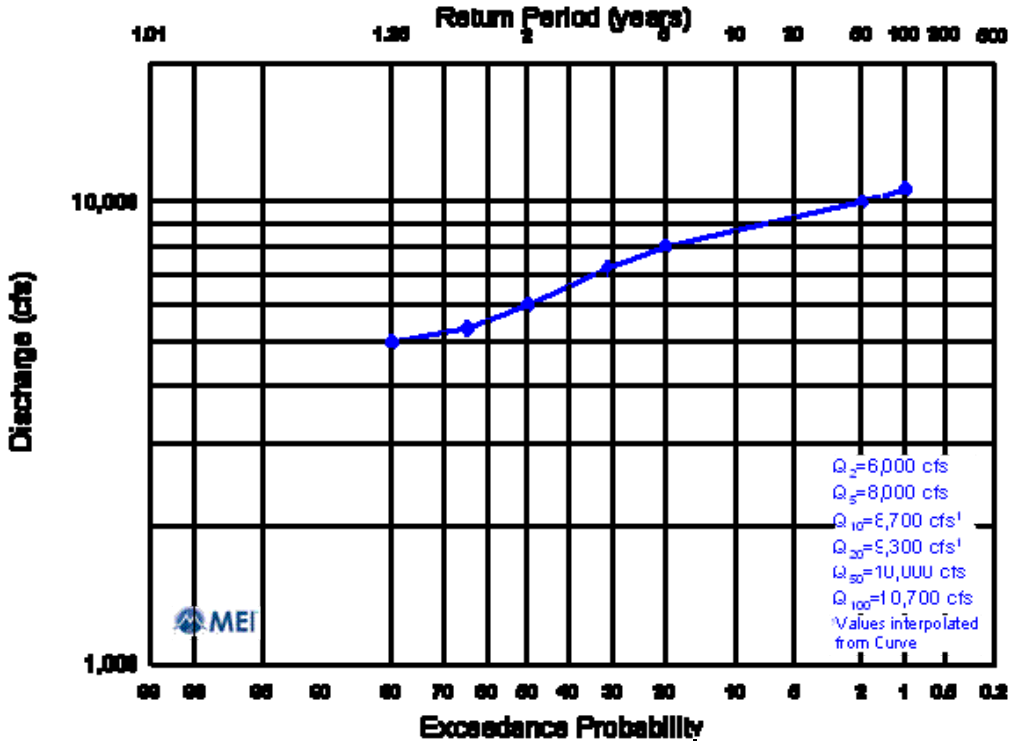

Figure 3.3. Exceedance probability for the Isleta Reach (MEI 2008).

3.4 WATER QUALITY

Current information for the water quality of the river system in the MRG is available from the USGS, the USACE, Reclamation, the University of New Mexico, the New Mexico Environment Department, and the USFWS, as well as other sources. Water quality constituents that are typically monitored include surface water temperature, pH, turbidity, dissolved oxygen (DO), suspended sediments (SSED), conductivity/total dissolved solids (TDS), and fecal coliform. These data may be collected in the Rio Grande, in adjacent canals, or within reservoirs. Typically, personnel at specific riverine, canal, or reservoir locations collect the data with automatic data logging devices at stream gage stations. Long-term water quality data for the Isleta Reach is lacking, but the available data for the Albuquerque Reach are characterized by a high degree of seasonal variability for several water-quality measures, as detailed in Table 3.1.

Table 3.1. Average Water Quality Data by Constituent for the Central Avenue Gage, Approximately 10 Miles (16 km) Upstream of the Upper Boundary of the Isleta Reach

Season	Turbidity (NTU)	DO (mg/L)	pH	Conductivity (mg/L)	Water Temp (°C)	TDS (mg/L)	Fecal coliform (col/100mL)	SSED (mg/L)
Nov–Feb	9.12	10.19	8.08	391.86	6.66	255.08	N/A	539.01
Mar–June	45.57	8.66	7.97	359.11	15.90	209.74	82.50	1167.12
July–Oct	25.67	8.03	8.13	387.95	18.89	273.17	8.00	2114.67

NTU=nephelometric turbidity unit; DO=dissolved oxygen; TDS=total dissolved solids; SSED=suspended sediments
Source: USGS 2003; Data are from 1975–2001.

The USGS has identified the following items as contributors in this region to water pollution: cyanide, fire retardant slurry, impervious surface/parking lot runoff, municipal point source discharges, on-site treatment systems (septic and similar decentralized systems), wastes from pets, and waterfowl.

New Mexico Environment Department water quality standards exist for stream and river reaches throughout the state of New Mexico. The water quality standards (Appendix D) are from the New Mexico Water Quality (NMWQ) Control Commission, as amended through May 23, 2005, and are for two reaches: 1) the mainstem of the Rio Grande from the headwaters of Elephant Butte reservoir upstream to the Alameda Bridge (NMWQ Standards [20.6.4.106]) and 2) the mainstem of the Rio Grande from Alameda Bridge upstream to the Angostura diversion works (NMWQ Standards [20.6.4.105]). The Elephant Butte to Alameda Reach encompasses all of the Isleta Reach and its subreaches. General criteria established to sustain and protect existing or attainable uses of surface waters of the state are found in the New Mexico Administrative Code (NMAC) (20.6.4.13). These general criteria apply to all surface waters of the state at all times.

3.5 CULTURAL RESOURCES AND TRADITIONAL CULTURAL PROPERTIES

3.5.1 CULTURAL HISTORY

Cultural resources include archaeological sites, sites eligible for the State Register of Cultural Properties and/or the National Register of Historic Places (NRHP), and properties of traditional religious or cultural importance (traditional cultural properties [TCPs]).

The indigenous population in the Rio Grande valley of New Mexico dates back at least 12,000 years (Cordell 1997:67–68). The steady influx of peoples of European descent into the Rio Grande valley of present-day New Mexico from the sixteenth century onward has given rise to a diverse cultural mosaic and has left a multitude of varied cultural resources that are more than 50 years old throughout the state. The state was part of the Spanish Colonial Empire until Mexico won its independence in 1821. Twenty-five years later, in 1846, New Mexico was claimed by the United States. These successive cultures have left archaeological sites (habitation, mining, industrial, and other), standing structures, bridges, utilities, and a network of irrigation canals and acequias more than 50 years old (Arrowsmith 1963; Cordell 1997:67–68; Rivera 1998; Van Citters 2003). However, archaeological resources in the LP1DR and Peralta subreaches of the Rio Grande floodplain are limited because of poor preservation, the result of flooding episodes, and a long history of agricultural use of the valley floor prior to the existence of a preservation ethic.

3.5.2 TRADITIONAL CULTURAL PROPERTIES

Reclamation has initiated consultation with Native American tribes and pueblos that may have an interest in the project and project area to determine if any TCPs must be considered in the decision-making process. Because of the sensitive nature of the Rio Grande for Native Americans, no decision would be made regarding the Proposed Action prior to conclusion of the tribal consultations.

3.6 VEGETATION AND WETLAND RESOURCES

The riverbank ecosystem found directly along the main channel of the MRG consists of open sand bars, riverbank areas with herbaceous and shrubby vegetation, and small, seasonally saturated or inundated areas characterized by a variety of hydrophytic wetland flora. Open sand bar areas are subject to frequent disturbance from erosion caused by flood events and typically have little or no vegetation establishment. Sparse growth on sand bars of young cottonwood, coyote willow, saltcedar, and a variety of herbaceous vegetation is occasionally found following reduced river flows, but because these areas are prone to frequent disturbance during moderate- and high-flow events, the vegetation typically does not have the opportunity to mature.

Herbaceous and shrubby vegetation is common along the riverbank in areas where the river channel has become deeply incised. Russian olive and saltcedar is prevalent throughout the floodplain, but especially along the channel margins. Vegetation has successfully established along the channel margins due to a decrease in overbank flooding, which results in a lack of scouring, displacement, and removal of substrate immediately adjacent to the riverbank. The root structures of the riverbank vegetation serve to reinforce the riverbank, causing less erosion, deeper channel incision, and a decrease in the potential for lateral river migration.

Wetland vegetated areas are located adjacent to the riverbank and are typically found in areas that are frequently saturated and/or inundated for at least a portion of the growing season. The number of these areas within the riparian ecosystem of the Rio Grande has substantially decreased, probably due to the lack of overbank flooding and lateral migration, and the increase in river channel incision. Common wetland vegetation in the project area includes common three-square (*Scirpus americanus*), narrowleaf cattail (*Typha angustifolia*), softstem bulrush (*Scirpus validus*), Baltic rush (*Juncus balticus*), and coyote willow.

Like the riverbank riparian vegetation, characteristics of vegetated islands within the river channel have changed significantly, due perhaps in part to the current drought. The lack of peak flows that alter island morphology and periodically remove island vegetation have resulted in the establishment and maturation of woody vegetation, which has been linked to the islands becoming more permanent features of the river channel (Fluder 2004). Because of the stability provided by the vegetative root structure of plants (especially large, woody species) found on islands, the potential for lateral migration of the river channel has been dramatically decreased, while the potential for continued incision of the river channel has increased.

Non-native species, such as saltcedar, Russian olive, and Siberian elm (*Ulmus pumila*), may have a competitive advantage over native riparian species in a condition of altered hydrological regimes that are exacerbated by the current climatological conditions. Non-native plant reproductive cycles are not as strongly tied to seasonal flood peaks as are their native counterparts. Additionally, these invasive species are able to withstand the drier soil conditions that result from channel incision and the reduction in peak flows.

The LP1DR Subreach was heavily impacted by the Belen fire in February 2007, which destroyed a large portion of the cottonwood-dominated bosque on the west bank of the project area. This area has been identified by the MRGCD as an important restoration area, particularly as it is now subject to on-going invasion by non-native saltcedar and Russian olive. Following a large fire,

such as the Belen fire, extensive invasive species colonization (e.g., saltcedar and Russian olive) frequently occurs (Busch and Smith 1995; Stuever 1997; Smith et al. 1998). The intent of the preferred action is to enhance the riparian and wetland habitats in this area of the reach and to encourage greater inundation and subsequent rehabilitation of the native vegetation in the burned area.

Despite the considerable attention that has been devoted to the ecology and biodiversity of the neighboring riparian bosque (Hink and Ohmart 1984; Crawford et al. 1993), little is known about the in-channel bars, which are perhaps the bosque's most diverse and biologically active component. These dynamic environments support young wetland and riparian vegetation along with most of the natural regeneration of Rio Grande cottonwoods in the river corridor (Milford and Muldavin 2004).

3.7 FISH AND WILDLIFE

Decreases in the river channel elevation relative to the floodplain, changes in the hydrologic and sediment regime, functions of the river channel, and the introduction of predatory species (game fish) have significantly impacted the fauna of the Rio Grande. The Rio Grande drainage in New Mexico historically supported at least 21 and perhaps 24 native fish species, representing nine or ten families (Propst 1999). Since the beginning of European settlement along the Rio Grande, this system has lost a larger proportion of its native fish fauna than any other major drainage in New Mexico. Shovelnose sturgeon (*Scaphirhynchus platorhynchus)*, longnose gar (*Lepisosteus osseus*), American eel (*Anguilla rostrata*), speckled chub (*Machrybopsis aestivalis aestivalis*), and Rio Grande shiner (*Notropis jemezanus*) have been extirpated from the Rio Grande in New Mexico, and blue catfish (*Ictalurus furcatus*), if it persists, occurs only in Elephant Butte Reservoir. Rio Grande bluntnose shiner (*Notropis simus simus*) and phantom shiner (*Notropis orca*) are extinct. The silvery minnow is the only state and federally protected fish species currently inhabiting the Rio Grande, but Rio Grande sucker (*Catostomus plebeius*) and Rio Grande chub (*Gila pandora*) may warrant state protection (Propst 1999).

Common fish species of the MRG include the silvery minnow, red shiner (*Cyprinella lutrensis*) river carpsucker (*Carpiodes carpio*), flathead chub (*Platygobio gracilis*), fathead minnow (*Pimephales promelas*), longnose dace (*Rhinichthys cataractae*), white sucker (*Catostomus commersoni*) common carp (*Cyprinus carpio*), western mosquitofish (*Gambusia affinis*), and channel catfish (*Ictalurus punctatus*) (Dudley and Platania 2008). Western mosquitofish, white sucker, and common carp are introduced species that are now common throughout the MRG.

In addition to the aquatic ecosystem of the Rio Grande, the riparian corridor of the MRG historically supported a wide diversity of herpetological species. Prior to increased anthropogenic control, the river system periodically spilled into the floodplain, contributing both water and nutrients that supported a number of reptilian and amphibian species that no longer inhabit the area. In the most intensive biological survey of the MRG to date, Hink and Ohmart (1984) found 18 different species of amphibians and reptiles in the MRG. Eastern fence lizard (*Sceloporus undulatus*), New Mexican whiptail (*Aspidoscelis neomexicanus*), and Woodhouse's toad (*Bufo woodhousii*) were common and widespread. Several species common to the MRG, such as bullfrog (*Rana catesbeiana*), leopard frog (*Rana pipiens*), and Woodhouse's toad, are

ubiquitous throughout the state. Others, such as the chorus frog (*Pseudacris triseriata*) and the common garter snake (*Thamnophis sirtalis*), are unique to the MRG (Hink and Ohmart 1984).

Throughout the year, riparian communities of the MRG provide important habitat during breeding and migration for many birds. Hink and Ohmart (1984) recorded 277 species of birds within 163 miles (262 km) of MRG bosque habitat. Stahlecker and Cox (1997) documented 126 species in Rio Grande Nature Center State Park and estimated that 60 to 65 species of birds breed in the park in most years. The 10 most common species during the winter of 1996–1997 were Dark-eyed Junco (*Junco hyemalis*), American Crow (*Corvus brachyrhynchos*), American Goldfinch (*Carduelis tristis*), White-crowned Sparrow (*Zonotrichia leucophrys*), American Robin (*Turdus migratorius*), Canada Goose (*Branta canadensis*), Red-winged Blackbird (*Agelaius phoeniceus*), Mallard (*Anas platyrhynchos*), European Starling (*Sturnus vulgaris*), and House Finch (*Carpodacus mexicanus*). The 10 most common species in the bosque during the summer of 1997 were Black-chinned Hummingbird (*Archilochus alexandri*), Red-winged Blackbird, Black-headed Grosbeak (*Pheucticus melanocephalus*), Spotted Towhee (*Pipilo maculatus*), Brown-headed Cowbird (*Molothrus ater*), Mourning Dove (*Zenaida macroura*), Bewick's Wren (*Thryomanes bewickii*), Black-capped Chickadee (*Poecile atricapillus*), Cliff Swallow (*Petrochelidon pyrrhonota*), House Finch, and European Starling (Stahlecker and Cox 1997). The most abundant bird species found along the river in winter were Mallard, Canada Goose, and Wood Duck (*Aix sponsa*). Red-tailed Hawk (*Buteo jamaicensis*), Cooper's Hawk (*Accipiter cooperii*), Western Screech Owl (*Megascops kennicottii*), and Great-horned Owl (*Bubo virginianus*) also occur in the proposed project area (Stahlecker and Cox 1997).

Hink and Ohmart (1984) recorded 35 mammal species in their study of the MRG, and Campbell et al. (1997) observed 14 mammal species in their survey of the Albuquerque Reach. Based on both surveys, the most common small mammals in the proposed project area include white-footed mouse (*Peromyscus leucopus*), western harvest mouse (*Reithrodontomys megalotis*), and house mouse (*Mus musculus*). Large mammals in the area include coyotes (*Canis latrans*), raccoon (*Procyon lotor*), beaver (*Castor canadensis*), muskrat *(Ondatra zibethicus*), pocket gopher (*Thomomys bottae*), and rock squirrel (*Spermophilus variegates*). Several species of bats also utilize the MRG.

3.8 THREATENED, ENDANGERED, AND SPECIAL STATUS SPECIES

The agencies that have primary responsibility for the conservation of plant and animal species in New Mexico are the USFWS, under authority of the ESA; the New Mexico Department of Game and Fish (NMDGF), under authority of the New Mexico Wildlife Conservation Act of 1974; and the New Mexico Energy, Minerals and Natural Resources Department, under authority of the New Mexico Endangered Plant Species Act. These agencies maintain lists of plant and animal species that have been classified, or are potential candidates for classification, as threatened or endangered (Table 3.2).

Protection from harassment, harm, or destruction of habitat is granted to species protected under the ESA. The New Mexico Wildlife Conservation Act and New Mexico Endangered Plant Species Act protect state-listed species by prohibiting taking without proper permits.

Table 3.2 Threatened (T), Endangered (E), Species of Concern (S), and Candidate (C) Plant and Wildlife Species That Could Occur within the Project Area

Common Name (*Scientific name*)	Status		General Habitat
	FED	STATE	
Fish			
Rio Grande silvery minnow (*Hybognathus amarus*)	E	E	Silt and sand substrates within slow backwaters
Birds			
Common Black-hawk (*Buteogallus anthracinus*)	–	T	Woodlands along lowland streams
Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*)	C	–	Dense riparian shrub
Southwestern Willow Flycatcher (*Empidonax traillii extimus*)	E	E	Dense riparian groves of willow or saltcedar
Bell's Vireo (*Vireo bellii)*	S	T	Select for lowland riparian vegetation
Bald Eagle (*Haliaeetus leucocephalus alascanus*)	–	T	Timbered riparian areas
Mammals			
New Mexican jumping mouse (*Zapus hudsonius luteus*)	C	E	Riparian vegetation, dense grass and willows
Plants			
Pecos sunflower (*Helianthus paradoxus*)	T	–	Saturated soils of spring-fed desert wetlands

3.8.1 FISH

Rio Grande Silvery Minnow (*Hybognathus amarus*)

The Rio Grande silvery minnow was federally listed as endangered under the ESA on July 20, 1994 (Federal Register [FR] 1994a), and is listed as endangered by the State of New Mexico. The final recovery plan for the silvery minnow was released in July 1999 (USFWS 1999). The primary objectives of the decision are to increase numbers of the silvery minnow, enhance its habitat in the MRG valley, and expand its current range by re-establishing the species in at least three other areas in its historic range (USFWS 2003).

Critical habitat was designated on February 19, 2003 (FR 2003). The critical habitat designation extends from Cochiti Dam downstream to the utility line crossing the Rio Grande upstream of the Elephant Butte Reservoir delta in Socorro County, excluding all Pueblo lands. Thus the project area lies entirely within the critical habitat designation.

The silvery minnow is a moderate-sized, stout minnow that reaches 3.5 inches (9 cm) total length and spawns in the late spring and early summer, coinciding with high spring snowmelt flows (Sublette et al. 1990). The silvery minnow is omnivorous, feeding primarily on diatoms (Shirey 2004; Magaña 2007). These fish travel in schools and tolerate a wide range of habitats (Sublette et al. 1990), but generally prefer low-velocity areas (<0.33 feet per second [10 cm/second]) over

silt or sand substrate that are associated with shallow (<15.8 inches [40 cm]) braided runs, backwaters, or pools (Dudley and Platania 1997). Adults are most commonly found in backwaters, pools, and habitats associated with debris piles, whereas young-of-year occupy shallow, low-velocity backwaters with silt substrates (Dudley and Platania 1997). Habitat includes stream margins, side channels, and off-channel pools where water velocities are low or reduced from main-channel velocities. Stream reaches dominated by straight, narrow, incised channels with rapid flows are not typically occupied by silvery minnow (Bestgen and Platania 1991).

The species is a pelagic spawner that produces 3,000 to 6,000 semi-buoyant, non-adhesive eggs during a spawning event (Platania 1995; Platania and Altenbach 1998). There may be more than one spawning peak during spring runoff and increased summer monsoon flows (USFWS 2003). Eggs and larvae may drift for 3 to 5 days and be transported from 134 to 223 miles (216–359 km) downstream (Platania 1995). Recent data from augmentation and relocation projects suggest that dispersal of eggs, larvae, and older age classes is usually less than 10 miles (16 km) (Remshardt and Davenport 2003; Porter and Massong 2004; Dudley et al. 2005). Silvery minnow larvae can be found in low-velocity habitats where food (mainly phytoplankton and zooplankton) is abundant and predators are scarce.

Platania (1995) suggested that historically the downstream transport of eggs and larvae of the silvery minnow over long distances was likely beneficial to the survival of their populations. The spawning strategy of releasing floating eggs allows recolonization of reaches impacted during periods of natural drought (Platania 1995). The results of two egg drift studies (SWCA 2007b) suggest that the egg retention in the Isleta Reach is higher than in the Albuquerque Reach, with bead retention rates during the high flow ascending limb and the constant high flow experiments. It is thought the greater egg retention rates in the Isleta Reach may be a result of differences in channel geomorphology and the size and numbers of inundated areas; the Isleta Reach shows a greater area of inundated vegetated surface areas. These results are consistent with Porter and Massong (2006) who found that bead retention was generally highest in flooded shoreline areas (e.g., benches and shelves) and on flooded island and sand bar surfaces.

Results from an SWCA (2008e) fisheries monitoring study at the Los Lunas Habitat Restoration Project site suggests that floodplain inundation provides important spawning habitat. To be effective, floodplain inundation must be sustained to exceed a threshold that provides adequate time for parental stock to occupy the floodplain, for embryos to develop and hatch, and for young-of-year to develop at least to the juvenile stage to enable fish evacuation when the floodplain drains (SWCA 2008e). The conclusions of this study support a working hypothesis that silvery minnow adaptively and preferentially spawn in low water exchange habitats and that restoration of inundated floodplains is a plausible strategy, along with the creation of backwater and other hydrologic retentive floodplain habitats, to minimize the downstream displacement of eggs and larvae (SWCA 2008e).

Swimming studies demonstrate that silvery minnow can traverse distances equivalent to 30 miles (50 km) in 72 hours (Bestgen et al. 2003). Bestgen et al. (2003) also recorded silvery minnow speed bursts up to 100 to 120 cm/second (60.0–72.0 m/minute) for periods of five to fifteen seconds.

The 2003 BiOp (USFWS 2003) lists the following primary constituent elements of silvery minnow critical habitat:

1. Throughout silvery minnow life-history, 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 backwaters, shallow side channels, pools, eddies, and runs of varying depth and velocity. These characteristics are necessary for silvery minnow life-history stages in given seasons (e.g., 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; 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 (river miles) to provide a variety of habitats with a wide range of depths and velocities.
3. Substrates predominantly of sand or silt.
4. Water of sufficient quality to maintain natural, daily, and seasonally variable water temperatures in the approximate range of more than 1ºC (35ºF) and less than 30ºC (85ºF) and mitigate degraded conditions (e.g., decreased dissolved oxygen, increased pH).

Silvery minnow population have been surveyed in the Isleta Reach have since 1994 on an ongoing basis by the American Southwest Ichthyological Research Foundation (Dudley et al 2006; Dudley and Platania 2007a, 2007b, 2008), Reclamation, the NMISC, and the USFWS. In 2004, an increased abundance of silvery minnow was observed (Dudley et al. 2005). This observed increase shows that population data vary temporally and geographically. Monitoring early in 2005 revealed low minnow numbers (Dudley et al. 2006); however, numbers rose drastically in June 2005 and remained high into 2006. High spring flows in 2007 and 2008 appeared to stimulate spawning, which resulted in relatively high silvery minnow numbers (Dudley and Platania 2007a, 2008). In these years, the Isleta Reach consistently records greater numbers and proportions of silvery minnow collected; in 2007, Dudley and Platania's counts near the U.S. 380 Bridge near San Antonio, New Mexico in the San Acacia reach were 7.53 per 100 square meters, compared to 22.19 silvery minnow per 100 square meters at their sampling site near the Belen Bridge in the Isleta reach (Dudley and Platania 2007a, 2007b, 2008). Most minnows were collected in low velocity habitats, such as shoreline and backwater areas (Dudley and Platania 2007a, 2007b, 2008). A recent study (SWCA 2008d) monitored silvery minnow densities and water quality parameters daily in the channel, as well as in any isolated pools during periods of dewatering, in both the Isleta and San Acacia reaches. Isolated pools were seined daily to monitor silvery minnow populations in relation to other species. Silvery minnow were found in some of the pools in the Isleta Reach.

3.8.2 BIRDS

Common Black-hawk (*Buteogallus anthracinus*)

The Common Black-hawk is listed as threatened by the State of New Mexico and may occur in the Isleta Reach (NMDGF 2004a). Though the Common Black-hawk is considered rare in Valencia County, nesting was observed in the Isleta Reach during the summer of 2003 (Williams

2003). The species primarily occupies riparian woodlands, particularly areas with well-developed cottonwood galleries, or a variety of woodland and marsh habitats along permanent lowland streams. Breeding Common Black-hawks require mature riparian forest stands near permanent water. The diet of this riparian-obligate species consists mainly of fish, insects, crayfish, amphibians, and reptiles, but occasionally they would take small mammals and birds. Loss of riparian habitat poses the greatest risk to the species. In 1996, the NMDGF estimated there were 60 to 80 breeding pairs in the state.

Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*)

The Western Yellow-billed Cuckoo is a USFWS candidate subspecies that occurs locally along riparian corridors throughout New Mexico. Ideal habitat appears to be dominated by cottonwood canopy with a well-developed willow understory. The Yellow-billed Cuckoo's diet consists mainly of caterpillars but may also include other insects, some fruit, and the occasional lizard or frog (NMDGF 2004b). The breeding range of Yellow-billed Cuckoo extends from California and northern Utah north and east to southwestern Quebec and south to Mexico. In New Mexico, historical accounts indicate that the Yellow-billed Cuckoo was very common along the Rio Grande but was rare statewide (NMDGF 2004b). Both Hink and Ohmart (1984) and Stahlecker and Cox (1997) reported Yellow-billed Cuckoo as a nesting bird in the bosque of the MRG.

Southwestern Willow Flycatcher (*Empidonax traillii extimus*)

The Southwestern Willow Flycatcher was listed as endangered without critical habitat designation on February 27, 1995 (FR 1995). Critical habitat was designated on July 22, 1997 (FR 1997), but was later withdrawn. In October 2004, the USFWS proposed a new extent of critical habitat, which was finalized in October 2005 (FR 2004, 2005). The historic range of the flycatcher includes riparian areas throughout Arizona, California, Colorado, New Mexico, Texas, Utah, and Mexico (FR 1993). The flycatcher is an insectivore that forages in dense shrub and tree vegetation along rivers, streams, and other wetlands (USFWS 2003) and prefers dense riparian thickets, typically willows with a scattered cottonwood overstory. Dense riparian woodlands are particularly important as breeding habitat.

The extent of critical habitat within Valencia County extends from the southern Isleta Pueblo boundary for 44.2 miles (71.1 km) to the northern boundary of Sevilleta National Wildlife Refuge (FR 2005). Thus, the project area lies entirely within the critical habitat designation. As described in the 2003 BiOp, declining flycatcher numbers have been attributed to loss, modification, and fragmentation of riparian breeding habitat; loss of wintering habitat; and brood parasitism by the Brown-headed Cowbird (USFWS 2003). Habitat loss and degradation are caused by a variety of factors, including urban, recreational, and agricultural development; water diversion and groundwater pumping; and channelization, dams, and livestock grazing.

In 2005, three flycatchers were detected at the Los Lunas Restoration Project site close to the proposed project area, and six flycatchers were detected at areas within the Isleta Reach between the Los Lunas and Belen bridges. All these detections occurred in late May and early June 2005; however, since no detections were made in subsequent surveys, it is believed that the flycatchers were probably migrants (Siegle 2005). During surveys by Reclamation in the area between the south boundary of Isleta Pueblo downstream to the Rio Puerco confluence, 30 flycatchers were

observed in 2005, 28 in 2006, and 44 in 2007 (Moore and Ahlers 2006a, 2006b, 2008). However, no flycatchers were fledged from nests in this subreach during this period (Moore and Ahlers 2006a, 2006b, 2008). Of the 44 flycatcher recorded in 2007, 33 were determined to be migrants, four were deemed to be late migrants, five were identified as male territories, and two formed a pair and nested south of U.S. Highway 60 (Moore and Ahlers 2008), which is well downstream of the project area.

Flycatcher nest sites in the Isleta Reach are most often located near the active river channel and in areas of inundation (Parametrix 2008). Work in the Los Lunas Subreach determined that burned cottonwood areas with a willow-dominated understory are probably the most suitable breeding habitat in the Belen Subreach (Siegle 2005). The Belen fire area exhibits these characteristics; therefore, restoration at the LP1DR site could potentially enhance flycatcher habitat in this portion of the Isleta Reach. Monitoring results suggest that small areas of highly suitable habitat currently exist within adjacent sites in the Belen Subreach (Reclamation 2002). These sites are apparently unoccupied by breeding flycatchers. The closest breeding populations that could serve as sources for flycatcher dispersal into the proposed sites are 14 miles (22.5 km) upstream of the Peralta Subreach at the Isleta Pueblo or 20 miles (32 km) downstream of the LP1DR site at the La Joya/Rio Puerco site. However, much of the riparian habitat in the Belen Subreach, including the restoration site, is currently suitable as stopover habitat for migrating flycatchers as confirmed by presence/absence surveys (Siegle 2005).

Bell's Vireo (*Vireo bellii*)

The Bell's Vireo is listed by the USFWS as a species of concern and as threatened by the State of New Mexico. Bell's Vireo is occasionally found during summer months in the lower MRG. The species uses cottonwood and willow habitat patches of 0.25 to 3.0 acres (0.1–1.25 hectares) in riparian corridors throughout the southwestern United States and Mexico. The species is suffering from the effects of habitat loss throughout its historic range. The species has also been impacted by Cowbird parasitism, with an estimate that 70% of all nests are abandoned because of parasitism.

Bald Eagle (*Haliaeetus leucocephalus*)

The Bald Eagle has been removed from the Federal List of Endangered and Threatened Wildlife in the lower 48 States of the United States. The Bald Eagle would continue to receive protection from the Bald and Golden Eagle Protection Act, the MBTA, and the State of New Mexico (FR 2007), as it is still listed by the State as threatened. Bald Eagles are associated with habitats near open water. In New Mexico, Bald Eagles commonly winter in areas adjacent to rivers and lakes or where carrion is available. The major food items for Bald Eagles in New Mexico are waterfowl, fish, and carrion (NMDGF 2004c). Bald Eagles are uncommon during the summer and have limited breeding sites in New Mexico, with documented nests in the extreme northern and western portions of the state. The number of birds wintering in the state has been steadily increasing. The Bald Eagle commonly winters along the Rio Grande, and over-wintering Bald Eagles have been recorded within the project area, where a few individuals may roost in tall cottonwood trees near the river.

3.8.3 MAMMALS

New Mexican Jumping Mouse (*Zapus hudsonius luteus*)

The New Mexican jumping mouse (*Zapus hudsonius luteus*), also known as the New Mexico meadow jumping mouse, is listed by the USFWS as a species of concern and is considered threatened by the State of New Mexico. The species is endemic to New Mexico and Arizona. It is restricted to mesic habitats, preferring permanent streams, moderate to high soil moisture, and dense and diverse streamside vegetation consisting of grasses, sedges, and forbs (NMDGF 2004d). In the Rio Grande valley, the species occurs mainly along the edges of permanent ditches and cattail stands.

3.8.4 PLANTS

Pecos Sunflower (*Helianthus paradoxus*)

The Pecos sunflower (*Helianthus paradoxus*) was afforded threatened species status under the ESA, as amended, on October 20, 1999 (FR 1999). The Pecos sunflower is the only sunflower capable of growing directly in the saturated soils of spring-fed, saline desert wetlands. These wetlands are most commonly desert springs and seeps that form wet meadows called cienegas. These are rare wetland habitats in the arid Southwest region (Hendrickson and Minckley 1984). The soils of these desert wetlands are typically saline or alkaline because the waters are high in dissolved solids and high rates of evaporation leave deposits of salts, including carbonates, at the soil's surface. Soils in these habitats are predominantly silty clays or fine sands with high organic matter content. Studies by Van Auken and Bush (1997, 1998) showed that Pecos sunflower grows in saline soils, but seeds germinate and establish best when precipitation and high water tables reduce salinity near the soil's surface. Like all sunflowers, this species requires open areas that are not shaded by taller vegetation (USFWS, Pecos Sunflower [*Helianthus paradoxus*] Recovery Plan 2005).

Incompatible land uses, habitat degradation and loss, and groundwater withdrawals are historic and current threats to the survival of Pecos sunflower. The loss or alteration of wetland habitat is the main threat. The lowering of water tables through aquifer withdrawals for irrigated agriculture and municipal use, diversion of water from wetlands for agriculture and recreational uses, and wetland filling for conversion to dry land uses destroyed or degraded desert wetlands before this sunflower was listed as threatened.

3.9 SOCIOECONOMICS

This analysis does not focus on all aspects of economics within the proposed project area, but considers only the projected economic costs of the Proposed Action and economic statistics at the state, county, and local levels to describe the economic context of the project.

The proposed project location is in Valencia County, New Mexico. In 2006, New Mexico had an estimated population of 1,954,599, with 66,152 persons residing in Valencia County as of the 2000 census (U.S. Census Bureau 2006). Valencia County, considered rural in character, is

approximately 1,067 square miles (2,763.51 km²) in area, with an average of 61.9 people per square mile.

In 2000, Valencia County had a median household income of $34,099, and in 2002 the per capita personal income in Valencia County was $20,598. This represents an increase of 18.9% from the levels recorded in 1997. This 2002 figure was 67% of the national per capita income, which was $30,906 (U.S. Census Bureau 2004a, 2004b).

For the last decade, the MRG as a whole has experienced rapid population growth, particularly in Bernalillo and Valencia counties. The result is an urban and suburban corridor, extending from the Town of Bernalillo in Sandoval County to Belen in Valencia County, which is essentially a single metropolitan unit despite each community in the area's distinct geographic borders. As such, each community in this region is economically interconnected with its surrounding communities.

It is expected that this project would bring some minor economic multipliers to the towns closest to the project areas. Construction crews would likely patronize local businesses for supplies such as fuel and food. Many of the economic benefits associated with this project would remain within the greater metropolitan area.

3.10 VISUAL AND AESTHETIC RESOURCES

The bosque area within the project area is valued for the visual and aesthetic appeal of mature forest and flowing water in an arid landscape. The bosque is also valued for its wildlife-watching opportunities.

The bosque and river are visible to the public from bridge crossings, such as the U.S. Highway 6 Bridge in Los Lunas, Main Street Bridge in Belen, U.S. Highway 346 Bridge near Bosque, and U.S. Highway 60 Bridge near Bernardo. These bridge vistas of the river and bosque provide thousands of urban residents with a regular and important visual aesthetic experience. The Belen Division of the MRGCD has a bosque access policy to allow for recreation within the river and bosque regions, typically used for hunting and fishing. No motorized vehicles except maintenance and emergency vehicles are allowed in this portion of the bosque, making the aesthetic experience of the recreating public one of a forest and riverside that is full of the sounds and sights of water and forest.

3.11 AIR QUALITY AND NOISE

The proposed project area lies within New Mexico's Air Quality Control Region 152. Region 152 includes most of Valencia County, which is in attainment for all criteria pollutants (carbon monoxide, lead, nitrogen dioxide, particulate matter, ozone, and sulfur oxides) of the National Ambient Air Quality Standards (NMAC 2004). The closest Class I area (a national park or wilderness area) is Manzano Mountain Wilderness, east of the proposed project area. Air quality in the project area is considered to be good. Due to inversions and an increase in the use of wood-burning stoves, carbon monoxide and airborne particulates are occasionally high in the Rio Grande valley during winter months. All vehicles involved in project activities would have emission control equipment that has passed state emissions tests. A fugitive dust permit would be

obtained from local municipalities if necessary, and Best Management Practices (BMPs), such as wetting down disturbed areas to minimize dust, would be followed during project activities.

Noise levels are limited to 90 decibels A-weighted (dBA) averaged over an 8-hour day by the Occupational Safety and Health Administration (29 Code of Federal Regulations [CFR] 1910.95). No worker may be exposed to 115 dBA averaged over an 8-hour day without hearing protection.

3.12 NET WATER DEPLETIONS

The Rio Grande Compact (1939) limits the amount of surface water that can be depleted annually in the MRG based upon the natural flow of the river measured at the Otowi gage near Los Alamos. In addition, the NMOSE has determined that the MRG is fully appropriated. Therefore, any increase in water use in one sector must be offset by a reduction in use in another sector to ensure that neither *Indian Water Rights*, other existing water rights, nor New Mexico's ability to meet its downstream delivery obligations are impaired. Additionally, the New Mexico State Water Plan (NMOSE/NMISC 2003) states that habitat restoration projects should not increase net water depletions, or that if depletions should occur they would be offset through a permitting process established by the NMOSE.

3.13 ENVIRONMENTAL JUSTICE

Executive Order 12898 (FR 1994b), Environmental Justice in Minority and Low-Income Populations, requires consideration of adverse impacts that would disproportionately affect such populations. The population of Valencia County has proportionately more persons of Hispanic and Native American background and fewer persons of African-American or Asian background than the national averages. Ethnic populations in the State of New Mexico are proportionally similar to those in Valencia County. It should be recognized that persons of Hispanic background might also claim identification with another ethnic group as well.

3.14 INDIAN TRUST ASSETS

Indian Trust Assets (ITAs) are legal interests in assets held in trust by the United States Government for Indian tribes or Indian individuals. Some examples of ITAs are lands, minerals, water rights, hunting and fishing rights, titles, and money. ITAs cannot be sold, leased, or alienated without the express approval of the U.S. Government. Secretarial Order 3175 and Reclamation ITA policy require that Reclamation assess the impacts of its projects on ITAs. An inventory of all ITAs within the proposed project area is required. If any ITAs are impacted, mitigation or compensation for adverse impacts to these assets is required.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 INTRODUCTION

This section of the EA evaluates direct, indirect, and cumulative impacts to all resources described in Section 3.0, Affected Environment. Environmental commitments, which would provide ongoing guidance for the proposed project, are summarized at the end of the section.

4.2 GEOMORPHOLOGY AND SOILS

Under the No Action Alternative, the geomorphology of the Rio Grande is expected to remain relatively stable on its current trajectory, though it may be exacerbated by drought conditions, which could cause channels between islands to narrow and deepen. In the absence of frequent and sustained high discharges, the river in this reach would continue to have high velocities. Meandering capability, a process that is important in moving and redefining islands and bars, would continue to be limited. Channels within the river are expected to degrade, resulting in high banks and islands that are rarely inundated. Islands and bars would be stabilized with increasingly mature vegetation, predominantly non-native species. The geomorphic trends produced under the No Action Alternative are unfavorable for the silvery minnow because of decreased capacity for egg retention or larval survival and decreased presence of quality mesohabitat.

Under the Proposed Action, the project would undertake actions to alter channel banks to create the desired habitat types. As a result, the current local geomorphology is anticipated to change. Changes in local geomorphology would facilitate an increase in the amount of habitat necessary for egg retention, rearing of larvae, and survival of young-of-year. Under the Proposed Action, there would be minimal to moderate soil and sediment disturbance levels. The overall effects would be monitored and quantified, but are expected to be beneficial and completely within normal parameters for a sand-bed river system.

Before the initiation of construction activities, environmental protection measures would be reviewed at a pre-project meeting. All activities would be in compliance with local, state, and federal regulations. To mitigate negative effects from erosion, native herbaceous communities may be planted.

4.3 HYDROLOGY AND HYDRAULICS

Under the No Action Alternative and the Proposed Action, there would be no change in the amount or duration of flow in the river. However, the Proposed Action would cause decreased flow velocities in some restoration locations, but based upon FLO-2D modeling, HEC-RAS modeling, and hydrologic analysis, the project is not expected to significantly alter the hydrologic conditions of the river on a broader scale. The results of the FLO-2D modeling show the amount of expected inundation in each reach based on flows. Using this information, the Proposed Action would work with the existing hydrologic conditions to develop the desired habitat types.

4.3.1 HYDRAULIC MODELING

Hydraulic models were run for the Isleta Reach to gain a better understanding of stream dynamics and the level of inundation at each of the two subreaches at given stream flows. HEC-RAS modeling was used to assess overtopping discharges of bank-attached bars and islands and FLO-2D modeling was used to assess the channel capacity, overbank flows and overbank flow paths at discharges greater than channel capacity (MEI 2008).

The HEC-RAS model was run for a range of discharges from 500 to 8,000 cfs in 500 cfs increments. Water surface profiles were developed to identify the overtopping discharges for delineated island and bank-attached bar surfaces. Table 4.1 summarizes the representative elevation and overtopping discharge for bank-attached bars and islands in the Peralta and LP1DR subreaches. Island and bank-attached bar inundation mapping is presented in Appendix B.

The results from the HEC-RAS modeling are presented in Figure 4.1 and Figure 4.2. Analysis of the existing areas of inundation indicate that 60% of the islands and 79% of the bank-attached bars are inundated at 3,500 cfs in the Peralta Subreach, while 23% of the islands and 54% of the bank-attached bars are inundated at 3,500 cfs in the LP1DR Subreach (Table 4.2and Table 4.3). The Proposed Action will not alter the channel capacity or the Base Flood Elevation of the Rio Grande floodway in the project area.

Table 4.1. Summary of Location, Area, Length, Representative Elevation, and Overtopping Discharge of the Bank-Attached and Mid-Channel Bars in the LP1DR and Peralta Subreaches (MEI 2008)

Feature	Easting (feet)	Northing (feet)	Area (acre)	Representative Elevation (feet)	Overtopping Discharge (cfs)	% MDF Exceedance	Exceedance days/year
Peralta_I1	1,491,754	1,343,144	2.05	4,814.00	3,121	8.5	31
Peralta_I2	1,491,738	1,342,513	3.39	4,814.00	3,726	4.9	18
Peralta_I3	1,492,062	1,341,662	3.60	4,813.00	3,339	7.5	27
Peralta_I4	1,492,447	1,339,305	3.84	4,811.00	3,948	3.7	14
Peralta_I5	1,492,382	1,338,673	1.58	4,811.00	4,619	1.7	6
Peralta_I6	1,491,912	1,337,746	5.20	4,809.00	2,267	14.7	53
Peralta_I7	1,491,588	1,337,106	0.93	4,809.00	2,694	11.1	40
Peralta_I8	1,491,215	1,335,802	2.87	4,806.00	2,034	16.9	62
Peralta_I9	1,491,199	1,334,068	17.45	4,807.00	4,375	2.3	8
Peralta_I10	1,491,394	1,334,485	2.87	4,806.00	2,691	11.1	40
Peralta_I11	1,491,187	1,332,841	8.77	4,805.00	2,456	12.9	47
Peralta_I12	1,492,495	1,330,935	11.74	4,803.00	2,475	12.7	46
Peralta_I13	1,493,253	1,329,736	1.42	4,802.00	2,900	9.7	35
LP1_I1	1,493,836	1,329,133	0.16	4,802.00	3,344	7.5	27
LP1_I2	1,494,048	1,327,845	0.13	4,800.00	2,276	14.6	53
LP1_I3	1,494,036	1,327,345	1.31	4,800.50	3,622	5.5	20
LP1_I4	1,494,119	1,327,383	0.22	4,801.00	4,311	2.4	9
LP1_I5	1,493,747	1,325,556	2.70	4,799.00	3,596	5.7	21
LP1_I6	1,493,576	1,325,193	1.70	4,799.00	4,178	2.9	10
LP1_I7	1,492,999	1,324,187	4.48	4,798.00	3,796	4.5	16
LP1_I8	1,492,297	1,323,195	1.49	4,797.00	3,454	6.7	24
LP1_I9	1,492,035	1,322,949	0.37	4,796.00	2,517	12.4	45
LP1_I10	1,490,686	1,321,317	0.95	4,795.00	2,783	10.5	38

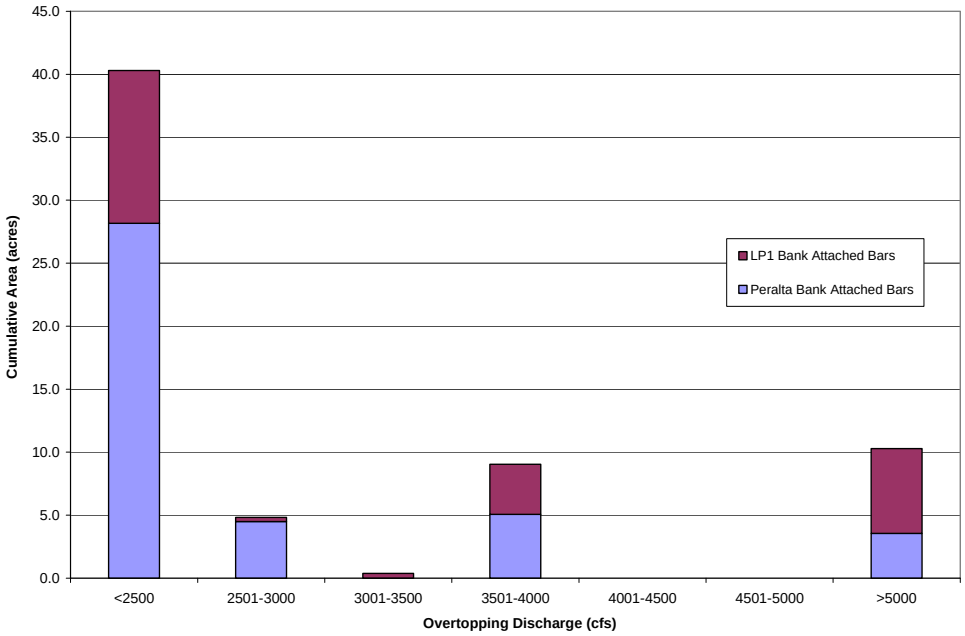

Figure 4.1. Inundation discharge summary for bank-attached bars.

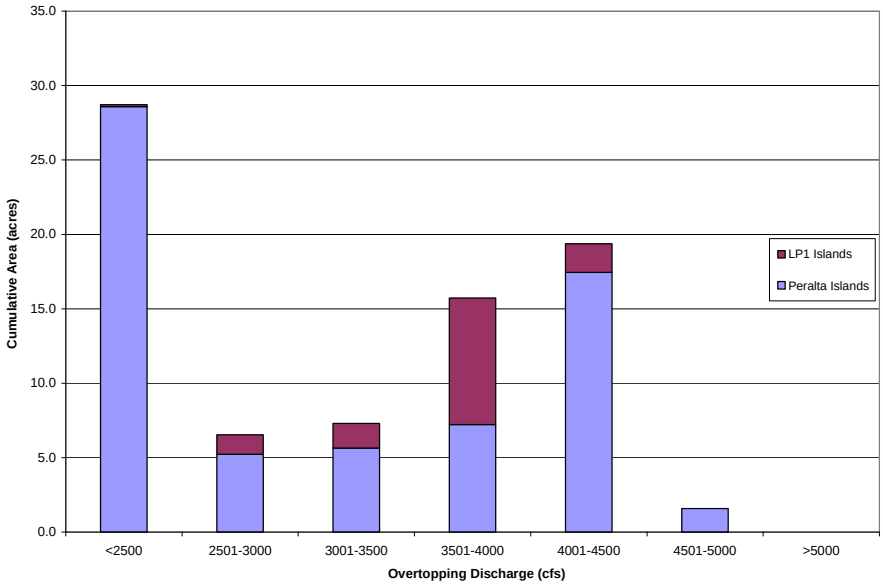

Figure 4.2. Inundation discharge summary for islands.

Table 4.2. Summary of Existing Areas of Inundation of Islands

Discharge (cfs)	Average number of days inundation per year	Peralta		LP1	
		(acres)	(%)	(acres)	(%)
<2,500	>46	28.6	43.5%	0.1	1.05
2,501–3,000	46–33	5.2	7.9%	1.3	9.8%
3,001–3,500	33–23	5.7	8.6%	1.7	12.2%
3,501–4,000	23–13	7.2	11.0%	8.5	62.8%
4,001–4,500	13–7	17.5	26.6%	1.9	14.2%
4,501–5,000	7–4	1.6	2.4%	0.0	0.0%
>5,000	<4	0.0	0.0%	0.0	0.0%
Total		**65.8**	**100.0%**	**13.5**	**100.0%**

Table 4.3. Summary of Existing Areas of Inundation of Bank-Attached Bars (MEI 2008)

Discharge (cfs)	Average number of days inundation per year	Peralta		LP1	
		(acres)	(%)	(acres)	(%)
<2,500	>46	28.2	68.1%	12.1	51.5%
2,501–3,000	46–33	4.5	10.9%	0.3	1.3%
3,001–3,500	33–23	0.0	0.0%	0.4	1.7%
3,501–4,000	23–13	5.1	12.3%	4.0	17.0%
4,001–4,500	13–7	0.0	0.0%	0.0	0.0%
4,501–5,000	7–4	0.0	0.0%	0.0	0.0%
>5,000	<4	3.6	8.7%	6.7	28.5%
Total		**41.4**	**100.0%**	**23.5**	**100.0%**

FLO-2D modeling was executed at steady-state discharges of 4,000 cfs through 8,000 cfs in 500 cfs increments, and overbank inundation mapping was provided (Appendix B). The results indicate that no overbank inundation was computed within the project area at discharges less than 3,000 cfs and begins at approximately 4,000 cfs in the Peralta and LP1DR subreaches (MEI 2008). Figure 4.3 indicates that the predicted area of overbank inundation and the associated mean daily flow exceedance values for the Peralta and LP1DR subreaches. At the Willie Chavez site in the LP1DR Subreach, inundation begins at 4,500 cfs. Approximately 16 acres (6.5 hectares) would be inundated, and based on the mean daily flow exceedance analysis, this discharge would be exceeded, on average, for approximately 8 days per year (MEI 2008).

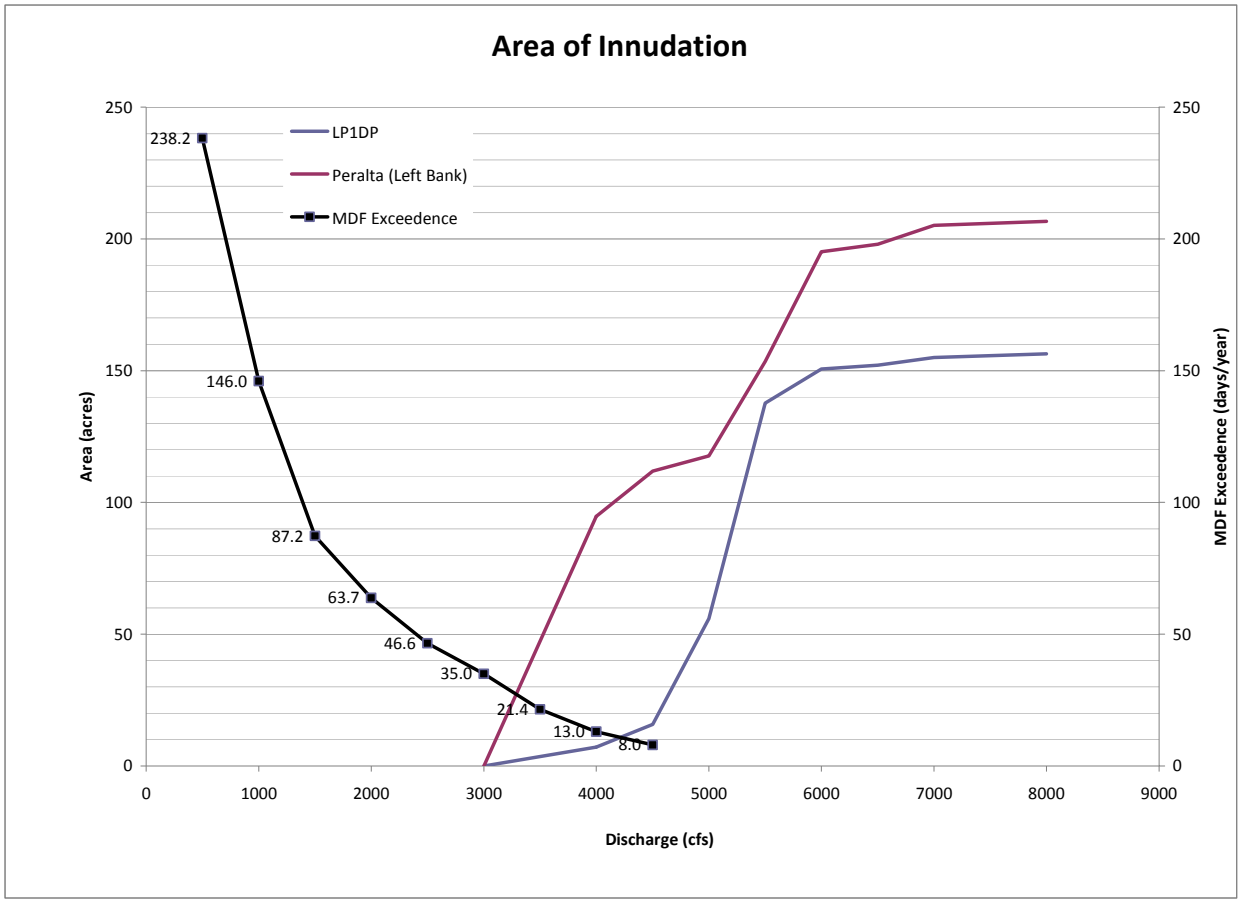

Figure 4.3. Predicted area of overbank inundation Peralta and LP1DR Subreaches and the corresponding mean daily flow exceedance values (MEI 2008).

Additional outputs from HEC-RAS and FLO-2D modeling in the Isleta Reach can be found in Appendix B.

4.4 WATER QUALITY

The No Action Alternative and the Proposed Action would not result in negative changes to water quality where it currently meets applicable standards for physical constituents, such as surface water temperature, pH, turbidity, DO, SSED, conductivity/TDS, and fecal coliform. A temporary and localized change in turbidity and TDS would occur under the Proposed Action because of the mobilization and dispersal of sediments within the river channel during excavation work. Turbidity and TDS levels are expected to return to normal shortly after completion of the excavation work.

The CWA provides protection for wetlands and waters of the United States from impacts associated with dredged or fill material in aquatic habitats, as defined under Section 404(b)(1). CWA compliance is required of all aspects of the project, and since most work associated with the Proposed Action would be completed within jurisdictional areas, a 404 permit from the USACE and 401 permits from the State of New Mexico are required for the NMISC project. For

the MRGCD portion of the project, it is unclear whether a 404 permit would be required; the MRGCD is in consultation with the USACE to determine this. If necessary, the MRGCD would obtain its own 404 permit for its portion of this project. Compliance with the CWA would ensure that the Proposed Action would have no adverse effect on the water quality of the MRG. Water quality would be monitored and evaluated for the duration of the project.

The Proposed Action would result in temporary and localized changes in the measures for physical constituents, particularly for turbidity and TDS, because of the mobilization and dispersal of sediments within the river channel. Short-term and localized adverse effects to water quality may result, but are not expected to exceed applicable standards. The techniques to be tested would depend on high-flow events to release and redistribute sediments within the floodplain. The high-volume flows would be expected to dilute the effects of added sediment load on water quality standards.

4.5 CULTURAL RESOURCES AND TRADITIONAL CULTURAL PROPERTIES

Under the No Action Alternative, there would be no change to cultural resources or TCPs.

Under the Proposed Action, the project would use existing depressions and abandoned channels to create high-flow ephemeral channel and backwater habitat for the silvery minnow within the floodplain. Additional willow habitat would be created adjacent to existing wetland depressions. Revegetation work to restore riparian habitat would be implemented throughout the 100-acre (40-hectare) Willie Chavez site.

Archaeological resources that are listed on or eligible for the NRHP are protected under the NHPA of 1966 (16 United States Code [USC] 470). To determine if any cultural resources sites known to be listed on or eligible for the NRHP are within the project area, Tom Messerli of SWCA conducted a records search for the proposed project in the Archaeological Records Management Section (ARMS) database of the New Mexico Historic Preservation Division on June 16, 2008. Eleven archaeological sites are within 3,281 feet (1,000 m) of the boundaries of the adjacent Peralta and LP1DR subreach project areas found in the course of 19 past cultural resources surveys, mostly for road and associated utility projects in the vicinity. Site and survey locations are provided in a confidential appendix (Appendix E). Most sites outside the project area are found just outside the floodplain. A check of the State and National Registers of Historic Places found no properties within 3,281 feet (1,000 m) of the project areas.

A cultural resources investigation of the Peralta and LP1DR subreaches was conducted during June 17 to 19, 2008, by Christopher Carlson of SWCA. A pedestrian survey was conducted using a transect interval of 50 feet (15 m) throughout the project areas, though dense thickets of brush and trees necessitated a more circuitous route in some portions of the project area. No archaeological sites were found inside the levees (within the historical floodplain of the river) where the Proposed Action would take place. However, Reclamation requested that jetty jacks (placed both parallel and perpendicular to the Rio Grande by the USACE in the early 1950s through the 1960s) be designated as cultural resources. Out of 42 jetty jacks recorded in the entirety of both the LP1DR and Peralta subreaches (labeled 1–42 from north to south), 23 were within or contained portions within the cultural resources survey area; their locations, characteristics, and representative photos are presented in Figure 4.4 through Figure 4.8 and Table 4.4.

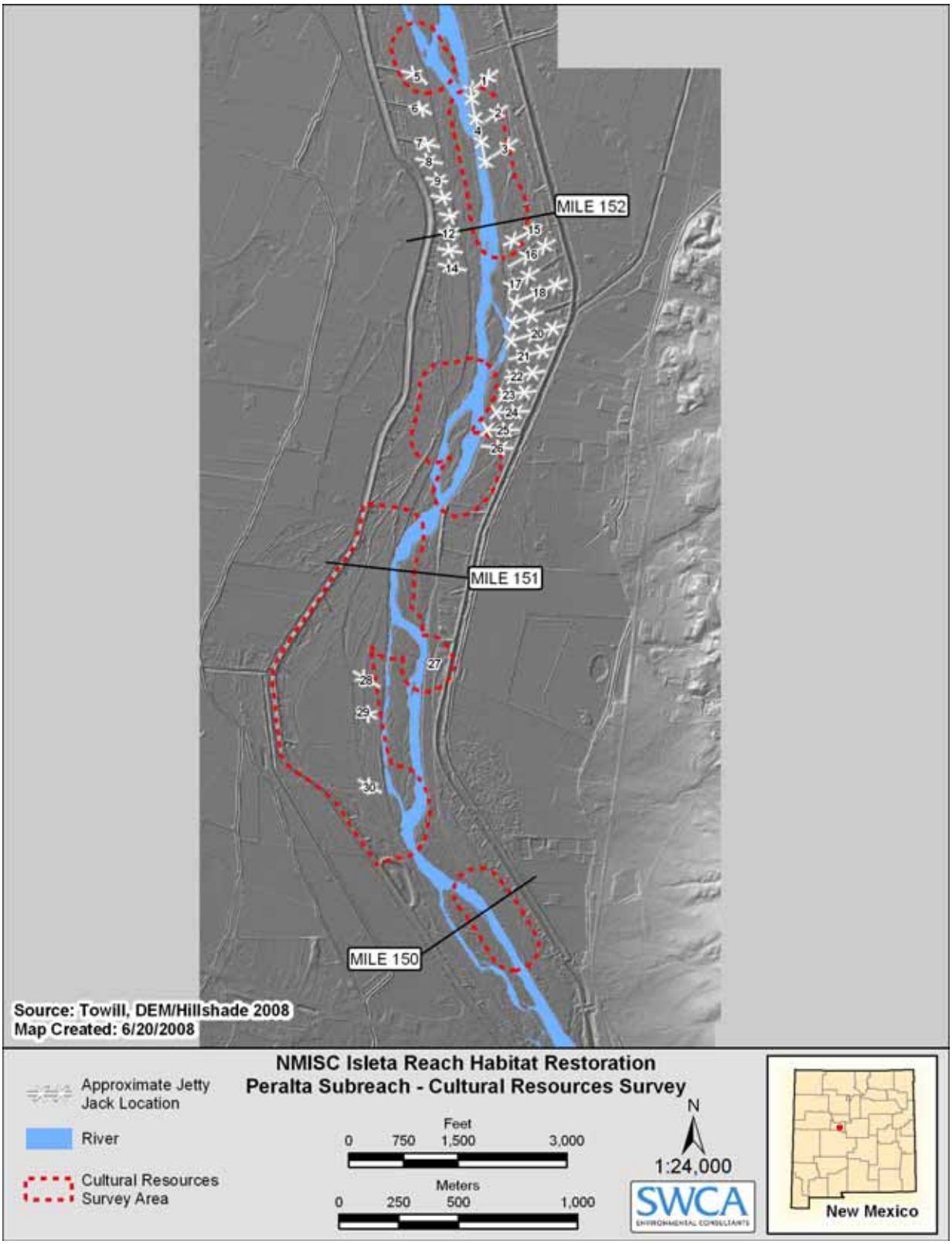

Figure 4.4. The cultural resources survey area within the Peralta Subreach.

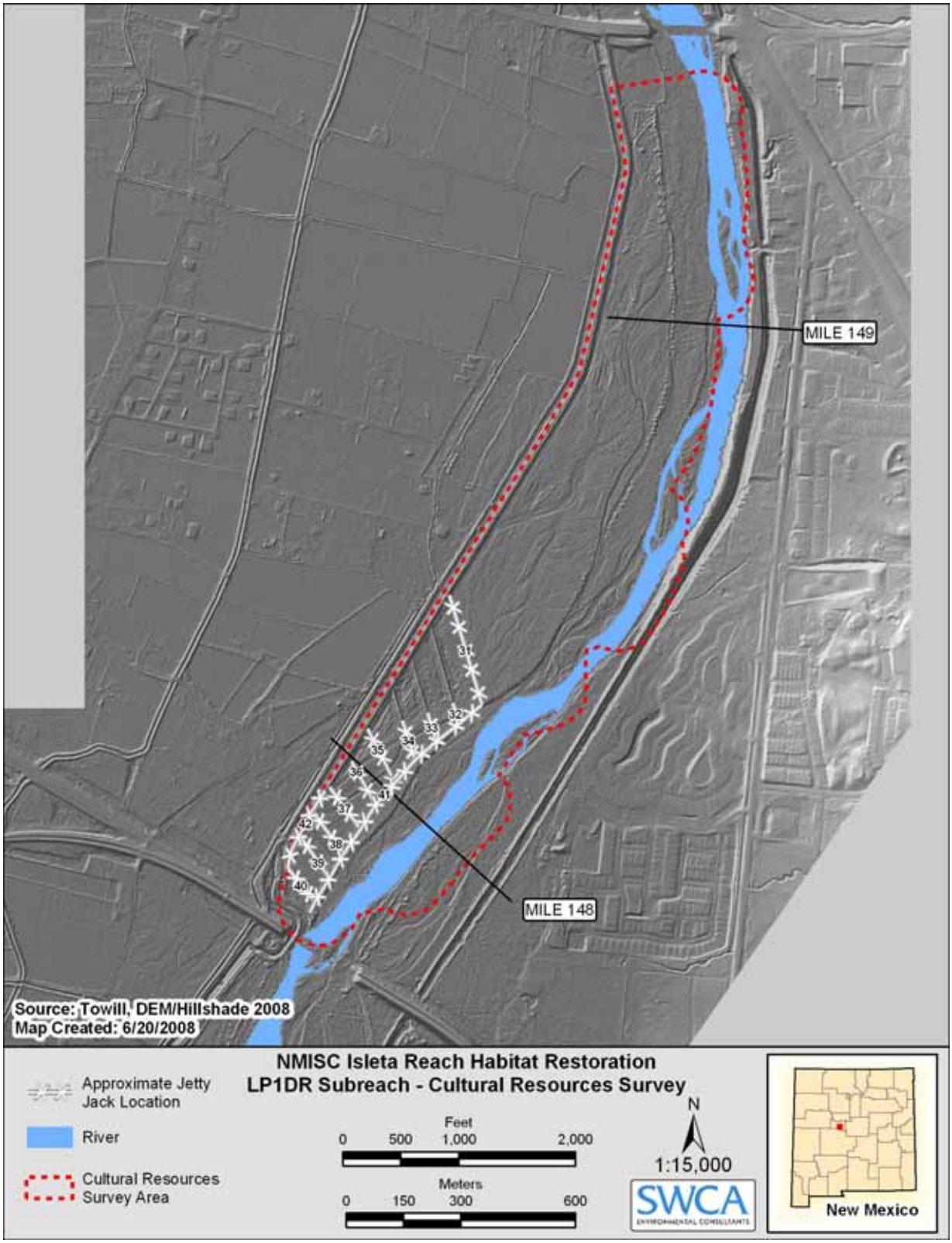

Figure 4.5. The cultural resources survey area within the LP1DR Subreach.

Figure 4.6. Partial overview of Jetty Jack No. 2, view facing west-southwest.

Figure 4.7. Partial overview of Jetty Jack 27, view facing west.

Figure 4.8. Overview of Jetty Jack No. 2, view facing west-southwest.

Table 4.4. Jetty Jack Characteristics within the Cultural Resources Survey Areas

Jetty Jack Number	Bank Side	Length (feet)	Length (m)	Length (m) of Segment within Cultural Resources Survey Area
1	East	466.4	142.2	21.1
2	East	444.0	135.3	98.8
3	East	443.1	135.1	85.8
4	East	1159.7	353.5	345.4
5	West	418.5	127.6	127.6
15	East	613.5	187.0	102.1
26	East	444.4	135.5	70.8
27	East	83.5	25.4	25.4
28	West	438.5	133.6	114.3
29	West	323.1	98.5	98.5
30	West	383.1	116.8	116.8
31	West	980.9	299.0	299.0
32	West	188.8	57.6	57.6
33	West	263.1	80.2	80.2
34	West	358.5	109.3	109.3
35	West	526.3	160.4	160.4
36	West	423.8	129.2	129.2
37	West	451.1	137.5	137.5
38	West	455.8	138.9	138.9
39	West	450.9	137.4	137.4
40	West	367.3	112.0	112.0
41	West	2345.2	714.8	714.8
42	West	749.7	228.5	228.5

Should archeological resources be found during construction at staging areas, access locations, or proposed construction sites, work would stop and the proper authorities (Reclamation Albuquerque Area Office Archaeologist, New Mexico SHPO) would be informed. Project activities would be restricted to the channel of the Rio Grande and to the banks and floodplain of the river. The channel would be accessed wherever it is possible, but most likely along existing access routes, minimizing adverse impacts to any potentially undiscovered archaeological resources from the Proposed Action.

Tribal entities have been contacted through a request for government-to-government consultation to determine whether any TCPs occur within or near the proposed project areas. If TCPs are identified, mitigation would be implemented to preclude any adverse impacts. Consultation with the New Mexico SHPO has been initiated.

4.6 VEGETATION AND WETLAND RESOURCES

Under the No Action Alternative, vegetation may increase, particularly non-native species, on islands and bars. Overbank flooding would remain very limited under current conditions. Under the Proposed Action, some temporary overbank flooding would occur, and over-island flooding would increase. Riparian vegetation is, by definition, subject to intermediate levels of disturbance from flooding. Reduced levels of annual maximum flows under the No Action Alternative have reduced these natural processes. Under the Proposed Action, some native and non-native vegetation would be disturbed by mechanical means during the implementation of the restoration techniques.

The proposed techniques have different levels of potential impact on riparian vegetation. All vegetative communities, native and non-native, would be altered on selected vegetated islands under the Proposed Action. Dead-and-downed native woody species may be used for in-channel placement to create LWD areas. Live native deciduous species would be avoided to the extent possible. Some herbaceous floodplain species may be trampled during construction, but impacts would be moderate.

The Rio Grande, including the proposed project locations, is a USACE jurisdictional waterway. Executive Order 11990 (Protection of Wetlands; FR 1977a) requires the avoidance of short- and long-term adverse impacts associated with the destruction, modification, or other disturbance of wetland habitats. Compliance with Sections 404/401 of the CWA would prevent the permanent loss of wetlands associated with project actions. The Proposed Action would disturb jurisdictional wetland areas; however, these impacts would be temporary, and full wetland functionality should be restored during the following growing season. Following construction, an increased amount of substrate would have the potential to be inundated and/or saturated for significant time periods, which should lead to a net gain in both the area and function of wetlands. Executive Order 11988 (Floodplain Management; FR 1977b) provides federal guidance for activities within the floodplains of inland and coastal waters and requires federal agencies to "ensure that [their] planning programs and budget requests reflect consideration of flood hazards and floodplain management" (FR 1977b). Proposed modification to riverbanks and islands would not result in significant changes in flooding patterns outside the existing floodplain.

4.7 FISH AND WILDLIFE

Short-term impacts to fish and wildlife resources would not occur under the No Action Alternative. Long-term adverse effects on breeding and foraging fish, birds, and mammals, however, are gradual and difficult to quantify. These effects result from long-term reduction in riparian ecological processes, encroachment of non-native species, increased fire hazard, and increased depth to groundwater.

By comparison, the Proposed Action would produce short-term direct impacts to wildlife in the immediate area of disturbance (Siegle 2005) and long-term beneficial effects on fish and riparian wildlife from improved ecological function and increased aquatic habitat. Habitat values particularly for birds are predicted to gradually increase if stands of riparian plants become established and develop adequate structure. To avoid direct impacts to migratory birds protected by the MBTA (16 USC 703, et seq.), clearing and grubbing of woody vegetation would be scheduled between August 15 and April 15, outside the normal breeding season for many birds. Should vegetation removal and construction take place between April 15 and August 15, pre-construction nesting bird surveys would be conducted to identify potential MBTA issues. Any positive pre-construction survey results or observations would be brought to the attention of the USFWS to determine methods of MBTA impact avoidance. Because there may be annual variation in breeding cycles, the NMISC and the MRGCD would consult with the USFWS and/or Reclamation if work would be planned within two weeks before April 15 or after August 15 and would conduct additional surveys if warranted to determine the presence of breeding flycatchers or other breeding birds.

Other wildlife species inhabiting vegetated islands, such as amphibians, reptiles, and mammals, would be temporarily displaced and may experience mortality during the implementation of the Proposed Action. The short-term effects would be outweighed by the long-term benefits of a healthier riparian ecosystem that includes aquatic habitat creation and increased food abundance within mesohabitats.

The LP1DR site that was impacted by the Belen fire in 2007 is likely to experience the greatest impacts on wildlife species abundance as native vegetation regenerates and treatments on invasive species are implemented. The MRGCD has already implemented the removal of dead trees and treatment of regenerating non-natives estimated at 50 to 200 stems per acre (personal communication, Wicklund 2008); approximately 150 native plants have already been planted in the regeneration area. Analysis of a 2000 burn site in riparian vegetation in Los Lunas that was later incorporated into the Los Lunas Habitat Restoration in 2003 revealed that the burned/regenerating cottonwood forest had an abundant and diverse avian population in 2003 and 2004, which is probably due to the dense regenerating understory vegetation (Siegle 2005). This dense new-growth understory of the cottonwood forest site provides high-quality foraging and nesting habitat, and similar conditions are expected at the LP1DR site.

4.8 THREATENED, ENDANGERED, AND SPECIAL STATUS SPECIES

Rio Grande Silvery Minnow (*Hybognathus amarus*)

The No Action Alternative would continue the trends of population decline for this species in the Isleta Reach. The channel in the Isleta Reach is incised, and degradation is expected to continue (Porter and Massong 2004). The silvery minnow is known to occur within the defined project area, and fish obtained from recent salvage operations conducted during river intermittency have been stocked in the Isleta Reach. Emergency salvage in 2007 occurred on fifty (50) days and relocated 546 (adults and juveniles) from isolated pools between the Los Lunas Bridge and the Peralta Wasteway (Remshardt 2008). Increasing the amount and/or quality of suitable riverine habitat is essential for application of rescue and recovery efforts associated with successful silvery minnow population management.

The Proposed Action may affect, but is not likely to adversely affect, designated silvery minnow critical habitat. The primary objective of the Proposed Action is to enhance, restore, and/or create mesohabitat for the silvery minnow at various life stages. The Proposed Action is expected to provide beneficial effects for the silvery minnow and their critical habitat, including improved egg and larva retention, increased recruitment rates, and the increased survival of young-of-year and adult silvery minnow in the Isleta Reach.

Silvery minnow critical habitat encompasses the entire project area (FR 2003). Short-term effects to silvery minnow critical habitat may occur following habitat restoration activities, as discussed in the Biological Assessment (SWCA 2008d). Portions of the work associated with construction activities would take place within the river channel. Developed BMPs would be strictly enforced to minimize erosion and sediment inputs into the river during construction.

The short-term construction activities and the deposition of sediment in shallow water (current habitat areas) of the Proposed Action is likely to adversely affect silvery minnow and lead to take. Consultation with the USFWS is required before construction can begin to ensure that the Proposed Action would not likely jeopardize the continued existence of the species (USFWS 2005).

Common Black-hawk (*Buteogallus anthracinus*)

The No Action Alternative would not cause any changes to riparian vegetation used by this species; therefore, no adverse impacts to the species and its habitat would occur.

The Proposed Action would include clearing of woody vegetation but not mature gallery trees. In addition, areas proposed for vegetation clearing and disturbance are not vegetated with mature forest habitats. Therefore, the Proposed Action should have no adverse impact on the Common Black-hawk.

Western Yellow-billed Cuckoo (*Coccyzus americanus occidentalis*)

The No Action Alternative would not cause changes in the riparian habitats used by this species, and no effects would occur.

The Proposed Action may affect, but is not likely to adversely affect, the Western Yellow-billed Cuckoo. Habitat enhancement resulting from revegetation may cause long-term benefits. To minimize impact on this and other riparian species, clearing and grubbing of woody vegetation would be scheduled to take place between August 15 and April 15. Should vegetation removal and construction be implemented during the breeding season (April–August), pre-construction breeding bird surveys would be conducted and monitoring would be performed to assure avoidance of impacts. Any positive pre-construction survey results or observations of affected species during construction would be discussed with the USFWS to coordinate nesting area avoidance.

Southwestern Willow Flycatcher (*Empidonax traillii extimus*)

A vegetation survey was conducted to evaluate the potential suitability of habitats for flycatcher in the project area. Vegetation of suitable height and density to support flycatcher breeding was not found in any areas to be impacted by the project. Further, there are no known flycatcher nesting territories within the proposal area (personal communication, R. Doster 2008). Without existing suitable habitat or records of breeding, the No Action Alternative would have no effect on the species.

The proposal area is within designated critical habitat for the flycatcher. Per the Southwestern Willow Flycatcher Recovery Plan (USFWS 2002), suitable habitat is defined as a riparian area with all the components needed to provide conditions suitable for breeding; these conditions are generally dense, mesic riparian shrub and tree communities 0.25 acre (0.1 hectare) or greater in size within floodplains large enough to accommodate riparian patches at least 33 feet (10 m) wide, measured perpendicular to the channel. Small quantities of this habitat may be disturbed by noise or by modification during the construction phase of the project. The Proposed Action would temporarily disturb or remove riparian vegetation that might support migrating flycatchers in the project area; however, this project should provide long-term benefit for the flycatcher by enhancing the available habitat. Since the proposed construction would take place outside of the breeding season for the flycatcher (flycatchers have a short, approximately 100-day breeding season, with individuals typically arriving in May or June and departing in August [Sogge et al. 1997]), no adverse effects to the species are anticipated.

The Proposed Action may affect, but is not likely to adversely affect, flycatcher migratory stop-over habitat. To minimize impact on this and other riparian species, clearing and grubbing of woody vegetation would be scheduled between September and April. Should vegetation removal and construction be implemented during the breeding season (April–August), pre-construction breeding bird surveys would be conducted and monitoring would be performed to assure avoidance of impacts. Any positive pre-construction survey results or observations of affected species during construction would be discussed with the USFWS to coordinate nesting area avoidance.

Bell's Vireo (*Vireo bellii*)

The No Action Alternative would not disturb the riparian vegetation where this species may occur; therefore, this alternative would have no effect on the species.

The Proposed Action may affect the Bell's Vireo summertime habitat during the construction phase. However, the construction phase of the project is slated for winter, when the species is not present in the MRG; thus, the species is not likely to be impacted by noise and the increased presence of humans. Long-term, the Proposed Action will not reduce habitat used by Bell's Vireo.

Bald Eagle (*Haliaeetus leucocephalus*)

The No Action Alternative would not disturb the riparian vegetation where this species may occur; therefore, this alternative would have no effect on the species.

The Proposed Action may affect, but is not likely to adversely affect, the Bald Eagle. Project activities may have short-term potential effects on Bald Eagles during construction, related to temporary noise and other disruptions. Removal of woody vegetation and other construction activities may take place during the winter months when Bald Eagles may be in the proposed project area. Guidelines would be employed to minimize the potential for disturbing Bald Eagles. If a Bald Eagle is visible within 0.25 mile (0.4 km) of the proposed project area in the morning when activity starts, or arrives during breaks in activity, the contractor would be required to suspend all construction activity until the bird leaves on its own volition, or the project biologist, in consultation with the USFWS, determines that the potential for harassment is minimal. However, if a Bald Eagle arrives during construction activities, or is observed 0.25 mile (0.4 km) or more from the construction site, activity would not be interrupted.

New Mexican Jumping Mouse (*Zapus hudsonius luteus*)

Lack of suitable habitat in the project area makes it unlikely that either the No Action Alternative or the Proposed Action would have an adverse effect on the New Mexican jumping mouse.

Pecos Sunflower (*Helianthus paradoxus*)

A survey conducted on September 3, 2008, indicated that the Pecos sunflower is not present in the project area. No further analysis will be conducted.

4.9 SOCIOECONOMICS

The long-term economic consequences of the No Action Alternative are unknown at this time and are difficult to assess. These impacts may be greater than those resulting from the Proposed Action due to the significant costs of other silvery minnow habitat restoration options that have been proposed by the Collaborative Program.

The Proposed Action would not adversely affect current economic and socioeconomic conditions within Valencia County. The salvage of firewood from the Belen fire site could provide economic benefit to local communities through approximately 2,500 cords of free wood use and potential use of local contractors. Depending on available funds, the cost of the Proposed Action is estimated at approximately $603,000. This amount is low in comparison with total federal expenditures in Valencia County (approximately $970 million in 2007, [U.S. Census Bureau 2008]) and would not adversely affect current economic conditions.

4.10 VISUAL AND AESTHETIC RESOURCES

The No Action Alternative and Proposed Action would not produce any long-term changes in the visual and aesthetic experience of the river user. The project would imitate the natural processes of shifting channel configuration, islands and bars, and the vegetation mosaic that are part of the river's aesthetic value. Channel and bank modifications may be visible to adjacent homeowners along the river edge or to pedestrians using bridges, trails, and the river edge during project implementation. Much of the area, formerly part of Willie Chavez State Park, was damaged in 2007 in a bosque fire, reducing the aesthetics of the project area. The area burned at the LP1DR (Willie Chavez) site is currently undergoing salvage work to reduce danger to the public as part of the MRGCD restoration project. The riparian restoration outlined in the Proposed Action would not interfere with this restoration and is likely to create no additional impact to visual and aesthetic resources. The proposed construction may be visible from the Belen Bridge. Visual and aesthetic impacts of the proposed project would be brief and limited, and may improve aesthetics in the burn area.

4.11 AIR QUALITY AND NOISE

The project area is a natural area in which a quiet atmosphere is expected. The No Action Alternative would hold ambient noise and air quality levels to this level.

The Proposed Action is not anticipated to generate ambient noise that exceeds county noise ordinances. Construction equipment to be used during the Proposed Action would create temporary variable noise levels that would likely exceed allowable ambient noise levels of 80 dBA in the immediate vicinity of the restoration site. However, all construction sites are anticipated to be more than 500 feet (152 m) from any sensitive noise receptors. The nearest noise receptors would include residents of nearby homes outside the levees. Under the Proposed Action, noise impacts during heavy equipment use would be short term, and heavy equipment would be used only during normal business hours to minimize noise disturbance. The riparian vegetation and levee would abate some of the noise generated by the equipment. A Construction Noise Permit may be issued by the appropriate city or county if sensitive noise receptors are identified within 500 feet (152 m) of restoration construction sites.

Under the Proposed Action, construction equipment would temporarily generate fumes and air emissions. The level of air emissions is anticipated to be low and in compliance with local and federal air emission standards.

4.12 NET WATER DEPLETIONS

The majority of proposed riverine restoration work would occur along the banks of the channel, most of the work falls within the nominal 600-foot (183-m) width of the channel (the original river channel design width for this reach to maintain flow delivery efficiency and reduce flood risk). The NMOSE considers features within the 600-foot (183-m) channel width to be dynamic aspects of the channel. Therefore, no depletion offsets are required for riverine restoration work within the nominal channel width. The NMISC anticipates that the bosque inundation portion of the project will require depletion offsets. The NMISC plans to use water available under the amended Emergency Drought Water Agreement (Appendix A) to offset the depletions that occur annually. These offsets will be made in accordance with the requirements of the NMOSE. The

NMISC may also use state funds to acquire water rights and provide offsets through the New Mexico Strategic Water Reserve a process currently under development. .

The NMISC will submit a permit application or applications, including the EA and other pertinent documentation as necessary. Work would not occur at locations where permits are needed until the necessary permits have been secured. Work at locations where NMOSE permits are not required would be phased for initial construction.

4.13 ENVIRONMENTAL JUSTICE

Under the No Action there would be no change to environmental justice.

The Proposed Action is in compliance with Executive Order 12898 (FR 1994b), Environmental Justice in Minority and Low-Income Populations. The proposed project is on the active floodplain of the Rio Grande, between the flood control levees and within the Isleta Reach of the river. Outside of the levees, nearby land use along this reach of the river includes residential neighborhoods of all economic strata, agricultural land, and commercial and industrial uses.

Regardless of their level, impacts would be similar throughout the Isleta Reach of the river and would affect a diverse group of communities and populations. There would be no disproportionately high or adverse human health or environmental effects on minority or low-income populations from the proposed project.

4.14 INDIAN TRUST ASSETS

The Pueblo of Isleta has been contacted to request a government-to-government consultation to identify any ITAs in the project area and to assess potential impacts in accordance with Secretarial Order 3175 and Reclamation ITA policy. No ITAs were identified; therefore, no impacts are anticipated from the No Action Alternative or the Proposed Action.

4.15 IRRETRIEVABLE COMMITMENT OF RESOURCES

The Proposed Action may result in unavoidable, temporary harm to the silvery minnow. While this result would represent a loss to the species, the USFWS did not anticipate that similar activities conducted under similar projects (Phase 1 and II Habitat Restoration Projects conducted by the NMISC) in the Albuquerque Reach (Reclamation 2007) would jeopardize the species' continued existence (USFWS 2005). Implementation of the project would also result in the commitment of resources such as fossil fuels, construction materials, and labor. In addition, state and federal public funds would be expended for the construction of the proposed project.

4.16 CUMULATIVE IMPACTS

NEPA defines cumulative effects as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions" (42 USC 4331–4335). Cumulative environmental impacts associated with the Rio Grande, including islands and riparian areas, have been evaluated for the following projects relative to the Proposed Action.

4.16.1 MIDDLE RIO GRANDE ENDANGERED SPECIES COLLABORATIVE PROGRAM

The Collaborative Program has solicited and funded multiple habitat restoration projects in the Isleta and Albuquerque reaches (Reclamation 2002). Silvery minnow augmentation funded by the Collaborative Program should provide positive synergistic interactions with the habitat that would be created by this project.

4.16.2 PERENNIAL RIO GRANDE SILVERY MINNOW REFUGIA AT DRAIN OUTFALLS

The MRGCD has performed work in the Isleta Reach near drain outfalls to create continual habitat by the creation of perennial pools (Reclamation 2007). These projects involve the placement of LWD in the channel to create scouring with the intent of creating deep pools that remain wet even during periods of river drying. These pools have the effect of providing refugia for the silvery minnow during periods of low or no flow.

4.16.3 NMISC HABITAT RESTORATION PROJECTS

Currently, the New Mexico Water Trust Board and the NMISC are conducting projects to improve silvery minnow habitat. These projects include increasing scientific knowledge of available food for aquatic species within the MRG and incorporating LWD for improved mesohabitat (Tetra Tech 2004). Phase I construction for the habitat restoration projects included modification of 37 acres (15 hectares) within three subreaches in the Albuquerque Reach of the MRG using many of the techniques outlined in this EA. Phase II of that project continued habitat restoration efforts in the Albuquerque Reach.

4.16.4 LOS LUNAS HABITAT RESTORATION PROJECT

In 2002, the USACE and Reclamation implemented the Los Lunas Habitat Restoration Project (USACE/Reclamation 2002) to improve habitat conditions for the silvery minnow and the flycatcher in a riparian area that had burned in 2000 in the Isleta Reach. The project permanently removed approximately 1,400 jetty jacks, created approximately 40 acres (16 hectares) of shallow-water/low-velocity aquatic habitats, and restored native vegetation to burned areas. Aquatic habitat features included the excavation of a series of high-flow channels, embayments, and backwater mesohabitats designed to provide egg retention and rearing habitat. The USACE and Reclamation have committed to providing 15 years of monitoring.

4.16.5 MIDDLE RIO GRANDE CONSERVANCY DISTRICT MAINTENANCE PROJECTS

The MRGCD routinely performs maintenance on irrigation canals and ditches throughout the MRG. In the Isleta Reach, the MRGCD has begun an effort to reduce sediment levels in the channels and reduce sediment contributions back into the channel at drain outfalls by dredging those canals. Additionally, the MRGCD has, in conjunction with the Pueblo of Isleta, performed work in the channel to destabilize islands to help re-create the dynamic nature of the channel.

4.16.6 U.S. ARMY CORPS OF ENGINEERS LEVEE MAINTENANCE

The U.S. Army Corps of Engineers routinely conducts maintenance on the levees in the Isleta area on an ad-hoc basis for the purpose of flood control. When work is conducted, disturbances

such as noise and increases in fugitive dust occur in and around the bosque. No levee work is currently proposed in close proximity with the restoration work.

4.16.7 U.S. BUREAU OF RECLAMATION PROPOSED DRAIN UNIT 7 PROJECT

Drain Unit 7, is a U.S. Bureau of Reclamation project designed to strengthen an area approximately 500 feet (152 m) upstream of San Acacia dam. This project will strengthen the streambank on the western side of the river. This project is approximately 33 miles (55 km) downstream of the proposed restoration area.

4.16.8 PUEBLO OF ISLETA HABITAT RESTORATION PROJECTS

The Pueblo of Isleta has undertaken several projects with the goal of increasing channel sinuosity and destabilizing in-channel bars. The Pueblo of Isleta's projects could increase suitable habitat for the silvery minnow and redistribute sediment in the channel. The project area is approximately 14 miles (23 km) upstream of the proposed restoration area.

4.17 ANALYSIS OF CUMULATIVE IMPACTS

The cumulative effects of the Proposed Action plus the described related projects may produce short-term changes in several aspects of the existing hydrology, hydraulics, and fluvial geomorphology throughout the Isleta Reach. The Proposed Action may affect other specific downstream restoration projects by changing local fluvial geomorphology and hydrology. Other projects described here may affect the Proposed Action by altering physical processes upon which the proposed techniques depend. Changes in upstream water operations may augment and improve or may decrease the effectiveness of proposed projects.

All treatment and control areas would be monitored for two years to determine the effectiveness of the methods implemented during Phase I of the Proposed Action and the potential hydrologic and geomorphic alterations to the project area. Long-term monitoring (up to 10 years) and adaptive management would be a coordinated effort with the Collaborative Program and would incorporate interagency objectives to assess the self-sustaining and successful regenerating ability of restoration treatments. After monitoring and natural reshaping, the remaining island areas void of native vegetation may be replanted with appropriate native species to stabilize the contours to the extent possible. Following restoration, the treated islands and bars are expected to have a surface elevation suitable for inundation at moderate to high river flows. Revegetation, whether natural or planted, would also provide suitable roughness to decrease flow velocities and increase egg and larva retention.

Fluvial geomorphic, vegetation, and fisheries monitoring would be components of the monitoring plan. Fluvial geomorphic monitoring would occur at least once a year following spring runoff or summer monsoons. Hydrologic events may constitute the need for additional geomorphic monitoring efforts. Vegetation monitoring would occur once a year.

All participants in the various activities on the Rio Grande recognize the need for dramatic change in the riverine ecosystem to provide better support for the endangered silvery minnow; however, the complex cumulative outcome of multiple actions is unpredictable and potentially

adverse to water quality and various indicators of silvery minnow reproductive success. The only effective means of assessing complex cumulative effects on ESA critical habitat and species is to have group participation among all involved parties. Sound scientific measurement of baseline parameters most closely associated with silvery minnow success needs to be developed, and a detailed silvery minnow monitoring protocol needs to be implemented.

4.18 SUMMARY OF EFFECTS

Different techniques considered for habitat restoration within the Isleta Reach would have short-term effects on environmental resources but long-term beneficial effects on biological resources, including the silvery minnow and the flycatcher and their critical habitats. The two subreaches considered for the different restoration techniques are not equally suitable. The overall effects of the proposed restoration techniques are summarized in Table 4.5.

Table 4.5. Environmental Consequences of Proposed Restoration Techniques and No Action Alternative

Environmental Resources	Proposed Action	No Action
Geomorphology and Soils	Short-term adverse impact to channel and bank characteristics; long-term beneficial effects on these altered channel features	Development of channel features that are unfavorable for silvery minnow egg retention and larval and adult success would continue
Hydrology and Hydraulics	Short-term minimal adverse impact to hydrology during construction when some increases in turbidity and total dissolved may be observed. The proposed work will not alter the channel capacity or the base flood elevation of the Rio Grande floodway in the project area. Long-term positive effect is anticipated	No change in the amount or duration of flows in the Isleta Reach
Water Quality	Short-term effects within applicable water quality standards (namely turbidity and TDS); no long-term adverse effects	No change in levels of constituents such as pH, DO, temperature, and turbidity
Cultural Resources and TCPs	No adverse effects on archaeological resources or TCPs are anticipated	No change in cultural resources and traditional cultural properties
Vegetation and Wetlands	Limited short-term effects on vegetation, including some wetlands; no adverse effect on dense, native woody vegetation > 10 feet (3 m) tall. Potential long-term benefits through the active revegetation	Continued trends in vegetation, such as increases in non-native species and woody vegetation on islands
Fish and Wildlife	Short-term adverse impacts; long-term positive effect on fish and wildlife abundance and diversity from habitat improvements are anticipated	Continued adverse trends toward decreased fish and wildlife abundance and diversity

Table 4.5. Environmental Consequences of Proposed Restoration Techniques and No Action Alternative, continued

Environmental Resources	Proposed Action	No Action
Threatened, Endangered, and Special Status Species	Short-term direct effects may occur from the operation of heavy equipment in the channel where the silvery minnow is known to occur, but effects would be minimal and not likely to jeopardize the continued existence of silvery minnow; may affect but not likely to adversely affect flycatcher, yellow-billed cuckoo, and bald eagle. Potential long-term benefits through enhancing existing habitat	Continued adverse trend toward decreased habitat for silvery minnow
Socioeconomics	No adverse effects; the costs of implementing the project are within the annual range of variability for federal and state expenditure for Valencia County	No short-term change in socio-economics is anticipated
Visual and Aesthetic Resources	Short-term negative impacts; long-term positive effect	No long-term or short-term changes in the visual and aesthetic experience
Air Quality and Noise	Short-term adverse impact from increased ambient noise levels; short-term adverse impacts to air quality may be observed because of ground disturbances leading to small increases in fugitive dust and particulate matter	No change in air quality or noise
Net Water Depletions	A small increase in net depletions may occur,, further evaluation required; these depletions would be off-set per NMOSE regulations	No change in net water depletions
Environmental Justice	No adverse effect	No change in environmental justice
Indian Trust Assets	No ITAs identified at this point in time; no adverse effects	No change in ITAs

4.19 ENVIRONMENTAL COMMITMENTS BY NMISC AND MRGCD

All applicable permits would be obtained separately by the NMISC and the MRGCD prior to implementation of each phase of their respective projects, including but not limited to:

- Landowner access permissions, including the MRGCD who would serve as a project partner for a portion of this project
- CWA Section 404—State Water Quality Certification under CWA, Section 401
- Temporary Construction Noise Permit, Valencia County Environmental Health Department
- Temporary Construction Noise Permit, Town of Belen Environmental Health Department

- National Pollutant Discharge Elimination System (NPDES) Permit
- Storm Water Pollution Prevention Plans

In addition to obtaining these permits, the following environmental commitments are to be undertaken separately by the NMISC and the MRGCD:

- Avoiding construction or location of staging areas in jurisdictional wetlands.
- Avoiding impacts to birds protected by the MBTA by scheduling construction outside of the bird breeding season. The NMISC and The MRGCD will consult with the USFWS and/or Reclamation if work will be planned within two weeks before April 15 or after August 15 and will conduct additional surveys if warranted to determine the presence of breeding birds.
- Implementing specific mitigation measures to avoid impacts to threatened or endangered species and their habitats that will be issued by the USFWS in the forthcoming BiOp for this project.
- Avoiding any TCPs identified in the project area identified during previous consultation with the SHPO and tribal entities.
- Implementing measures to stop work and notify the Reclamation Area Archaeologist in the event that prehistoric or historic remains, human burials, or other archaeological resources are discovered during construction or monitoring.
- Assessing water depletions for each site. If increases do occur, they would be offset through a permitting process established by the NMOSE.
- Using silt curtains and fences to minimize any potential increases in turbidity in the river during and immediately after construction-related activities.
- Conducting monitoring at each site to ensure that project goals are met.

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Agencies and other entities contacted formally or informally to coordinate efforts in preparation of this EA include:

- University of New Mexico – Bosque Ecological Monitoring Program
- Hawks Aloft
- Isleta Pueblo
- Middle Rio Grande Conservancy District
- Middle Rio Grande Endangered Species Collaborative Program
- New Mexico Office of the State Engineer
- New Mexico State Historic Preservation Division
- U.S. Army Corps of Engineers
- U.S. Fish and Wildlife Service
- University of New Mexico Heritage Program

Copies of the Public Draft EA are available for a 30-day public inspection and review at the following locations in Albuquerque, Belen, Los Lunas, and Santa Fe:

- Albuquerque Main Library: 501 Copper NW, Albuquerque, NM 87102, (505) 768-5141
- Belen Public Library: 333 Becker St., Belen, NM 87002, (505) 864-7522
- Bureau of Reclamation: 555 Broadway, Suite 100, Albuquerque, NM 87102, (505) 462-3540
- Los Lunas Community Library: 460 Main St. NE, Los Lunas, NM 87031, (505) 839-3850
- Santa Fe Library: 145 Washington Ave., Santa Fe, NM 87501, (505) 955-6780

The Draft EA is available for public inspection online at:
http://www.usbr.gov/uc/albuq/envdocs/index.html

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APPENDIX A
NMOSE RESTORATION OFFSET POLICY, EMERGENCY DROUGHT WATER RELINQUISHMENT AGREEMENT AND AMENDMENT

NMISC GH/AL
10/3/2007

New Mexico Interstate Stream Commission comments to MRG ESA CP Coordination Committee on Quantifying Depletions Associated with Habitat Restoration Projects in the Middle Rio Grande

October 3, 2007

The Interstate Stream Commission (ISC) as signatory to the Middle Rio Grande Endangered Species Collaborative Program wants to ensure that the Program is aware of how depletions must be accounted when undertaking habitat restoration projects. The ISC has confirmed with the Office of the State Engineer (OSE) the current science and policy for accounting for depletions. It is necessary that the OSE review any potential increases in open water for evaporation losses.

The OSE and ISC support the concept of habitat restoration for endangered species. However, habitat restoration projects have the potential to increase depletions from the river system, which impairs water rights holders and compact deliveries. The Rio Grande Compact limits the amount of water that can be depleted in the Middle Rio Grande. Any increase in net depletions constitutes a new appropriation on the system that will jeopardize the ability of the State of New Mexico to meet its downstream delivery obligations. Therefore, the OSE requires that new projects demonstrate that they will not result in any increases in net water depletions, or that any increases are offset by purchased or leased water rights.

The State Engineer maintains that habitat restoration projects implemented by the Bureau of Reclamation, Army Corps of Engineers, or NMISC in the middle Rio Grande floodway do not require water rights permits because of those agencies' respective flood control and compact delivery statutory roles, but that additional depletions caused by those activities must be offset as described below. Habitat restoration projects proposed by other entities will be evaluated with regard to permitting requirements on a case-by-case basis.

General Protocol

If an entity plans to conduct a habitat restoration project that involves diversion of water from a waterway or creation of new open water surface area, that entity needs to provide the Office of the State Engineer with information describing the proposed project. Plans should be sent to the District I office in Albuquerque. The Office of the State Engineer will make a determination of permitting and depletion offsetting requirements.

The OSE and ISC are only concerned with increased evaporation from open water surfaces. Project plans should address evaporative loss from increases in open water surface area. Project plans should not address theoretical net gains to or losses from the system from changes in vegetation.

Criteria for Quantifying Depletions

1. Depletions resulting from any increase in the amount of open water surface area attributable to a project will be quantified at the State Engineer's recognized open water

1

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evaporation rate. Artificial or restored marsh and wetlands are considered equivalent to open water.

According to Office of the State Engineer Memorandum, Water Rights Division – Policy Memorandum dated August 13, 2004; direct evaporation for open water will be derived from Soil Conservation Service Map 4-R-33582 (Gross Annual Lake Evaporation, New Mexico, 1972). Rainfall is not subtracted from the gross evaporation shown on map because the State Engineer is only concerned with losses due to evaporation – not net depletions to the reservoir. An example for calculating evaporation follows below.

For a 15-acre pond, the contour for average annual evaporation is shown as 55 inches or 4.583 feet per year. Evaporation loss is calculated by multiplying 4.583 feet per year by 15 acres for a result of 68.75 acre-feet evaporation loss per year.

2. The State Engineer does not recognize credits or debits for removal or establishment of vegetation. Scientific information collected from the evapotranspiration monitoring sites within the Middle Rio Grande Floodway and elsewhere indicate that water savings from removal or modification of vegetation is relatively small or nonexistent and ephemeral.

3. Work activities conducted by the Bureau of Reclamation, Army Corps of Engineers, or NMISC in the river channel within the Rio Grande Floodway are not likely to increase depletions. The extent of the river channel for different reaches is currently being quantified by OSE/ISC.

2

EMERGENCY DROUGHT WATER AGREEMENT

The Parties to this Emergency Drought Water Agreement ("Agreement") are the State of New Mexico ("New Mexico") acting through the New Mexico Interstate Stream Commission ("NMISC") and the New Mexico Attorney General, and the United States of America ("United States"), acting through the Army Corps of Engineers ("Corps") and the United States Department of the Interior, Bureau of Reclamation ("BOR"). This Agreement amends the Conservation Water Agreement of June 29, 2001, entered into by the Parties.

1. The purposes of this Agreement are to:

A. Provide water for any Reasonable and Prudent Alternatives ("RPAs") or Reasonable and Prudent Measures ("RPMs") for Biological Opinions issued by the United States Fish and Wildlife Service ("FWS") regarding BOR and the Corps' proposed federal actions related to water management operations and river maintenance activities in the Middle Rio Grande and non-federal water management operations in the Middle Rio Grande.

B. Reduce the risk that conditions in the Middle Rio Grande for the next ten years will result in a finding that these actions are likely to jeopardize the continued existence of species listed under the Endangered Species Act ("ESA"), 16 U.S.C. § 1531 et seq. At this time those species are the Rio Grande Silvery Minnow (*Hybognathus amarus)* and the Southwestern Willow Flycatcher (*Empidonax trailii extimus*).

C. Promote the recovery of the listed species and further efforts to populate the silvery minnow in the Middle Rio Grande above San Acacia.

D. Contribute to and support the efforts of the Middle Rio Grande ESA Collaborative Program Workgroup (ESA Workgroup).

E. Address and protect the interests, needs, and rights of Indian Pueblos and Tribes and of all other Middle Rio Grande stakeholders.

F. Recognize the hydrologic realities and the limitations on the water supply that exist in the Middle Rio Grande Basin in a manner consistent with the provisions of applicable state and federal law and the relevant interstate compacts.

2. Term. Except as expressly provided herein in paragraph 8, this Agreement shall expire on February 28, 2013.

3. Definition. "Emergency Drought Water" is water stored and made available by New Mexico consistent with the relevant interstate compacts and with state and Federal law as a conservation pool above Elephant Butte Reservoir. Water that is native to the Rio Grande basin may be stored in reservoirs upstream of Elephant Butte following relinquishment of New Mexico's Rio Grande Compact credits, and upon acceptance of the relinquishment by the State of Texas under Article VII of the Rio Grande Compact. Emergency Drought Water consists of water for needs of the Middle Rio Grande Project ("Project") and to benefit the listed species.

4. Obligations of New Mexico.

A. Provided that the conditions specified in paragraph 8 of this Agreement are met, New Mexico shall make available to the United States up to 70,000 acre-feet of Emergency Drought Water over the term of this Agreement. A maximum of 20,000 acre-feet of Emergency Drought Water made available by New Mexico may be released by the United States in any one calendar year; provided that the United States may release a maximum of 30,000 acre-feet of Emergency Drought Water in 2003. New Mexico further agrees that the United States shall have the right to carry over for release in a future year of this Agreement any portion of a particular year's allocation of the Emergency Drought Water that the United States does not release in that year, in which case the United States shall not be responsible to pay for evaporative losses on such water.

B. The NMISC shall be the lead non-federal agency responsible for obtaining any approvals or agreements from non-federal agencies or entities which are required for the storage of Emergency Drought Water above Elephant Butte Reservoir, including, without limitation, any consent of the Rio Grande Compact Commission which may be required under applicable law, except with respect to any agreement with the Middle Rio Grande Conservancy District ("MRGCD") as further described herein. The NMISC shall be the lead state agency for coordination of implementation of this Agreement with the federal agencies.

C. New Mexico agrees to use payments received from the United States pursuant to this Agreement for purposes of conservation and recovery of the listed species in the Middle Rio Grande Basin, including for purposes of optimizing MRGCD operations.

D. New Mexico will administer the non-Indian water rights in the Rio Chama so as to ensure that releases of Emergency Drought Water are protected. In the event that Emergency Drought Water flows are not protected from diversion, the United States may elect to terminate this Agreement.

5. Emergency Drought Water shall be made available to the United States only for the following purposes:

A. To satisfy the provisions of a RPA or RPM of a Biological Opinion (BO) issued by the FWS, and accepted by BOR and the Corps.

B. To fulfill terms and conditions of permits issued to the United States by the New Mexico Office of the State Engineer for the pumping of water from the Low-Flow Conveyance Channel into the Rio Grande regarding the offset of additional depletions resulting from the operation of such pumps.

C. To fulfill terms and conditions of permits issued to the United States by the New Mexico Office of the State Engineer for the pumping of water from existing or new wells or for other activities for the benefit of the listed species regarding the offset of additional depletions resulting from such pumping or activities.

D. Release to the Rio Grande for beneficial uses occurring in the Rio Grande between two specified locations consistent with a permit issued by the New Mexico Office of the State Engineer pursuant to paragraph 6B with such flows being protected from diversion pursuant to paragraph 4D.

E. Provide to MRGCD, the six Middle Rio Grande Pueblos, or other water users in exchange for water willingly provided by such entities for the benefit of the silvery minnow during bypass operations or emergency situations as may be requested by the United States.

F. To offset new or additional net depletions, if any, resulting from Rio Grande habitat restoration projects by the United States pursuant to an agreement with the State Engineer.

6. Obligations of the United States

A. For purposes of this Agreement only, New Mexico and the United States agree that the value of the release of Emergency Drought Water pursuant to the terms of this Agreement is One Hundred Dollars ($100.00) for each acre-foot released on behalf of the listed species. Payment therefore shall be made to New Mexico no later than February 28 of the year following when such water was released. Under the Article VII dry-year scenario in the BO, when MRGCD storage has been exhausted, Jemez Canyon Dam outflow is negligible, and MRGCD is diverting all the direct flow of the river at Angostura diversion dam to meet irrigation demand within the Albuquerque Division, New Mexico and the United States will meet to negotiate as to payment on that portion of the water released by BOR to flow over Angostura diversion dam to meet the Albuquerque gage flow target that is thereafter diverted by the MRGCD at Isleta diversion dam.

B. The United States agrees to join with the NMISC to apply for any required permits from the New Mexico Office of the State Engineer to store and release any Emergency Drought Water. In the event that a permit is required and the permit issued does not provide for storage and releases of Emergency Drought Water in a manner consistent with the BO from the FWS or with this Agreement, the United States may elect to terminate this Agreement. The parties agree that the release of water stored on behalf of the listed species is an extraordinary action taken under the authority of New Mexico through the relinquishment of New Mexico's Rio Grande Compact credits. When water is stored in El Vado Reservoir under Permit No. 1690 consistent with existing agreements, the six Middle Rio Grande Pueblos have rights to benefit from that storage. Nothing herein is intended to affect Permit No. 1690.

C. The United States shall be responsible for determining the timing, amount, and manner of the storage and release of the Emergency Drought Water in accordance with paragraphs 4A and 6E and in coordination with the six Middle Rio Grande Pueblos through the Bureau of Indian Affairs' Designated Engineer and with the MRGCD.

D. The United States shall perform the hydrologic accounting for all Emergency Drought Water stored and released pursuant to this Agreement in accordance with all current water accounting methods approved by the Rio Grande Compact Commission.

E. Subject to the completion of all necessary approvals and regulatory requirements, the United States will seek to capture, store, and release up to 210,000 acre-feet of Emergency Drought Water over the term of this Agreement, to be allocated as follows: 70,000 acre-feet to the United States, 140,000 acre-feet to the MRGCD, or *pro rata* if due to insufficient runoff such capture, storage and release is not possible. A maximum of 66,667 acre-feet may be released in any one year, with an exception for 2003, and allocated on the same *pro rata* basis, subject to the terms and conditions in this Agreement. A maximum of 76,667 acre-feet may be released in 2003 with a maximum of 30,000 acre-feet released on behalf of the listed species. A maximum of 120,000 acre-feet can be captured and stored under this Agreement in 2003. Such capture, storage and release is to be done in accordance with permits issued by the New Mexico Office of the State Engineer. The United States shall inform the NMISC on a regular basis regarding the status of storage activities.

F. For a period of five years from the date of this Agreement, the emphasis for silvery minnow habitat restoration projects shall be placed on river reaches north of the San Acacia Diversion Dam.

G. The United States shall continue to cooperate in good faith with representatives of New Mexico that apply for permits or authorizations to monitor, collect, and participate in research and data collections and evaluations concerning the silvery minnow.

7. Avoidance of New Depletions.

A. The United States acknowledges that habitat restoration activities done to benefit listed species may cause depletions to the Rio Grande and that such depletions may adversely affect New Mexico's ability to meet its Rio Grande Compact obligations or may impair senior water rights holders. The United States further acknowledges that the NMISC and the New Mexico State Engineer are entrusted under state law with administering the

laws of New Mexico so that New Mexico's Compact obligations may be met and so that senior water rights holders are not impaired.

B. The United States and New Mexico agree:

1. the United States will submit annual reports to the State Engineer outlining all habitat restoration projects, including estimated net depletions resulting from such projects; and

2. to work together so that all future projects that the United States, New Mexico and/or the ESA Workgroup finance or conduct will be designed or constructed so that net depletions will not increase; however, New Mexico acknowledges that certain projects may be of such value to the listed species and that offsetting depletions at that site may not be feasible, in which case the United States agrees to use its best efforts to otherwise offset depletions caused by such projects.

8. Conditions for Availability of Emergency Drought Water. The Parties recognize that the contents and conclusions of Biological Opinions are not subject to this Agreement. However, the parties also recognize that New Mexico will only make Emergency Drought Water available under certain conditions, and the Parties explicitly agree that if any of the following occur, this Agreement may be terminated by New Mexico or the United States:

A. If the FWS issues and BOR and the Corps accept a Biological Opinion for discretionary water management operations and river maintenance activities by BOR and the Corps which does not contain incidental take statements that authorize take that may result from the diversion and use of the waters of the Rio Grande, San Juan-Chama Project water or hydrologically connected groundwater pursuant to valid existing uses of water, the exercise of activities associated with the use of valid and existing water rights, permits issued by the New Mexico Office of the State Engineer, or other uses authorized within the limits of the Rio Grande Compact;

B. If a final Biological Opinion that is not contrary to paragraph 8A above is issued, but the final Biological Opinion is determined to be inadequate or invalid by a court of law or is not accepted by BOR and the Corps;

C. If the United States is required to reinitiate consultation pursuant to 50 C.F.R. Section 402.16, and New Mexico provides written notification to the Parties that it chooses to terminate the Agreement rather than participate in the re-initiation of inter-agency consultation;

D. If a specific federal action implemented to avoid the likelihood of jeopardy to listed species causes any beneficial user of water in the Middle Rio Grande or San Juan-Chama contractor to be prevented, without its consent, from diverting, storing, or using water to which it is entitled;

E. If, prior to April 22, 2003, the United States fails to reach an agreement with the MRGCD satisfactory to New Mexico for the storage, diversion, use, and consumption of water by the MRGCD in a manner that optimizes MRGCD's operations to provide water to farmers for the entire irrigation season and to efficiently satisfy the provisions of a RPA or RPM of a Biological Opinion; or

F. If, by the close of business on April 24, 2003, New Mexico fails to enter into an agreement satisfactory to New Mexico with the State of Texas pursuant to which the State of Texas agrees to accept relinquishment of New Mexico's Rio Grande Compact credits for an amount of up to 217,500 acre-feet of water for the purposes of (i) providing up to 210,000 acre-feet of Emergency Drought water, and (ii) allowing the City of Santa Fe to store up to 7,500 acre-feet of water. If the total amount of water available for storage by New Mexico pursuant to relinquishment of its Rio Grande Compact credits is less than 217,500 acre-feet of water, then the actual amount so available shall be allocated *pro rata* between Emergency Drought Water and City of Santa Fe water.

9. Upon expiration or termination of this Agreement or of the Agreement between the United States and MRGCD referenced in paragraph 8F, any Emergency Drought Water previously stored pursuant to this Agreement will be released as directed by the NMISC.

10. Nothing in this Agreement shall be construed as an admission or concession of any issue of fact or law by any Party.

11. No member of or delegate to Congress shall be entitled to any share or part of this Agreement, or to any benefit that may arise from it.

12. It is the United States's position that implementation of this Agreement is contingent on specific and sufficient Congressional appropriations to carry out the terms of this Agreement. It is New Mexico's position that implementation of this Agreement is contingent on specific and sufficient appropriations by the New Mexico Legislature to carry out the terms of this Agreement. This Agreement is also contingent upon approval of the NMISC.

13. Nothing in this Agreement may be construed to require the obligation, appropriation, or expenditure of any money from the U.S. Treasury. This Agreement is subject to the requirements of the federal Anti-Deficiency Act, and the parties acknowledge that the United States will not be required under this Agreement to expend any federal agency's appropriated funds unless and until an authorized official of that agency affirmatively acts to commit to such expenditures as evidenced in writing.

14. Nothing in this Agreement shall affect or be construed or applied in a manner that is inconsistent with New Mexico law, including the State's authority to regulate and control non-Indian depletions. Nothing in this Agreement shall affect or be construed or applied in a manner that is inconsistent with federal law, or the Rio Grande Compact of 1938, which states:

> "Nothing in this compact shall be construed as affecting the obligations of the United States of America to Mexico under existing treaties, or to the Indian tribes, or as impairing the rights of the Indian tribes."

This Agreement shall not be construed or implemented in a manner that affects or impairs rights of the Pueblos or the obligations of the United States to the Pueblos. This Agreement does not affect the United States' existing obligations with respect to storage and delivery of water to the six Middle Rio Grande Pueblos.

Dated this 23 day of April, 2003.

United States Department of the Interior

Jennifer Gimbel, Department of the Interior

United States Army Corps of Engineers

Dana R. Hurst, Lt. Col., Commander, Albuquerque District

State of New Mexico

Estevan R. Lopez, Director
New Mexico Interstate Stream Commission

Patricia A. Madrid, New Mexico Attorney-General

APR 17 2008

ALB-441
WTR-4.03

CERTIFIED - RETURN RECEIPT REQUESTED

Mr. Kevin Flanigan
New Mexico Interstate Stream Commission
121 Tijeras Ave NE, Ste. 2000
Albuquerque, NM 87102

Subject: Transmittal of Amendment No. 1 to the 2003 Emergency Drought Water Agreement

Mr. Flanigan:

Amendment No. 1 to the 2003 Emergency Drought Water Agreement was executed on March 31, 2008. Enclosed, please find one (1) original of the amendment for your records.

Should you have any questions regarding this amendment, please contact Ms. Tammie Padilla at 505-462-3590.

Sincerely,

James P. Wilber

James P. Wilber, Manager
Facilities and Lands Division

Enclosure

WBR:TPadilla:kmichel:505-462-3590:04/16/08
G:\SecFiles\Fac & Lands\TPadilla\2008.ISCTransmit.EDWA.04162008.doc

EMERGENCY DROUGHT WATER AGREEMENT
AMENDMENT NO. 1

The Emergency Drought Water Agreement of 2003 ("Agreement") is hereby amended to allow the State of New Mexico to make additional relinquishment water available for storage and release by the United States.

1. The first sentence of Section 4(A) of the Agreement is revised as follows:

New Mexico shall make available to the United States up to 82,000 acre-feet of Emergency Drought Water over the term of this Agreement.

2. Section 5(F) of the Agreement is replaced by the following:

To offset new or additional net depletions, if any, resulting from Rio Grande habitat restoration projects by the United States and New Mexico pursuant to an agreement with the State Engineer. The United States agrees that up to 2,000 acre-feet of additional Emergency Drought Water made available to it by New Mexico pursuant to amended Section 4(A) shall be reserved and released by the United States only as directed by the New Mexico Interstate Stream Commission for offset of habitat restoration project depletions.

3. The first sentence of Section 6(A) of the Agreement is revised as follows:

For purposes of this Agreement only, New Mexico and the United States agree that the value of the release of Emergency Drought Water pursuant to the terms of the Agreement is One Hundred Dollars ($100.00) for each acre-foot released on behalf of the listed species up to and not to exceed 80,000 acre-feet.

4. The following provision shall be added to the Agreement as the last sentence of Section 6(A):

No Payment shall be made by the United States to New Mexico for the release of up to 2,000 acre-feet of water pursuant to amended Section 5(F).

5. The first sentence of Section 6(E) of the Agreement is revised as follows:

Subject to the completion of all necessary approvals and regulatory requirements, the United States will seek to capture, store, and release up to 232,000 acre-feet of Emergency Drought Water over the term of this agreement,

to be allocated as follows: 82,000 to the United States, 150,000 to the MRGCD, or *pro rata* if due to insufficient runoff such capture, storage and release is not possible.

Except as specifically provided above, this amendment shall not modify the Agreement, the terms of which shall remain in full force and effect.

Dated this 31st day of March, 2008.

State of New Mexico

Estevan R. Lopez
Director, New Mexico Interstate Stream Commission

Gary King, New Mexico Attorney-General

United States Department of the Interior

Larry Walkoviak, Regional Director
Department of the Interior

United States Army Corps of Engineers

Bruce Estok, Lt. Col., Commander, Albuquerque District

APPENDIX B
HYDRAULIC MODELING RESULTS

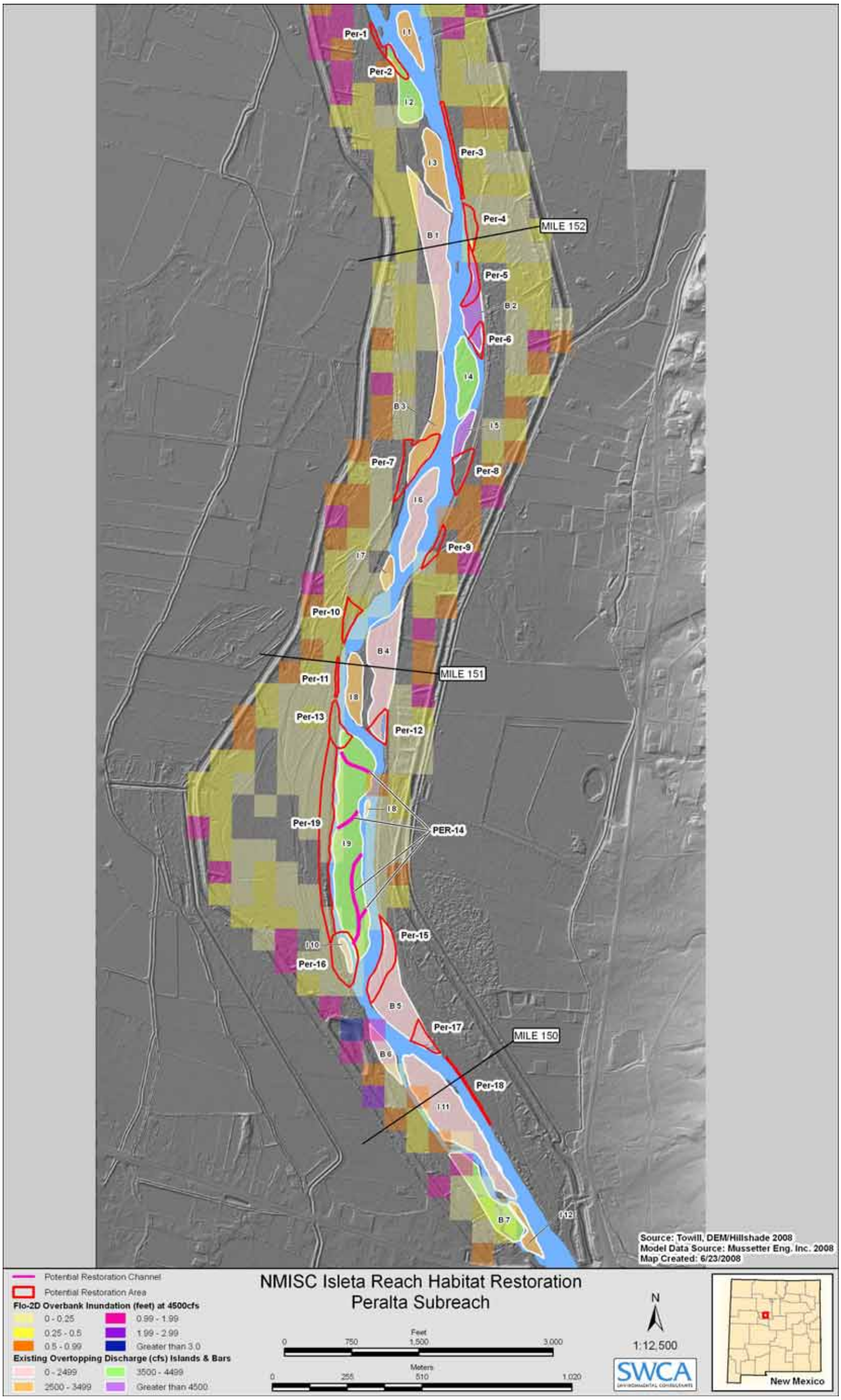

Figure B.1. Peralta Subreach FLO-2D modeling with island/bar and restoration site delineation displayed on the digital elevation model (DEM).

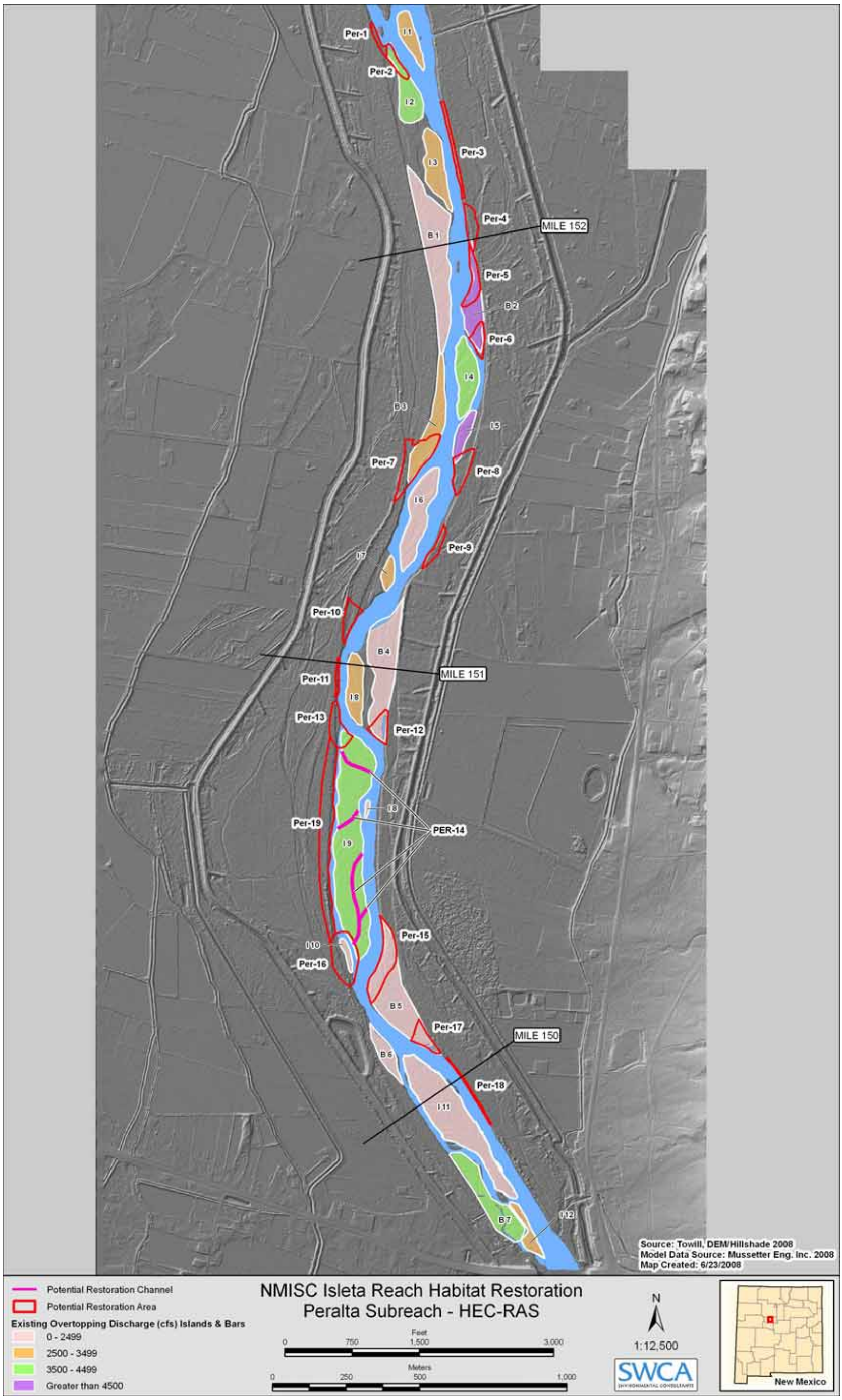

Figure B.2. Peralta Subreach HEC-RAS modeling with island/bar and restoration site delineation displayed on the DEM.

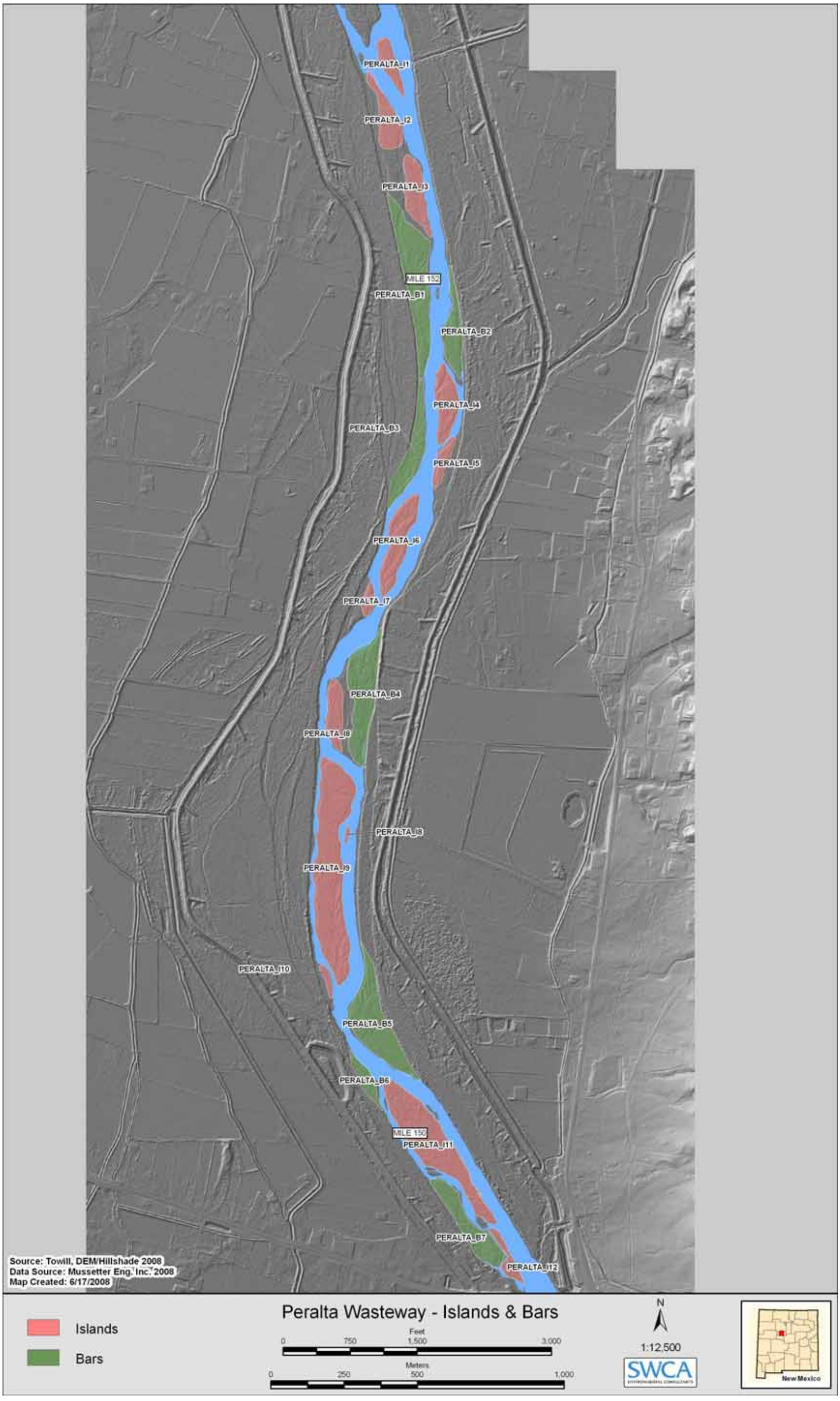

Figure B.3. Peralta Subreach island and bar delineation displayed on the DEM.

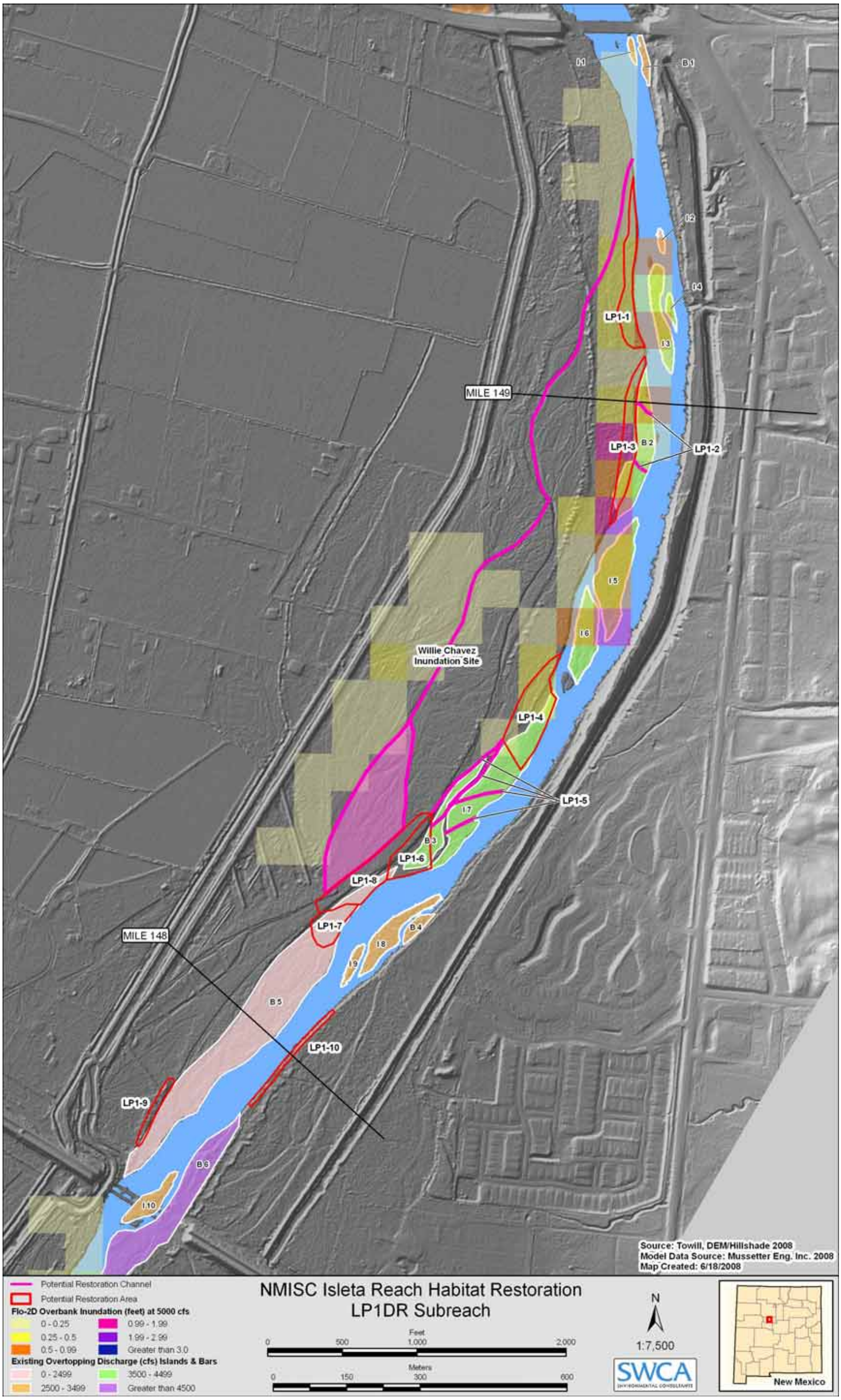

Figure B.4. LP1DR Subreach with Bosque inundation site FLO-2D modeling with island/bar and restoration site delineation displayed on the DEM.

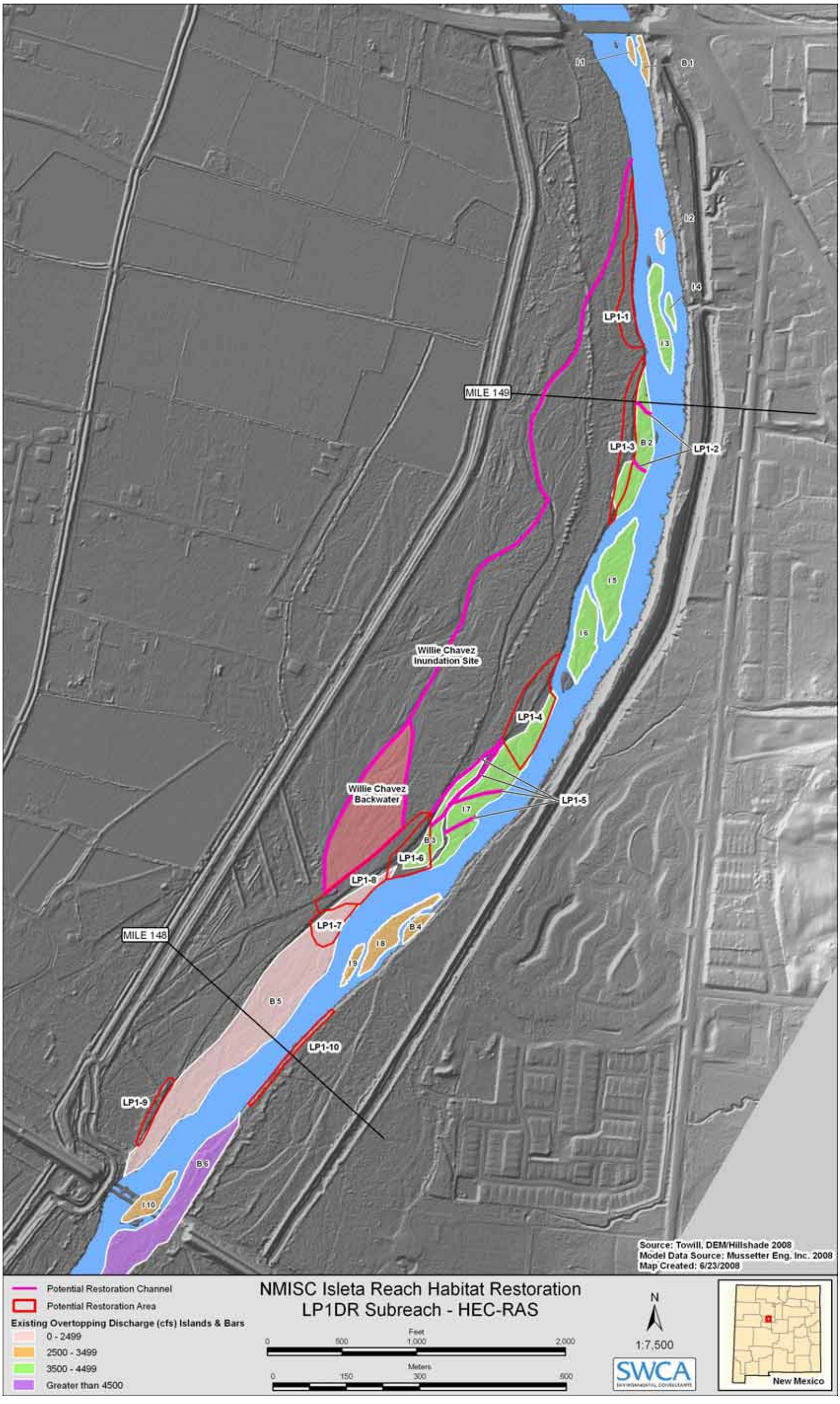

Figure B.5. LP1DR Subreach with Bosque inundation site HEC-RAS modeling with island/bar and restoration site delineation displayed on the DEM.

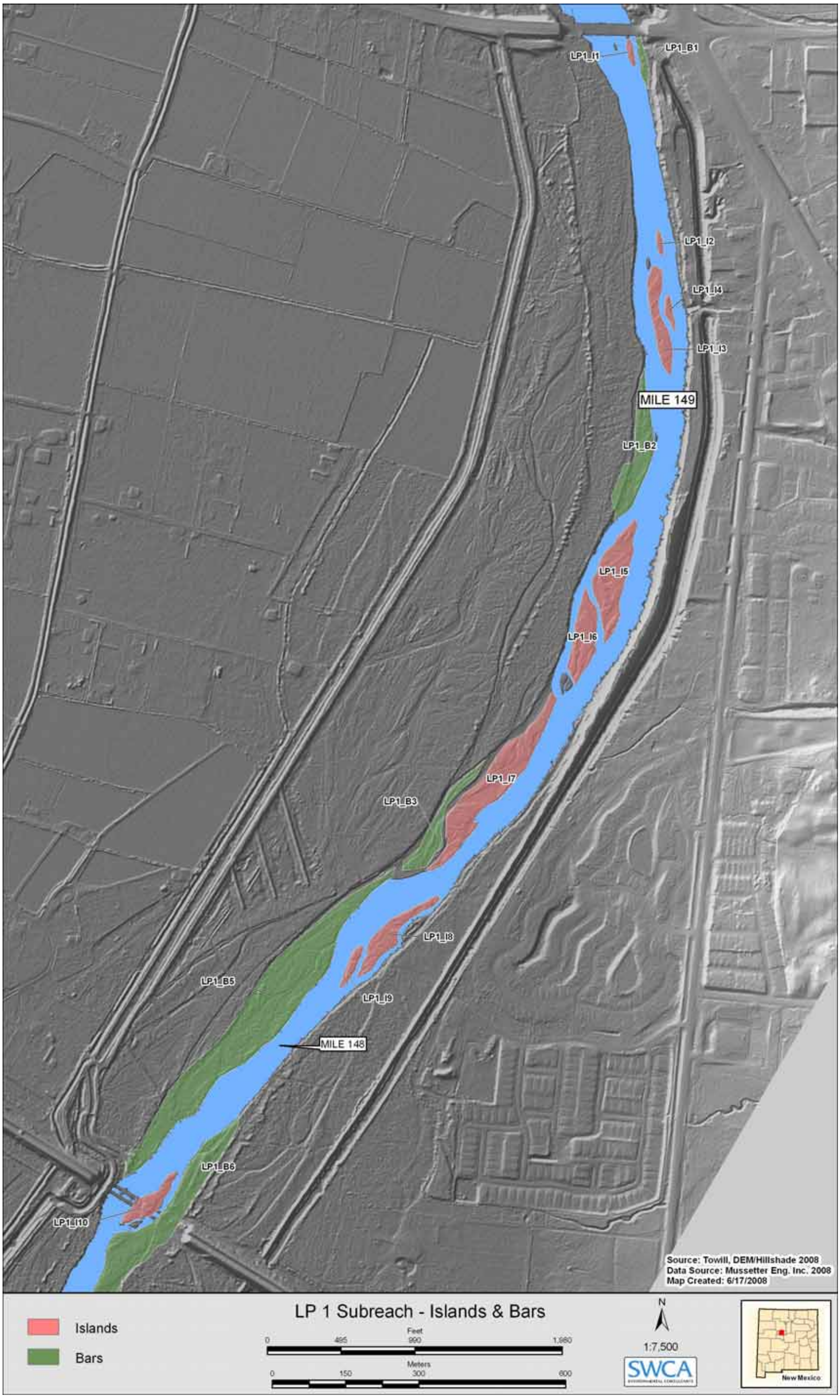

Figure B.6. LP1DR Subreach with Bosque inundation site island and bar delineation displayed on the (DEM).

APPENDIX C
SITE PHOTOS

Peralta Subreach

Figure C.1. Peralta Subreach wetland WL1, view facing north.

Figure C.2. Peralta Subreach wetland WL1, view facing south.

LP1DR Subreach

Figure C.3. Vegetation in LP1DR Subreach wetland WL5.

Figure C.4. In-channel Island in the LP1DR Subreach

APPENDIX D
NEW MEXICO ENVIRONMENT DEPARTMENT
WATER QUALITY STANDARDS

NEW MEXICO WATER QUALITY STANDARDS FOR THE ELEPHANT BUTTE TO ALAMEDA BRIDGE REACH (NMAC 20.6.4.105):

A. Designated Uses: irrigation, marginal warmwater aquatic life, livestock watering, wildlife habitat, and secondary contact.

B. Criteria:

(1) In any single sample: pH within the range of 6.6 to 9.0 and temperature 32.2°C (90°F) or less. The use-specific numeric standards set forth in NMAC 20.6.4.900 are applicable to the designated uses listed above in Subsection A of this section.

(2) The monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less; single sample 410 cfu/100mL or less (see Subsection B of 20.6.4.14 NMAC)

(3) At mean monthly flows above 100 cfs, the mean monthly average concentration for: TDS 1,500 mg/L or less, sulfate 500 mg/L or less, and chloride 250 mg/L or less.

NEW MEXICO WATER QUALITY STANDARDS FOR THE ALAMEDA TO ANGOSTURA REACH (NMAC 20.6.4.106):

A. Designated Uses: irrigation, marginal warmwater aquatic life, livestock watering, wildlife habitat, and secondary contact.

B. Criteria:

(1) In any single sample: dissolved oxygen greater than 5.0 mg/L, pH within the range of 6.6 to 9.0 and temperature less than 32.2°C (90°F). The use-specific numeric standards set forth in 20.6.4.900 NMAC are applicable to the designated uses listed above in Subsection A of this section.

(2) The monthly geometric mean of E. coli bacteria 126 cfu/100 mL or less; single sample 410 cfu/100mL or less (see Subsection B of 20.6.4.14 NMAC)

(3) At mean monthly flows above 100 cfs, the mean monthly average concentration for: TDS 1,500 mg/L or less, sulfate 500 mg/L or less, and chloride 250 mg/L or less.

GENERAL CRITERIA FOR WATERS OF THE STATE OF NEW MEXICO (NMAC 20.6.4.13):

A. Bottom Deposits and Suspended or Settleable Solids:

(1) Surface waters of the state shall be free of water contaminants including fine sediment particles (less than two millimeters in diameter), precipitates or organic or inorganic solids from other than natural causes that have settled to form layers on or fill the interstices of the natural or dominant substrate in quantities that damage or impair the normal growth, function or reproduction of aquatic life or significantly alter the physical or chemical properties of the bottom.

(2) Suspended or settleable solids from other than natural causes shall not be present in surface waters of the state in quantities that damage or impair the normal growth, function or reproduction of aquatic life or adversely affect other designated uses.

B. Floating Solids, Oil and Grease: Surface waters of the state shall be free of oils, scum, grease and other floating materials resulting from other than natural causes that would cause the formation of a visible sheen or visible deposits on the bottom or shoreline, or would damage or impair the normal growth, function or reproduction of human, animal, plant or aquatic life.

C. Color: Color-producing materials resulting from other than natural causes shall not create an aesthetically undesirable condition nor shall color impair the use of the water by desirable aquatic life presently common in surface waters of the state.

D. Organoleptic Quality:

(1) Flavor of Fish: Water contaminants from other than natural causes shall be limited to concentrations that will not impart unpalatable flavor to fish.

(2) Odor and Taste of Water: Water contaminants from other than natural causes shall be limited to concentrations that will not result in offensive odor or taste arising in a surface water of the state or otherwise interfere with the reasonable use of the water.

E. Plant Nutrients: Plant nutrients from other than natural causes shall not be present in concentrations that will produce undesirable aquatic life or result in a dominance of nuisance species in surface waters of the state.

F. Toxic Pollutants:

(1) Except as provided in 20.6.4.16 NMAC, surface waters of the state shall be free of toxic pollutants from other than natural causes in amounts, concentrations or combinations that affect the propagation of fish or that are toxic to humans, livestock or other animals, fish or other aquatic organisms, wildlife using aquatic environments for habitation or aquatic organisms for food, or that will or can reasonably be expected to bioaccumulate in tissues of fish, shellfish and other aquatic organisms to levels that will impair the health of aquatic organisms or wildlife or result in unacceptable tastes, odors or health risks to human consumers of aquatic organisms.

(2) Pursuant to this section, the human health criteria shall be as set out in 20.6.4.900 NMAC. For a toxic pollutant for human health not listed in 20.6.4.900 NMAC, the following provisions shall be applied in accordance with 20.6.4.11, 20.6.4.12 and 20.6.4.14 NMAC.

(a) The human health criterion shall be the recommended human health criterion for "consumption of organisms only" published by the U.S. Environmental Protection Agency pursuant to Section 304(a) of the federal Clean Water Act. In determining such criterion for a cancer-causing toxic pollutant, a cancer risk of 10-5 (one cancer per 100,000 exposed persons) shall be used.

(b) When a numeric criterion for the protection of human health has not been published by the U.S. Environmental Protection Agency, a quantifiable criterion may be derived from data available in the U.S. Environmental Protection Agency's Integrated Risk Information System (IRIS) using the appropriate formula specified in *methodology for deriving ambient water quality criteria for the protection of human health (2000)*, EPA-822-B-00-004.

(3) Pursuant to this section, the chronic aquatic life standard shall be as set out in 20.6.4.900 NMAC. For a toxic pollutant for aquatic life with no chronic standard listed in 20.6.4.900 NMAC, the following provisions shall be applied in sequential order in accordance with 20.6.4.11, 20.6.4.12 and 20.6.4.14 NMAC.

(a) The chronic aquatic life criterion shall be the "freshwater criterion continuous concentration" published by the U.S. environmental protection agency pursuant to Section 304(a) of the federal Clean Water Act; 20.6.4 NMAC 11

(b) If the U.S. environmental protection agency has not published a chronic aquatic life criterion, a geometric mean LC-50 value shall be calculated for

the particular species, genus or group that is representative of the form of life to be preserved, using the results of toxicological studies published in scientific journals.

(i) The chronic aquatic life criterion for a toxic pollutant that does not bioaccumulate shall be 10 percent of the calculated geometric mean LC-50 value; and

(ii) The chronic aquatic life criterion for a toxic pollutant that does bioaccumulate shall be: the calculated geometric mean LC-50 adjusted by a bioaccumulation factor for the particular species, genus or group representative of the form of life to be preserved, but when such bioaccumulation factor has not been published, the criterion shall be one percent of the calculated geometric mean LC-50 value.

(4) Pursuant to this section, the acute aquatic life criteria shall be as set out in 20.6.4.900 NMAC. For a toxic pollutant for aquatic life with no acute criterion listed in 20.6.4.900 NMAC, the acute aquatic life criterion shall be the "freshwater criterion maximum concentration" published by the U.S. environmental protection agency pursuant to Section 304(a) of the federal Clean Water Act.

(5) Within 90 days of the issuance of a final NPDES [National Pollutant Discharge Elimination System] permit containing a numeric criterion selected or calculated pursuant to Paragraph 2, Paragraph 3 or Paragraph 4 of Subsection F of this section, the department shall petition the commission to adopt such criterion into these standards.

G. Radioactivity: The radioactivity of surface waters of the state shall be maintained at the lowest practical level and shall in no case exceed the criteria set forth in the New Mexico Radiation Protection Regulations, 20.3.1 and 20.3.4 NMAC.

H. Pathogens: Surface waters of the state shall be free of pathogens from other than natural sources in sufficient quantity to impair public health or the designated, existing or attainable uses of a surface water of the state.

I. Temperature: Maximum temperatures for each classified water of the state have been specified in 20.6.4.101 through 20.6.4.899 NMAC. However, the introduction of heat by other than natural causes shall not increase the temperature, as measured from above the point of introduction, by more than 2.7°C (5°F) in a stream, or more than 1.7°C (3°F) in a lake or reservoir. In no case will the introduction of heat be permitted when the maximum temperature specified for the reach would thereby be exceeded. These temperature criteria shall not apply to impoundments constructed offstream for the purpose of heat disposal. High water temperatures caused by\ unusually high ambient air temperatures are not violations of these standards.

J. Turbidity: Turbidity attributable to other than natural causes shall not reduce light transmission to the point that the normal growth, function or reproduction of aquatic life is impaired or that will cause substantial visible contrast with the natural appearance of the water. Turbidity shall not exceed 10 NTU [nephalometric turbidity units] over background turbidity when the background turbidity is 50 NTU or less, or increase more than 20 percent when the background turbidity is more than 50 NTU. Background turbidity shall be measured at a point immediately upstream of the turbidity-causing activity. However, limited-duration activities necessary to accommodate dredging, construction or other similar activities and that cause the criterion to be exceeded may be

authorized provided all practicable turbidity control techniques have been applied and all appropriate permits and approvals have been obtained.

K. Total Dissolved Solids (TDS): TDS attributable to other than natural causes shall not damage or impair the normal growth, function or reproduction of animal, plant or aquatic life. TDS shall be measured by either the "calculation method" (sum of constituents) or the filterable residue method. Approved test procedures for these determinations are set forth in 20.6.4.14 NMAC.

L. Dissolved Gases: Surface waters of the state shall be free of nitrogen and other dissolved gases at levels above 110 percent saturation when this supersaturation is attributable to municipal, industrial or other discharges.