4. Species Description, Federal Listing Status and Life History

The listed species in the project area, as well as their habitats, include the Rio Grande silvery minnow, southwestern willow flycatcher, and Pecos sunflower. Currently, the only recognized Pecos sunflower population within the action area is located specifically on the Rhodes property south of Arroyo de las Cañas or on land managed by the New Mexico Department of Game and Fish. Reclamation will work with the Service to avoid impact to the sunflower populations on any maintenance activities that would affect the Pecos sunflower population. The project area is on the outside periphery of the interior least tern's breeding range, and terns typically are not observed along the Middle Rio Grande. The analysis for this BA component focuses on the silvery minnow and the flycatcher and can be found in Chapter 4. Species Description, Federal Listing Status and Life History of the Joint Biological Assessment, Bureau of Reclamation and Non-Federal Water Management and Maintenance Activities on the Middle Rio Grande, New Mexico, Part I – Water Management.

5. MRG Maintenance Baseline

5.1 Introduction

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

The environmental baseline describes a "snapshot in time" that includes the effects of all past and present Federal and non-Federal human activities. All existing facilities and all previous and current effects of operation and maintenance of the Project, as well as all ongoing, non-Federal irrigation activities and existing physical features such as diversion dams, storage dams, and flood control levees are part of the environmental baseline. The environmental baseline for the Part II – Maintenance is described in Chapter 5. Environmental Baseline of the Joint Biological Assessment, Bureau of Reclamation and Non-Federal Water Management and Maintenance Activities on the Middle Rio Grande, New Mexico, Part I – Water Management. Additional geomorphic and background supporting information also may be found in the Middle Rio Grande River Maintenance Plan, Part 1 Report (Reclamation 2007), the Middle Rio Grande River Maintenance Program Comprehensive Plan and Guide (Reclamation 2012a), and the report titled Channel Conditions and Dynamics of the Middle Rio Grande by Makar and AuBuchon (2012).

This river maintenance baseline includes additional baseline information on river maintenance work between 2001–2013 (see section 5.2). This section was added to provide baseline information on the historical MRG work that has been done through river maintenance. The time period covers work that has been done (2001–2012) and work (2012–2013) that is expected to occur before the BiOp associated with this BA is issued. This historical perspective provides a picture of the current river maintenance practice that considers environmental resources along with the more traditional river maintenance concerns of channel sustainability, protection of riverside infrastructure and resources, and effective water delivery. Some of the methods that have been used for river maintenance projects are similar to those used for habitat restoration work on the MRG (see the

Habitat Restoration subsection of the Environmental Baseline for Reclamation's Water Management BA component). While the purposes for the work may have been different, these methods have a similar effect on the surrounding local morphology.

5.2 MRG River Maintenance Historical Perspective

5.2.1 MRG River Maintenance Priority Site Criteria

The decision process for identifying individual river maintenance projects and actions follows criteria developed to prioritize river maintenance needs (Smith 2005). A river maintenance priority site is defined as a site at which one or more of the following exist and could be addressed by river maintenance activities:

- The continuation of current trends of channel migration or morphology likely will result in damage to riverside infrastructure within the foreseeable future.

- Similar conditions have historically resulted in failures or near failures at flows less than the 2-year flood.

- Existing conditions cause significant economic loss, danger to public health and safety, or loss of effective water delivery.

Monitored sites are locations that have the potential of becoming future priority sites based on the above criteria. The river maintenance program has established a methodology for assessing existing sites and identifying new site locations. This methodology involves ongoing aerial monitoring and field reviews of river channel conditions. Factors incorporated into the priority site review methodology process include engineering analysis and judgments, river geomorphic considerations, environmental considerations, public involvement, political considerations, and economic considerations (i.e., the value of riverside infrastructure). The fundamental activities that support decisionmaking on channel maintenance needs are monitoring changes in the river channel morphology, evaluating channel stability, and modeling channel and levee capacity (Smith 2005). The priority site review methodology rates sites for maintenance implementation to determine their relative priority to each other as well as to document decisions that are made to undertake river maintenance activities for each site. Additional information about the decision process for determining river maintenance activities at priority and monitored sites can be found in the report, Middle Rio Grande River Maintenance Plan, Part 1 (Reclamation 2007).

5.2.2 MRG River Maintenance Sites: 2001–2012

A summary of acreage impacts and project durations for river maintenance projects between 2001–2012 is shown in table 17. The information in table 17 represents statistical river maintenance project information on a per project basis. These are projects that have been implemented or are in the process of being implemented. Information on the type and amount of river maintenance projects completed between 2001–2012 is shown in table 18. An illustration of the impact acreage (wet and dry) for river maintenance projects completed between 2001–2012 is shown in figure 3 as a percent exceedance curve. The projects are a combination of new project sites, completed sites where adaptive management was needed, and interim/ unanticipated work.

Table 17. 2001–2012 River Maintenance Acreage Impacts and Project Durations

	Access roads (acres)	Project impact area in the dry (acres)	Project impact in the wet (acres)	Total project impact (acres)	Project Duration (months)
Maximum	18	[1]68	[2]62	88	16
Minimum	0	0	0	1	1
Average	3	7	5	12	6

[1] See table 25 for information on the Bosque del Apache (BDA) Channel Widening river maintenance project.
[2] See table 22 for information on the Santa Ana Restoration Phase 1 river maintenance project.

Table 18. River Maintenance Projects by Year

Year	Adaptive Management Sites	New Project Sites	Interim or Emergency Work	Total
2000				0
2001		1		1
2002		2	1	3
2003		1		1
2004		1		1
2005	1	4	3	8
2006			1	1
2007	3	3	1	7
2008		4		4
2009	1	2		3
2010	1		1	2
2011		2	1	3
2012	1	2	1	4
Total	**7**	**22**	**9**	**38**
Average per year	**1**	**2**	**1**	**4**

Tables 19–26 provide an overview of river maintenance work between 2001–2012 separated by geomorphic reach (see section 2.1). The tables include the type of project (new, adaptive management, or interim/unanticipated), a brief description of the project purpose, the types of river maintenance methods used for the project, implementation techniques employed on the project, access road acreage, project impact acres in the wet and dry, project duration, habitat features created because of the project, and general observations about the project's success or failure.

Acreage for access roads describes the use area for new or minimally used access roads. Existing maintained roads that were used for access are not included in this total. The acres listed for wet and dry impact areas are the footprint or planview impact areas for the projects at low flows. The acreage listed was calculated by delineating the project footprints in geographic information system (GIS) using aerial photography during low-flow periods. The listed acreage does not account for specific river maintenance implementation techniques, such as river crossings.

Notations are added to the project duration to indicate if the project involved work in the river. Those projects requiring equipment to be working in the active portion of the river (either sitting in or touching) were designated with the notation "wet." Typically, this is the area of the river that is inundated at 1,000 cfs or less. Projects that could be implemented outside of the active portion of the river were designated as "dry." Where the channel was relocated such as the Santa Ana Project (table 23), the "wet" area included the relocated channel because these were the impacted, wetted channel areas, even though the relocation pilot channel was constructed prior to introducing river flows. Projects that did not span the entire river include only the portion of the affected channel at base flows, as designated using aerial photography (typically around 1,000 cfs). As noted in table 17, there are two projects that account for the maximum "wet" and "dry" acreages. The remaining 36 projects, in tables 19–26, have significantly less acreage. This can be seen graphically in figure 3 by noting that, between 2001–2012, less than 10% of the implemented river maintenance projects had a project footprint in the wet greater than 10 acres and in the dry greater than 20 acres. Figure 4 shows individual project footprint by reach, along with statistical trendlines (average and one-half the standard deviation). Project names for site numbers listed in figure 4 are provide in tables 19–26.

5.2.3 MRG River Maintenance Sites 2012–2013

Tables 27–29 provide an overview of anticipated river maintenance work from 2012–2013 separated by geomorphic reach (see section 2.1). The tables include the type of project (new or adaptive management) a brief description of the project purpose, the types of river maintenance methods used for the project, expected construction techniques employed on the project, access road acreage,

Table19. Historical River Maintenance Work: Velarde to Rio Chama Reach (2001–2012 work)

Project Name	Site Number (See Figure 4)	Project Type and Purpose	River Maintenance Methods	Construction Techniques (Method Category BMPs)	Access Roads (Acres)	Project Impact Area in the Dry (Acres)	Project Impact in the Wet (Acres)	Project Duration	Habitat Features Created	Observations
La Canova (2005)	1	**New Site** – Project undertaken to stop bank line erosion on west bank that threatened integrity of irrigation facility.	Longitudinal stone toe with bioengineering, riparian vegetation establishment	Bank line work, material placement	0.2	0.3	1.22	3 months (wet)	0.2 acre of bioengineered bank line (inherent part of design).	• Native vegetation has become established. • Design functioning as intended.
Lyden Outfall Structure (2007)	2	**New Site** – Project undertaken to address localized bank erosion at irrigation outfall (Reclamation constructed) that threatened to flank existing concrete structure.	Longitudinal stone toe with gabion basket revetment	Bank line work, material placement	0.2	2.5	0.03	1 month (wet)	None.	• Design functioning as intended.
Salazar Pit (2005)	3	**New Site** – Project undertaken to address gully formation in an arroyo where there had been a pre-existing Reclamation rock quarry. Project was not on the MRG.	Gabion basket weirs	N/A – work was done out of MRG corridor on dry land	2.8	0.5	N/A	7 months (dry)	None.	• Large rainfall event in 2006 caused damage to tops of constructed gabion weirs. • Some concern that original design did not provide adequate bank reinforcement in some areas.
Salazar Pit (2007)	4	**Adaptive Management** – Project undertaken to correct damage and address observed concerns to original design (2005) that were observed as a result of the 2006 monsoonal events.	Gabion basket weirs	N/A – work was done out of MRG corridor on dry land	2.8	0.5	N/A	6 weeks (dry)	None.	• Design functioning as intended after adaptive management.

Table 20. Historical River Maintenance Work: Rio Chama to Otowi Bridge Reach (2001–2012 work)

Project Name	Site Number (See Figure 4)	Project Type and Purpose	River Maintenance Methods	Construction Techniques (Method Category BMPs)	Access Roads (Acres)	Project Impact Area in the Dry (Acres)	Project Impact in the Wet (Acres)	Project Duration	Habitat Features Created	Observations
San Ildefonso (2007)	5	**New Site** – Project undertaken to address bank erosion due to lateral migration of a river bend that threatened integrity of a fishing pond.	Riparian vegetation establishment, diagonal vane, trench-filled bendway weirs	N/A – work was done out of the MRG active channel on dry land.	0.7	0.9	N/A	1 month (dry)	Planted tree poles (project mitigation).	• Localized scour in bend undercut bank vegetation during 2009 spring runoff.. • Bank erosion exposed three trench-filled bendway weirs, threatening to flank the northern ones. • Exposed portions of diagonal vane were directing flow into the bank. • Lost about quarter of planted poles from bank erosion.
San Ildefonso (2010)	6	**Adaptive Management** – Project undertaken to correct damage and address observed concerns to original design (2007) that were observed as a result of the 2009 spring runoff. This was an interim fix to provide time to plan and coordinate a longer term solution.	Trench-filled riprap, riprap windrow.	N/A – work was done out of the MRG active channel on dry land.	0.7	0.9	N/A	2 months (dry)		• Design functioning as intended after adaptive management. • Bank erosion continues but has not yet caused self-launching of the riprap windrow. • Secondary currents have created scallop areas between the weirs in the bank that have variable depth and velocity areas.

Table 21. Historical River Maintenance Work: Cochiti Dam to Angostura Diversion Dam Reach (2001–2012 work)

Project Name	Site Number (See Figure 4)	Project Type and Purpose	River Maintenance Methods	Construction Techniques (Method Category BMPs)	Access Roads (Acres)	Project Impact Area in the Dry (Acres)	Project Impact in the Wet (Acres)	Project Duration	Habitat Features Created	Observations
Santa Fe River Confluence (2004)	7	**New Site** – Project undertaken to address bank erosion south of the confluence with the Santa Fe River that threatened the integrity of a spoil berm protecting a drain facility.	Infrastructure setback, longitudinal bank lowering, riprap revetment, riparian vegetation establishment.	N/A – work was done out of the MRG active channel on dry land.	Used existing roads	3.0	N/A	5 weeks (dry)	Reconnection of flood plain to river (1.6 acres), and native species planting (1.6 acres) (both inherent part of design).	• Design functioning as intended. • Planted vegetation slow to establish.
Cochiti RM 228.9 (2007–2008)	8	**New Site** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting a drain facility.	Island and bank clearing and destabilization, side channels, longitudinal bank lowering, bank line embayment (backwater area), longitudinal stone toe with bioengineering, riparian vegetation establishment.	River diversion, river reconnection, river crossings, river work, material placement.	0.4	1.0	1.9	7 months (wet)	Backwater area (3.0 acres), secondary channel network (3.5 acres), bioengineered bank line (0.1 acre), and natural reseeding at site (all inherent part of design).	• Longitudinal stone toe with bioengineering functioning as intended. • Native riparian vegetation in backwater area is coming in well naturally. • Side channel constructed through destabilized island has widened considerably and created riffles, runs, and an inset flood plain within the historical abandoned flood plain. • Planted vegetation slow to establish.
Cochiti RM 231.3 (2007–2008)	9	**New Site** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting a drain facility.	Side channels, jetty removal, longitudinal stone toe with bioengineering, infrastructure setback (road), French drain, riparian vegetation establishment	River diversion, river reconnection, river work, material placement, material removal	2.8	0.5	2.3	7 months (wet)	0.6 acre of bioengineered bank line, and natural reseeding at site (both inherent part of design)	• Longitudinal stone toe with bioengineering functioning, but elevation to overtop stone toe is greater than design. • Planted vegetation doing exceptionally well. • French drain functioning as intended
San Felipe RM 213.4 (2010–2011)	10	**New Site** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting a drain facility.	Longitudinal stone toe with bioengineering, riparian vegetation establishment	River diversion, working platform, material placement	0.9	9.0	2.4	9 months (wet)	Bioengineered bank (0.4 acre) – inherent part of design.	• Design functioning as intended • Planted vegetation slow to establish

Table 21. Historical River Maintenance Work: Cochiti Dam to Angostura Diversion Dam Reach (2001–2012 work) (continued)

Project Name	Site Number (See Figure 4)	Project Type and Purpose	River Maintenance Methods	Construction Techniques (Method Category BMPs)	Access Roads (Acres)	Project Impact Area in the Dry (Acres)	Project Impact in the Wet (Acres)	Project Duration	Habitat Features Created	Observations
San Felipe RM 213.7 (2010–2011)	11	**New Site** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting an irrigation facility.	Longitudinal stone toe with bioengineering, riparian vegetation establishment.	River diversion, working platform, material placement.	0.9	9.0	2.5	9 months (wet)	Bioengineered bank (0.5 acre), and willow trench (0.1 acre) -– inherent part of design.	• Design functioning as intended • Bioengineering vegetation slow to establish. • Trench vegetation dong well.
San Felipe RM 212.0 (2011–2012)	12	**New Site** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting a drain facility.	Island and bank clearing and destabilization, riprap revetment, longitudinal stone toe with bioengineering, riparian vegetation establishment.	River reconnection, river crossings, working platforms, bank line work, river work, material placement, material removal.	2.3	16.5	5.3	12 months (wet)	Bioengineered bank (0.8 acre); inherent part of design.	• Design functioning as intended. • Multiple flow paths observed where portion of midchannel bar was removed.
San Felipe Phase 1 Mitigation Sites (2010–2012)	13	**New Site** – Project required as mitigation for San Felipe Phase 1 project construction (RM 213.4, RM 213.7, RM 212.0, and RM 215.5)	Island and bank clearing and destabilization, bank line embayment (backwater area), side channels destabilization, riparian vegetation establishment.	River crossings, material placement.	2.3	18.0	0.7	1 month (wet), 3 months(dry)	Five high-flow backwater areas (2.9 acres), connection bar (0.7 acre), flow through channel (1.1 acres). All featured were part of project mitigation.	• Design functioning as intended; no high spring runoff flows since project completion; • Established side channel has ground water connection to river that allows channel to flow without direct upstream connection.
San Felipe RM 215.5 (2011–2012)	14	**New Site** – Project undertaken to address development of alternating thalweg pattern and channel narrowing from vegetation encroachment that has the potential to cause bank erosion threatening the integrity of a road and nearby houses in the village of San Felipe.	Island and bank clearing and destabilization.	River crossings, river work, material removal.	0.8	12.1	2.4	2 months (wet)	0.2 acres of willow trench; inherent part of design.	• Design being amended to only include bar removal. • Bar removal expected to be short term.

Table 22. Historical River Maintenance Work: Angostura Diversion Dam to Isleta Diversion Dam Reach (2001–2012 work)

Project Name	Site Number (See Figure 4)	Project Type and Purpose	River Maintenance Methods	Construction Techniques (Method Category BMPs)	Access Roads (Acres)	Project Impact Area in the Dry (Acres)	Project Impact in the Wet (Acres)	Project Duration	Habitat Features Created	Observations
Santa Ana Restoration Phase 1 (2000–2001)	15	**New Site** – Phase 1 of a project undertaken to address bank erosion and channel incision that threatened the integrity of a spoil berm protecting a drain facility.	Channel relocation using pilot channel, longitudinal dikes, jetty removal, longitudinal stone toe with bioengineering, gradient restoration facility, sediment augmentation.	River diversion, river reconnection, dewatering, river crossings, river work, material removal, material placement	2.0	5.5	62	16 months (wet)	0.6 acre of bioengineering bank line (inherent part of design).	• Gradient restoration facility and longitudinal stone toe with bioengineering functioning as designed • Potential for flanking of gradient restoration facilities (GRF) on west bank observed after the 2005 spring runoff. • Potential for flanking of GRF on east bank observed after the 2010 spring runoff. • Spoil pile from pilot channel was not removed by natural flows as per original designs. • Planted vegetation doing exceptionally well. • Potential for flanking of stone toe with bioengineering bank line protecting south bank of Jemez River at confluence with Rio Grande observed after the 2005 spring runoff.
Santa Ana Restoration Phase 2 (2002)	16	**New Site** – Phase 2 of a project undertaken to address bank erosion and channel incision that threatened the integrity of a spoil berm protecting a drain facility.	Bank line embayment (backwater area), longitudinal bank lowering, riparian vegetation establishment.	N/A – work was done out of the MRG active channel on dry land.	0.8	47.5	2.4	4 months (dry)	0.8 acre of backwater areas; 45 acres of flood plain reconnection (inherent part of design).	• Backwater areas had deposition at mouths and lacked drainage back to river. • Portions of the riparian vegetation were eroded from the 2005 spring runoff.
Santa Ana Restoration Phase 2 (2004–2005)	17	**Adaptive Management** – Project undertaken to correct damage and address observed concerns to backwater area drainage from Phase 2 and natural spoil pile removal.	Bank line embayment (backwater area), riparian revegetation, sediment augmentation.	N/A – work was done out of the MRG active channel on dry land.	2.0	5.5	10.5	4 months (dry)	Backwater areas planted with coyote willows (inherent part of design)	• Backwater areas were inundated during 2005 and subsequent spring runoff years. This brought in silt/clay material that deposited . • Deposition has occurred at mouth of backwater areas. • Backwater areas functioning as intended after adaptive management. • Planted vegetation doing exceptionally well in backwater areas. • Spoil pile management during 2005 spring runoff saw a portion of the sediment eroded, but significant amounts remained. Sediment appear to have deposited downstream and caused additional bank erosion.

Table 22. Historical River Maintenance Work: Angostura Diversion Dam to Isleta Diversion Dam Reach (2001–2012 work) (continued)

Project Name	Site Number (See Figure 4)	Project Type and Purpose	River Maintenance Methods	Construction Techniques (Method Category BMPs)	Access Roads (Acres)	Project Impact Area in the Dry (Acres)	Project Impact in the Wet (Acres)	Project Duration	Habitat Features Created	Observations
Santa Ana Restoration Phase 3 (2007 and 2009)	18	**Adaptive Management** – Project undertaken to correct damage and address observed concerns to Phase 1 project that were observed as a result of the 2005 spring runoff and to remove the portion of the spoil pile that remained on Pueblo of Santa Ana land. Project also addressed bank erosion observed as a result of depositing sediment from 2005 spoil pile management. Also constructed a third backwater area.	Bank line embayment, backwater area, longitudinal bank lowering, trench-filled bendway weirs, riparian vegetation establishment.	River diversion, river reconnection, river crossings, material placement.	0.8	2.5	8.8	8 months (wet)	0.6 acre of backwater areas, 20 acres flood plain reconnection to river, and 0.4 acre of native species vegetation plantings (all are inherent part of design).	• Increased inundation of flood plain observed during the 2010 spring runoff as a result of the spoil pile removal. • Areas repaired functioning as designed. • Bank erosion area that was restored is functioning as designed. • Planted vegetation doing well. • Constructed backwater area doing well.
Santa Ana Restoration, GRF 1 Repair (2012)	19	**Adaptive Management** – Project undertaken to correct damage and address observed concerns to Phase 1 project that were observed as a result of the 2010 spring runoff	Longitudinal stone toe with bioengineering, riparian vegetation establishment.	Partial excavation of bank, bank line work, material placement.	1.2	1.3	6.2	2 months (wet)	Riparian planting on flood plain, and bioengineering planting –both are inherent part of design.	• Planted vegetation doing well
Las Huertas Creek (2002)	20	**New Site** – Project undertaken to address bank erosion on east bank of Rio Grande and south bank of Las Huertas Creek that threatened local landowner holdings. Project done as mitigation for landowner allowing access for Santa Ana projects.	Riprap revetment, riparian vegetation establishment.	Bank line work, material placement, material removal.	1.1	8	0.2	2 months (wet)	None.	• Design functioning as intended. • Planted vegetation doing well.
Bernalillo (2006–2007)	21	**New Site** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting a drain facility.	Island and bank clearing and destabilization, side channels, longitudinal bank lowering, jetty removal, riparian vegetation establishment, trench-filled bendway weirs rootwads,	River diversion, river reconnection, river crossings, river work, material placement, material removal.	3.1	0.9	6.3	7 months (wet)	2 acres of secondary channel, 1.1 acres of vegetation planting, 3.8 acres of flood plain lowering and riparian habitat (All are inherent part of design).	• Bendway weir design functioning as intended. • Some of the bendway weirs have been exposed. • Secondary currents have created scallop areas between the exposed bendway weirs in the bank that have variable depth and velocity areas. • Side channels have filled in and function as high-flow channels. • Planted vegetation doing well. • Some native vegetation recruitment.

Table 22. Historical River Maintenance Work: Angostura Diversion Dam to Isleta Diversion Dam Reach (2001–2012 work) (continued)

Project Name	Site Number (See Figure 4)	Project Type and Purpose	River Maintenance Methods	Construction Techniques (Method Category BMPs)	Access Roads (Acres)	Project Impact Area in the Dry (Acres)	Project Impact in the Wet (Acres)	Project Duration	Habitat Features Created	Observations
Sandia (2002)	22	**Interim Work** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting a drain facility. This was an interim fix to provide time to plan and coordinate a longer term solution	Riprap windrow	N/A – work was done out of the MRG active channel on dry land.	0.8	1.6	N/A	2 months (dry)	None.	• Long-term project constructed before riprap windrow self-launched. • Riprap windrow removed as part of 2007–2008 Sandia project.
Sandia (2007–2008)	23	**New Site** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting a drain facility.	Island and bank clearing and destabilization, bank line embayment (backwater area), side channels, longitudinal bank lowering, jetty removal, riparian vegetation establishment, trench-filled bendway weirs, rootwads,	River diversion, river reconnection, river crossings, river work, material placement, material removal.	0.8	1.6	9.1	14 months (wet)	0.65 acre - two backwater areas; 3.5 acres of secondary channels and bank lowering and vegetation planting areas (all are inherent part of design).	• Design discharge for crest height of weirs has increased due to incision. Bendway weirs still appear to be functioning as designed. • Some of the bendway weirs have been exposed. • Secondary currents have created scallop areas between the exposed bendway weirs in the bank that have variable depth and velocity areas. • Some of the exposed weirs have extensive scalloping that, if it continues, may have the potential to cause flanking. • Erosion at upstream and downstream ends that has the potential to flank rootwad bank protection. • Side channels have filled in and function as high-flow channels. • Backwater areas have filled in and require a higher discharge to inundate. • Planted vegetation doing well. • Native vegetation recruitment is high in backwater areas.

Table 23. Historical River Maintenance Work: Rio Puerco to San Acacia Diversion Dam Reach (2001–2012 work)

Project Name	Site Number (See Figure 4)	Project Type and Purpose	River Maintenance Methods	Construction Techniques (Method Category BMPs)	Access Roads (Acres)	Project Impact Area in the Dry (Acres)	Project Impact in the Wet (Acres)	Project Duration	Habitat Features Created	Observations
Drain Unit 7 (2005)	24	**Unanticipated Work** – Project undertaken to address bank erosion observed during the 2005 spring runoff that threatened the integrity of a spoil berm protecting an irrigation facility.	Riprap revetment.	Bank line work, material placement.	5.5	0.5	0.5	1 month (wet)	None.	• Placed riprap held bank line during 2005 spring runoff. • Additional bank erosion upstream of the 2005 bank erosion was observed during the 2007 spring runoff.
Drain Unit 7 (2007)	25	**Unanticipated Work** – Project undertaken to address bank erosion observed during the 2007 spring runoff that threatened the integrity of a spoil berm protecting an irrigation facility.	Riprap revetment.	Bank line work, material placement.	5.5	0.5	N/A	1 week (dry)	None.	• Placed riprap held bank line during 2007 spring runoff.
Drain Unit 7 (2009)	26	**New Site** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting an irrigation facility.	Riprap revetment, riprap windrow, riparian vegetation establishment.	Working platform, material placement.	5.5	3.8	1.0	4 months (wet)	0.04 acre of trench planting and 0.1 acre of soil choked riprap planting (project mitigation).	• Design functioning as intended. • Vegetation cleared to allow project to proceed has returned and is doing well. • Vegetation on banks has done well in areas where maintenance is not an issue. • Planted vegetation has not been successful due to high water levels associated with checking up the water at the San Acacia Diversion Dam during irrigation season and from San Acacia Diversion Dam maintenance activities.

Table 24. Historical River Maintenance Work: San Acacia Diversion Dam to Arroyo de las Cañas Reach (2001–2012 work)

Project Name	Site Number (See Figure 4)	Project Type and Purpose	River Maintenance Methods	Construction Techniques (Method Category BMPs)	Access Roads (Acres)	Project Impact Area in the Dry (Acres)	Project Impact in the Wet (Acres)	Project Duration	Habitat Features Created	Observations
San Acacia RM 113/114 (2005–2007)	27	**New Site** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting the LFCC.	Infrastructure setback jetty removal, riparian vegetation establishment, steel sheet pile grade control (on arroyo), sediment augmentation.	N/A – work was done out of the MRG active channel on dry land.	12.0	12.6	9 (in LFCC)	12 months (dry)	187 acres of widening of river corridor (inherent part of design); 27 acres of native species planting; and 4 acres of environmental feature establishment (the last two were project mitigation).	• Design functioning as intended. • Bank erosion has been allowed to proceed. • San Lorenzo Arroyo has re-connected to the Rio Grande, bringing in additional sediment. • Planted native vegetation is doing okay, still sparse groundcover. • Some exotic vegetation control is still needed, especially saltcedar.
San Acacia RM 111 (2006)	28	**Interim Work** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting the LFCC. This was an interim fix to provide time to plan and coordinate a longer term solution.	Riprap windrow.	N/A – work was done out of the MRG active channel on dry land.	2.8	1.5	N/A	7 weeks (dry)	None.	• Long term project constructed before riprap windrow self-launched. • Riprap windrow removed as part of 2007–2009 San Acacia RM 111 project.
San Acacia RM 111 (2007–2009)	29	**New Site** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting the LFCC.	Infrastructure setback, riparian vegetation establishment.	N/A – work was done out of the MRG active channel on dry land.	7.9	7.2	6.4 (in LFCC)	12 months (dry)	59 acres of widening of river corridor (inherent part of design), and 1.8 acres of environmental feature establishment (project mitigation).	• Design functioning as intended. • Bank erosion has been allowed to proceed. • Planted native vegetation is doing okay, still sparse groundcover.
Arroyo de la Parida (2004)	30	**New Site** – Project undertaken to address bank erosion as a result of sediment from the Arroyo de la Parida pushing Rio Grande flows towards the west bank. The erosion threatened the integrity of sedimentation structure within the LFCC temporary outfall.	None.	Material removal (removal of sedimentation structure).	Used O&M roads	0.5	0.2 (in LFCC)	1 month (dry)	None.	• Erosion allowed to proceed with monitoring. • LFCC temporary outfall structure operational without sedimentation structure.

Table 25. Historical River Maintenance Work: San Antonio Bridge to River Mile 78 Reach (2001–2012 work)

Project Name	Site Number (See Figure 4)	Project Type and Purpose	River Maintenance Methods	Construction Techniques (Method Category BMPs)	Access Roads (Acres)	Project Impact Area in the Dry (Acres)	Project Impact in the Wet (Acres)	Project Duration	Habitat Features Created	Observations
BDA Channel widening (2003)	31	**New Site** – Project undertaken to provide mitigation (channel widening in a section of the MRG through BDANWR) for the 2000 Temporary Channel project.	Channel relocation using pilot cut, island and bank clearing and destabilization.	River diversion, river reconnection, river crossings.	1.4	67.5	20.7	8 months (wet)	Widened river corridor (inherent part of design).	• Design functioned as intended. • Channel widened from 150 feet to around 600 feet, majority during the 2005 spring runoff.
BDA Sediment Plug (2008)	32	**New Site** – Project undertaken to reconnect portions of the MRG separated by a sediment plug in order to facilitate delivery of water.	Pilot cut through sediment plug.	River reconnection, bank line work, river work.	0.6	13.3	7.3	6 weeks (wet)	None.	• Design functioned as intended: river widened pilot cut channel to presediment plug channel width. • Sediment continuity restored.
BDA Levee (2009–2010)	33	**Adaptive Management** – Project undertaken to strengthen existing levee (raising and widening) to provide ability to pass design capacity flows.	Levee strengthening.	N/A – work was done out of the MRG active channel on dry land.	18.0	1.0	N/A	15 months (dry)	None.	• Design is functioning as intended.
BDA Levee (2012)	34	**Adaptive Management** – Project undertaken to strengthen existing levee (widening) to provide ability to pass design capacity flows.. Widening stretch of BDA levee north of the BDANWR that wasn't widened in 2009–2010.	Levee strengthening.	N/A – work was done out of the MRG active channel on dry land.	4.0	1.0	N/A	2 months (dry)	None.	• Design is functioning as intended.

Table 26. Historical River Maintenance Work: River Mile 78 to Full Pool Elephant Butte Reservoir Level Reach (2001–2012 work)

Project Name	Site Number (See Figure 4)	Project Type and Purpose	River Maintenance Methods	Construction Techniques (Method Category BMPs)	Access Roads (Acres)	Project Impact Area in the Dry (Acres)	Project Impact in the Wet (Acres)	Project Duration	Habitat Features Created	Observations
Tiffany Sediment Plug (2005)	35	**New Site** – Project undertaken to reconnect portions of the MRG separated by a sediment plug in order to facilitate delivery of water.	Pilot cut through sediment plug.	River reconnection.	0	7.3	N/A	9 weeks (dry)	None.	• Design functioned as intended: majority of river widened pilot cut channel to presediment plug channel width. • Some portions of river did not widen out and spoil berms from pilot channel were left in place.
Tiffany Levee (2005)	36	**Unanticipated Work** – Project undertaken to strengthen existing levee (raising and widening) to address concerns about levee seepage problems and levee cracks caused by 2005 spring runoff flows.	Levee strengthening.	N/A – work was done out of the MRG active channel on dry land.	4.0	1.0	N/A	2 months (dry)	None.	• Design is functioning as intended.
San Marcial Levee (2005)	37	**Unanticipated Work** – Project undertaken to repair levee breaches on access road between San Marcial Railroad Bridge and the San Marcial Levee and to strengthen existing levee (raising and widening) to address concerns about levee seepage problems and levee cracks caused by 2005 spring runoff flows	Levee strengthening.	N/A – work was done out of the MRG active channel on dry land.	2.0	1.0	N/A	1 months (wet)	None.	• Design is functioning as intended.
Fort Craig Bend (2011)	38	**Interim Work** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting the LFCC. This is an interim fix to provide time to plan and coordinate a longer term solution.	Riprap windrow, riparian vegetation establishment.	N/A – work was done out of the MRG active channel on dry land.	3.6	Used riprap stock pile as staging area	N/A	3 months (dry)	Vegetation planting (project mitigation).	• Riprap windrow has not self-launched yet. • Project mitigation is still in planning phase.

Table 27. Anticipated River Maintenance Work: Rio Chama to Otowi Bridge Reach (2012–2013 work)

Project Name	Description	River Maintenance Methods	Construction Techniques (Method Category BMPs)	Access Roads (Acres)	Project Impact Area in the Dry (Acres)	Project Impact in the Wet (Acres)	Project Duration	Habitat Features Created
San Ildefonso (2013)	**Adaptive Management** – Project undertaken to correct damage and address observed concerns to original design (2007) that were observed as a result of the 2009 spring runoff. This is the longer term solution.	To be determined (TBD) – Methods within channel modification and bank protection/stabilization categories	TBD.	0.7	0.9	1.2 (estimated)	4 months (wet) (estimated)	To be determined (project mitigation and inherent part of design)

Table 28. Anticipated River Maintenance Work: Angostura Diversion Dam to Isleta Diversion Dam Reach (2012–2013 work)

Project Name	Description	River Maintenance Methods	Construction Techniques (Method Category BMPs)	Access Roads (Acres)	Project Impact Area in the Dry (Acres)	Project Impact in the Wet (Acres)	Project Duration	Habitat Features Created
Santa Ana RM 205.8 (2013)	**New Site** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting a drain facility.	TBD - Methods within channel modification and bank protection/stabilization categories.	TBD.	0.2 acre (estimated)	3.0 (estimated)	2.5 acres (estimated)	3 months (wet) (estimated)	TBD

Table 29. Anticipated River Maintenance Work: Cochiti Dam to Angostura Diversion Dam Reach (2012–2013 work)

Project Name	Description	River Maintenance Methods	Construction Techniques (Method Category BMPs)	Access Roads (Acres)	Project Impact Area in the Dry (Acres)	Project Impact in the Wet (Acres)	Project Duration	Habitat Features Created
Santo Domingo RM 225.1 (2012–2013)	**New Site** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting a drain facility.	Longitudinal bank lowering , trench filled riprap, riparian vegetation establishment.	River crossings (mob/demob).	3.1	0.5	N/A	2 months (dry) (estimated)	Increased area of inundation (inherent part of design).
Galisteo Creek (RM 224.6) (2012–2013)	**New Site** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting a drain facility.	Island and bank clearing and destabilization, jetty removal, longitudinal stone toe with bio-engineering, bendway weirs, riparian vegetation establishment.	River crossings (mob/demob), bank line work, river work, material placement, material removal.	0.4	1.0	3.2	4 months (wet) (estimated)	Bioengineered bank line, (inherent part of design).
Santo Domingo RM 223.9 (2012–2013)	**New Site** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting a drain facility.	Channel reconstruction, island and bank clearing and destabilization, bank line embayment (backwater area), jetty removal, riprap revetment, longitudinal stone toe with bioengineering, riparian vegetation establishment.	River diversion, river reconnection, river crossings, bank line work, river work, material placement, material removal.	1.4	2.5	3.3	8 months (wet) (estimated)	Bioengineered bank line and 1.1 acres of backwater areas (inherent part of design).
San Felipe Phase 2: RM 214.4 (2013–2014)	**New Site** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting a drain facility.	TBD – Methods within channel modification and bank protection/stabilization categories.	TBD.	1 (estimate per project)	8 (estimate per project)	7 (estimate per project)	24 months (wet) (estimated)	TBD.
San Felipe Phase 2: RM 210.3 (2013–2014)	**New Site** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting a drain facility.	TBD – Methods within channel modification and bank protection/stabilization categories.	TBD.	1 (estimate per project)	8 (estimate per project)	7 (estimate per project)	24 months (wet) (estimated)	TBD.
San Felipe Phase 2: RM 210.0 (2013–2014)	**New Site** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting a drain facility.	TBD – Methods within channel modification and bank protection/stabilization categories.	TBD.	1 (estimate per project)	8 (estimate per project)	7 (estimate per project)	24 months (wet) (estimated)	TBD.
San Felipe Phase 2: RM 210.1 (2013–2014)	**New Site** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting a drain facility.	TBD – Methods within channel modification and bank protection/stabilization categories.	TBD.	1 (estimate per project)	8 (estimate per project)	7 (estimate per project)	24 months (wet) (estimated)	TBD..
San Felipe Phase 2: RM 211.3 (2013–2014)	**New Site** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting a drain facility.	TBD – Methods within channel modification and bank protection/stabilization categorie.s	TBD.	1 (estimate per project)	8 (estimate per project)	7 (estimate per project)	24 months (wet) (estimated)	TBD
San Felipe Phase 2: RM 212.8 (2013–2014)	**New Site** – Project undertaken to address bank erosion that threatened the integrity of a spoil berm protecting a drain facility.	TBD – Methods within channel modification and bank protection/stabilization categories.	TBD.	1 (estimate per project)	8 (estimate per project)	7 (estimate per project)	24 months (wet) (estimated)	TBD.

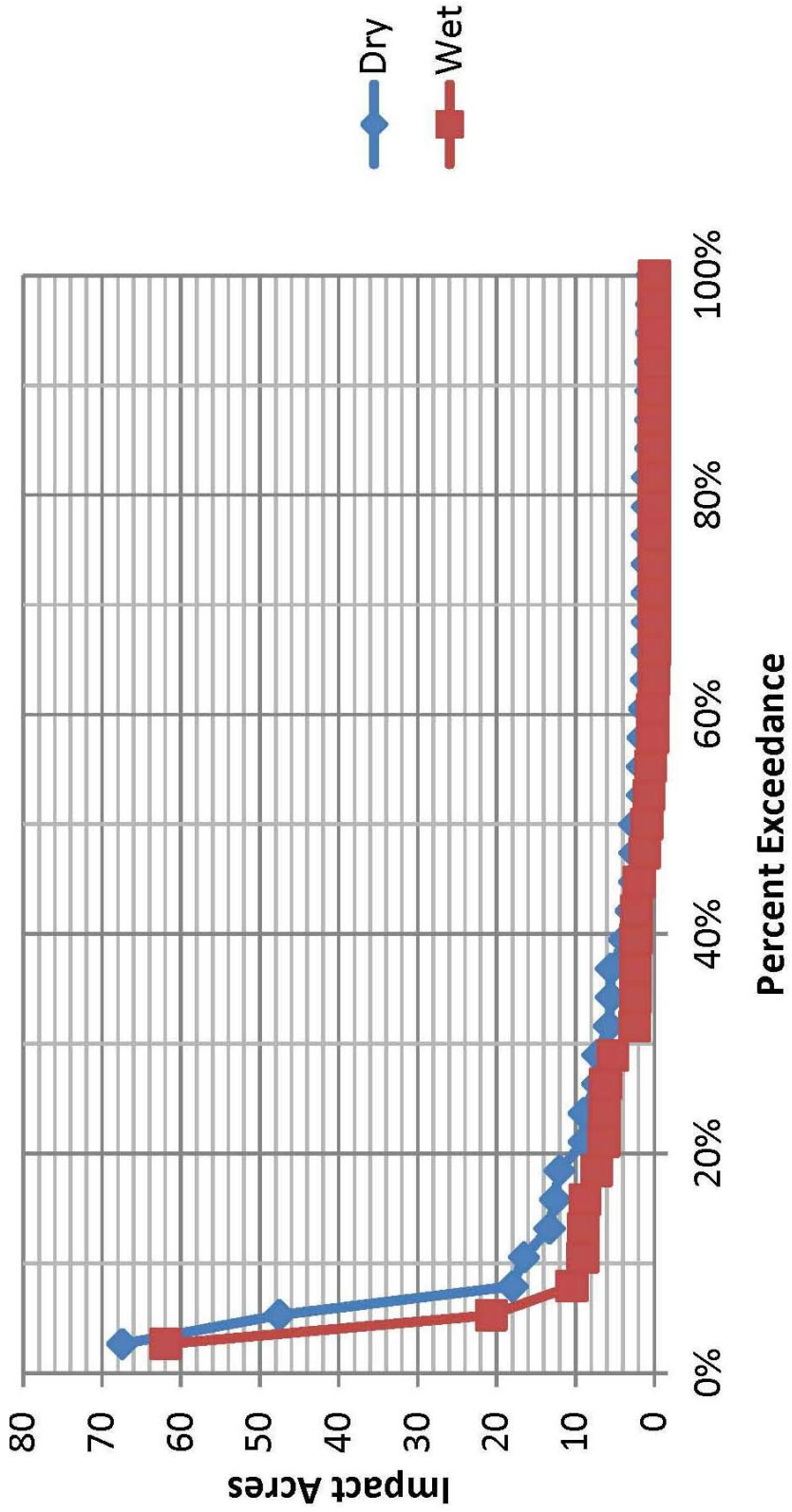

Figure 3. Percent exceedance curves for river maintenance project footprint impacts (2001–2012).

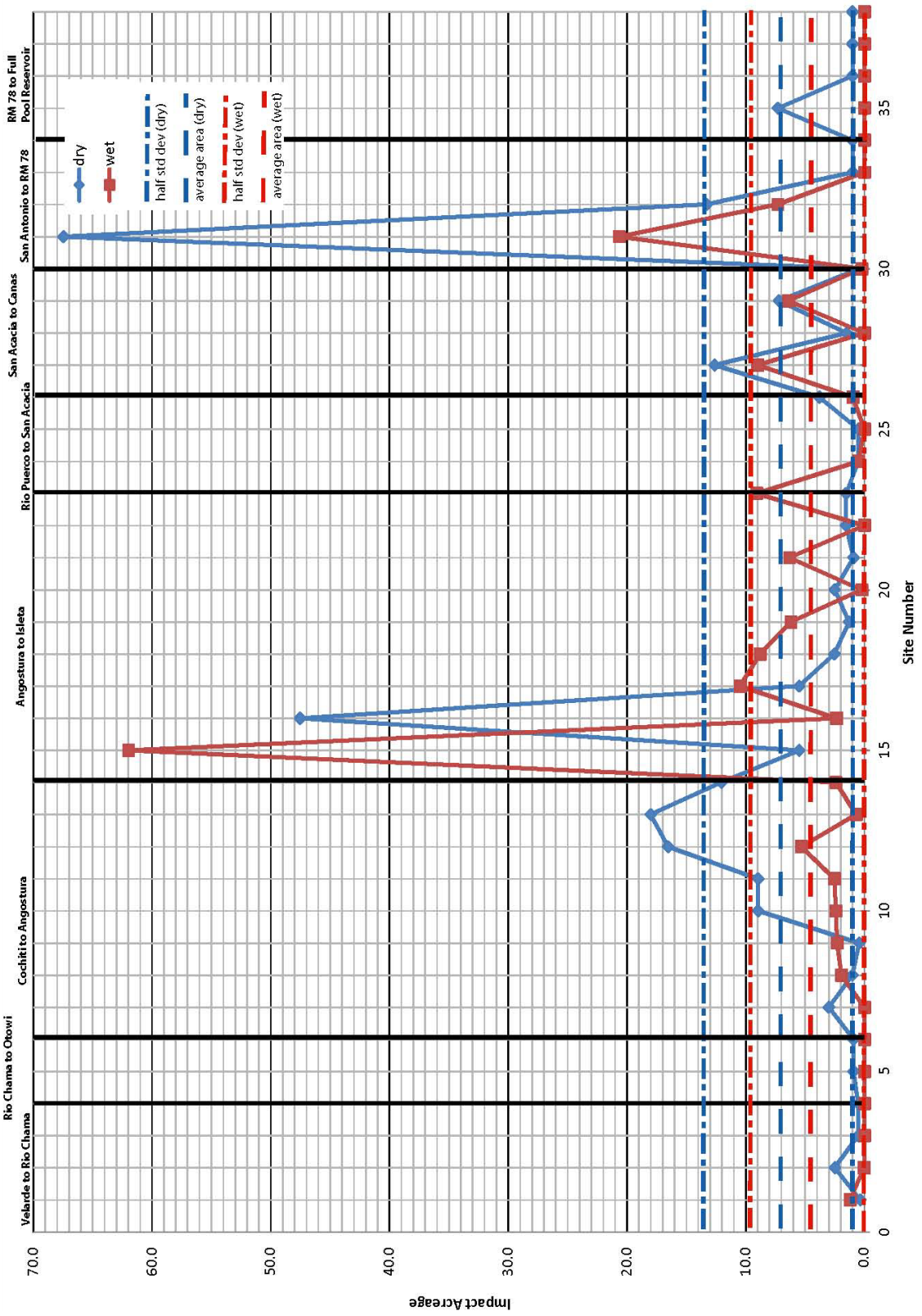

Figure 4. River maintenance project area by reach (2001–2012)

project impact acres in the wet and dry, project duration, habitat features created because of the project, and general observations about the project's success or failure. Sites designated as new sites in tables 27–29 are existing river maintenance priority site locations that potentially may be implemented (e.g., expect to have compliance initiated or in place) before March 2013.

Acreage for access roads describes the use area for new or minimally used access roads. Existing maintained roads that were used for access are not included in this total. The acres listed for wet and dry impact areas are the footprint or planview impact areas for the projects at low flows. The acreage listed was calculated by delineating the project footprints in GIS using aerial photography during low flow periods or estimated using typical project footprints. The listed acreage does not account for specific river maintenance implementation techniques, such as river crossings.

Notations are added to the project duration to indicate if the project may involve work in the river. Those projects requiring equipment to be working in the active portion of the river (either sitting in or touching) are designated with the notation "wet." Typically, this is the area of the river that is inundated at 1,000 cfs or less. Projects that may be implemented outside of the active portion of the river were designated as "dry."

5.2.4 River Maintenance Support Activities

There are several support activities for river maintenance actions that have required historic field activity to successfully and efficiently complete. These activities, summarized in the following sections, provide information on materials essential to complete river maintenance actions (sections 5.2.4.2 and 5.2.4.3) and data collection (section 5.2.6.4**).**

5.2.4.2 Stockpiles and Storage Yards

Reclamation currently has 10 established stockpile sites and two storage yards that support the MRG river maintenance needs within the defined action area. These areas are outside the flood plain of the MRG. The names and approximate acreage of these sites are listed in table 30. These sites were used on a recurring basis over the last 10 years, providing support through the storage of material, supplies, and equipment. This support activity, while useful for planned river maintenance actions, also allowed for a quicker response time in emergency situations.

Table 30. Reclamation Stockpile Sites and Storage Yards for the MRG

Stockpile Sites	Site Footprint (acres)
Velarde	5.8
Angostura	1.2
Bernalillo	13.9
Drain Unit 7	1.8
RM 111 east	6.8
RM 111 west	10.5
Escondida	2.7
San Antonio – Highway 380	1.9
Tiffany Junction	1.4
Ft. Craig	19.2
Storage Yards	
Socorro	1.1
San Marcial	1.0

Stockpile sites primarily were used to store material, typically riprap, for a particular river maintenance project or for unspecified future river maintenance work. These sites also were used on a temporary basis to store equipment and other supplies for a nearby river maintenance project. Storage yards were used for continuous storage of equipment and supplies, but were also be used to temporarily store material. Periodically, these sites required vegetation clearing (mowing and trimming), grading, graveling, drainage, and/or fencing. Appropriate land use and access permission and all necessary regulatory permits were obtained prior to initial use of the sites. All appropriate permissions and permits are kept current while these sites are being used.

5.2.4.3 Borrow and Quarry areas

Reclamation currently has one active borrow area (Valverde Pit) and one active quarry area (Red Canyon Mine) to support river maintenance within the defined action area. The locations are outside the river corridor. Valverde Pit is located near Fort Craig and is used to provide soil material for use in river maintenance actions. Soil is extracted through a process that initially requires vegetation clearing (clearing) of the area and then removing the soil for placing at river maintenance sites. The total acreage of the Valverde Pit is around 114 acres, but the typical historical river maintenance project disturbance for acquiring soil material from Valverde Pit was 10 acres or less.

The Red Canyon Mine is used to produce and process riprap of a required gradation for use on river maintenance actions. This quarry location is located in

the Magdalena front range on Bureau of Land Management (BLM) land. Extracting riprap involves a process that first requires placing explosives to break apart the rock walls of the quarry to produce variable sized riprap. This is followed by processing the riprap to obtain the design gradation. If the blast was successful, the processing involved sieving the blasted material (typically done through using a grizzly) and loading the material onto transport trucks to take to a river maintenance project site or a riprap stockpile site. If the blast was not successful and produced larger than the desired size gradation, an additional processing step was necessary, requiring a rock breaker to break down the larger rock pieces. The total acreage of the Red Canyon Mine is around 18 acres. Appropriate land use and access permission and all necessary regulatory permits were obtained prior to initial use of these sites. All appropriate permissions and permits also are kept current while these sites are being used.

5.2.4.4 Data Collection

Data collection activities are required to support river maintenance actions and typically occur for two main purposes: specific projects and monitoring trends. Data collection for monitoring trends is necessary to assess changes in river bed elevation and slope, channel position, width, depth, flow velocity, sinuosity, channel capacity, and sediment. This data collection supports trend analysis and future projections of geomorphic trends, sediment transport, and hydraulic geometry; all of which are necessary and feed into river maintenance actions. Typically, these were a more spatially extensive, reach-based data collection effort. Similar types of data were collected for specific projects. Specific project data collection, however, was more localized and collected information that supported planning, design, environmental compliance, and maintenance/adaptive management implementation for specific river maintenance projects.

Rangelines were established along the river as part of Reclamation's hydrographic data collection program for river channel monitoring. These rangelines typically run perpendicular to the channel and allow collection of survey data within the channel and flood plain. For rangeline monitoring, these lines were cleared of vegetation (clearing and trimming by hand) to a width of about 3 feet to create a clear line-of-sight. Reclamation, on average, historically cleared and collected rangeline information for about 100 lines a year between 2001–2012 within the described action area. The range in any given year varied between 40–200 lines. Although the specific rangeline lengths vary throughout the MRG project area, a typical annual impact range for rangeline clearing was approximately 1–23 acres, with an average near 12 acres. A summary of the rangeline monitoring impact by reach and year is shown in tables 31 and 32.

Table 31. Historical River Maintenance Rangeline Monitoring (Number of Lines)

Reach	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average
Verlade to Rio Chama	0	0	0	0	0	0	0	0	0	0	0	0	0
Rio Chama to Otowi Bridge	0	0	0	0	9	0	0	10	6	0	0	0	2
Cochiti Dam to Angostura Diversion Dam	1	1	0	7	7	0	102	0	20	0	0	0	12
Angostura Diversion Dam to Isleta Diversion Dam	74	2	65	45	48	5	0	0	42	0	17	57	30
Isleta Diversion Dam to Rio Puerco	0	15	0	14	14	0	0	0	0	0	0	0	4
Rio Puerco to San Acacia Diversion Dam	0	0	0	0	0	8	0	0	0	0	0	15	2
San Acacia Diversion Dam to Arroyo de las Cañas	0	32	28	7	55	9	0	0	15	42	0	13	17
Arroyo de las Cañas to San Antonio Bridge	0	10	0	0	11	0	0	0	11	0	0	23	5
San Antonio Bridge to River Mile 78	5	16	3	5	17	0	5	11	10	0	0	18	8
River Mile 78 to Full Pool Elephant Butte Reservoir Level	10	44	30	49	35	27	64	47	0	0	0	0	26
Totals	**90**	**120**	**126**	**127**	**196**	**49**	**171**	**68**	**104**	**42**	**17**	**126**	**103**

Table 32. Historical River Maintenance Rangeline Monitoring (Acreage Impact)

Reach	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	Average
Verlade to Rio Chama	0	0	0	0	0	0	0	0	0	0	0	0	0
Rio Chama to Otowi Bridge	0	0	0	0	0.4	0	0	0.4	0.3	0	0	0	0.1
Cochiti Dam to Angostura Diversion Dam	0	0	0	0.3	0.3	0	3	0	0.6	0	0	0	0.4
Angostura Diversion Dam to Isleta Diversion Dam	3.6	0.3	3.2	2.3	2.4	0.2	0	0	1.9	0	0.8	2.7	1.5
Isleta Diversion Dam to Rio Puerco	0	1.2	0	1.1	0.9	0	0	0	0	0	0	0	0.3
Rio Puerco to San Acacia Diversion Dam	0	0	0	0	0	0.6	0	0	0	0	0	0.9	0.1
San Acacia Diversion Dam to Arroyo de las Cañas	0	4.5	1.4	0.2	4.4	0.7	0	0	1.4	4.1	0	1.1	1.5
Arroyo de las Cañas to San Antonio Bridge	0	0.5	0	0	0.6	0	0	0	0.6	0	0	1.6	0.3
San Antonio Bridge to River Mile 78	1.5	4.3	0.9	1.5	4.6	0	1.5	2.6	2.8	0	0	5.1	2.1
River Mile 78 to Full Pool Elephant Butte Reservoir Level	1.5	9.8	7.2	14.8	9	4.2	17.2	8.7	0	0	0	0	6
Totals	**7**	**21**	**13**	**20**	**23**	**6**	**22**	**12**	**8**	**4**	**1**	**11**	**12**

5.3 Other Reclamation MRG Project Historical Maintenance Actions

There are other activities, distinct from river maintenance actions and river maintenance support activities, which help achieve Reclamation's authorization under the Flood Control Acts of 1948 and 1950. These activities, as described in the authorization, include irrigation and drainage rehabilitation (maintenance) and operation and maintenance on the Low Flow Conveyance Channel (Reclamation 1947; Reclamation 2003). Descriptions of the historical maintenance activities are provided in the following sections.

5.3.1 LFCC O&M Historical Actions

The LFCC was constructed by Reclamation between 1951–1959. The LFCC was originally constructed at the site of the San Acacia Diversion Dam extending to the Narrows of Elephant Butte Reservoir, a distance of about 70 miles. The design capacity of the LFCC was originally 2,000 cfs. Its purpose was to reduce water loss due to evaporation and transpiration, by conveying Rio Grande water in a narrower, deeper channel, rather than in the wider and shallower floodway. The portion of the LFCC between the South Boundary of BDANWR and the Elephant Butte Reservoir was constructed between 1951 and 1953, with river diversions into this reach beginning in 1953 at San Marcial (Reclamation, 1953; Reclamation, 1956). The LFCC between San Acacia Dam and the South Boundary BDANWR was constructed between 1956 and 1959, with diversions from San Acacia Dam beginning in 1959 (Reclamation 1959). High reservoir levels at Elephant Butte in the 1980s resulted in the lower 8 miles of the LFCC filling in with sediment (Klumpp and Baird 1995), so that, by March 1985, the LFCC was forced out of operation (Reclamation 1985). While it was estimated that between 50,000–70,000 acre-feet of water were salvaged annually by operation of the LFCC (Reclamation 1985), diversions have been minimal after 1985. The only diversion has been into a 9-mile section of the LFCC (San Acacia Dam to the Escondida outfall), which also was used between 1997–2004 to conduct experimental operations (Tetra Tech 2004) to explore rehabilitation options for the LFCC (Reclamation 2001). It should be noted that between RM 111 and RM 114, the LFCC and the protecting spoil levee have been relocated. The relocated LFCC has a riprap-lined capacity of 500 cfs. It also should be noted that no LFCC operational changes from the status quo are proposed as part of this BA. Since the 1980s, the LFCC has functioned much in the same manner as an irrigation drain, collecting and transporting return flows.

Reclamation has continued to maintain the LFCC as it does serve important functions, including improving drainage, supplementing irrigation water supply to MRGCD, and supplying water to BDANWR for irrigation and other uses. In many locations, the LFCC is the lowest point in the valley, and it provides

essential drainage benefits by collecting ephemeral storm runoff, subsurface drainage water, irrigation return flows, and in some areas seepage water from the river.

Historical maintenance of the LFCC has included the following activities: vegetation control, removal of material, road maintenance, and structure maintenance. For all of these activities, equipment that was used on a given job underwent high-pressure spray cleaning and inspection prior to initial operation in the project area. Spill kits are kept with equipment to contain accidental releases of fluid.

5.3.2 Project Drain Past Actions

MRG project authorization provides f**o**r Reclamation (Reclamation 1947; Reclamation 2003) to perform irrigation and drain rehabilitation. The majority of drains and irrigation facilities in the MRG are currently operated and maintained by MRGCD. There are a few drains, however, that MRGCD does not maintain and that benefit the State of New Mexico by increasing water salvage, thereby assisting the State in fulfill**i**ng the Rio Grande Compact requirements. Historically, Reclamation usually performed drain maintenance under a cost-sharing arrangement in which Reclamation provided engineering, environmental compliance, and inspection, while a partner agency (most commonly NMISC) contributed funding to cover the cost of Reclamation's construction crew and equipment. Until about the year 2000, Reclamation regularly maintained the Project drains using the implementation techniques described in section 3.7.2.1. During 2000–2010, drain maintenance was greatly reduced because of a sharp decrease in available funding from cooperating agencies. Activities during that period consisted of occasional mowing, road maintenance, and repairs to heavily damaged portions of the drains as necessary to maintain public safety.

5.4 The MRGCD MRG Historical Maintenance Actions

The MRGCD operates and maintains the diversion dams and its irrigation, drainage, recreation, and flood control facilities pursuant to the 1923 New Mexico Conservancy Act, Federal Congressional Acts of 1928 and 1935, Office of the State Engineer Permit No. 0620, and the 1951 Contract[1] to meet the following requirements:

[1] Contract No. 178r-423, dated September 24, 1951, between MRGCD and Reclamation for Rehabilitation and Construction of Project Works and Repayment of Reimbursable Construction Costs.

- Diverting and delivering water stored in and released from El Vado Dam and native Rio Grande water to satisfy the needs of private property holders and users of water within its service area and newly reclaimed lands of the Six Middle Rio Grande Pueblos.

- Diverting and delivering native Rio Grande water for lands of the six MRG pueblos with federally designated prior and paramount water rights, through the Cochiti Heading and Angostura and Isleta Diversion Dams, as requested by the Bureau of Indian Affairs designated engineer.

- Re-diverting the MRGCD's contracted San Juan-Chama Project water, which, by statute, cannot be used by the United States for ESA purposes, except upon a willing seller basis.

- Maintaining the diversion dams.

- Operating and maintaining the MRGCD water delivery system (canals/drains) throughout the MRG.

The MRGCD constructs, maintains, modifies, repairs, and replaces irrigation and flood control structures and facilities throughout its boundaries to ensure the proper functioning of these facilities for their intended purpose. Maintenance typically has involved vegetation control or removal, debris removal, earthwork, sediment removal, concrete work, cleaning, painting, etc. Repair, replacement and modification involved earthwork and concrete work. These MRGCD activities may be divided into four broad categories as follows.

The MRGCD is comprised of four divisions: Cochiti, Albuquerque, Belen, and Socorro, serving irrigated lands from Cochiti Dam to the BDANWR. The full description of MRGCD facilities is located in the Joint Biological Assessment, Bureau of Reclamation and Non-Federal Water Management and Maintenance Activities on the Middle Rio Grande, New Mexico, Part I – Water Management.

5.4.1 MRGCD Measurement

The MRGCD operates and maintains a system of measurement stations, or gauges, along its canal and drain network. These gauges report water level and rates of flow back to the MRGCD on 30-minute intervals. Data is collected via FM radio telemetry, processed (converted from raw electronic signals to usable values and units), then through file transfer protocol, sent to three separate computer databases (MRGCD, Reclamation, and USACE). This entire process occurs automatically, 24 hours a day, throughout the year.

At present, the MRGCD provides data from about 130 sites on its system, and continues to add several new locations each year. In addition, the MRGCD collects, processes, and distributes data from Reclamation's RGSM pumping sites in Socorro County, and the NMISC's RGSM Atrisco habitat project in Bernalillo

County. The MRGCD maintains its gauge network through periodic calibration measurements using a variety of flow measuring devices. In addition, MRGCD makes flow measurements in ungauged areas of its system, and along the Rio Grande itself.