Berino East and West Site Restoration Final Monitoring Report

Prepared for

MWH Americas, Inc. and the International Boundary and Water Commission

Prepared by

SWCA Environmental Consultants

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Prepared for

MWH Americas, Inc.
10010 San Pedro Ave
Suite 390
San Antonio, TX 78216
Telephone: (210)340-5252; Facsimile: (201)340-2215
www.mwhglobal.com

International Boundary and Water Commission
United States Section
4171 N. Mesa, Suite C-100
El Paso, TX 79902

Prepared by

Cody Stropki, Ph.D.
Conor Flynn, M.S.

SWCA ENVIRONMENTAL CONSULTANTS
5647 Jefferson Street NE
Albuquerque, New Mexico 87109
Telephone: (505) 254-1115; Facsimile: (505) 254-1116
www.swca.com

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1 INTRODUCTION

This final monitoring report describes the restoration activities and summarizes the monitoring of the planting success from the habitat restoration activities at the Berino East and West sites in Dona Ana County, New Mexico. The goal of this restoration work was to actively manage the riparian zone in order to increase habitat available for southwestern willow flycatcher (*Empidonax traillii extimus*; flycatcher) and the Yellow-billed cuckoo (*Coccyzus americanus*). This was in response to the Record of Decision (ROD) on long-term management of the Project areas by the IBWC on June 4, 2009. The ROD authorizes restoration of aquatic habitat and a mosaic of native riparian plant communities at 30 sites totaling more than 500 acres over the next 10 years (through 2019) (USIBWC 2009). The principal objectives of the restoration are to enhance river-floodplain hydrologic connectivity; destabilize banks to encourage channel lateral migration and channel diversity at arroyo mouths; reduce exotic vegetation; restore Southwestern Willow Flycatcher (flycatcher) habitat; and reestablish riparian habitat (USACE 2009). In order to increase habitat for these key species the non-native vegetation was removed through the root crown extraction method and masticated on site. After the removal, native plantings of trees and shrubs occurred in order to create willow (*Salix* sp.) dominated stands, a cottonwood (*Populus deltoids spp. Wislizeni*) gallery forest, and a buffer areas with native riparian shrubs typical of the surrounding floodplain. All plantings were done in strategic locations in order to maximize the footprint of the existing native vegetation and the available groundwater.

1.1 SITE HISTORY

The Rio Grande in southern New Mexico no longer inundates the historical floodplain benches, altering the natural hydrology and vegetation of these areas. One factor contributing to the degradation of the floodplain was the Rio Grande Canalization Project. This project was created to facilitate compliance with equitable allocation of water between the United States and Mexico under the U.S. Mexico Convention of 1906. To meet these allocations, the Rio Grande has been straightened and channelized with armored riverbanks and constructed levees. At the same time, floodplain vegetation was cleared and/or mowed. These activities, coupled with the water demand for irrigated agricultural and municipal use, have resulted in lowered groundwater levels that have further disconnected the floodplain from the river, limiting the extent of the native riparian and wetland habitat throughout the region.

2 SITE CONDITIONS

2.1 PRIOR TO RESTORATION

2.1.1 BERINO EAST

Historically the Berino East site has been mowed, limiting the height and cover of woody vegetation and maintaining intact native grassland communities. Mowing was discontinued in 2011, allowing both native and non-native shrub and tree species to colonize the area (Figure 2.1).

Prior to restoration the vegetation conditions included a mixture of native and exotic riparian vegetation communities with coyote willow (*Salix exigua*) and saltcedar (*Tamarix chinensis*) along the banks and saltcedar patches encompassing the floodplain. Along the banks the dominant coyote willows reach upwards of 20 feet with saltcedar intermixed in small patches. Native shrub and herbaceous species found throughout the project area included alkali sacaton (*Sporobolus airoides*), inland saltgrass (*Distichlis spicata*), arrowweed (*Pluchea sericea*), wolfberry (*Lycium torreyi*), and desert seepweed (*Suaeda nigra*), while non-native species include saltcedar, Russian olive (*Elaeagnus angustifolia*), Bermudagrass (*Cynodon dactylon*), kochia (*Bassia scoparia*), and Russian thistle (*Salsola tragus*).

Overall there is a dominant overstory of coyote willow along the river banks and a relatively intact grassland of alkali sacaton on the floodplain intermixed with disturbed areas dominated by saltcedar, Bermudagrass, and Russian thistle (Table 2.1). A majority of the disturbed areas are located along two-track roads that have been created by off-highway vehicle (OHV) use Wildlife observed in the area included gophers (Geomyidae) and other small rodents, jackrabbits (*Lepus* sp.), coyotes (*Canis latrans*), doves (*Columbidae*), red-tailed hawk (*Buteo jamaicensis*), and prairie falcon (*Falco mexicanus*).

The soils on the Berino East site are primarily loamy sand to fine sandy soils; however, there are patchy areas that can reach up to 20% clay content. The salinity of the soils on-site is low and should not impact any of the restoration plantings. The measured pre-restoration groundwater levels ranged from 3.5 feet during the irrigation season when surface flow is occurring in the river down to 10.5 feet during the dry season (May). However, during restoration planting in February, excavation (trenching) revealed spatially heterogeneous groundwater levels. Some areas on the floodplain had groundwater between 8 and 10 feet, but in other areas groundwater was not reached until 14 to 16 feet. It seems likely that prehistoric river channel gravels, sand bars, and clay accumulations are preserved beneath the surface of the current floodplain, influencing the flow or blockage of subsurface water.

Groundwater levels can also be influenced by the amount of supplemental moisture the area has received from rainfall. Surface water flows in the Rio Grande channel are regulated and dependent on releases typically starting in May or June. There are also large flood-irrigated pecan orchards located to the east of the project area that may supply supplemental groundwater to the project area during the irrigation season.

Figure 2.1. Overview of Berino East before restoration.

2.1.2 BERINO WEST

The Berino West project area was dominated by large saltcedar stands with very few willow patches intermixed (Figure 2.2). The floodplain overstory is different from the Berino East site, as it includes a mixture of screwbean mesquite (*Prosopis pubescens*) and saltcedar. The understory consists of inland saltgrass swales and patches of alkali sacaton intermixed with non-natives such as Russian thistle, saltcedar, Bermudagrass, and slim amaranth (*Amaranthus hybridus*) (see Table 2.1). Like the Berino East site, the majority of the invasive herbaceous weeds are found along the two-track roads that have been created by OHV use. Wildlife observed in the area included gophers (mounds), doves, red-tailed hawk, herons (Ardeidae), sparrows (Passeridae), Say's phoebe (*Sayornis saya*), rabbits (Leporidae), and coyotes, and mockingbirds (Mimidae).

The soils on the Berino West site are similar to the soils found on the Berino East site with a majority being loamy and fine sandy soils with clay contents ranging from 4% to 30%. Salinity tests rated the soils as having a limited salinity hazards. The groundwater levels observed have ranged from 23 to 50 inches during the irrigation season down to 10.5 feet during the dry season.

Figure 2.2. Overview of Berino West before restoration.

Table 2.1. Vegetative Species Observed Prior to Restoration at the Berino East and Berino West Sites

Scientific Name	Common Name	Family	Native/ Invasive	USACE Wetland
Amaranthus hybridus	Slim amaranth	Amaranthaceae	I	UPL
Amorpha fruticosa	False indigo bush	Fabaceae	N	FACU
Bassia scoparia	Kochia, burningbush	Chenopodiaceae	I	FACU
Chloracantha spinosa	Spiny chloracantha	Asteraceae	N	UPL
Chloris virgata	Feather fingergrass	Poaceae	I	FACU
Cynodon dactylon	Bermudagrass	Poaceae	I	FACU
Distichlis spicata	Inland saltgrass	Poaceae	N	OBL
Elaeagnus angustifolia	Russian olive	Elaeagnaceae	I	FACU
Machaeranthera tanacetifolia	Tanseyleaf tansyaster	Asteraceae	N	UPL
Pluchea sericea	Arrowweed	Asteraceae	N	FACW
Portulaca pilosa	Kiss me quick	Portulacaceae	N	FACU
Prosopis glandulosa	Honey mesquite	Fabaceae	N	UPL
Prosopis pubescens	Screwbean mesquite	Fabaceae	N	FAC
Salsola tragus	Prickly Russian thistle	Chenopodiaceae	I	FACU
Sesuvium verrucosum	Verrucose seapurslane	Aizoaceae	N	FACW
Setaria leucopila	Streambed bristlegrass	Poaceae	N	UPL
Setaria pumila	Yellow foxtail	Poaceae	I	FAC
Solanum elaeagnifolium	Silverleaf nightshade	Solanaceae	I	UPL
Sphaeralcea	Globemallow	Malvaceae	N	UPL
Sporobolus airoides	Alkali sacaton	Poaceae	N	FAC
Sporobolus contractus	Spike dropseed	Poaceae	N	UPL
Sporobolus cryptandrus	Sand dropseed	Poaceae	N	UPL
Suaeda nigra	Desert seepweed	Chenopodiaceae	N	OBL
Tamarix chinensis	Five-stamen tamarisk	Tamaricaceae	I	FACW
Lycium torreyi	Torrey wolfberry	Solanaceae	N	FAC

Note: USACE = U.S. Army Corps of Engineers; UPL = Upland; FACU = Facultative Upland; FACW = Facultative Wetland; OBL = Obligate.

2.2 DESIRED CONDITIONS

This project aims to increase available habitat for the southwestern willow flycatcher and the yellow-billed cuckoo. Yellow-billed cuckoo habitat can be characterized by woody plant species composition, habitat structure, patch size, and connectivity (Halterman et al. 2015). Breeding yellow-billed cuckoos are riparian obligates that nest in patches at least 50 acres or more containing native riparian woodlands with cottonwood and willow trees and shrubs (Johnson et al. 2010). Structurally, forest areas with dense canopy closure are needed for nesting (McNeil et al. 2013).

The southwest willow flycatcher shows more adaptability in breeding habitat selection, as demonstrated by the variability in dominant plant species (both native and exotic), size and shape of breeding patch, and canopy height and structure (U.S. Fish and Wildlife Service 2002). Generally speaking, its habitat is characterized by dense riparian tree or shrub composition that is more than 9 feet tall, with or without a higher overstory layer (Allison et al. 2003). Occupied habitat patches can be as small as 2 acres, although the species has only rarely been found in narrow (less than 30-foot-wide), linear riparian fringes along rivers (Sogge et al. 2010).

3 RESTORATION AND MONITORING METHODS

The project endeavored to create patches of multilayered riparian tree and shrub habitat, set in a matrix of existing native habitats at the sites. Existing native habitats, including sand dropseed (Sporobolus cryptandrus) grassland, screwbean mesquite woodland, arrowweed shrubland, and saltgrass meadows, were avoided during restoration work to minimize disturbance to these intact habitats. Areas with saltcedar or large amounts of exotic invasive annuals were prioritized for invasive removal and native planting activities.

3.1 NON-NATIVE EXTRACTION AND MASTICATION METHODS

Large saltcedar trees and other non-natives were removed from the site using an excavator that grabs the trees and pulls out the associated root crown (Figure 3.1). Once the trees were removed they were spread and masticated on-site. Mastication involves the shredding of plant material into coarse fragments and is a faster and more cost-effective way of dealing with the woody material. Masticating the woody material also adds needed organic cover to the soil surface. As an added benefit, the masticated material was spread on existing two-track OHV trails to discourage the continued driving through the restoration site (Figure 3.2)

Figure 3.1. Saltcedar being extracted from the Berino East site.

Figure 3.2. Masticated material covers an existing two-track OHV road.

3.2 METHODS USED FOR REVEGETATION OF NATIVES

A number of techniques were used to optimize planting efficiency. Heterogeneous soil texture and saturation depth conditions created a difficult and unpredictable planting environment. Field personnel responded to changing information about soil conditions by utilizing different planting techniques. For example, swale construction was prioritized in areas with relatively shallow depth to groundwater, while a front loader-mounted auger was used to bore holes in intact native grassland in order to minimize the surface disturbance.

3.2.1 SWALE EXCAVATION AND PLANTING

Existing low-lying areas were excavated to create swale habitat for dense willow planting. Willows colonize more effectively when the soil surface is saturated (Caplan 2013). Swales lower the existing floodplain surface to improve the chances that overbank flow, runoff, or groundwater capillary rise can wet the soil surface (Figure 3.3). Topsoil layers were removed and spread on nearby bare ground areas on existing roads or areas adjacent to the levee. Once the swales were excavated Coyote and Goodding's willow (Salix gooddingii) were planted within the swales (Figure 3.4). In some cases, swales and trenches were excavated simultaneously to minimize soil disturbance and save time.

Figure 3.3. A swale is excavated by removing the top several feet of soil to lower the soil surface elevation. Removed topsoil is trucked to spread on nearby roads. Note native wolfberry shrubs flagged to avoid damage or disturbance (Main Swale, Berino East).

Figure 3.4. Planting willows into an excavated trench in a swale habitat (North Swale, Berino West).

3.2.2 PLANTING USING AUGERS

Augers were mounted on a skidsteer and a frontloader, with extensions capable of excavating 24-inch-diameter holes up to 12 feet deep. This technique was used to plant longstem shrubs and trees in areas where excavating trenches would have unduly disturbed native saltgrass meadows or sand dropseed grasslands (Figure 3.5). This technique was also used to plant willows and cottonwoods along the river banks following the clearing of saltcedar. These willow and cottonwood plantings were situated to fill in areas between existing stands of willow to create continuous strips of riparian habitat. There were many areas on both the east and west site banks that were unable to be planted because of dense riprap within these banks. It is expected however, that the planted willows adjacent to these riprap areas will eventually fill in these gaps as the willow stands mature and spread.

Figure 3.5. Restoration crew planting cottonwood poles into intact native grassland using a frontloader-mounted auger (Grassland Auger Area, Berino East).

4 RESULTS

4.1 PLANTED AREA RESULTS

In total, more than 10,000 trees were planted at Berino East and West during the implementation in February 2015 (Table 4.1). Monitoring was conducted monthly following restoration, and as of June 2015, we estimated the total survival rate between both sites to be around 90% for the planted tree species. However, as seen in Table 4.2 and Table 4.3 there is quite a bit of variability among survival of the stems within the different planted areas In contrast to the planted trees, of the more than 1,000 longstem shrubs planted, we estimate that less than 100 are still alive, for a survival rate of approximately 10%.

Table 4.1. Vegetative Species Planted during Restoration at the Berino East and West sites

Scientific Name	Common Name	Berino East	Berino West	Total Planted
Salix exigua	Coyote willow	3,850	4,500	8,350
Salix gooddingii	Goodding's willow	800	750	1,550
Populus deltoides	Cottonwood	250	250	500
Amorpha fruticosa	False indigo bush	69	90	159
Rhus trilobata	Skunkbush sumac	99	108	207
Baccharis salicina	Willow baccharis	405	306	711

Table 4.2. Survival of the Vegetative Species Planted during Restoration at the Berino East sites

Restoration Area	Planted Coyote Willow Stems	Planted Goodding's Willow Stems	Cotton wood Stems	Depth to Groundw ater (ft)	Surviving Coyote Willow Stems (%)	Surviving Goodding's Willow Stems (%)	Surviving Cottonwood Stems (%)
Main Swale	2400	300	100	6 to 12	2160 (90%)	285 (90%)	95 (95%)
Grassland Auger Area	100	80	50	7 to 12	65 (65%)	56 (70%)	35 (70%)
Back Bench Swale	1300	300	50	8 to 12	975 (75%)	285 (95%)	47 (95%)
South Swale	50	20	20	15+	37 (75%)	15 (75%)	15 (75%)
Total Stems Planted	3850	700	220				
Total Stems Surviving (%)	3237 (84%)	641 (92%)	192 (87%)				

Table 4.3. Survival of the Vegetative Species Planted during Restoration at the Berino West sites

Restoration Area	Planted Coyote Willow Stems	Planted Goodding's Willow Stems	Cottonwood Stems	Depth to Ground water (ft)	Surviving Coyote Willow Stems (%)	Surviving Goodding's Willow Stems (%)	Surviving Cottonwood Stems (%)
Back Bench Auger Area	100	100	50	8 to 12	85 (85%)	90 (90%)	45 (90%)
North Swale	1000	200	50	8 to 12	850 (85%)	190 (95%)	47 (95%)
Bankside Planting Area	1500	250	25	2 to 6	1425 (95%)	237 (95%)	24 (95%)

Restoration Area	Planted Coyote Willow Stems	Planted Goodding's Willow Stems	Cottonwood Stems	Depth to Ground water (ft)	Surviving Coyote Willow Stems (%)	Surviving Goodding's Willow Stems (%)	Surviving Cottonwood Stems (%)
Bankside Swale	500	100	55	8 to 12	475 (95%)	95 (95%)	52 (95%)
Center Swale	1400	50	20	8 to 12	700 (50%)	45 (90%)	17 (85%)
Bankside Tree Area	0	100	50	7 to 12	NA	90 (90%)	42 (85%)
South Saltgrass Area	0	50	50	7 to 11	NA	37 (75%)	37 (75%)
Total Stems Planted	4500	850	300				
Total Stems Surviving (%)	3535 (79%)	785 (92%)	265 (89%)				

4.1.1 BERINO WEST PLANTING AREAS

For more detailed information about survival rates in each planting area seen in Figure 4.1, please see the Qualitative Monitoring Field Sheets in Appendix A. Berino West had more than 3 acres of plantings implemented and were situated along banks and in swales where invasive saltcedar had been removed.

In the north half of the site, the Back Bench Auger Area was planted with a mixture of Goodding's willow and cottonwood poles. More than one stem was planted per hole to maximize survival rates in this large auger planting area. The North Swale was excavated into an existing slight depression with a high water table and planted with a mix of willow and cottonwood. The Bankside Planting Area was constructed using an auger to take advantage of the shallowest groundwater depth (2–6 feet) in the project area. It links existing stands of willow together to form a continuous riparian bank habitat. The Bankside Swale extends inland from the bankside planting area in discontinuous patches that were determined by the location of suitable groundwater. All of these areas show vigorous growth as of June 2015 (Figure 4.2).

In the southern half of the site, the Center Swale was excavated from an existing old irrigation drain to create a deep willow swale. Although groundwater appeared adequate at the time of planting, trees in the east third of this planting area had high mortality during April and May 2015, indicating that depth to groundwater probably increased in this area during this time. This excavation was also intended to preclude off-road driving through the north half of the project site, but traffic has continued by running over some of the plantings and creating a new road through the swale (Figure 4.3).

The Bankside Tree Area was planted with a small number of Goodding's willow and cottonwood stems due to difficulty augering into riprap. The South Saltgrass Area was planted with an auger into an existing thick stand of native saltgrass. Although the clay soils in this area appear to remain moist throughout much of the growing season, tree mortality here was higher than other areas.

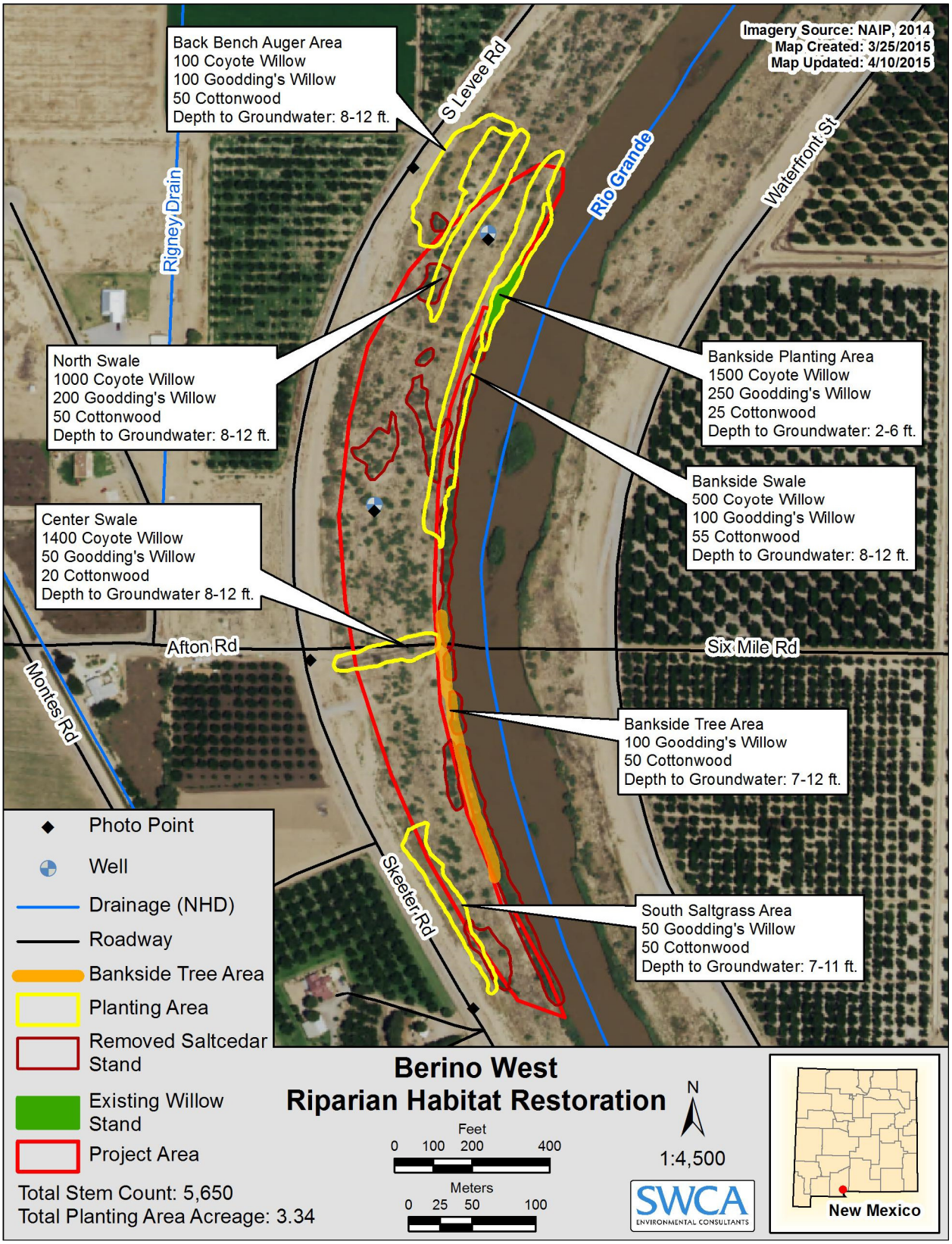

Figure 4.1. Overview of the planted areas at the Berino West site.

Figure 4.2. Berino West Bankside Planting Area, June 16, 2015.

Figure 4.3. Off-road driving has continued over and through a constructed swale (Center Swale, Berino West).

4.1.2 BERINO EAST PLANTING AREAS

For detailed information about survival rates in each planting area, please see the Qualitative Monitoring Field Sheets attached in Appendix A. At Berino East, shallow soil moisture was not encountered near the stream banks but instead was located near the back of the floodplain bench. Due to the difficulty in locating suitable planting areas, only a little over 1 acre of habitat was created (Figure 4.4).

The Main Swale in Berino East was constructed by excavating several feet from a low-lying weed-filled area while avoiding nearby intact native grasslands and shrublands (see Figure 3.3). More than 2,800 trees were densely planted in this area to take advantage of the relatively shallow groundwater (6 to 12 feet) and this area is now growing vigorously and has saturated soil conditions (Figure 4.5). The Grassland Auger Area was constructed to continue to utilize the shallow depth to groundwater without disturbing the native grasses. Survival was lower in this area than surrounding areas, indicating that either holes were not augered deep enough or trees were not planted deep enough (see Section 5, Conclusions). The Back Bench Swale was trenched 8 to 12 feet to groundwater to continue creating willow habitat. The South Swale was an attempt to reach groundwater in another planting location, and while a few trees were planted into groundwater, much of this area appears to have depths to groundwater in excess of 15 feet. Survival of planted areas in Berino East is generally good to excellent, except for the Grassland Auger Area.

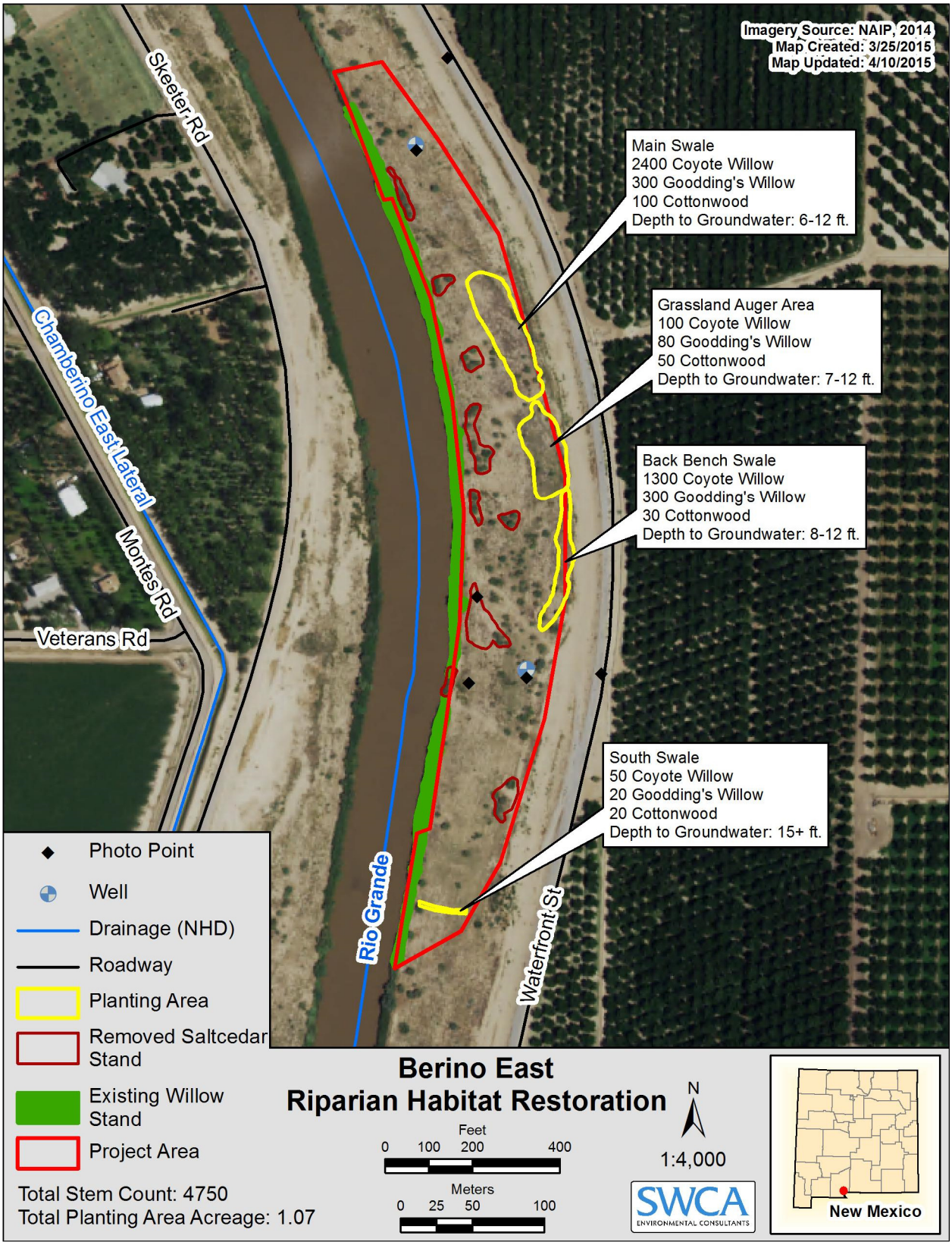

Figure 4.4. Overview of the planted areas at the Berino East site.

Figure 4.5. Vigorous growth of willow and cottonwood poles planted in the Main Swale at the Berino East site.

4.2 SPECIES-SPECIFIC RESULTS

4.2.1 EXISTING INVASIVE SPECIES

As expected, annual invasive species already present at the site, such as kochia, colonized many areas disturbed by restoration activities. While there is no evidence of saltcedar colonization, about a hundred existing pieces of saltcedar rootstock that were left buried in the soil or were buried during restoration activities have resprouted as of June 2015. Most of these sprouts were easily hand removed with shovels or clipped back with loppers and treated. However, there are areas along the banks where saltcedar has resprouted but could not be treated due to the species' location in the flowing river channel. It is unknown if these sprouts will survive inundation for an extended period of time, but the banks should be checked again for resprouts once the river is turned off following the irrigation season.

4.2.2 INTRODUCED INVASIVE SPECIES

As of June 2015, no new invasive species were observed in the project area following restoration.

4.2.3 EXISTING NATIVE SPECIES

Machine operators were instructed to avoid flagged areas of native grasslands and shrubland areas to reduce unnecessary damage to existing habitats (e.g., see Figure 3.3). Nonetheless, some roads were created and/or used to remove saltcedar and to auger holes or excavate soil for restoration plantings. As of June 2015 these areas are recovering well, with damaged shrubs (e.g., Torrey wolfberry [*Lycium torreyi*]) vigorously leafed out and buried grasses (e.g., sand dropseed) emerging through masticated material and excavated soil (Figure 4.6).

Figure 4.6. Masticated road recolonizing with native species (June 2015).

4.2.4 INTRODUCED NATIVE TREES

During the May monitoring visit, all trees showed drought stress. Data showed groundwater levels fell from February through May, despite (or perhaps because of) irrigation of the surrounding pecan orchards. By June, however, the Rio Grande was flowing again and groundwater levels rose to 4 to 5 feet below ground surface. However, many small coyote willow whips were already dead. These small (less than 0.5-inch-diameter) stems lack the carbohydrate reserves to survive harvesting, storage, transportation, and planting. Some small-diameter cottonwood stems had also died, as had some of the larger and taller cottonwoods and Goodding's willow. It is possible that some of the taller trees had too much leaf area relative to the amount of water they were able to access for transpiration.

A small (less than 5%) proportion of dead trees was found intermixed with thriving poles, indicating that groundwater levels were not the culprit. While the cause of mortality for any individual tree cannot be determined with certainty, it is possible that some of these trees were not

planted deep enough to reach groundwater. While every effort was made to ensure adequate soil moisture before planting, some tree poles had very large stem bases that may have prevented them from being pushed deep enough to establish a connection with the saturated zone. Auger areas were planted with more than one stem/hole in order to ensure that at least on stem survived (Figure 4.7).

Figure 4.7. Auger plantings with more than 1 stem per hole.

As of June 2015, many trees have already put on a foot (12 inches) of new growth. Most of this vigorous growth has likely occurred since adequate soil moisture levels were restored by water flow in the Rio Grande. Most trees are now leafed out and should thrive throughout the rest of the growing season.

4.2.5 Introduced Native Longstem Shrubs

Unfortunately, longstem shrubs had very low survival, around 10%. Water table and associated capillary fringe appear to have been too deep for plantings limited to less than 5 feet deep (Natural Resources Conservation Service 2015).

5 CONCLUSIONS – SUGGESTIONS AND LESSONS LEARNED

The goal of this restoration work was to actively manage the riparian zone in order to increase habitat available for southwestern willow flycatcher (*Empidonax traillii extimus*; flycatcher) and the yellow-billed cuckoo (*Coccyzus americanus*) through the removal of non-native vegetation and the subsequent replanting of native trees and shrubs. These plantings were designed to create willow (*Salix* sp.) dominated stands, a cottonwood (*Populus deltoids spp. wislizeni*) gallery forest, and a buffer areas with native riparian shrubs typical of the surrounding floodplain. Overall, the initial restoration was a success in achieving most of the outlined goals. However, one area of shortcomings was with the native long-stemmed shrubs as they only had about a 10% survival rate. The tree plantings however, were very successful and had a 90% survival rate, which should increase the available habitat for both the southwestern willow flycatcher and the yellow-billed cuckoo significantly.

5.1 PRE-RESTORATION

Maximum depth to groundwater should be accurately assessed at multiple sites on the floodplain prior to restoration work to facilitate planting area location. The two wells found at each site gave an indication of groundwater depths, but do not adequately capture the variability found across the sites. During restoration work we determined that depth to groundwater can vary by a factor of two across the floodplain in a non-linear manner. Simply stated, there are pockets or paleochannels of shallower groundwater interspersed in a matrix of generally drier soils. Having several sets of nested piezometers located at different areas across the floodplain would help capture this variability before and during restoration allowing the plantings to occur in areas with good groundwater connection. When areas have a good connection to groundwater when excavated water can be seen rapidly entering through permeable sediments in the sides of the pit. In general, areas where the river is more deeply incised will have correspondingly deeper depths to groundwater. Selection of sites close to regular water inputs, such as near water treatment plants or irrigation ditch returns, should offer shallower depth to groundwater.

5.2 INVASIVE REMOVAL

- We suggest masticating saltcedar earlier in season to allow a longer drying time for the root stock fragments that can resprout and become established.
- For resprouts, we suggest treating with herbicide at the end of the growing season in late September into October. Herbicide application at this time is more effective at killing both aboveground and—more importantly—the belowground rootstock due to the plant no longer putting energy into vegetative growth, but instead focusing energy into the root stock which draws the herbicide down into the plants root system.
- Monitoring of the invasive vegetation (predominately salt cedar) should continue on a bi-annual basis in order to limit the recolonization within the sites. When infestations occur they should be treated once a year during the fall period as mentioned above.

5.3 RESTORATION PLANTINGS

- Swales should be excavated prior to delivery of planting material to aid planning and speed planting. This would also allow more accurate determination of groundwater levels.
- Poles with large "butts" should be sawed off to create sharp ends to push into holes with collapsing soils.
- Longstem potted shrubs may be helped by a program of watering until soil moisture increases with river flows in June. Installing watering tubes and dry water (absorbent gel) during planting may also be helpful. Watering tubes would need to be filled once a month during the dry season prior to irrigation. Alternatively, since these shrubs are potted they could be planted once the irrigation season begins and the soil moisture increases, however, this would result in additional costs for time and mobilization.
- Restoration Plantings should continue to be monitored on a seasonal basis in order to assess the effectiveness of the restoration plantings.
- Most importantly, areas with inadequate soil groundwater should be avoided.

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APPENDIX A
Qualitative Monitoring Field Sheets

(1)

Restoration Work Effectiveness - Qualitative Monitoring Field Sheet

Site: Berino West Date: June 16, 2015

Participants: Cody Stropki, Conor Flynn Target Habitat: Riparian Bosque

Identifiable Native Species	Abundance (None, Sporadic individuals, Low, Moderate, High)	Percent Cover (Estimate)	Comments
Salix exigua	Moderate - along river	5%	
Prosopis pubescens	Moderate	15%	
Pluchea sericea	Low - patches	10%	
Sporobolus cryptandus	High - Common grass	30%	Intact grasslands look good
Identifiable Exotic (Non-Native) Species	**Abundance (None, Sporadic individuals, Low, Moderate, High, Monotypic)**	**Percent Cover (Estimate)**	**Comments**
Saltcedar	Sporadic Individuals	2%	few resprouts
Bassia Scoparia	High	20%	Common, esp. in disturbed area
Sphaerophysa Salsula	Moderate - localized	5%	Growing in Bank Beach Access Area
Salsola tragus	Sporadic Individuals	2%	Few

Success of plantings: "Bankside Tree Area"

Species	General Planting Area (s)	Vigor (stressed, normal, thriving)	Density (stems /acre)	Height Range	Survival Rate (average of 3 subplot counts) A = Alive, D = Dead Average = Sum A/ (Sum D + Sum A)				Comments
					Plot 1	Plot 2	Plot 3	Average	
Coyote Willow		NA			A	A	A		
					D	D	D		
Goodding's Willow	Bankside	Thriving		5-10'	A	A	A	90%	Lush growth
					D	D	D		
Cottonwood	"	Thriving		5-10'	A	A	A	85%	
					D	D	D		
Long Stem Shrub (specify in comments)	"	Stressed		2-3'	A	A	A	5%	
					D	D	D		
Other					A	A	A		
					D	D	D		

General Site Conditions: Existing and planted trees much improved from a month ago. Lush growth, full-leaf out. Most trees look good,

Observed Wildlife: Redwing blackbird, Killdeer, W. Kingbird, Rodent (sign), Morning Doves, Mockingbirds, Black-chinned Hummingbird, Jackrabbit

Photos Taken: -> Repeat photos and details of each planting area.

USIBWC Rio Grande Canalization Project Restoration Site Monitoring Program *last updated June 11, 2013*

90% Overall Survival of Pole plantings.

(2)

Species	General Planting Area (s)	Vigor (stressed, normal, thriving)	Density (stems /acre)	Height Range	Survival Rate (average of 3 subplot counts) A = Alive, D = Dead Average = Sum A/ (Sum D + Sum A)				Comments
South Saltgrass Area					Plot 1	Plot 2	Plot 3	Average	
Coyote Willow		NA			A	A	A		
					D	D	D		
Goodding's Willow		normal			A	A	A	75%	
					D	D	D		
Cottonwood		normal			A	A	A	75%	
					D	D	D		
Long Stem Shrub (specify in comments)		stressed			A	A	A	5%	
					D	D	D		
Other					A	A	A		
					D	D	D		

General Site Conditions:

Observed Wildlife:

Photos Taken:

Species	General Planting Area (s)	Vigor (stressed, normal, thriving)	Density (stems /acre)	Height Range	Survival Rate (average of 3 subplot counts) A = Alive, D = Dead Average = Sum A/ (Sum D + Sum A)				Comments
Center Swale					Plot 1	Plot 2	Plot 3	Average	
Coyote Willow	Stressed/Normal				A	A	A	50%	
					D	D	D		
Goodding's Willow	Normal				A	A	A	90%	
					D	D	D		
Cottonwood	Normal				A	A	A	95%	
					D	D	D		
Long Stem Shrub (specify in comments)	Stressed				A	A	A	5%	
					D	D	D		
Other					A	A	A		
					D	D	D		

General Site Conditions:

Observed Wildlife:

Photos Taken:

(3)

Species	General Planting Area (s)	Vigor (stressed, normal, thriving)	Density (stems /acre)	Height Range	Survival Rate (average of 3 subplot counts) A = Alive, D = Dead Average = Sum A/ (Sum D + Sum A)				Comments
					Plot 1	Plot 2	Plot 3	Average	
Bankside	Swale								
Coyote Willow		Thriving			A	A	A	95%	Lush, thick growth
					D	D	D		
Goodding's Willow		"			A	A	A	95%	"
					D	D	D		
Cottonwood		"			A	A	A	95%	"
					D	D	D		
Long Stem Shrub (specify in comments)		Stressed			A	A	A	10%	
					D	D	D		
Other					A	A	A		
					D	D	D		

General Site Conditions:

Observed Wildlife:

Photos Taken:

USIBWC Rio Grande Canalization Project Restoration Site Monitoring Program *last updated June 11, 2013*

Species	General Planting Area (s)	Vigor (stressed, normal, thriving)	Density (stems /acre)	Height Range	Survival Rate (average of 3 subplot counts) A = Alive, D = Dead Average = Sum A/ (Sum D + Sum A)				Comments
					Plot 1	Plot 2	Plot 3	Average	
Bankside	Planting Area								
Coyote Willow		Thriving			A	A	A	95%	Lush, thick growth.
					D	D	D		
Goodding's Willow		"			A	A	A	95%	"
					D	D	D		
Cottonwood		"			A	A	A	95%	"
					D	D	D		
Long Stem Shrub (specify in comments)		Dead			A	A	A	0%	
					D	D	D		
Other					A	A	A		
					D	D	D		

General Site Conditions:

Observed Wildlife:

Photos Taken:

USIBWC Rio Grande Canalization Project Restoration Site Monitoring Program *last updated June 11, 2013*

(4)

Species	General Planting Area (s)	Vigor (stressed, normal, thriving)	Density (stems /acre)	Height Range	Survival Rate (average of 3 subplot counts) A = Alive, D = Dead Average = Sum A/ (Sum D + Sum A)				Comments
					Plot 1	Plot 2	Plot 3	Average	
North	Swale								
Coyote Willow	Normal				A	A	A	85%	
					D	D	D		
Goodding's Willow	Thriving				A	A	A	95%	Lush growth
					D	D	D		
Cottonwood	Thriving				A	A	A	95%	"
					D	D	D		
Long Stem Shrub (specify in comments)	Stressed				A	A	A	5%	
					D	D	D		
Other					A	A	A		
					D	D	D		

General Site Conditions:

Observed Wildlife:

Photos Taken:

USIBWC Rio Grande Canalization Project Restoration Site Monitoring Program *last updated June 11, 2013*

Species	General Planting Area (s)	Vigor (stressed, normal, thriving)	Density (stems /acre)	Height Range	Survival Rate (average of 3 subplot counts) A = Alive, D = Dead Average = Sum A/ (Sum D + Sum A)				Comments
					Plot 1	Plot 2	Plot 3	Average	
Back berm	Auger Area								
Coyote Willow	Thriving				A	A	A	85%	Lush growth
					D	D	D		
Goodding's Willow	"				A	A	A	90%	
					D	D	D		
Cottonwood	"				A	A	A	90%	
					D	D	D		
Long Stem Shrub (specify in comments)					A	A	A		
					D	D	D		
Other					A	A	A		
					D	D	D		

General Site Conditions:

Observed Wildlife:

Photos Taken:

USIBWC Rio Grande Canalization Project Restoration Site Monitoring Program *last updated June 11, 2013*

Restoration Work Effectiveness - Qualitative Monitoring Field Sheet

Site: Berino East Date: June 16, 2015

Participants: Cody Stropki, Conor Flynn Target Habitat: Riparian Bosque

Identifiable Native Species	Abundance (None, Sporadic individuals, Low, Moderate, High)	Percent Cover (Estimate)	Comments
Salix exigua	High - along river	20%	
Lycium torreyi	Moderate	5%	
Sporobolus cryptandrus	High - extensive grasslands	35%	
Suaeda nigra	Moderate - patches	10%	
Identifiable Exotic (Non-Native) Species	**Abundance (None, Sporadic individuals, Low, Moderate, High, Monotypic)**	**Percent Cover (Estimate)**	**Comments**
Saltcedar	Sporadic individuals	2%	
Bassia scoparia	High	20%	Growing in disturbed areas
Solanum eleagnifolium	Low - few patches	5%	

Success of plantings:

Species	General Planting Area (s)	Vigor (stressed, normal, thriving)	Density (stems /acre)	Height Range	Survival Rate (average of 3 subplot counts) A = Alive, D = Dead Average = Sum A/ (Sum D + Sum A)				Comments
					Plot 1	Plot 2	Plot 3	Average	
Back bench swale									
Coyote Willow		Thriving			A	A	A	75%	
					D	D	D		
Goodding's Willow		"			A	A	A	95%	
					D	D	D		
Cottonwood		"			A	A	A	95%	
					D	D	D		
Long Stem Shrub (specify in comments)		Stressed			A	A	A	15%	
					D	D	D		
Other					A	A	A		
					D	D	D		

General Site Conditions: Water in river is flowing almost at bankful and the impact on plants is immediately obvious. Water table has risen to soil surface in excavated swales, and phreatophyte growth is lush and vigorous.

Observed Wildlife: Mourning Doves, W. Kingbird, Gophers (sign).

Photos Taken: Repeat photos and detail photos of planting areas.

USIBWC Rio Grande Canalization Project Restoration Site Monitoring Program *last updated June 11, 2013*

95% Overall Survival of tree plantings.

Species	General Planting Area (s)	Vigor (stressed, normal, thriving)	Density (stems /acre)	Height Range	Survival Rate (average of 3 subplot counts) A = Alive, D = Dead Average = Sum A/ (Sum D + Sum A)				Comments
					Plot 1	Plot 2	Plot 3	Average	
Grassland	Auger Area								
Coyote Willow	Normal				A	A	A	65%	
					D	D	D		
Goodding's Willow	Normal				A	A	A	70%	
					D	D	D		
Cottonwood	Normal				A	A	A	70%	
					D	D	D		
Long Stem Shrub (specify in comments)	Stressed				A	A	A	20%	
					D	D	D		
Other					A	A	A		
					D	D	D		

General Site Conditions:

Observed Wildlife:

Photos Taken:

Species	General Planting Area (s)	Vigor (stressed, normal, thriving)	Density (stems /acre)	Height Range	Survival Rate (average of 3 subplot counts) A = Alive, D = Dead Average = Sum A/ (Sum D + Sum A)				Comments
					Plot 1	Plot 2	Plot 3	Average	
Main Swale									
Coyote Willow	Thriving				A	A	A	90	
					D	D	D		
Goodding's Willow	"				A	A	A	95%	
					D	D	D		
Cottonwood	"				A	A	A	95%	
					D	D	D		
Long Stem Shrub (specify in comments)	Stressed				A	A	A	20%	
					D	D	D		
Other					A	A	A		
					D	D	D		

General Site Conditions:

Observed Wildlife:

Photos Taken: