CHAPTER 2. WETLAND/RIPARIAN VEGETATION MITIGATION

2.1 General Land Acquisition

2.1.1 Requirement to Acquire All Mitigation Property Prior to Initiation of Construction

In the 2000 FSEIS, Reclamation committed to acquiring the lands to be used for mitigation purposes prior to the initiation of the construction of the ALP Project.

2.1.1.1 Progress in Acquisition of Mitigation Property:

The mitigation property was purchased in three parcels, with the first parcel (tract II) purchased in March of 2001. In September of 2002 Reclamation completed the acquisition of the mitigation property with the purchase of tract I, the final parcel. This purchase was completed prior to any construction activity for the ALP Project.

2.1.1.1.1 Completion of 95% of Acquisition of Mitigation Property:

This requirement has no 95% of physical features completion threshold associated with it.

2.1.1.1.2 Full Completion of Acquisition of Mitigation Property:

Reclamation has completed this requirement through the purchase of the approximate 6,000 acres of MA lands in 2002.

2.2 Hydrology Health Limiting Factors

2.2.1 Continue Use of MA Water Rights and Monitor Hydrologic Conditions

In the 2003 WMMP Reclamation committed to monitoring La Plata River flows and to ensuring that the return flows from irrigation in the MA will continue to contribute to return flows reaching the La Plata River in Tract III, Block D (also called 'Redmesa', the furthest upstream).

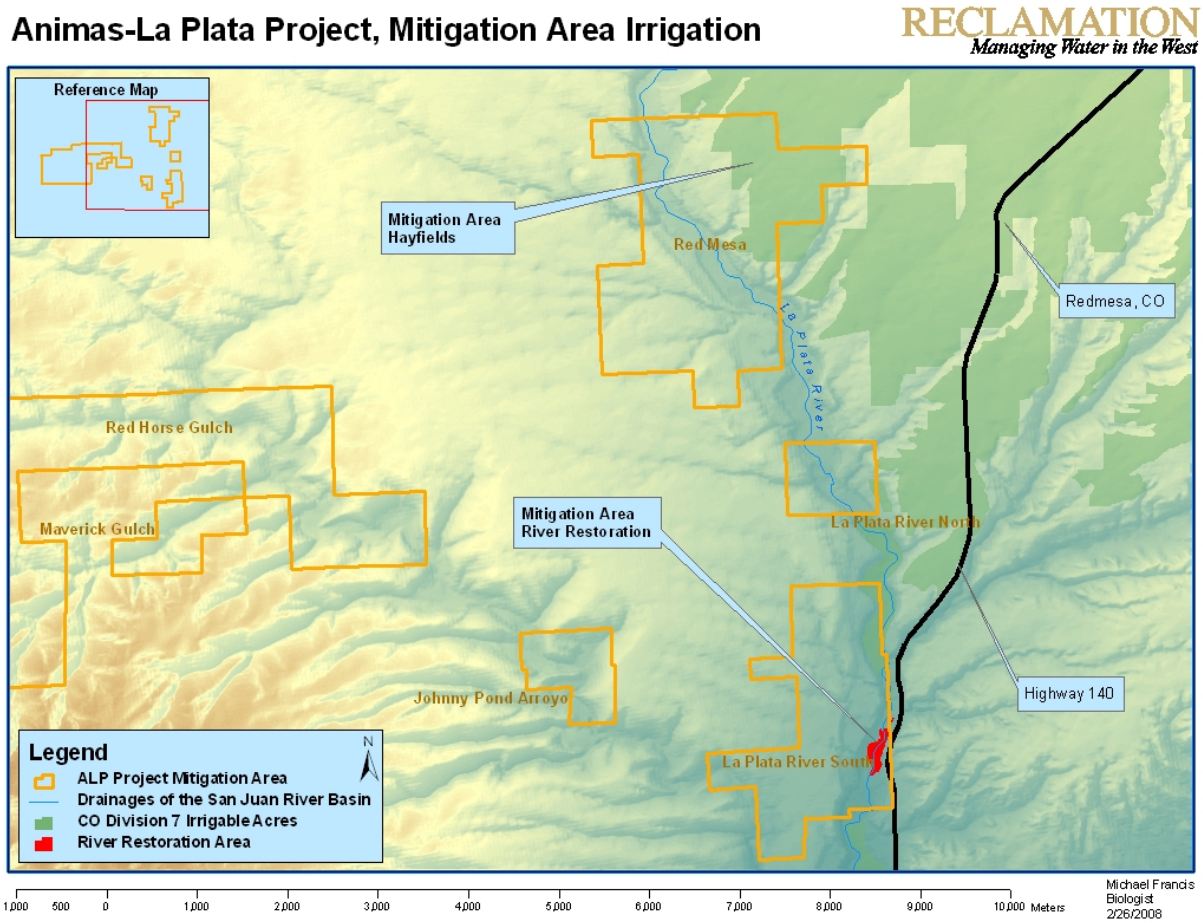
2.2.1.1 Progress in Utilizing Reclamation's Water Rights:

From 2003 through 2007 Reclamation contracted with private entities to operate and maintain irrigation on the acquired MA irrigable hayfield acres (Figure 4, below). Irrigation of this tract is planned to continue through 2008 and beyond. This commitment is part of the FSEIS commitment to mitigate for the loss of wetland and riparian vegetation in Ridges Basin and along Basin Creek.

In 2005 Reclamation developed and employed a substitute water supply plan (SWSP), as

approved by the Colorado Division of Water Resources. Reclamation utilized a small portion of Reclamation's acquired water from storage in Redmesa-Ward Reservoir further downstream in the La Plata River restoration area (Figure 4) as a measure to ensure mitigation vegetation establishment (Figure 5). Reclamation will not seek to renew the SWSP in 2008 as vegetative standards are being attained in the river restoration area.

Figure 4. 2007 Mitigation Area Irrigation.



2.2.1.1.1 Completion of 95% of Physical Features in Utilizing Water Rights:

This limiting factor has no 95% of physical features completion threshold associated with it.

2.2.1.1.2 Full Completion of Utilizing Reclamation's Water Rights:

Reclamation has completed this requirement through the annual application of its acquired water rights in the irrigation of hayfields and the river restoration area of the MA.

Figure 5. River Restoration Area Irrigated During Spring of 2007.

2.2.1.2 Progress in Monitoring Hydrology:

Figures 6-11 below display the annual results of Reclamation's La Plata River flow monitoring for 2002 through 2007. Years of particular note are 2002 (a very low water year, Figure 11) and 2005 (a very high water year, Figure 8).

There is no result in these years of data that indicates that the long-term viability of the wetland/riparian mitigation is threatened. Reclamation will not be seeking to change the use of any of its water rights to support the MA wetland/riparian mitigation at this time based upon these results over a wide range of water-years.

Based upon the snowpack and forecasts at the time of preparing this report, 2008 will likely be another high water year. In the future, Reclamation will rely solely upon the USGS gauges at Hesperus and the Colorado/New Mexico state line for indicators of a significant change in La Plata River hydrology that may threaten Reclamation's wetland/riparian vegetation mitigation credit acres.

2.2.1.2.1 Completion of 95% of Physical Features in Monitoring Hydrology:

This limiting factor has no 95% of physical features completion threshold associated with it.

2.2.1.2.2 Full Completion in Monitoring Hydrology:

Reclamation has completed this requirement by annual monitoring of the La Plata River flow rates on the river below the confluence with Long Hollow Creek.

Figure 6. La Plata River Monitoring Summary Results for 2007.

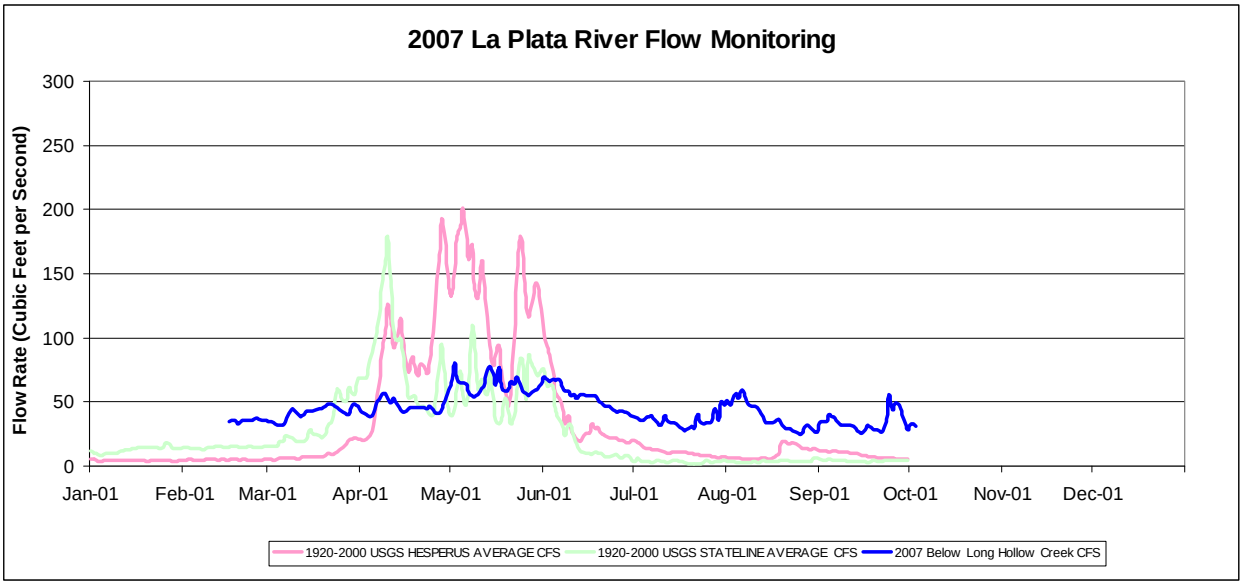


Figure 7. La Plata River Monitoring Summary Results for 2006.

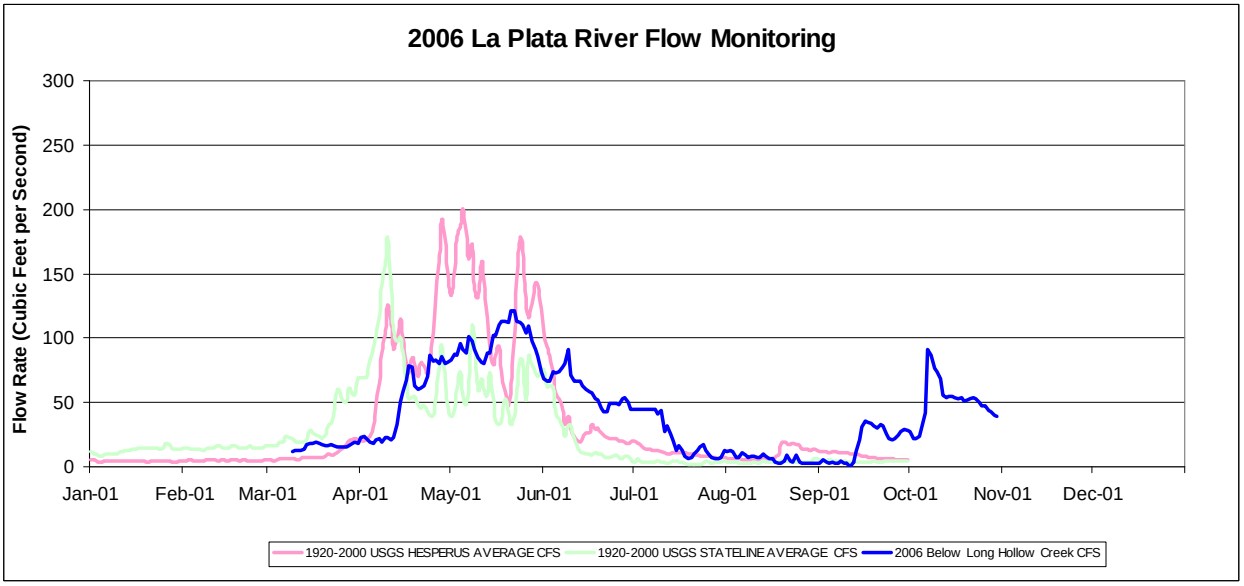


Figure 8. La Plata River Monitoring Summary Results for 2005.

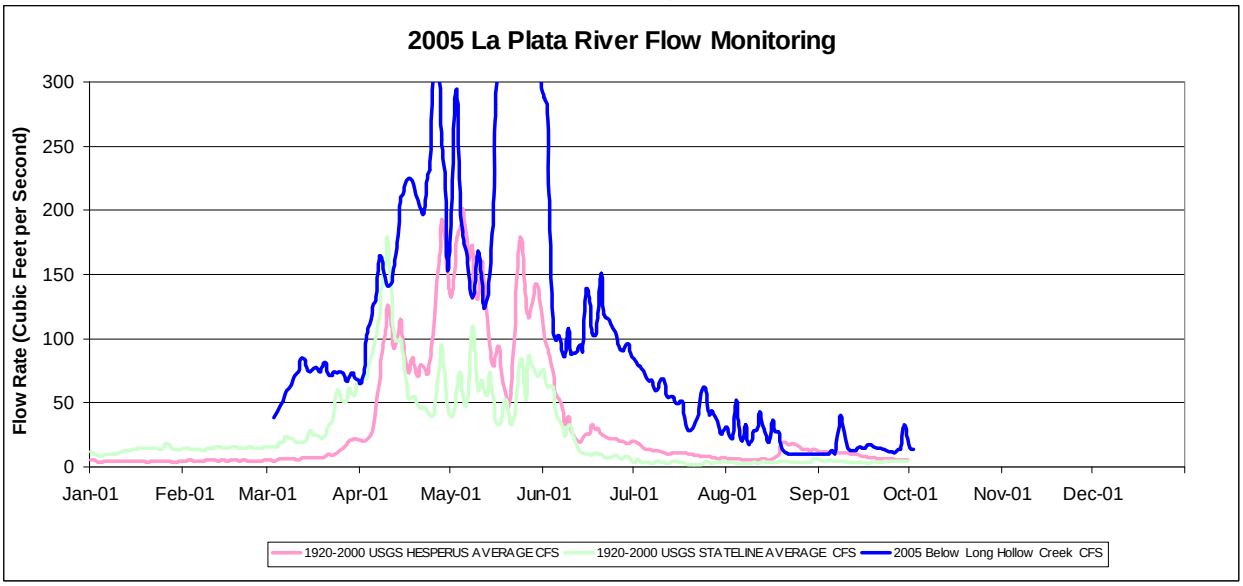


Figure 9. La Plata River Monitoring Summary Results for 2004.

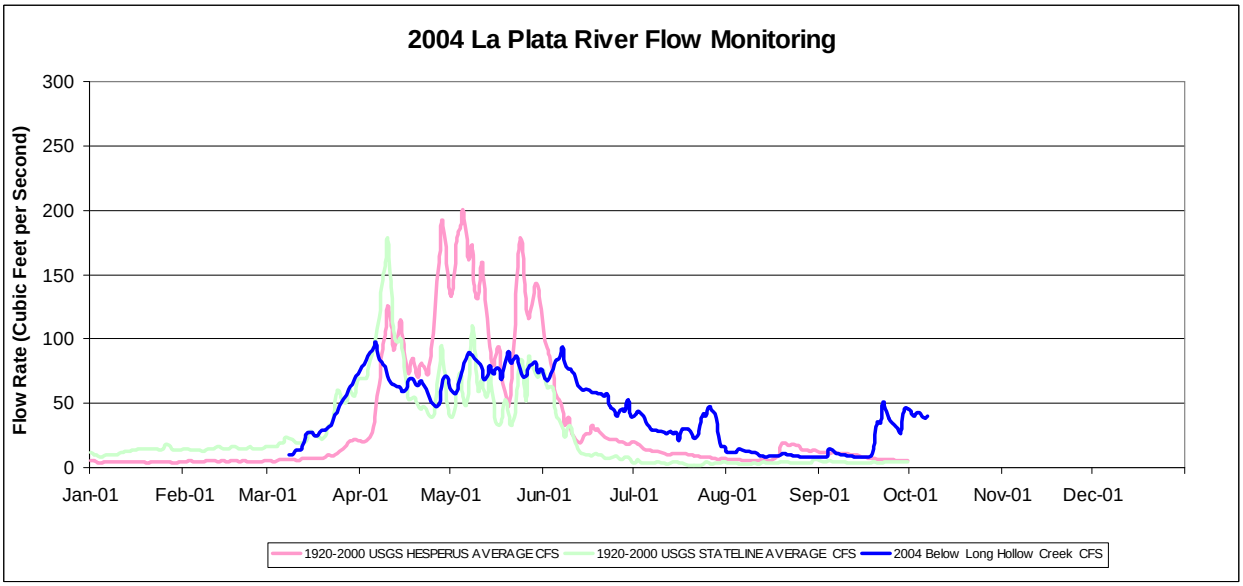


Figure 10. La Plata River Monitoring Summary Results for 2003.

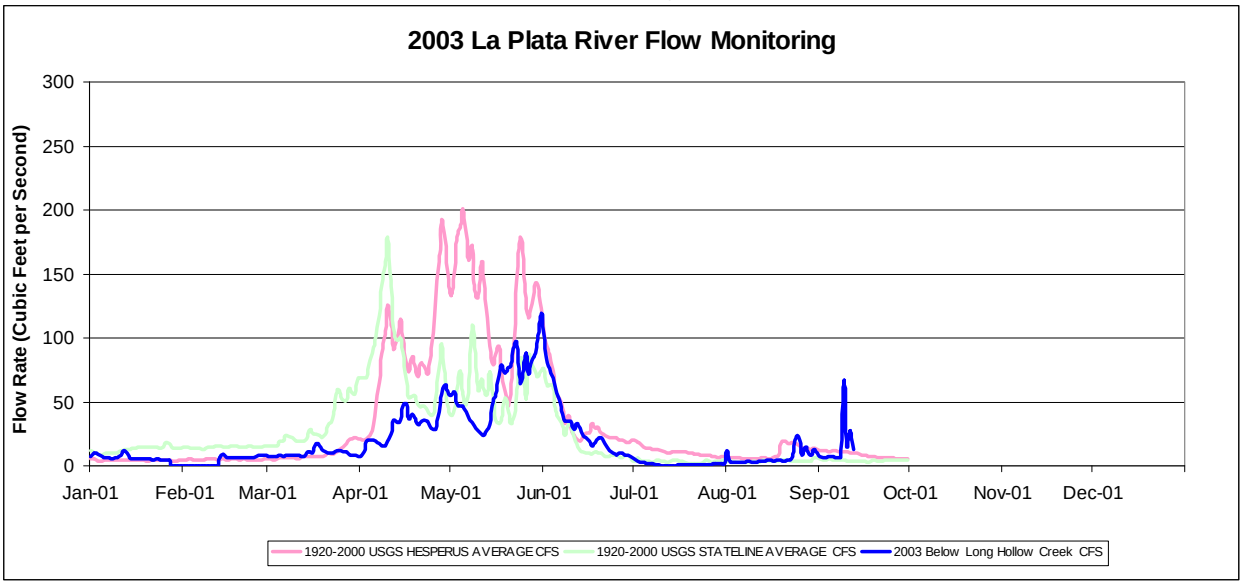
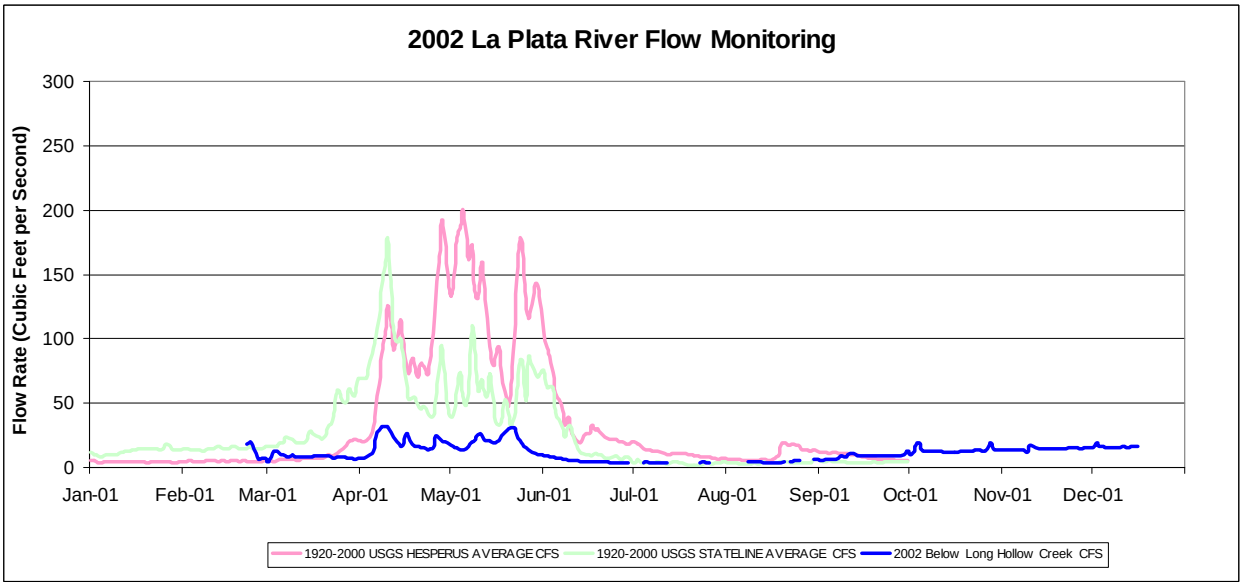


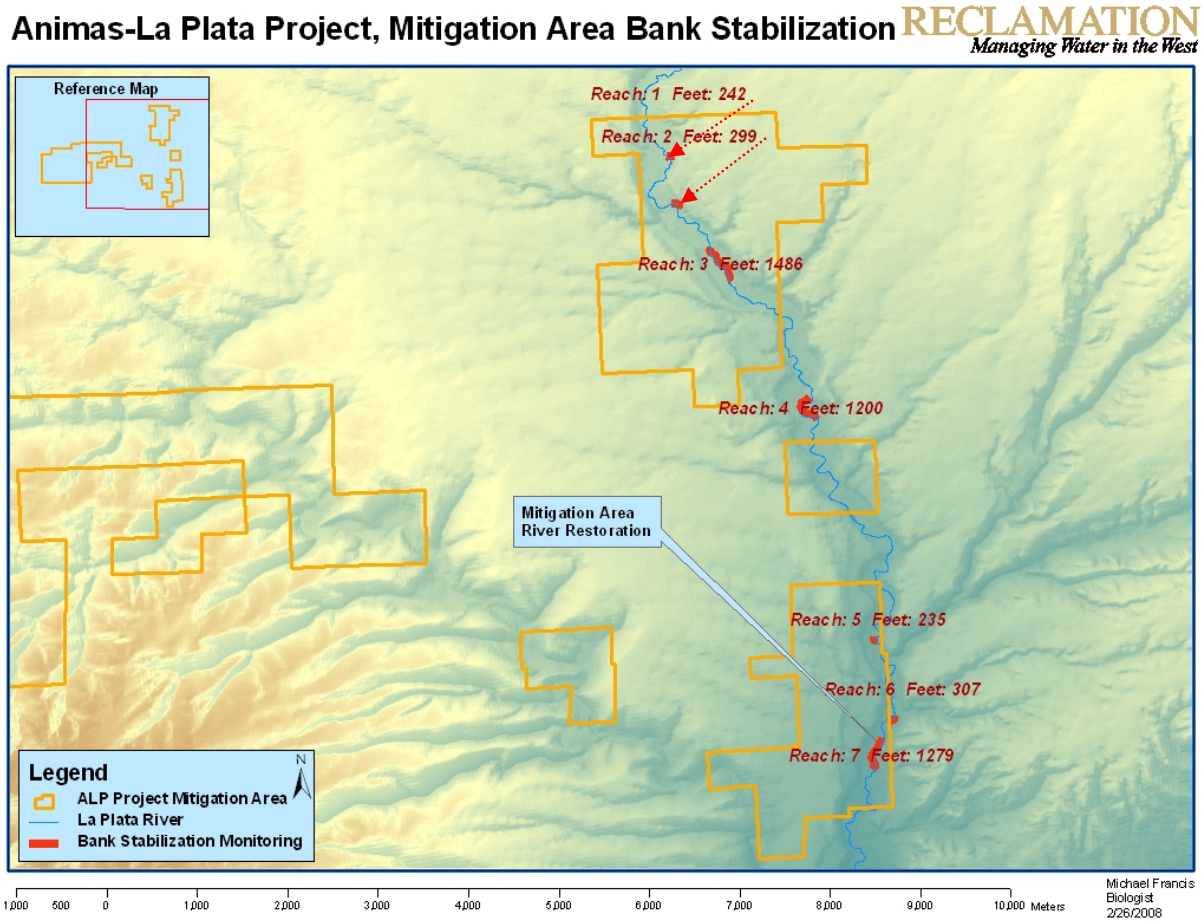
Figure 11. La Plata River Monitoring Summary Results for 2002.



2.2.2 Stream Bank Stabilization

Based on studies completed in 2001, a total of seven different locations (approximately 1,500 total linear feet) of La Plata River stream bank were found to be experiencing accelerated erosion and were possibly in need of stabilization (Figure 12, below). From 2003 through 2007, Reclamation monitored these locations to determine if natural vegetation recovery following the removal of cattle and horse grazing would suffice to protect denuded/damaged stream banks.

Figure 12. La Plata River Bank Stabilization Monitoring Locations.



Of most concern to date are the river restoration reaches (reaches 6 and 7, Figure 12) and reach 3 which changed channel location and had significant sediment deposition resulting from flooding in 2005. Reclamation has not continued monitoring reach 4, as it is not located on Reclamation property.

Observations made through 2007 indicate that morphologic changes occurred at all of these reaches due to periodic spring and late summer flood flows following 2003. However, the removal of uncontrolled livestock grazing followed by selective seeding has resulted in the expansion of each reach's desirable vegetative community and has subsequently provided for stabilization. Segments 6 and 7 were stabilized through both reconstruction and revegetation.

2.2.2.1 Progress in Stream Bank Stabilization:

Monitoring of sensitive and potentially unstable bank lines continued through 2007 with

application of the 'greenline'[2] method. To date, in stabilization reaches 1, 2, 3 and 5, natural vegetation is recovering and stream banks do not require active (constructed) stabilization. In reaches 6 and 7, active stream channel and floodplain restoration and stabilization took place (see section 2.2.3, below).

Note that reach 4 is not on Reclamation land and has been removed from this evaluation. Photos of some recovering reaches and graphic representations are provided in Figures 13 to 28 below. Photos of reach 5 were not available for this report.

Figure 13. Reach 1 in 2002.

[2] The 'Greenline Riparian-Wetland Monitoring' method is described in USDOI Technical Reference 1737-8 (1993) as developed by the US Bureau of Land Management. This method is useful as an evaluation tool for determining if site-specific vegetation objectives of coverage and composition are being met. In this context, Reclamation desired to determine whether native vegetation along destabilized river banks was naturally recovering or not. The greenline method describes existing conditions, has measurable objectives and is useful as a descriptor of change over time.

Figure 14. Reach 1 Natural Bankline Recovery in 2007.

Figure 15. Greenline Monitoring Results for Reach 1, 2003-2007.

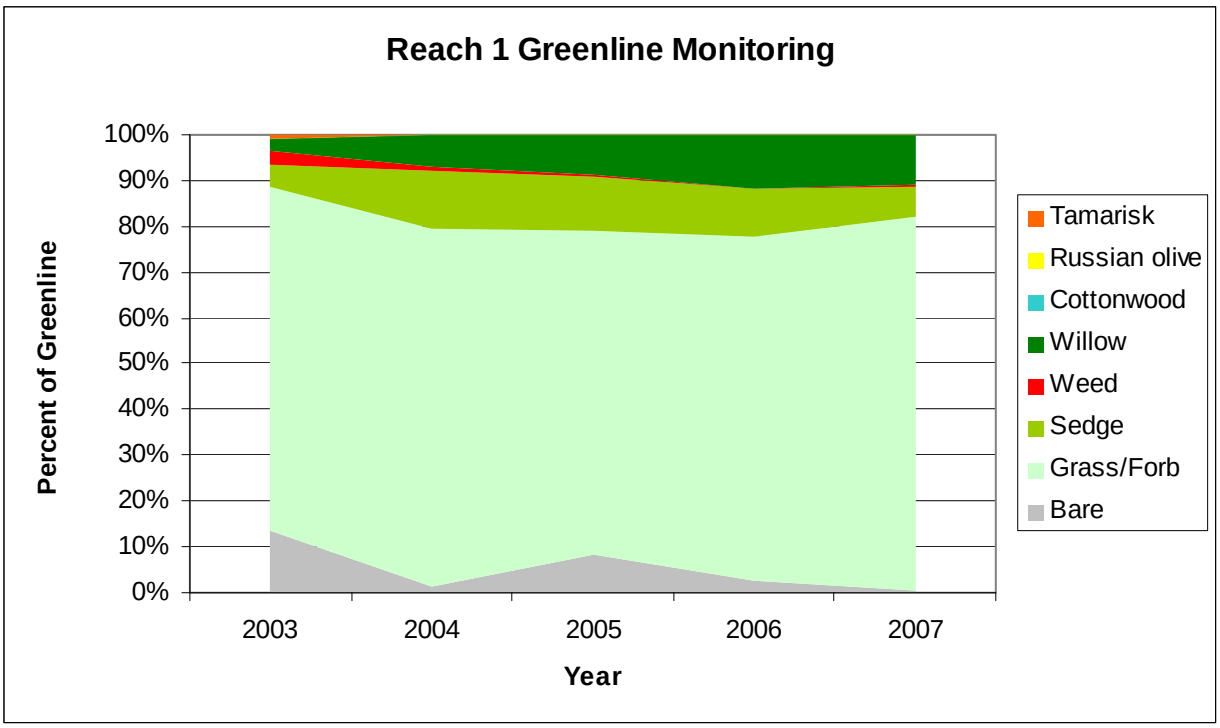


Figure 16. Reach 2 in 2002.

Figure 17. Reach 2 Natural Bankline Recovery in 2007.

Figure 18. Greenline Monitoring Results for Reach 2, 2003-2007.

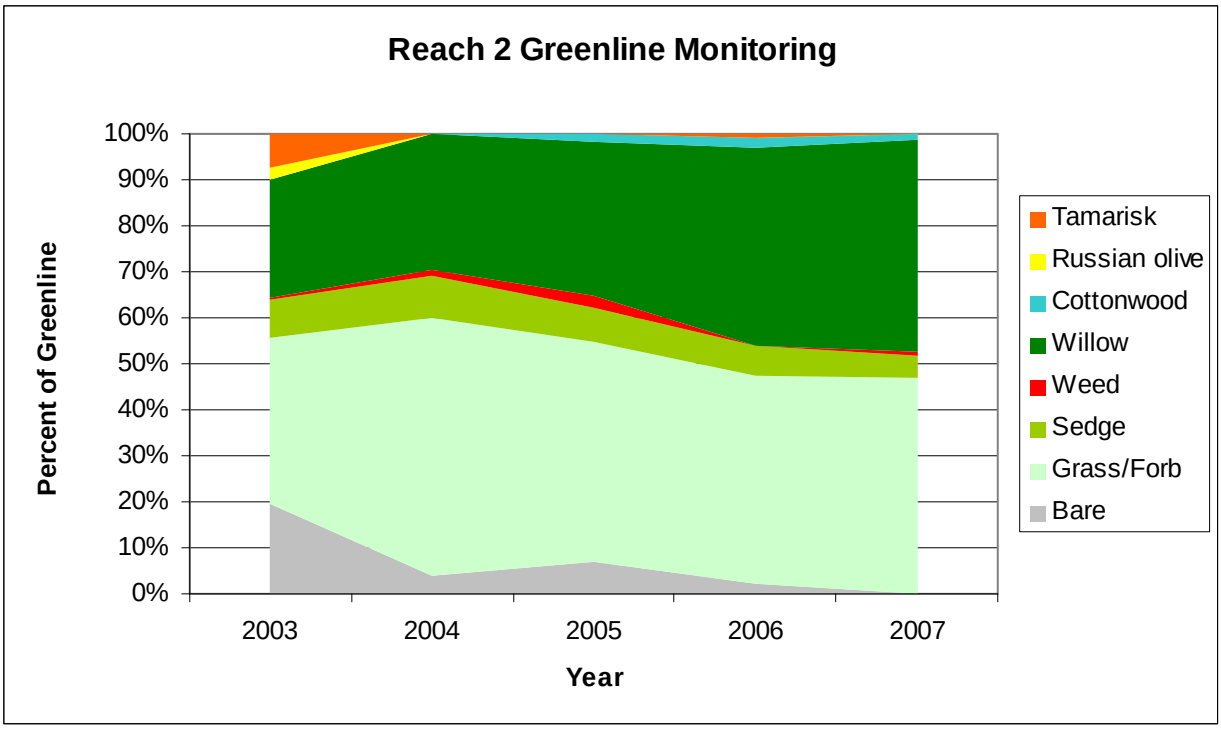


Figure 19. Looking Downstream Through Reach 3 in 2002.

Figure 20. Looking Downstream Through Reach 3 in 2007.

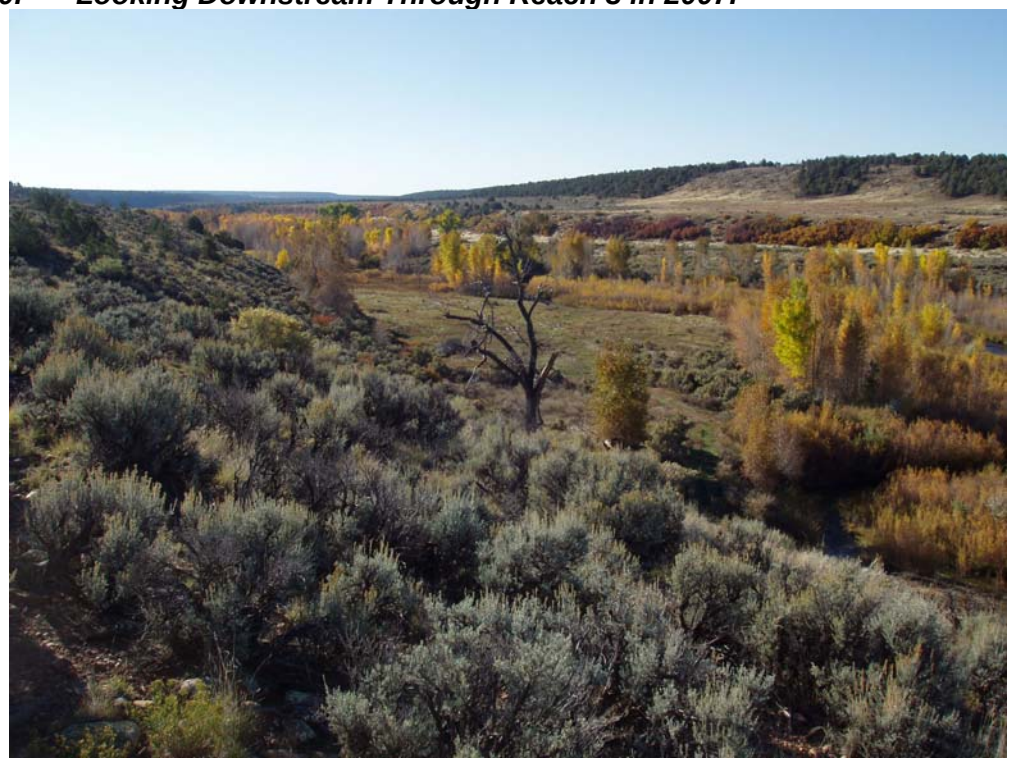


Figure 21. Greenline Monitoring Results for Reach 3, 2003-2007.

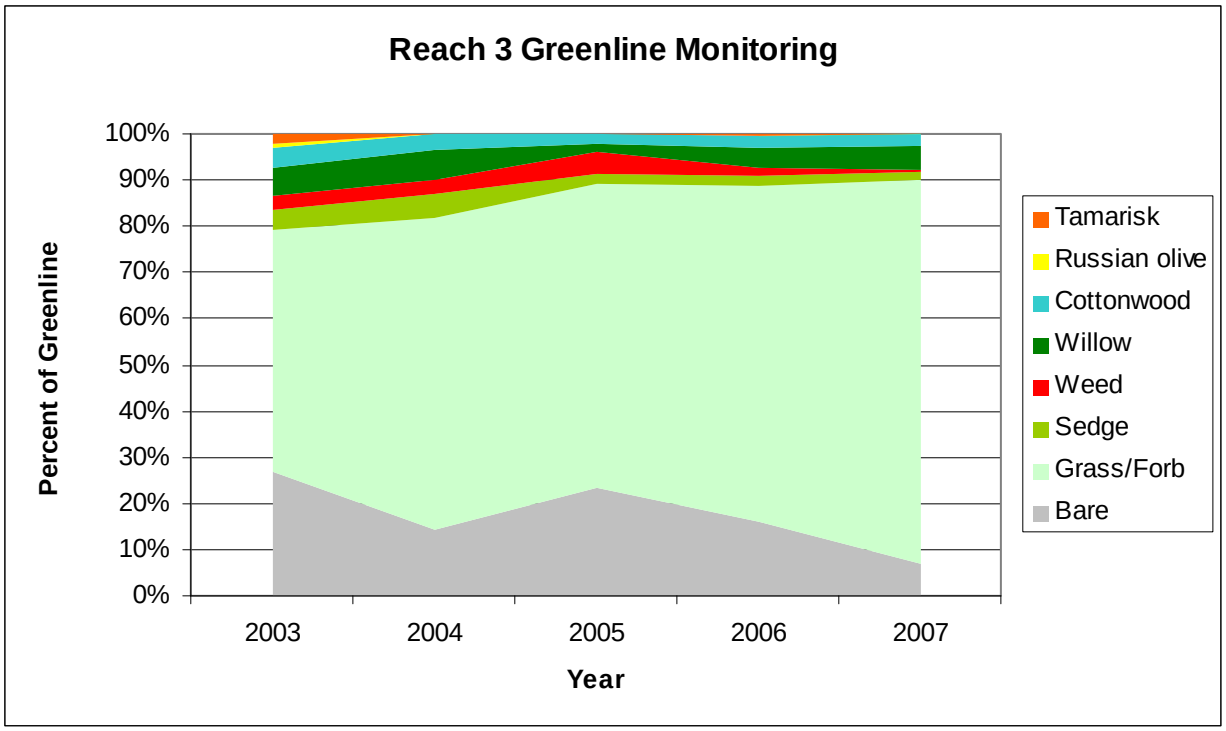
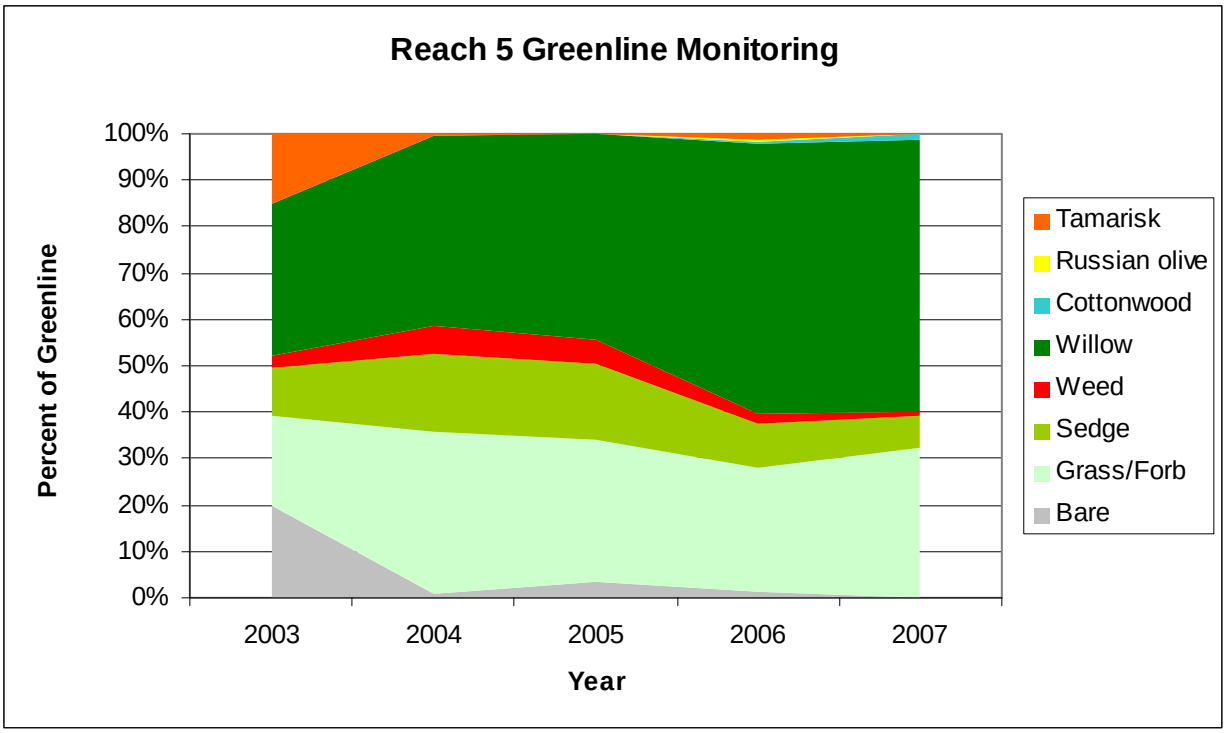


Figure 22. Reach 5 in 2002.

Figure 23. Reach 5 Natural Bankline Recovery in 2007.

Figure 24. Greenline Monitoring Results for Reach 5, 2003-2007.



The lower end of the Reach 3 location is as stabilized as it practicably can be. Stabilization is limited due to its unique location between the two drainages spilling into the La Plata River at almost the same location from the east (Silva Draw) and west (an unnamed draw, Figure 12, above), with heavy sediment loading and high runoff during rain events. This segment may remain chronically braided and it may not be feasible to expect the reach to fully stabilize, although grasses (various desirable species) and riparian shrub vegetation are filling in bare areas. The over-story (tree canopy) of cottonwood trees (*Populus spp.*) remains stable and vigorous.

Heavy seeding occurred in this reach in 2006 and showed considerable improvement in ground cover in 2007. All monitored reaches are considered successfully recovered as the woody vegetation community and the desirable herbaceous coverage has improved considerably since project initiation in 2002.

Reaches 6 and 7 (below) were actively stabilized and included in the river restoration plan. Reach 6 includes complete armoring for stabilization due to its proximity to Colorado Highway 140 and its threat to the downstream river restoration effort.

Reach 7 is contained fully within the river restoration area where complete bank and floodplain reconstruction and revegetation occurred.

Figure 25. Reach 6 Stabilization Work with Vegetation Establishment in 2007.

Figure 26. Greenline Monitoring Results for Reach 6, 2003-2007.

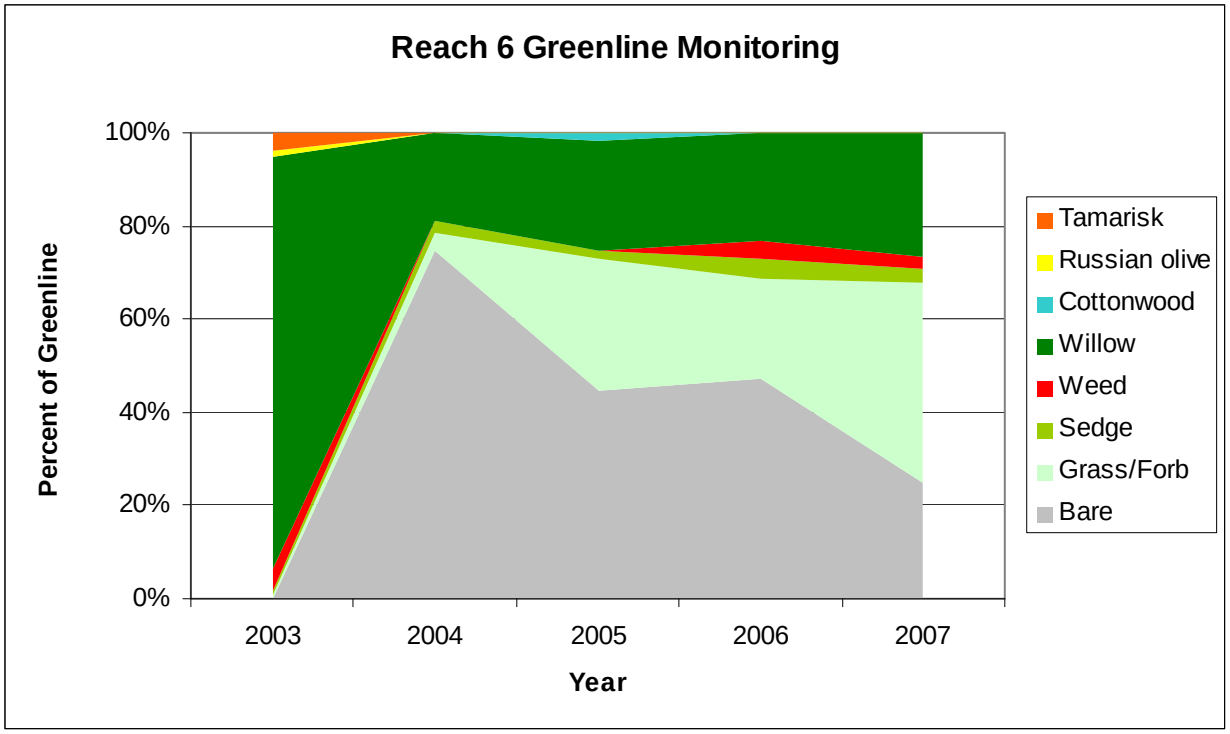
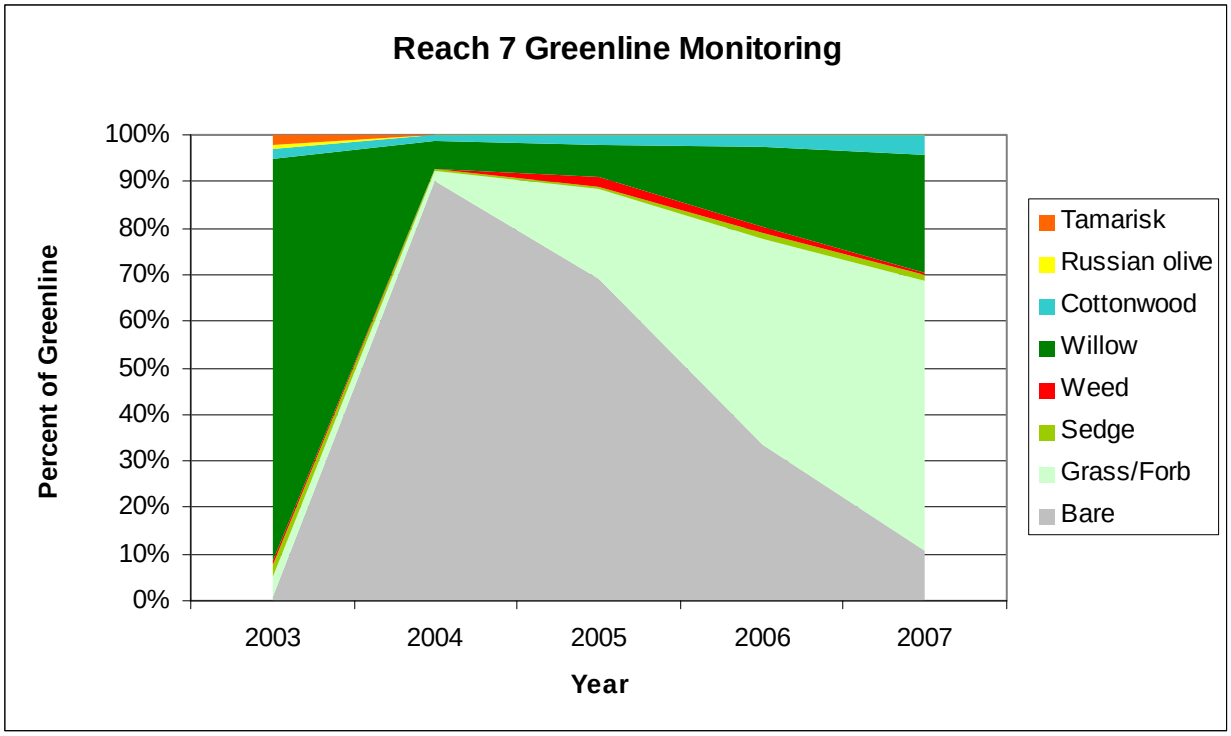


Figure 27. A Portion of Reach 7 in the Spring of 2007.

Figure 28. Greenline Monitoring Results for Reach 7, 2003-2007.



2.2.2.1.1 Completion of 95% of Physical Features in Bank Stabilization:

Reclamation has met this requirement through both greenline monitoring of all identified destabilized river segments on Reclamation property and by actively stabilizing the river restoration area.

2.2.2.1.2 Full Completion in Bank Stabilization:

Reclamation also reached full completion of this requirement by meeting the standards described above under 2.2.2.1.1.

2.2.3 Stream Channel and Floodplain Restoration

A significant part of Reclamation's wetland/riparian vegetation mitigation commitment is to create and restore habitats along the La Plata River (along with protection and enhancement of these same habitats). Reclamation's restoration of 1700 linear feet of channel with its associated 13 acres of floodplain on the La Plata River entailed eliminating the unnatural levees, re-establishing a sinuous river channel and re-establishing river/floodplain interactions to restore the river's zone-of-influence. The result of these measures has served both to restore and create new functional wetland/riparian habitats. The primary channel and floodplain restoration construction was completed in December of 2004 with minor remediation in 2005 following severe spring flooding. Figures 29 – 38 below, shows changes in the river restoration area over time.

Figure 29. Restoration Area Prior to Restoration or Weed Control (2002).

Figure 30. Prior to Restoration and after Tamarisk Control (2003).

Figure 31. River Restoration under Construction in 2004.

Figure 32. River Restoration Construction Completion in 2004.

Figure 33. Flooding in 2005 (Not at Peak Flows).

Figure 34. Flooding Receding in 2005.

Figure 35. La Plata Channel Remediation at Near-Completion, Summer 2005.

Figure 36. Channel Restoration Area 2 Years Following Remediation, Spring 2007.

2.2.3.1 Progress in Stream Channel/Floodplain Restoration:

Reclamation contracted with a private company for the development of a river restoration design which was reviewed and completed in August of 2003. Construction of the restored La Plata River channel and floodplain were completed in December of 2004. Re-planting a small segment of trees and shrubs was completed in early spring of 2005. Discussion regarding revegetation efforts is included under section 2.3.2, below.

Severe flooding in the mid-spring (end of May through the first part of June) of 2005 caused considerable damage to the river restoration work before vegetation could be established (Figures 33, 34, and Figure 8. (See the ALP Project Wetland/Riparian Mitigation 2005 Annual Report for added detail). In 2005 Reclamation completed the remediation and correction of the flood damage with minor modifications to aid in sediment transport (Figure 35). The 2006 and 2007 growing seasons saw the vegetation density and composition significantly improve and the remediated channel functioning well (Figures 36 and 38). The river channel has been designed to allow for natural meandering over time.

According to the WMMP, Reclamation bears responsibility to take corrective action for the river restoration effort only when a reach of our river restoration shows increased destabilization resulting in more erosion for two consecutive years. This allows for annual natural events such

as floods, drought, beaver dam blow-outs and other normal occurrences to have their expected natural effect without generating constant response from Reclamation. The constructed channel could be abandoned entirely by the La Plata River and Reclamation would still claim full success if the key goals of the restoration effort remain functional. The key goals for the river restoration area (floodplain restoration, increased sinuosity and restored connectivity between channel and floodplain) remain fully functional in 2007 and will likely remain so despite the flashy flows and heavy-pulse sediment loading inherent to the La Plata River system.

2.2.3.1.1 Completion of 95% of Physical Features in River Restoration:

Reclamation has completed this requirement through the successful design, construction, remediation and revegetation of 1700 linear feet of the La Plata River with its associated floodplain.

2.2.3.1.2 Full Completion in River Restoration:

Reclamation reached full completion of this requirement as described above under 2.2.3.1.1. Aerial/satellite images of before and after river restoration are below in figures 37 and 38.

Figure 37. Channel Restoration Area <u>Before</u> Restoration, 1997.

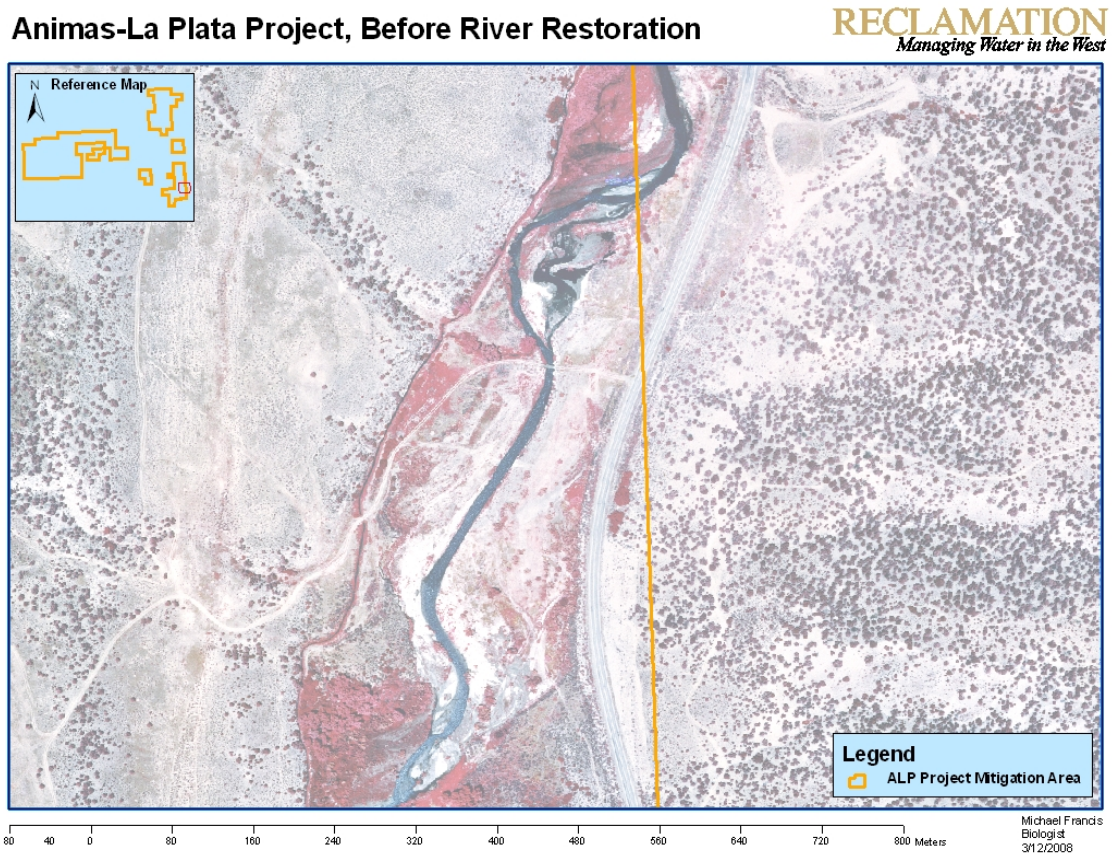


Figure 38. Channel Restoration Area <u>After</u> Restoration, 2006 Satellite Image.

2.3 Integrated Vegetation Management

2.3.1 Livestock Management (Fencing)

The negative effects of livestock grazing have been removed from the wetland/riparian portions of the MA by the installation and maintenance of a functional external boundary fence and the careful management of any grazing used for vegetation management purposes.

2.3.1.1 Progress in Livestock Management (Fencing):

In 2002 Reclamation successfully removed all pre-existing leases for grazing from the MA.

In 2005 Reclamation completed minor, temporary fencing on the boundaries of tract 3, (Redmesa) to prevent trespass grazing where fence lines had not been established previously. Reclamation also completed additional temporary fencing on the perimeter of the La Plata River restoration area.

In 2007, Reclamation removed all temporary fencing from the MA and completed the construction of permanent riparian tract external boundary fencing to control trespass grazing issues that have occurred in the wetland/riparian and buffer mitigation acres.

Reclamation conferred with the Colorado Division of Wildlife (CDOW), SUIT and the U.S. Fish and Wildlife Service (Service) on a suitable wildlife friendly fence design. See Figures 39 – 41, below.

2.3.1.1.1 Completion of 95% of Physical Features in Livestock Management:

Reclamation has completed the 95% milestone for livestock management through the successful design and construction of approximately 37,000 linear feet of fencing on the external boundaries of tracts II and III of the MA. The required fencing was completed in January of 2008.

2.3.1.1.2 Full Completion in Livestock Management:

Reclamation reached full completion in livestock management as described above under 2.3.1.1.1 and by the removal of all grazing leases from the MA.

Figure 39. Upland Boundary of Tract III (Redmesa) with New Fencing.

Figure 40. La Plata River Fence Crossing Below Long Hollow Confluence.

Figure 41. Riparian Boundary of Tract II with another River Crossing.

2.3.2 Weed Management and Native Vegetation Re-establishment

As a measure to enhance and restore the functions and values of the La Plata River corridor, Reclamation committed to controlling Colorado listed noxious weeds in the MA. The original weed coverage in the MA (as assessed in 2001) was 144.2 acres of weed ground coverage in approximately 250 total acres of treatment area (see the IVMP for further detail). Reclamation also committed to replace weed tree species with native species on an approximate one-for-one basis and to re-establish desirable herbaceous vegetation to the maximum extent practicable to establish a naturally self-sustaining functional riparian ecosystem along the La Plata River.

Reclamation completed mitigation vegetation monitoring via belt transects, vegetation plots and photopoints through 2007 to provide quantitative and qualitative examinations of various vegetation communities to be found within the La Plata River drainage, particularly within the MA. Updated photopoint records comparing 2002 conditions to 2007 conditions are provided in Appendix C. This ongoing monitoring illustrates successful native plant community natural recovery as well as the effectiveness of Reclamation's planting and seeding efforts.

In 2006 and 2007, Reclamation did not monitor neighboring wetland/riparian land as we had in past years, as potential cooperative efforts in vegetation management did not occur. Thus the data in this report show a different distribution of vegetation than past years' reporting as only 31 of the 40 previously monitored transects were measured to reflect only Reclamation lands. Some of the remaining transects were also truncated so that they only read vegetative cover on the MA where property boundaries crossed transects. Reclamation re-examined data collected in 2002 and excluded data from neighboring properties. This data analysis approach provides for a more accurate assessment of Reclamation's vegetation management success.

2.3.2.1 Progress in Riparian Weed Management:

Reclamation initiated weed control actions in the fall of 2002 with a 75 acre test treatment of tamarisk and Russian olive within the southern portion of tract II (La Plata River South, including the future river restoration area). All remaining acres infested with tamarisk and Russian olive received their primary treatment in 2003 and 2004. Re-treatments of re-sprouting or previously missed tamarisk and Russian olive trees were conducted each fall from 2005 through 2007. In 2006, the three Siberian elm (*Ulmus pumila*) trees found on site were also removed. Ongoing spot treatments of these species will remain part of the maintenance of the MA.

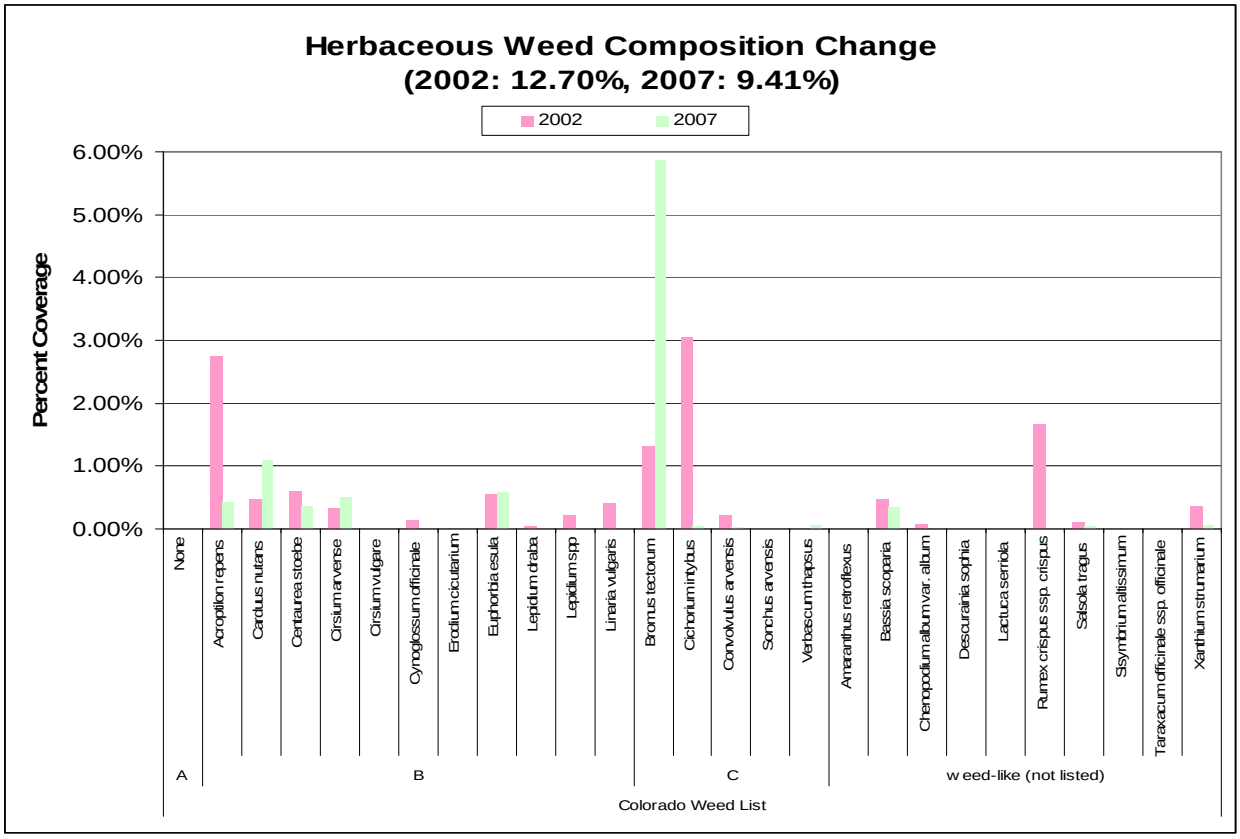
In 2003 Reclamation began its herbaceous weed control efforts with applied herbicides within approximately 250 acres of riparian and buffer zone habitats as a first stage in treatment for tracts II and III. Biological (insect) controls were employed for spotted knapweed (*Centaurea stoebe)* and leafy spurge (*Euphorbia esula*) as prescribed by weed control insectary release guidelines. Biological controls are expected to assist in long-term control of spurge and knapweed.

A goat grazing program for weed control was initiated in the fall of 2004 with 100 animals and

expanded to a maximum of 750 animals in 2006. The primary focus of goat grazing was to aid in the control of leafy spurge, knapweeds and tamarisk in both riparian and upland areas. Targeted goat grazing greatly enhanced Reclamation's weed control activities by the prevention of seed production, stressing weed root reserves, reducing total herbicide needed and making some weeds accessible for spraying by thinning other vegetation. Reclamation did not use grazing for weed management in 2007 as grazing could have affected overall vegetation monitoring results.

Herbaceous treatment in the riparian and riparian buffer zones, particularly against annual weed species, was the most problematic issue in the weed control effort (Figure 42). (See Appendix B for a list of common and scientific names of the plants listed in the following figures.)

Figure 42. Herbaceous Weed Quantified Coverage 2002 vs. 2007 in Riparian/Buffers.



There are several factors acting in synergy that made annual weed control challenging within the MA during the mitigation development period. First, as perennial noxious weeds were being controlled with aggressive herbicide application and grazing, a void was left for annual weeds to re-colonize from the existing weed-laden seedbed. Second, the compounding effect of drought conditions at the beginning of the weed management work likely stressed many desirable plants on the fringes of the riparian zone and in the buffers, enabled some weeds to spread readily where competition was reduced. Third, with the removal of intensive year-round cattle grazing, there was a loss of heavy grazing controls on some annual (and perennial) weeds, particularly

cheatgrass (*Bromus tectorum*).

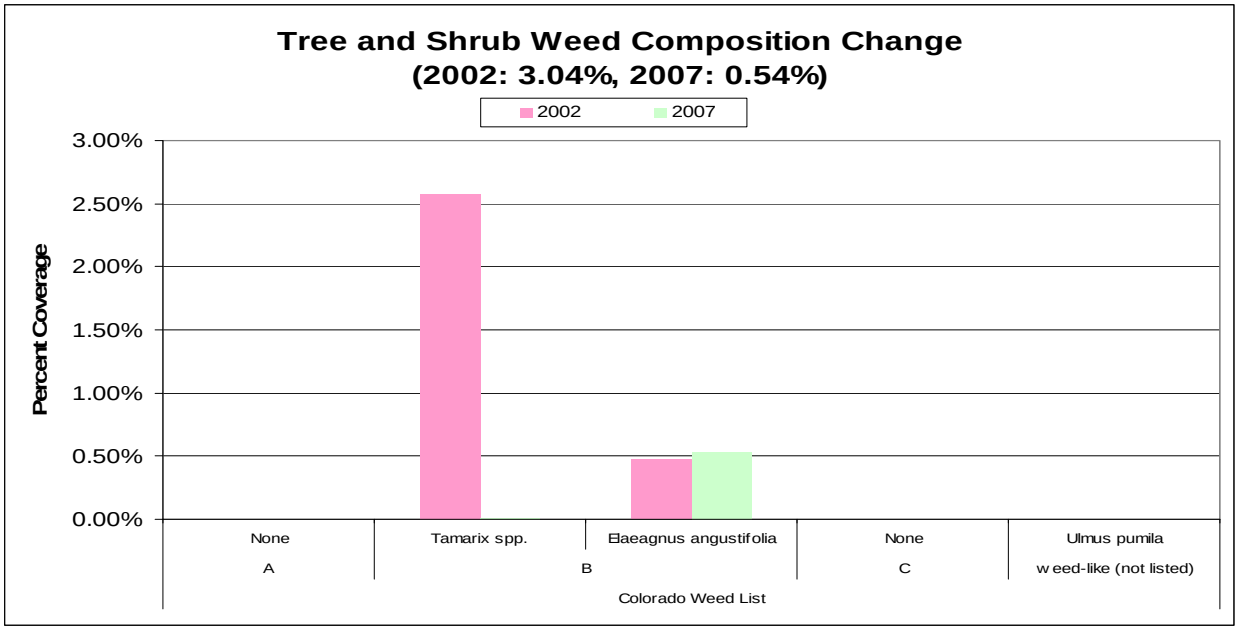
In 2007 Reclamation employed a performance-based contract for weed management to help ensure the success of the weed management efforts. This contracting mechanism, with close weekly monitoring, was extremely successful and likely resulted in Reclamation reaching the full mitigation success level much earlier than anticipated.

The riparian and riparian buffers infested with herbaceous weeds treated through 2006 were re-treated in 2007, primarily with spot-spraying by backpack or off-road vehicle. Herbicide applications included the use of *Journey* and *Amine 4* for leafy spurge, *Garlon* and *Amine 4* for Canada thistle and other miscellaneous weeds and *Habitat* on tamarisk and Russian olive re-sprouts and new treatments.

Tamarisk and Russian olive control is proving to be effective with annual maintenance efforts, but numerous small (below 1 meter) re-sprouts and new seedlings were detected in 2007 (Figure 43). It is important to note that these Russian olives were treated again in October of 2007, after the annual vegetation monitoring measurements were taken, so total woody weed coverage is currently even less than indicated in the figure.

It is also important to note that while the figures in this section reflect weed coverage in the MA in 2002 and 2007, these years do not represent the maximum weed coverage experienced in 2003 and 2004, following the removal of cattle grazing. There was a significant rise in weed coverage that had to be addressed before any net decline could be achieved. A recommendation for other similar programs would be consideration of replacement or changes in grazing regimes, not exclusion.

Figure 43. Tree/Shrub Weed Quantified Coverage 2002 vs. 2007.



There is a distinction between this report and past annual mitigation reports for the ALP project. From 2002 through 2005 Reclamation was including monitoring data on riparian conditions in lands bordering the MA, with the intent of developing a cooperative effort to provide additional benefit to the La Plata River system. This cooperative effort did not materialize and therefore Reclamation has excluded that data from the 2002 information presented here and from the monitoring done in 2007 to provide the most accurate illustration of Reclamation's mitigation progress.

Table 2, below, describes the two-tailed non-parametric statistical analysis of the weed control quantitative data, comparing 2002 to 2007 weed coverage for herbaceous and woody weed species combined. Use of a combined species test reflects the goal of 10% or less areal coverage for all weeds to meet the goals for this limiting factor.

Table 2. Statistics for Weed Comparison, 2002 vs. 2007[3].

CY2007 Vs. CY2002 ALL WEEDS Wilcoxon Signed Ranks Test			
Ranks	**N**	**Mean Rank**	**Sum of Ranks**
CY2007 < CY2002	15	14.26666641	214
CY2007 > CY2002	9	9.555555344	86
CY2002 = CY2007	5		
Total	29		
Z (based on CY2007 > CY2002) =	-1.828944683		
Asymp. Sig. (2-tailed) =	**0.067407899**	**level of significance**	

2.3.2.1.1 Completion of 95% of Physical Features in Weed Management:

Reclamation has successfully implemented the IVMP which appears as an appendix to the 2003 WMMP. This meets the 95% threshold identified in the WMMP.

2.3.2.1.2 Full Completion in Weed Management:

Reclamation reached full completion of this requirement by reducing total weed areal coverage in the MA to less than 10% through the implementation of the IVMP (Figures 42, 43 and Table 2, above). Reclamation has also successfully removed tamarisk and Russian olive trees from the tree and shrub canopies of the MA and continues to treat re-sprouts and new seedlings.

Figures 44-48, below, illustrate some of the weed control conditions and efforts over the mitigation development period. Various methods were employed throughout the weed management effort based upon site-specific access limitations, weed types, river proximity, soil moisture and recent precipitation.

Note the Russian knapweed, tamarisk and bare ground dominating the foreground in Figure 44.

[3] Reclamation employed SPSS for Windows© 2001(version 11.0.1) statistical software and Microsoft® Excel© 2007 for statistical analysis in this report.

Figure 44. Conditions in the River Restoration Area, 2002.

Figure 45. Initiation of Tamarisk Control in the River Restoration Area, 2002.

Figure 46. Russian Knapweed in Riparian Buffer Zones of the MA, 2002.

Figure 47. Backpack Herbicide Applications in 2004.

Figure 48. Initiation of Goat Grazing for Weed Control in 2004.

2.3.3 Native Vegetation Re-establishment

In the WMMP and its appended IVMP Reclamation committed to improve the composition and density of the wetland/riparian vegetation along the La Plata River within the MA. Improvements were to be accomplished by weed control as discussed above; the exclusion of uncontrolled grazing; the planting and establishment of native trees and shrubs as well as seeding with desirable species to improve the herbaceous canopy condition.

2.3.3.1 Progress in Native Vegetation Re-establishment:

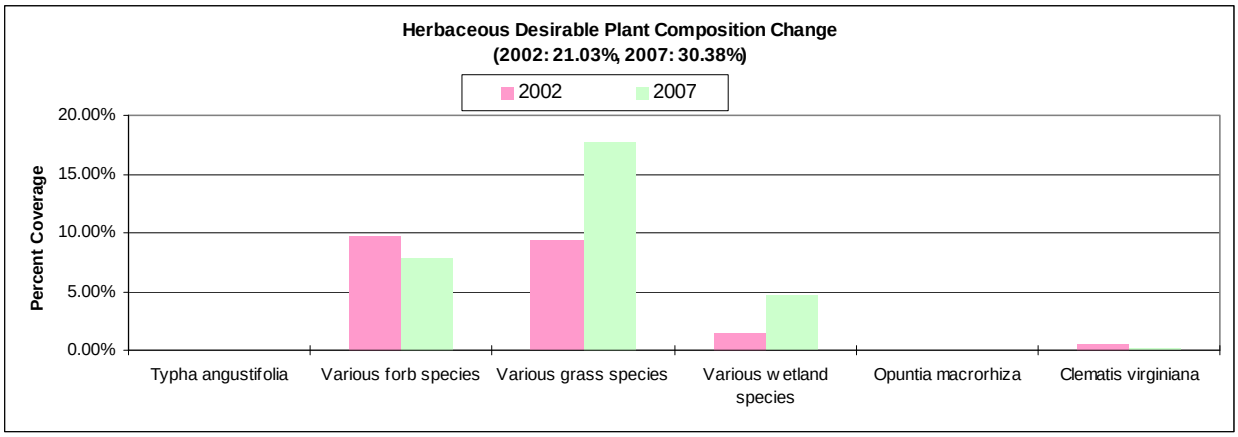
Reclamation has committed to reduce the proliferation of undesirable (noxious weed) species and to replace them with desirable species. Native plant community re-establishment and enhancement within the MA relative to weed treatment and stream restoration has been accomplished. To meet the objective of tree and shrub replacement, Reclamation has planted and monitored more than 8,000 native trees and shrubs to replace tamarisk and Russian olive trees removed from the MA. All of these trees and shrubs were planted prior to 2005 spring flooding in the river restoration portion of the MA.

Additionally, natural recruitment for cottonwoods and willows was extremely successful in 2005. Many thousands of additional new seedlings became naturally established following spring flooding. A supplemental planting of 55 native shrubs was accomplished in 2006,

including Gambel's oak (*Quercus gambelii* var. *gambelii*), silver buffaloberry (*Shepherdia argentea*), New Mexican privet (*Forestiera pubescens* var. *pubescens*) and three leaf sumac (*Rhus trilobata* var. *trilobata*) to replace minor losses.

Reclamation also committed to improving the desirable herbaceous ground coverage percentage through the riparian and buffer zones. Figures 49 – 51 below, illustrate the overall changes in desirable species by canopy type in the riparian and riparian buffer zones combined. Common names of species identified in the flowing graphs are provided in Appendix B.

Figure 49. Desirable Herbaceous Quantified Coverage 2002 versus 2007.



Desirable forb, grass and wetland indicator plants were gathered into a single category each for the purposes of this evaluation and report.

Figure 50. Desirable Shrub Quantified Coverage 2002 versus 2007.

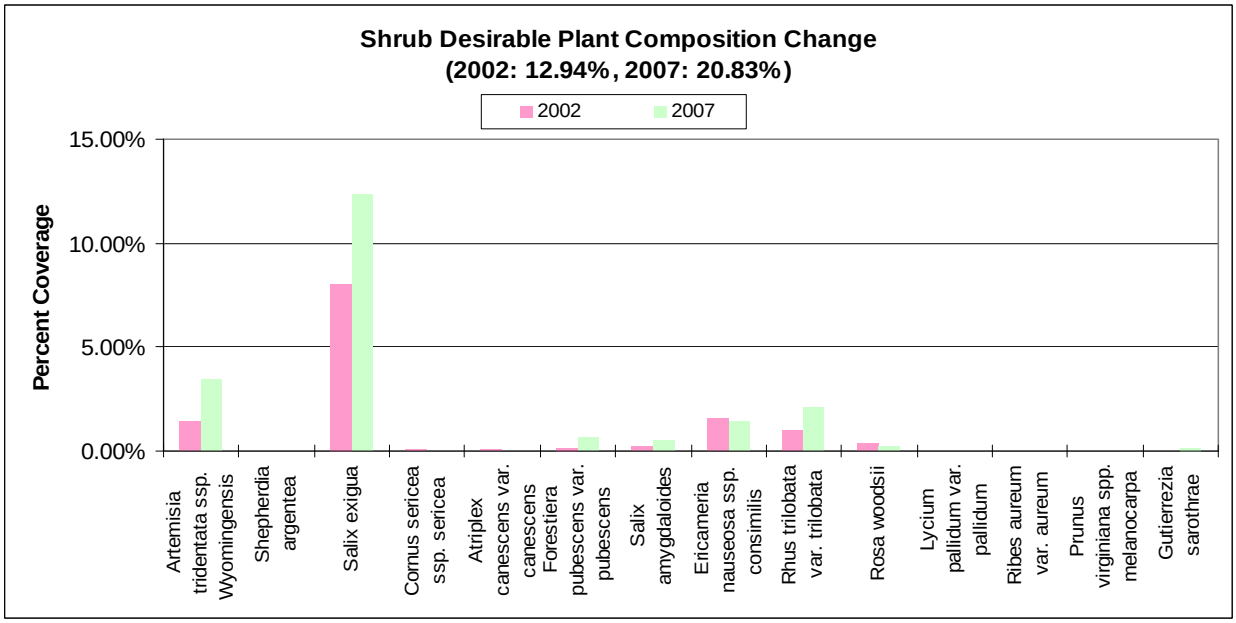


Figure 51. Desirable Tree Quantified Coverage 2002 versus 2007.

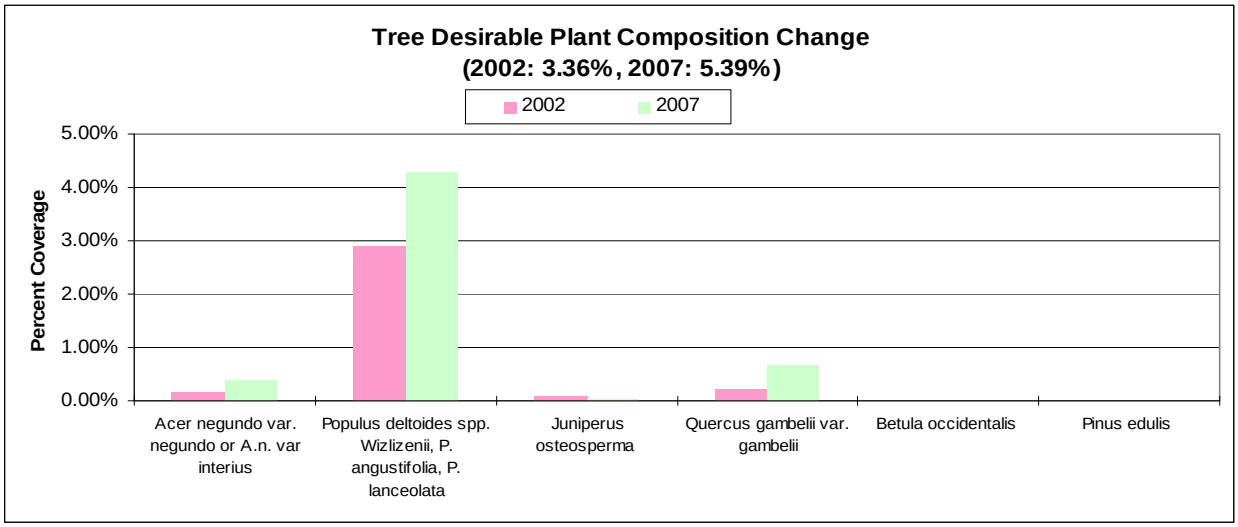


Table 3, below, describes the two-tailed non-parametric statistical analysis of the quantified vegetation re-establishment monitoring data, comparing 2002 to 2007 desirable plant coverage for herbaceous and woody species combined. Use of a combined species test reflects the goal of improving areal coverage for all desirable species.

Table 3. Statistics for Desirable Plant Coverage Comparison, 2002 vs. 2007.

CY2007 vs. CY2002 ALL DESRIABLE VEGETATION Wilcoxon Signed Ranks Test			
Ranks	**N**	**Mean Rank**	**Sum of Ranks**
CY2007 < CY2002	9	7	63
CY2007 > CY2002	12	14	168
CY2002 = CY2007	5		
Total	26		
Z (Based on CY2007 < CY2002) =	-1.824776649		
Asymp. Sig. (2-tailed) =	**0.068034738**	**level of significance**	

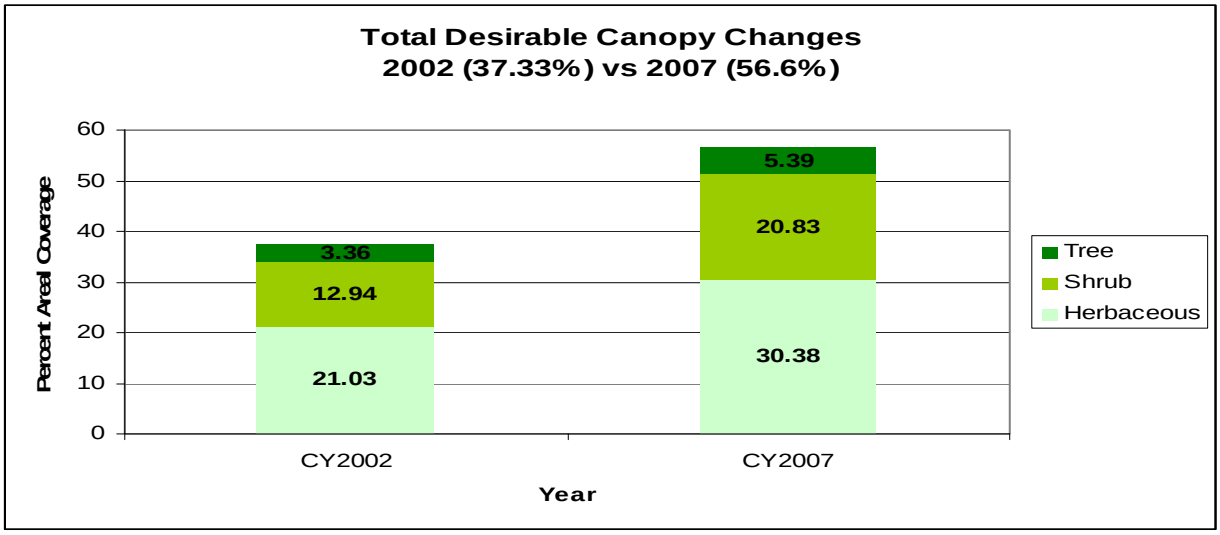
2.3.3.1.1 Completion of 95% of Physical Features in Revegetation:

Planting and re-seeding with desirable species has been accomplished and the revegetation has been monitored for the riparian areas being restored and enhanced. All weed-treated areas within the MA where herbaceous canopy cover has been reduced have been re-seeded with desirable herbaceous species. The riparian restoration area cleared of Russian olive and tamarisk has been revegetated with native vegetation, emphasizing native cottonwood and willow species.

About 5,000 of the 8,000 planted trees and shrubs were cottonwoods of local native species: Rio Grande (*Populus deltoides* spp. *wizlizenii*), narrowleaf (*P. angustifolia*) and lanceleaf (*P. lanceolata*, a hybrid) were planted in an approximately 50/50 ratio of male to female plants. About half were planted in the primary floodplain and half on the next terrace. All plantings occurred on 10-foot (3 meter) centers to one another.

Figure 52, below, summarizes the improvements in riparian and riparian buffer desirable canopy coverage achieved by Reclamation from the base of 2002 to completion in 2007.

Figure 52. Total Desirable Quantified Canopy Coverage 2002 versus 2007.



2.3.3.1.2 Full Completion in Revegetation:

By reaching the replanting establishment goals set forth in the IVMP Reclamation has fully met the full mitigation success milestone for revegetation in the MA. Figures 53 – 55, below, describe the growth and survivorship targets for tree, willow and other shrub establishment in the MA.

Reclamation committed to having a minimum of 80% survival rate and an average height of 2 meters for planted cottonwood trees at time of "mitigation success" with the resulting vegetation canopy densities maintained for the life of the project. Live cottonwood trees planted in the MA are an average of 1.99 meters in height and more than 88% have survived to date. See Figure 53, below. Thus Reclamation has essentially met the growth target and exceeded the survivorship standards for all cottonwoods planted.

Figure 53. Planted Cottonwood Growth and Survivorship.

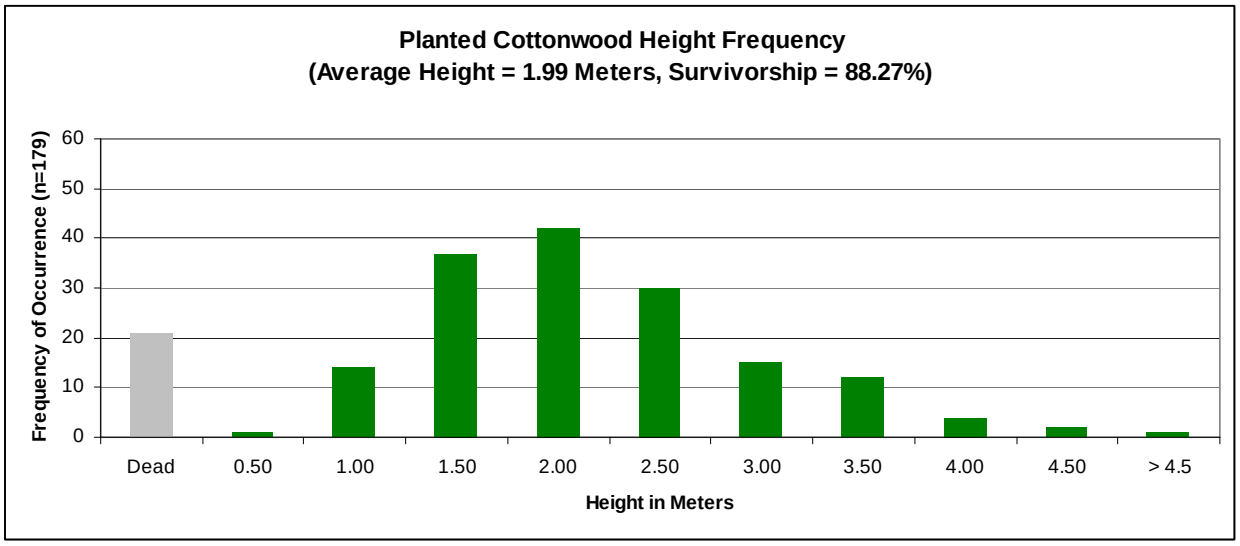


Table 4, below, describes the statistical analysis of surviving planted cottonwood tree growth in the MA.

Table 4. Statistics for Live Cottonwood Growth.

LIVE COTTONWOOD HEIGHT IN METERS			
Descriptives	N = 158	**Statistic**	**Std. Error**
Mean		1.985949367	0.064655453
95% Confidence Interval for Mean	*Lower Bound*	1.858242616	
	Upper Bound	2.113656118	
5% Trimmed Mean		1.949296765	
Median		1.8	
Variance		0.660491768	
Std. Deviation		0.812706446	
Minimum		0.03	
Maximum		4.8	
Range		4.77	
Interquartile Range		1	
Skewness		0.763965086	0.193054618
Kurtosis		0.575764653	0.38379466

About 2,200 total coyote willow (*Salix exigua*) and peachleaf willow (*S. amygdaloides*) were planted on the active floodplain of the river restoration area. Reclamation's target was to assure an 80% survival rate with an average height of 1.5 meters at time of reservoir filling. Plantings occurred on 10 foot (3 meter) centers (or denser). Figure 54, below, shows how the live planted willows have reached an average of 1.5 meters in height and how more than 93% of the planted willows have survived to date. Willow establishment has achieved both growth and survivorship goals.

Figure 54. Planted Willow Growth and Survivorship.

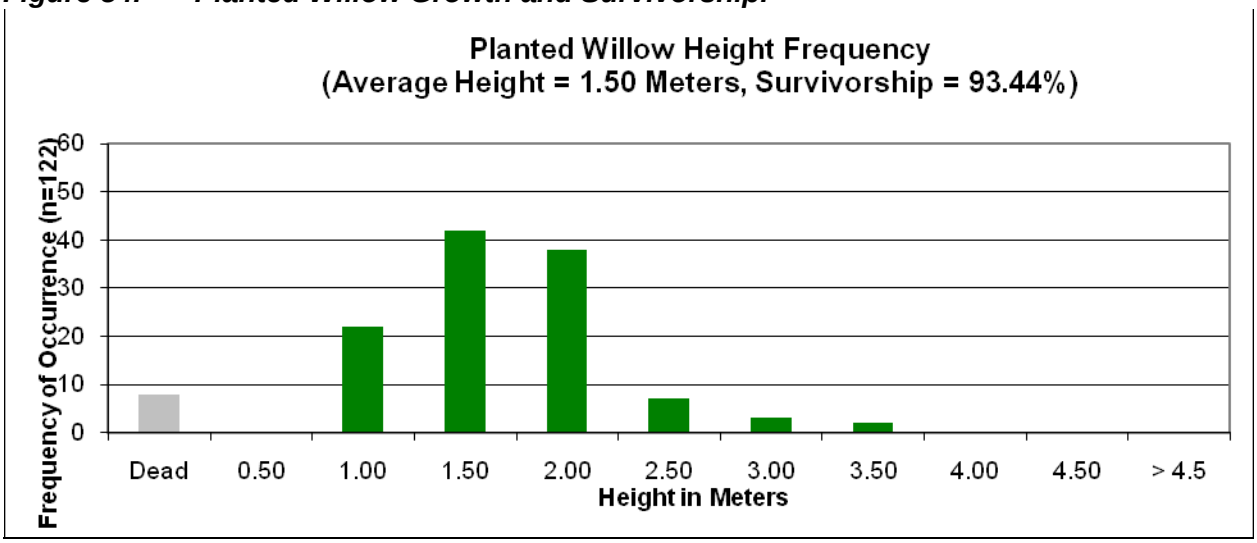


Table 5, below, describes the statistical analysis of surviving planted willow shrub growth in the MA.

Table 5. Statistics for Live Willow Growth.

LIVE WILLOW HEIGHT IN METERS			
Descriptives	**N = 114**	**Statistic**	**Std. Error**
Mean		1.501754386	0.046977954
95% Confidence Interval for	*Lower Bound*	1.408682585	
Mean	*Upper Bound*	1.594826187	
5% Trimmed Mean		1.471150097	
Median		1.5	
Variance		0.251589815	
Std. Deviation		0.501587296	
Minimum		0.65	
Maximum		3.3	
Range		2.65	
Interquartile Range		0.7	
Skewness		0.890547389	0.226472988
Kurtosis		1.332440383	0.449261888

Approximately 800 total mixed desirable woody shrub species were also planted in the river restoration area: chokecherry (*Prunus virginiana* spp. *melanocarpa*), three-leaf sumac, New Mexican privet and silver buffaloberry. Reclamation committed to assuring a minimum of 80% survival rate with a mean height of 1 meter at time of reservoir filling with the resulting vegetation densities maintained for the life of the project. Native rabbitbrush (*Ericameria nauseosa* ssp. *consimilis*) and big sagebrush (*Artemisia tridentata* ssp. *Wyomingensis*) were also established from seed in the river restoration area. Figure 55, below, illustrates the average growth of live shrubs and the overall shrub survivorship in the river restoration area. Reclamation has essentially met the growth target with the average height of 0.96 meters and has well exceeded the target survivorship at nearly 95%.

Figure 55. Planted Shrub Growth and Survivorship.

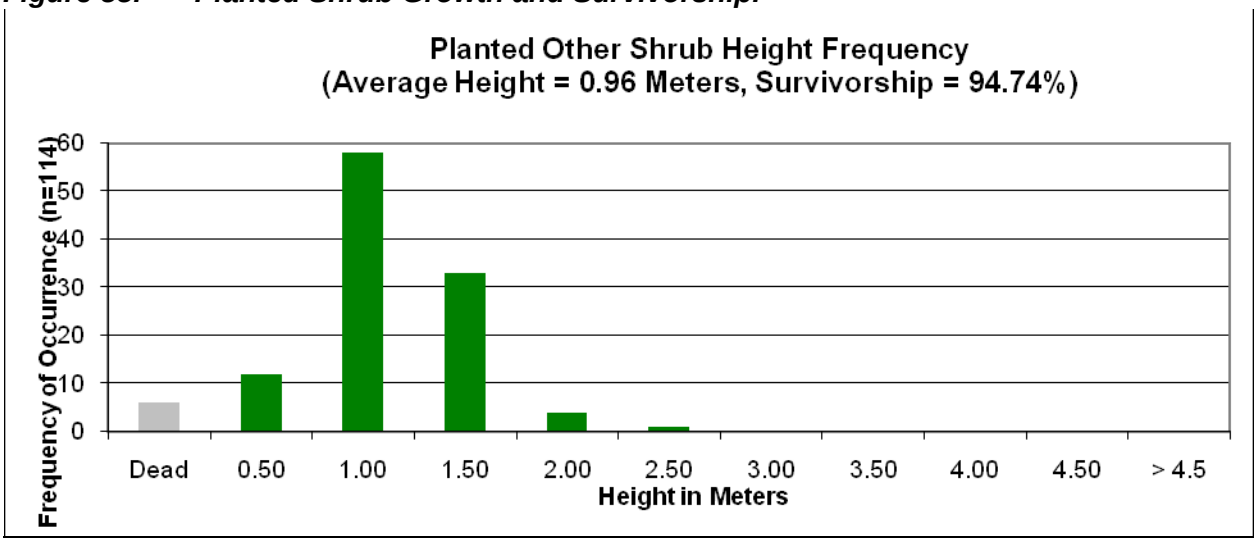


Table 6, below, describes the statistical analysis of surviving planted other shrub growth in the MA.

Table 6. Statistics for Live Other Shrub Growth.

LIVE OTHER SHRUB HEIGHT IN METERS			
Descriptives	**N = 108**	**Statistic**	**Std. Error**
Mean		0.959722222	0.033652794
95% Confidence Interval for	*Lower Bound*	0.893009483	
Mean	*Upper Bound*	1.026434961	
5% Trimmed Mean		0.944855967	
Median		0.9	
Variance		0.122311137	
Std. Deviation		0.349730092	
Minimum		0.25	
Maximum		2.2	
Range		1.95	
Interquartile Range		0.45	
Skewness		0.663711143	0.232515399
Kurtosis		0.874898798	0.461055262

Where riparian meadow layer planting occurred a mean minimum 50% ground cover was the full success target with a mean desirable plant height of at least 20 cm to be achieved by the time of reservoir filling. Planted species composition was coordinated with CDOW, the Service and the Colorado Ute Tribes.

In late 2004 Reclamation planted 20 acres of riparian restoration area with a mixture of western wheatgrass (*Pascopyrum smithii*) and streambank wheatgrass (*Elymus lanceolatus* ssp. *lanceolatus*). Reclamation performed augmentation seeding in 2006 on approximately 50 total acres of riparian and riparian buffer areas. Figure 56, below, illustrates the average quantified live plant ground cover in the MA along the La Plata River through the MA where riparian

meadows experienced supplemental seeding. Reclamation has exceeded the target of an average of 50% groundcover. Measurements were not necessary to confirm that the average desirable plant height well exceeded 20 cm.

Figure 56. Groundcover for Riparian Meadows.

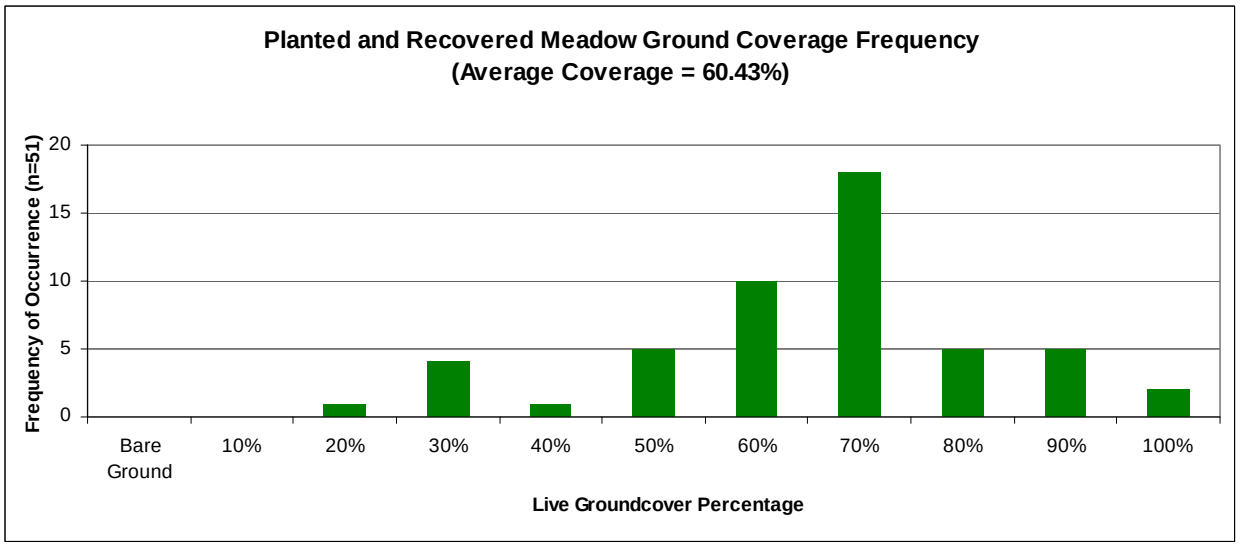


Table 7. Statistics for Live Ground Cover Percentage.

LIVE GROUND COVER PERCENTAGE			
Descriptives	**N = 51**	**Statistic**	**Std. Error**
Mean		0.604313725	0.024047755
95% Confidence Interval for	*Lower Bound*	0.556012389	
Mean	*Upper Bound*	0.652615062	
5% Trimmed Mean		0.607331155	
Median		0.63	
Variance		0.02949302	
Std. Deviation		0.171735318	
Minimum		0.17	
Maximum		0.97	
Range		0.8	
Interquartile Range		0.19	
Skewness		-0.436259064	0.333464129
Kurtosis		0.346596896	0.655920435

Figures 57 and 58, below, are examples of groundcover height from seeding and natural recovery, respectively with grazing excluded.

Figure 57. Planted Riparian Groundcover Growth Example.

Figure 58. Natural Riparian Meadow Groundcover Recovery (MA on the right).

2.3.4 Riparian Buffer Zone Management

As described previously, the health of transitional riparian buffer zone habitats greatly affects the functional condition of the riparian habitats they border. The removal of livestock grazing and the treatment of weed problem areas combined with selective re-seeding have greatly improved the condition of the buffer zones for wildlife use and overall ecological function.

Reclamation's general goal to improve the condition of degraded buffer areas adjoining riparian habitats was to be met by the goals of 100% of tamarisk and Russian olive tree removal from the tree and shrub canopies of the MA and by the implementation of an herbaceous weed control program for the riparian area of the MA that included all of the buffer areas. Planting and re-seeding with desirable species was to be accomplished and monitored along with the riparian areas being restored and enhanced as discussed above.

2.3.4.1 Progress in Riparian Buffer Zone Management:

Reclamation is including buffer zone management in its ongoing weed management, grazing management and in planting mitigation activities. Buffer acres were treated for weed infestation in each year since 2003. Tamarisk and Russian olives were also removed from riparian buffer zones and adjoining arroyos and canyons draining into the riparian areas.

Reclamation broadcast seeded most of the riparian buffers in late 2005 and utilized goats to trample in the seed as a measure to improve germination rates. Approximately 100 acres of additional buffer zone was seeded in 2007. Buffer zones now show significant improvement in overall condition.

2.3.4.1.1 Completion of 95% of Physical Features in Riparian Buffer Zones:

100% of tamarisk and Russian olive trees have been removed from the tree and shrub canopies of the riparian buffer zones of the MA. Reclamation has also implemented an IVMP that includes the riparian buffer zones of the MA. Planting and re-seeding with desirable species has been accomplished and monitored for the riparian buffer areas being enhanced.

2.3.4.1.2 Full Completion in Riparian Buffer Zones:

Reclamation has met the full completion criterion for riparian buffer zone enhancement.

Reclamation has reduced weed infestations to less than 10% areal coverage through the implementation of an IVM Plan. This has included the tamarisk and Russian olive removal noted above as well as herbaceous weed control. Figures 42 and 43 above, regarding riparian weed control include data collected in the riparian buffers as the targets for both were the same.

Further, all areas cleared of Russian olive and tamarisk have been revegetated with native vegetation, with emphasis applied to the river restoration area and its immediate buffers as

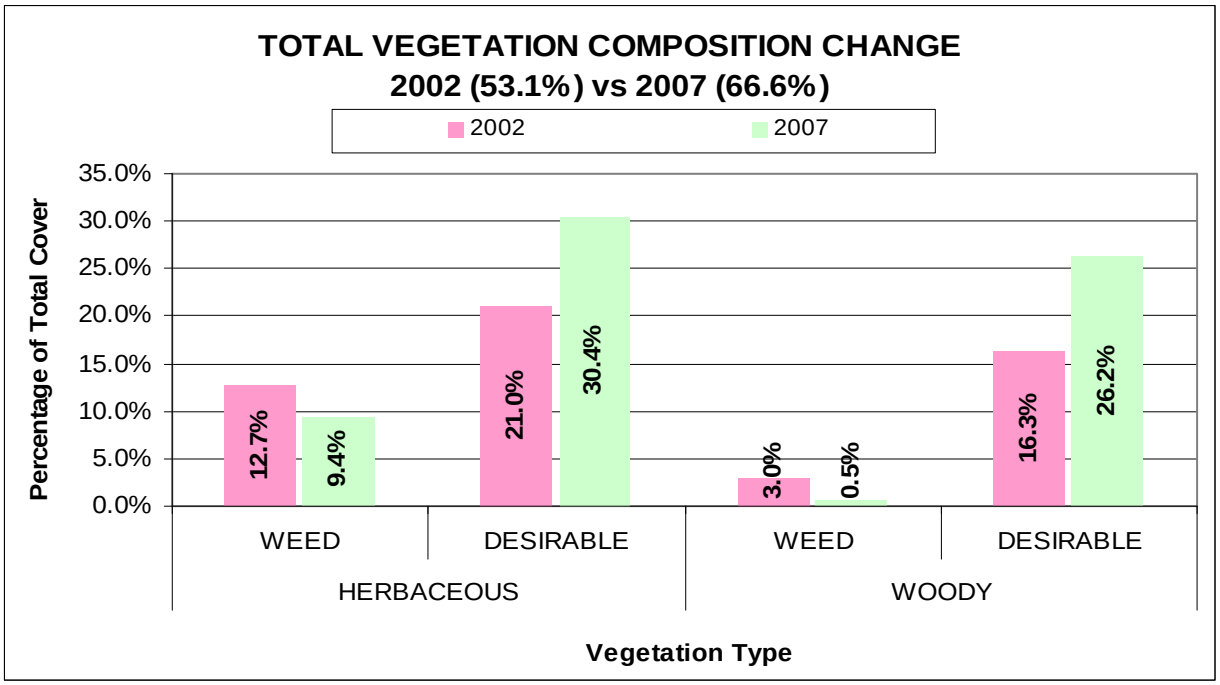
described above.

Reclamation established the arbitrary objective of reaching 30% ground cover in desirable species and a minimum of 10 cm mean desirable plant height in the riparian buffer zone herbaceous layer unless unforeseen site specific conditions limited plant establishment. The average desirable herbaceous plant height well exceeds 10 cm overall (by observation), but herbaceous ground cover for buffer zones is less than anticipated (only 13% calculated mean desirable plant coverage.

With the dryer conditions and poorer soils of this semi-desert region, natural recovery and seeded improvement of the buffer zone herbaceous layer has been slower and less effective than desired. With the good water years of 2005 and 2007 and the same seed mix becoming well established in true riparian areas, the indication is that this is the best desirable plant coverage that can be practicably established in these semi-desert riparian buffer zones.

Figure 59, below, summarizes the overall change in the composition of the combined riparian and riparian buffer vegetative communities in the MA from 2002 to 2007 for both desirable and weed species in both the herbaceous and three/shrub canopies.

Figure 59. Summary Vegetation Coverage Change in Riparian and Buffer Areas.



2.3.5 Riparian Vegetative Functional Quality Improvement

In the WMMP Reclamation identified three levels of riparian forest or riparian scrub-shrub habitat (collectively riparian forest) conditions found to exist in the MA. RFS-1 is high

functioning quality; RFS-2 is medium, while RFS-3 is low functioning. Similarly riparian meadow existing conditions were identified (RM-1 is high functioning; RM-2 has medium functional values, while RM-3 is low functioning). These riparian forest and meadow reference vegetative conditions are provided in the following tables (Table 8 and Table 9).

Table 8. Riparian Forest Vegetative Reference Standards

Vegetative Functional Quality Reference Standards for Riparian Forest Habitat Type			
	Low	**Medium**	**High**
Average Live Stem Density	35-	36 to 60	61+
Canopy Strata Present	Lacks tree strata, shrub and herb strata variable	Herbaceous, shrub and tree strata present	Herbaceous, shrub and tree strata present
Percent Desirable Plant Species	25%-	25-85%	85%+

Table 9. Riparian Meadow Vegetative Reference Standards

Vegetative Functional Quality Reference Standards for Riparian Meadow Habitat Type			
	Low	**Medium**	**High**
Desirable Plant Height	5"-	5 to 12"	12”+
Percent Total Plant Cover	50%-	50-90%	90%+
Percent Desirable Plant Species	40%-	40-90%	90%+

Reference standards for soils and hydrology were also established, but Reclamation does not expect to significantly improve soil and hydrology conditions in the wetland/riparian areas during the mitigation development period. The vegetative standards are considered indicative of the site habitat functionality and are used to indicate how Reclamation has improved the overall functionality of riparian habitats.

The following figures (Figures 60 and 61) illustrate the pre-condition found in 2001, the expected final condition as estimated in the 2005 IVMP and the actual changes achieved as found in the in the 2007 monitoring. The acreages in the figures do not include the following wetland/riparian habitats also found in the MA: riverine habitat, emergent wetland habitat, cottonwood-oak habitat or cottonwood-sagebrush habitat.

Figure 60. Riparian Forest Conditions (2001 vs. Goals vs. 2007).

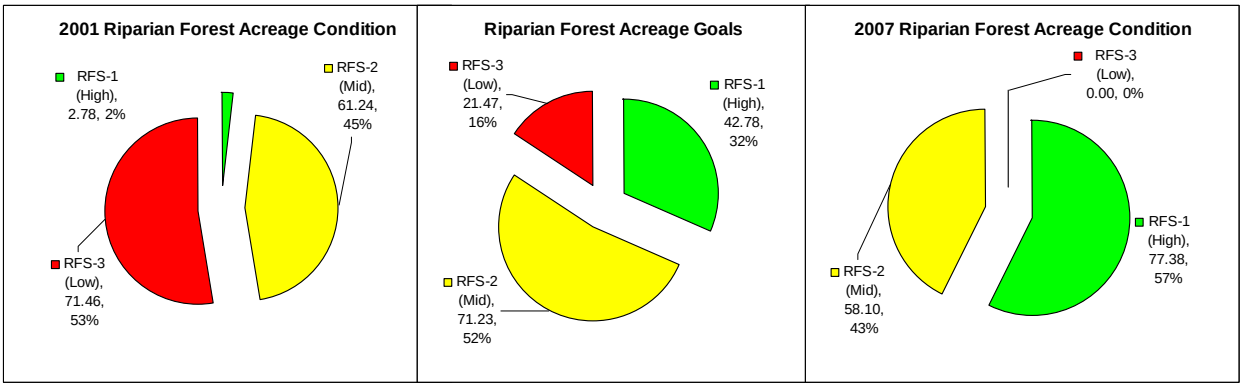
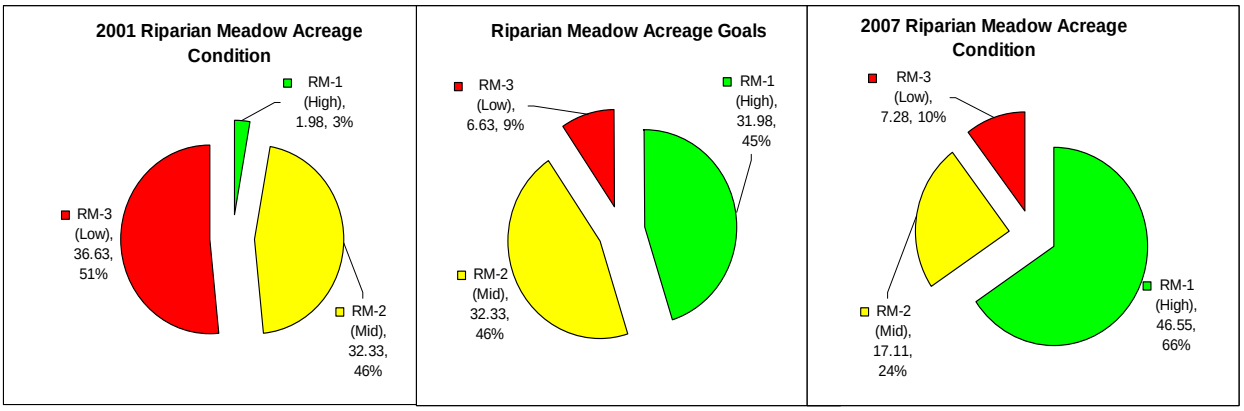


Figure 61. Riparian Meadow Conditions (2001 vs. Goals vs. 2007).



2.3.5.1 Progress in Riparian Vegetative Functional Quality Improvement

Through weed treatment, both herbaceous and tree/shrub species, the exclusion of grazing and active revegetation efforts, Reclamation has improved the functional quality of riparian habitats in the MA.

2.3.5.1.1 Completion of 95% of Physical Features in Riparian Functional Quality Improvement:

100% of tamarisk and Russian olive trees have been removed from the tree and shrub canopies of the riparian forest areas of the MA. Reclamation has also implemented an IVMP for the riparian herbaceous layers of the MA to include both meadow and forest/scrub-shrub habitats. Planting and re-seeding with desirable species has been accomplished and monitored for the riparian habitats being enhanced.

Reclamation has exceeded in improving all riparian habitats in the MA beyond the expected levels as described in the 2005 IVMP using reference standards established in 2001.

2.3.5.1.2 Full Completion in Riparian Functional Quality Improvement:

Reclamation has met the full completion criterion for riparian habitat functional quality improvement as described above under 2.3.4.1.1 and in other sections in this document.