2008 Rio Grande Riparian Stabilization Project – Phase 3

Final Report, December 2012

Colorado Rio Grande Restoration Foundation

Rio Grande Headwaters Restoration Project

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Rio Grande Headwaters Restoration Project

Heather Dutton, Coordinator, Rio Grande Headwaters Restoration Project

The Mission of the Rio Grande Headwaters Restoration Project: To restore and conserve the historical functions and vitality of the Rio Grande in Colorado for improved water quality, agricultural water use, riparian health, wildlife and aquatic species habitat, recreation, and community safety while meeting the requirements of the Rio Grande Compact.

Final Report Executive Summary
Project Title: Rio Grande Riparian Stabilization Project – Phase 3

Grant Source/Contract Number
CDPHE CO NPS Grant Contract Number: 10FAA 00105
CWCB Contract Number: C150452

Project Start Date: June 15, 2009 **Project Completion Date:** December 31, 2012

FUNDING

Total CO NPS Grant: Cash	$250,000.00	
Total Colorado Water Conservation Board: Cash	$285,000.00	
Local/Private: Cash	$58,886.00	
Subtotal Cash		$593,886.00
In-kind Contributions	$16,893.80	
Subtotal In-kind		$16,893.80
TOTAL FUNDING		**$610,779.80**

EXPENDATURES

Expenditures of CO NPS Program (EPA) Funds	$250,000.00	
Expenditures of CO Water Conservation Board Funds	$285,000.00	
Other Expenditures	$58,886.00	
TOTAL EXPENDATURES		**$593,886.00**

Summary Accomplishments
The 2008 Rio Grande Riparian Stabilization Project – Phase 3 (Phase 3) was a riparian restoration and stabilization Project completed by the Rio Grande Headwaters Restoration Project (RGHRP) in 2012. The Goal of Phase 3 was to improve water quality by reducing sediment entering the river within the project boundaries. Through Phase 3, streambank stabilization was completed on 1.8 miles of riparian areas on 4 privately owned and 1 public site. Based on estimated erosion rates, the reduction in sediment loading from these efforts is 16,750 cubic feet per year. Aggressive revegetation efforts were implemented on Project sites to further stabilize the streambanks and improve riparian habitat. Volunteers and a crew from the Southwest Conservation Corps worked to increase streambank vegetation, contributing 500 volunteer hours. The RGHRP gave tours and provided updates to local newspapers and community groups as part of outreach and education. Monitoring has shown Project efforts were successful. The RGHRP will continue long-term monitoring, with help from the Colorado Measurable Results Program.

Phase 3 reduced sediment loading by stabilizing the streambanks, improved the riparian and upland habitat by increasing willow and riparian vegetation cover, and enhanced the fishery. Additionally, the capacity of the Rio Grande to transport sediment that has entered the system from upstream reaches was increased. Finally, improvements to riparian habitat and floodplain function improved the condition of wetlands located throughout the riparian areas within the project boundary.

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1.0 Introduction

The Colorado Rio Grande Restoration Foundation (Foundation) is the fiscal agent for the Rio Grande Headwaters Restoration Project (RGHRP). The RGHRP was formed to implement the recommendations of a study completed in 2001, the 2001 Study. The 2001 Study was prompted by a group of citizens who were concerned that the river had been impaired. The 2001 Study, sponsored by the San Luis Valley Water Conservancy District and funded by the Colorado Water Conservation Board, analyzed 91 miles of the Rio Grande from South Fork to the Alamosa/Costilla County line. This reach was identified as the portion of the Rio Grande in Colorado that has been most impacted by human intervention in the past 100 years. The 2001 Study analyzed the current vegetation, human impact, agricultural disturbance, geomorphology, hydrology, wildlife habitat, and aquatic habitat of the 91-mile reach. The 2001 Study determined that a major cause of the deterioration in river function was the continual increase in sediment loading caused by unstable and eroding streambanks. Sediment input degrades the Rio Grande by reducing water quality and sediment transport capacity. Reduced water quality negatively impacts the fisheries, wetlands, critical wildlife habitat, historic agriculture communities, and recreation economy: all of which rely on high quality water supplied by the Rio Grande. Furthermore, lowered sediment transport capacity inhibits the ability of the Rio Grande to supply water to the ecosystems and economies that depend on it.

Since 2001, the RGHRP has worked to improve the function of the Rio Grande in Colorado. The Rio Grande Riparian Stabilization Project – Phase 3 (Phase 3) continued these efforts. The Goal of Phase 3 was to improve water quality by reducing sediment entering the river within the project boundaries.

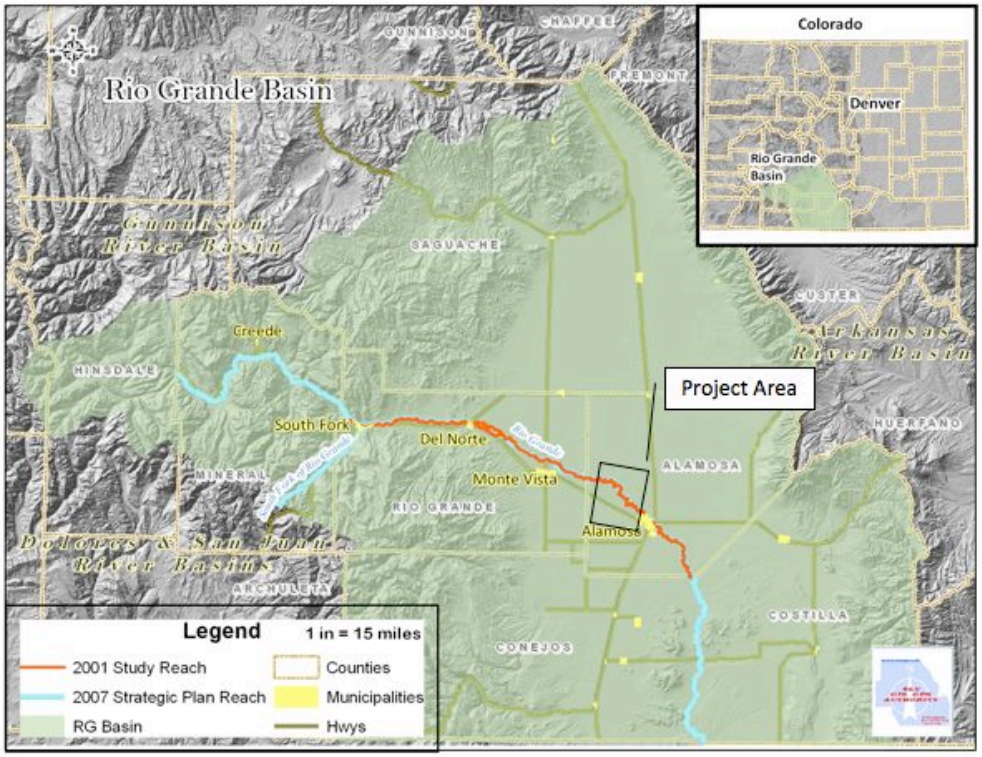

Figure 1. Location of Phase 3 Project Area within the Rio Grande Watershed.

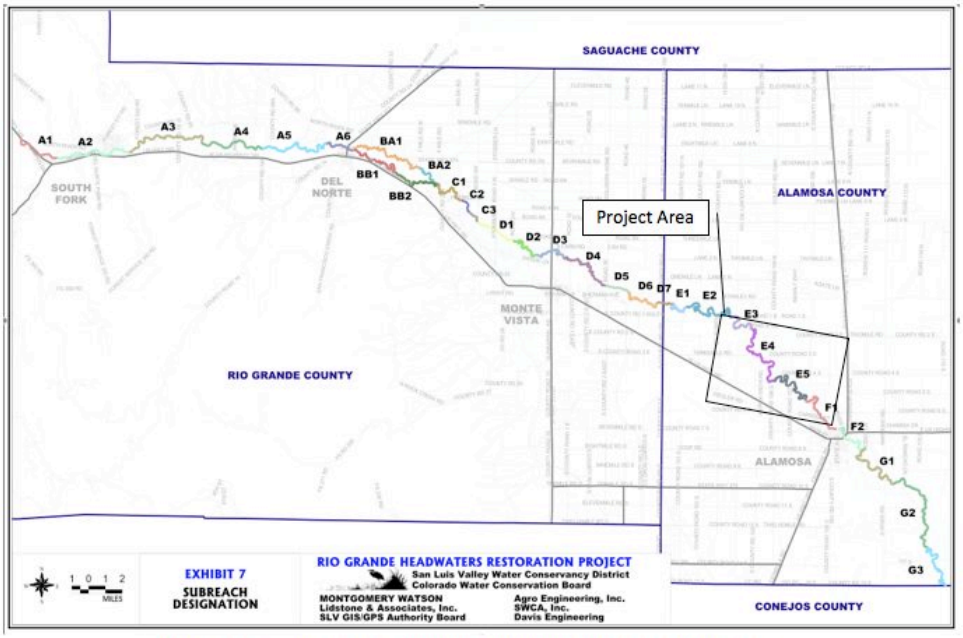

Figure 2. Location of Phase 3 Project Area within the 2001 Study Reach.

In Phase 3, five (5) sites underwent streambank stabilization and riparian restoration; actions reduced sediment loading by stabilizing the streambanks, improved the riparian and upland habitat by increasing willow and riparian vegetation cover, and enhanced the fishery. Additionally, the capacity of the Rio Grande to transport sediment that has entered the system from upstream reaches was increased. Finally, improvements to riparian habitat and floodplain function improved the condition of wetlands located throughout the riparian areas within the project boundary.

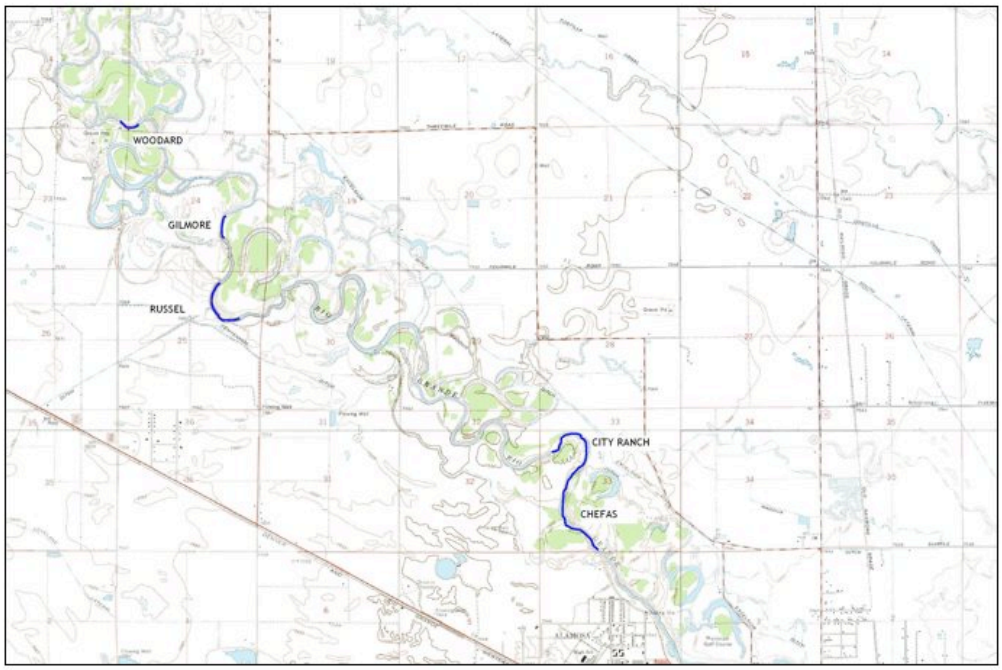

Figure 3. Location of Phase 3 Project Sites within Project Area.

2.0 Project Goals, Objectives, and Activities

Phase 3 Environmental Goal - Improve the function of the Rio Grande by reducing sediment loading by 16,000 cubic feet per year in Alamosa County, Colorado.

Objective 1 – Improve water quality, reduce sediment loading, and enhance sediment transport by stabilizing up to 1.5 miles of streambank and reconfiguring the stream channel at five sites on the Rio Grande in Alamosa County.

Task 1 – Hire third party engineers and contractors to design and implement streambank stabilization methods on 1.5 miles of riparian area. Utilize methods including, but not be limited to bank shaping, channel reconfiguration, and rock or log structure installation.

Task 2 – Hire third party engineers and contractors to design and implement bioengineering techniques in order to further stabilize the streambanks following construction in Task 1. Techniques used in the riparian areas may include, but are not limited to willow clump and bundle plantings, bareroot shrub plantings, and grass and forb seeding. Reseed upland areas disturbed during onsite activities with appropriate species. Organize volunteer events to aid in revegetation efforts.

Phase 4 Programmatic Goal 1 – Reduce streambank erosion and protect the riparian area after streambank stabilization with improved grazing techniques, where applicable.

Objective 2– Identify and implement grazing best management practices (BMPs) to reduce sediment input and enhance riparian areas on sites where livestock grazing occurs.

Task 3 – Implement identified grazing BMPs. Methods may include, but are not limited to, fencing, short duration grazing rotations, prohibiting all grazing, or other improved grazing practices.

Phase 4 Programmatic Goal 2 – Track the progress of Phase 3 activities and long-term site condition with evaluation and monitoring.

Objective 3 – Ensure Project design is implemented accurately. Monitor sites to track long-term condition and evaluate overall success of reaching Goals and Objectives.

Task 4 – Work with the third party engineers to characterize sites before on-site work to establish baseline condition. Monitor on-site activities to ensure on-the-ground efforts are consistent with Project design. Monitor sites according to the Phase 3 Sampling and Analysis Plan (SAP) to ensure proper function and determine if Projects successfully attain Goals and Objectives.

Phase 4 Programmatic Goal 3 – Promote community awareness of and involvement in non-point source pollution and water quality related issues through Outreach and Education.

Objective 4 – Increase understanding of water quality issues and encourage involvement in Phase 4 by reaching out to the community with presentations, tours, and volunteer events.

Task 5 – Develop visual aids about Phase 3; speak at public meetings, local schools, and conferences about the importance of water quality and healthy rivers; submit articles to local newspapers with Project information and updates; organize volunteer revegetation efforts and tours for local schools and community groups.

Phase 4 Programmatic Goal 4 – Determine most cost efficient and effective riparian stabilization methods for implementation at the five Project sites.

Objective 5 – Facilitate discussions with the Technical Advisory Team, a multi-discipline team of expert advisors, to identify the most appropriate riparian stabilization methods for implementation at each site.

Task 6 – The RGHRP will organize site visits for the Technical Advisory Team. The Technical Advisory Team will discuss suitable methods to address the causes of increased sediment loading. Using lessons learned from previous projects and the best available science, the Technical Advisory Team will determine the most effective and cost-efficient methods for implementation at each site. This information will be incorporated into Objectives 1 and 2. The Technical Advisory Team will also visit sites after construction to evaluate success of chosen methods.

Phase 4 Programmatic Goal 5 – Administer Phase 3 efficiently, within budgeted costs and Project timelines, and in accordance with Project Goals, Objectives, and Tasks.

Objective 6 – Complete all necessary contracts, status reports, and internal and external documents. Ensure Tasks are completed within approved costs and timelines.

Task 7 – The RGHRP will administer Phase 3. This includes completing contracts with the CDPHE, CWCB, landowners, third party engineers, and contractors; obtaining the necessary environmental permits; managing budgets and reimbursement requests; and completing semi-annual and final reports. Additionally, the RGHRP will perform Project oversight; making certain project design and implementation are timely and accurate. The RGHRP will organize outreach and education efforts and complete site monitoring in accordance the Phase 3 SAP.

2.1 Planned and Actual Milestones, Products, and Completion Dates

Objective 1 – Improve water quality, reduce sediment loading, and enhance sediment transport by stabilizing streambanks and reconfiguring the stream channel on the Rio Grande in Alamosa County.

Task 1 – Streambank Stabilization: The RGHRP hired third party engineering firm, Riverbend Engineering, and restoration contractors, SLV Earthmovers, to design and implement streambank stabilization methods on 1.8 miles of riparian area. The methods utilized included sloping and shaping banks, building floodplain benches, reconfiguring the channel to move the thalwag away from the bank, and installing rock barbs to move water away from and stabilize the streambanks. Based on erosion rates calculated in the 2001 Study, the estimated reduction in sediment loading from these efforts is 16,750 cubic feet per year. These efforts resulted in improved water quality, reduced erosion, increased sediment transport capacity, increased quality of riparian areas and habitat, and proper functioning floodplains.

Products – Stabilized streambanks, annual sediment loading reduced by 16,750 cubic feet, and reconfigured stream channel on five (5) sites.

Channel and Streambank Shaping.

Rock Barb Installation and Clump Willow Plantings.

Streambank Shaping and Topsoiling.

Figure 4. Streambank Stabilization Techniques, Utilized on Woodard Site.

Table 1. Phase 3 - Task 1 Accomplishments

Site	2001 Study Subreach	Feet of Streambank Stabilized	Rock Barbs Installed	Acres of Revegetation	Estimated Cubic Feet of Sediment Reduced Annually
Woodard	E4	600	3	0.5	798
Gilmore	E4	870	8	0.7	1,157
Russell	E4	2,330	12	5.1	3,098
Alamosa Ranch	F1	3,700	15	5.3	7,770
Chefas	F1	1,870	15	2.6	3,927
	TOTAL	9,370	53	14.2	16,750

Task 2 – Bioengineering: The RGHRP hired Riverbend Engineering and SLV Earthmovers to design and implement bioengineering techniques in order to further stabilize the streambanks following construction in Task 1. Techniques used in the riparian areas included, willow clump plantings, and grass and forb seeding. Upland areas disturbed during onsite activities were reseeded with appropriate species. The RGHRP organized 3 volunteer revegetation events: in October 2010, 21 volunteers from the community and Sargent High School planted 60 willow bundles and 30 sedge clump transplants. In April 2011, 8 volunteers planted 360 bareroot shrubs and trees purchased from the Colorado State Forest Service. In September 2012, 51 volunteers from the Alamosa Boy Scouts planted 50 willow bundles. In 2012, it was noted that revegetation was low in sandy areas with low organic matter near the streambanks. As such, a crew of 9 from the Southwest Conservation Corps was hired for two weeks in October 2012 to spread 38 tons of compost and reseed 7 acres of streambanks. The crew also planted 290 willow bundles in the Phase 3 Project Area.

Products – Reestablished riparian vegetation, increased streambank stability, and reduced erosion. Three coordinated volunteer events and one youth corps effort, through which groups of volunteers, community organizations, and a crew from the Southwest Conservation Corps completed revegetation efforts at the Project sites.

Boy Scouts Planting Willow Bundles During Volunteer Day.

Southwest Conservation Corps Spreading Compost (top) on Sites with Low Organic Matter and Planting Willow Bundles (bottom).

Successful Willow Clump Planting at Russell Site.

Figure 5. Bioengineering Methods.

Objective 2 – Identify and implement grazing best management practices (BMPs) to reduce sediment input and enhance riparian areas on sites where livestock grazing occurs.

Task 3 – Grazing Management: The landowners on three of the five restoration sites graze livestock on their property. These landowners protected the riparian area from overuse and implemented grazing BMPs, including fencing and short duration grazing rotations. The other two sites are never grazed.

Products - Improved riparian zones through grazing BMP implementation and a demonstration of the benefits of improved grazing management.

Figure 6. Grazing Best Management Practice, Fencing, Implemented at Gilmore Site.

Objective 3 – Ensure Project design is implemented accurately. Monitor sites to track long-term condition and evaluate overall success of reaching Goals and Objectives.

Task 4 – Monitoring: The RGHRP and third party engineers characterized sites before on-site work to establish baseline condition. RGHRP monitored on-site activities to ensure on-the-ground efforts were consistent with Project design. RGHRP personnel will continue to monitor sites according to the Phase 3 Sampling and Analysis Plan (SAP) to ensure proper function and determine if Projects successfully attain Goals and Objectives.

Products - Monitoring Reports that can be compared to determine if the riparian stabilization was successful and the desired results have been achieved.

Figure 7. Monitoring Cross Section at Gilmore Site.

Objective 4 – Promote community participation and increase understanding of water quality issues and encourage involvement in Phase 3 by reaching out to the community with presentations, tours, and volunteer events.

Task 5 – Outreach and Education: The RGHRP developed visual aids about Phase 3; spoke at public meetings, local schools, and conferences about the importance of water quality and healthy rivers; submitted articles to local newspapers with Project information and updates; organized three volunteer revegetation efforts and two tours for members of the public.

Products - A well-informed community regarding, non-point source issues in the watershed, the activities of the RGHRP, and the importance of healthy rivers. Increased community involvement in riparian stabilization Projects; three volunteer revegetation efforts. Finally, two community tours of completed Projects were given to interested community groups and individuals.

Figure 8. Outreach and Education - Public Tour, Fall 2012.

Objective 5 – Facilitate discussions with the Technical Advisory Team, a multi-discipline team of expert advisors, to identify the most cost efficient and effective riparian stabilization methods for implementation at each site.

Task 6 – The RGHRP organized three site visits for the Technical Advisory Team. The Technical Advisory Team visited sites before design to discuss suitable methods to address the causes of increased sediment loading. Using lessons learned from previous projects and the best available science, the Technical Advisory Team determined the most effective and cost-efficient methods for implementation at each site. The Technical Advisory Team visited the sites a second time after construction of three sites to observe the results of the site treatments and make recommendations for changes to the designs of the final two sites. Finally, the technical team visited the sites a final time to review the results of onsite work and develop "lessons learned" for future efforts.

Products - A Team of professionals committed to selecting the most technically and cost effective mitigation measures to be implemented at each Project site. A detailed look at the completed sites to determine how future efforts can be improved.

Figure 9. Technical Advisory Team Post Construction Site Visit, July 2010.

Objective 6 – Administer Phase 3 efficiently, within budgeted costs and timelines, and in accordance with Project Goals, Objectives, and Tasks. Complete all necessary contracts, status reports, and internal and external documents. Ensure Tasks are completed within approved costs and timelines.

Task 7 – The RGHRP administered Phase 3. This included completing contracts with the CDPHE, CWCB, landowners, third party engineers, and contractors; obtaining the necessary environmental permits; managing budgets and reimbursement requests; and completing semi-annual and final reports. Additionally, RGHRP performed Project oversight; making certain project design and implementation were timely and accurate. The RGHRP organized outreach and education efforts and completed site monitoring in accordance the Phase 3 SAP.

Products – All appropriate contracts, external and internal reports, and on-site Project activities completed within planned period and anticipated costs.

Table 2. Project Milestones: 2008 Rio Grande Riparian Stabilization Project - Phase 3

Task Description	Year 1 - 2009				Year 2 - 2010				Year 3 -2011				Year 4 - 2012			
	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Task 1 - Streambank Stabilization																
Complete Project Design and Planning		■	■	■	■	■	■	■								
Project Construction					■	■	■	■	■	■						
Task 2 - Bioengineering																
Use bioengineering techniques during Project construction: including planting willow clumps and reseeding disturbed areas.					■	■	■	■	■	■	■	■				
Implement Bioengineering techniques through volunteers events and with crews from the Southwest Conservation Corps. Methods include dormant willow plantings, shrub and tree planting, compost application, and reseeding where needed.								■		■					■	
Task 3 - Implement Grazing BMPs																
Take necessary measures to promote improved grazing management in the riparian areas.						■	■	■	■	■	■	■	■	■	■	■
Task 4 - Site Evaluation and Monitoring																
Monitor site before, during and after construction and onsite mitigation measures.					■	■	■	■	■	■	■				■	■
Task 5 - Outreach and Education STOP!																
Develop visual aids. Give presentations to local stakeholder and community groups. Submit status updates to newspapers and radio stations.					■	■	■	■	■	■	■	■	■	■	■	
Recruit participants for volunteer revegetation efforts.					■	■	■	■	■	■	■	■	■	■	■	
Task 6 - Establish Technical Team																
Organize Technical Team; Visit sites before site design and after construction.		■				■					■					
Task 7 - Project Administration																
Approval of PIP by CDPHE and EPA	■	■														
Execute EPA 319 Contract with CDPHE		■														
Execute CWCB Contract			■													
Maintain Financial Records; submit reimbursement reports.			■	■	■	■	■	■	■	■	■	■	■	■	■	■
Execute Agreements with Project Landowners					■	■	■			■						
Execute Contract with 3rd Party Engineer, Riverbend Engineering			■													
Obtain USACE 404 Permits					■	■	■		■	■						
Obtain Cultural Clearance Surveys					■											
Complete Engineering Design and Cost Estimates			■	■	■											
Select and Execute Contract with Contractor				■												
Oversee Project Construction and Monitoring					■	■	■	■	■	■	■	■	■	■	■	■
Phase 4 Final Reporting															■	■

2.2 Evaluation of Goal Achievement and Relationship to the State NPS Management Plan
The actions taken in Phase 3 to reduce sediment input and improve river function are consistent with the recommendations of the 2001 Study and the 2007 Rio Grande Watershed Strategic Plan, and with the Stream Restoration guidelines outlined in the Colorado Non Point Source (CO NPS) Management Plan. The CO NPS Management Plan states that partners should approach Projects at a watershed scale, identify impacted areas and rehabilitation priorities, and define expected condition; this evaluation should be completed by examining the hydraulic processes, stream geomorphology, channel condition, and riparian vegetation of the stream. The 2001 Study and 2007 Strategic Plan were completed in accordance with this recommended approach. The CO NPS Plan highlights the importance of restoring and rehabilitating streams to improve sediment conveyance and water flow, which was one of the primary goals of Phase 3. Finally, the CO NPS Plan describes the importance of a rigorous scientific approach and application of sound scientific principles and engineering techniques in a timely and cost-efficient manner. The RGHRP has been managing riparian stabilization Projects since 2001. Through these efforts, and with the guidance of the Technical Advisory Team, the RGHRP has used sound science to select the most effective and cost efficient treatments for implementation. Long-term monitoring of these sites has allowed the RGHRP to determine which methods are most successful and applicable to future efforts. By combining these "lessons learned" with the best available science, the RGHRP strives to implement the mitigation measures with the highest success at greatest cost efficiency.

Section 3.0 Best Management Practices Developed and/or Revised
Streambank Stabilization was completed on 1.8 miles of riparian areas on 4 privately owned and 1 public site. The methods utilized included sloping and shaping banks, building floodplain benches, reconfiguring the channel to move the thalwag away from the bank, and installing 53 rock barbs to move water away from and stabilize the streambanks. Based on erosion rates calculated in the 2001 Study, the estimated reduction in sediment loading from these efforts is 16,750 cubic feet per year.

Bioengineering techniques were implemented on 14.2 acres in order to further stabilize the streambanks and improve riparian habitat. Techniques used in the riparian areas included, willow clump plantings, and grass and forb seeding. Upland areas disturbed during onsite activities were reseeded with appropriate species. Between construction of the sites, it was observed that revegetation on recently completed sites was slow due to low organic matter, sandy soils, high winds, and lack of rain. Through discussions with the technical advisory team, a recommendation was made to stockpile topsoil during construction and place it upon the completed streambanks. As such, topsoil was stockpiled and spread on the slope of the final site completed. This increase in organic matter and vegetative material greatly increase the rate of revegetation. Stockpiling topsoil is now a standard BMP for similar projects. On sites where topsoil was not stockpiled, a crew was hired to spread compost and reseed upland areas with low vegetation.

Grazing BMPs were utilized on three of the five restoration sites. Landowners protected the riparian area from overuse and implemented grazing BMPs, including fencing and short duration grazing rotations.

Section 4.0 Monitoring Results

In accordance with the Phase 3 SAP, monitoring includes cross sections, photo points, Stream Visual Assessment Protocol, and Grazing BMP compliance. The following tables and photos show the improvements in stream bank stability and riparian condition as a result of Phase 3 activities.

Woodard Site: Construction in May 2011.

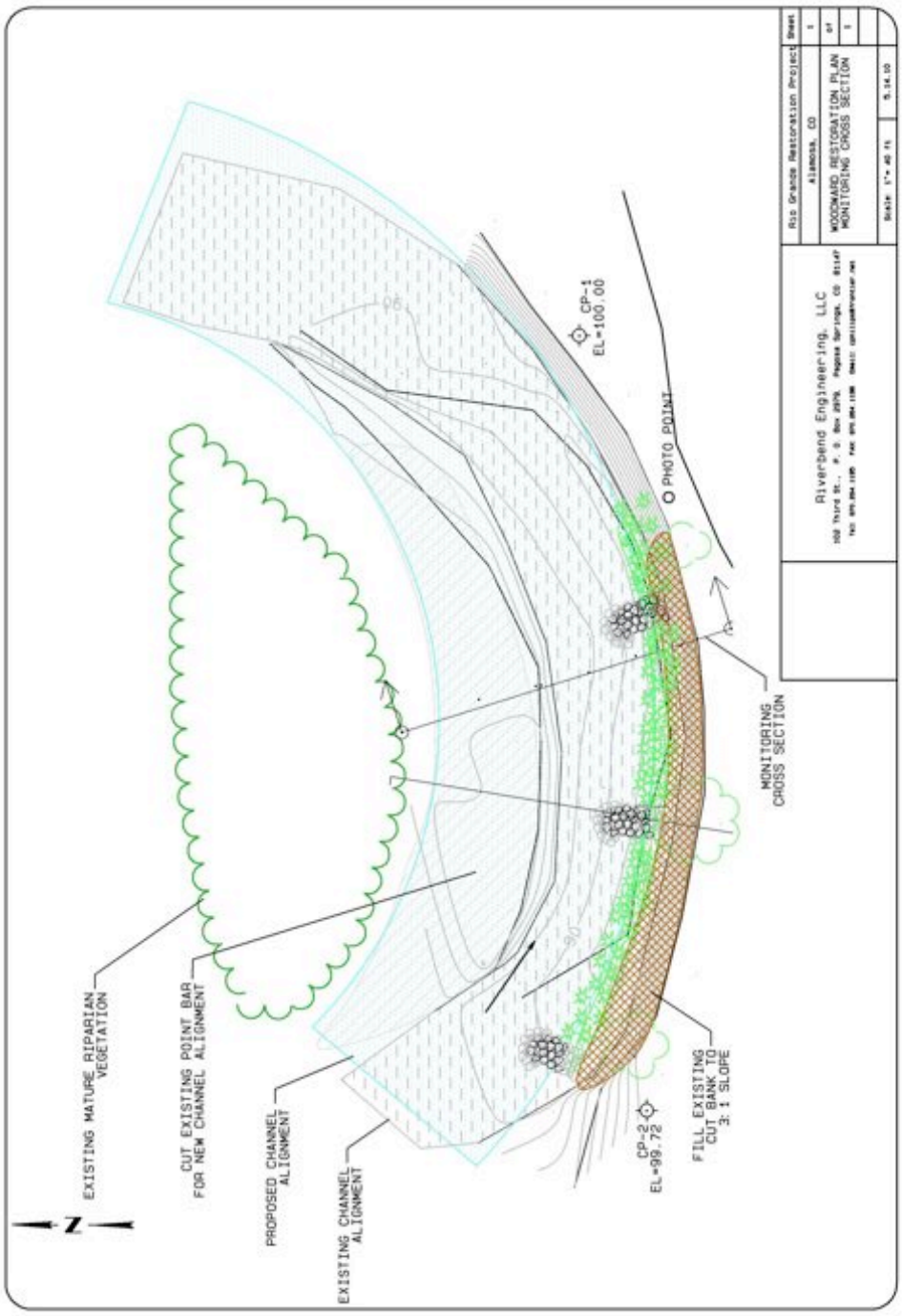

Figure 10. Woodard Site Design, Cross Section Location, and Photopoint Location.

Before - June 2009

After - August 2012

Figure 11. Woodard Site Photos Before and After Construction.

Table 3. Woodard Stream Visual Assessment Scores		
Assessment Category	Preconstruction May-11	2012 Monitoring August-12
Channel Condition	1	10
Hydrologic Alteration	1	7
Riparian Zone	3	10
Bank Stability	1	9
Water Appearance	6	10
Nutrient Enrichment	7	7
Barriers to Fish Movement	10	10
Instream Fish Cover	3	5
Pools	6	3
Invertebrate Habitat	3	4
Canopy Cover	1	1
Manure Presence	5	5
Salinity	N/A	N/A
Riffle Embededdness	3	5
Macroinvertebrates Observed	N/A	N/A
Overall Score	3.85	6.62

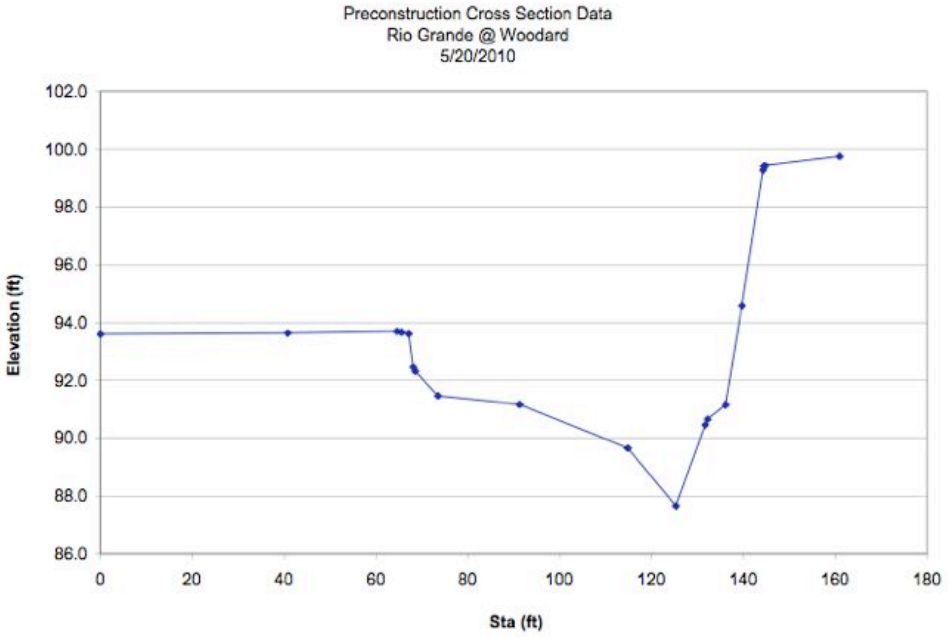

Figure 12. Woodard Site Cross Section Data Before Construction.

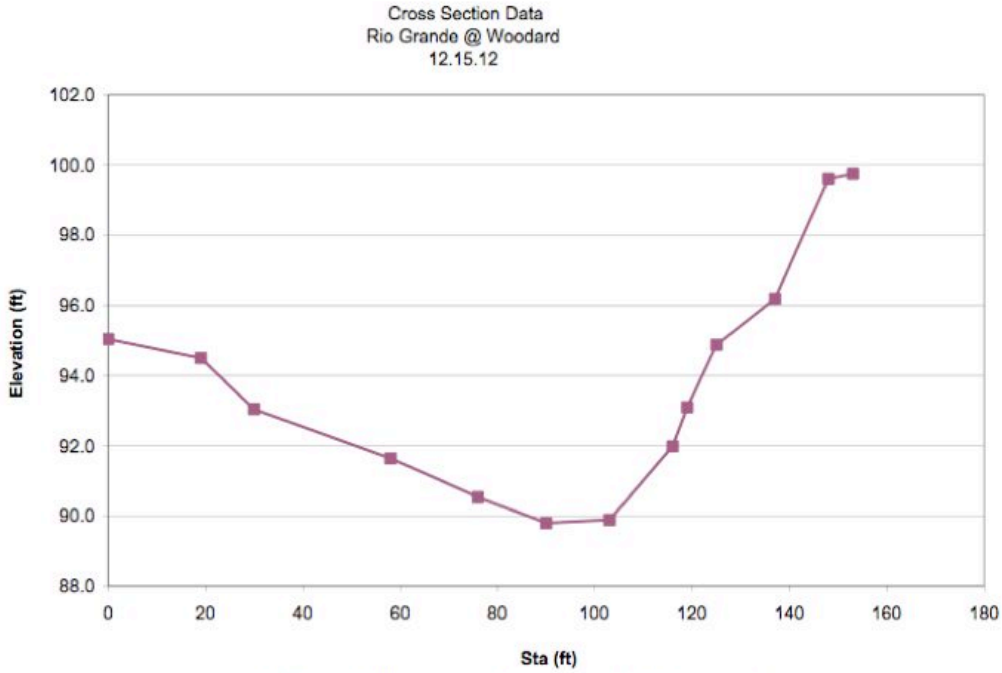

Figure 13. Woodard Site Cross Section Data After Construction.

Gilmore Site: Construction in April/May 2010.

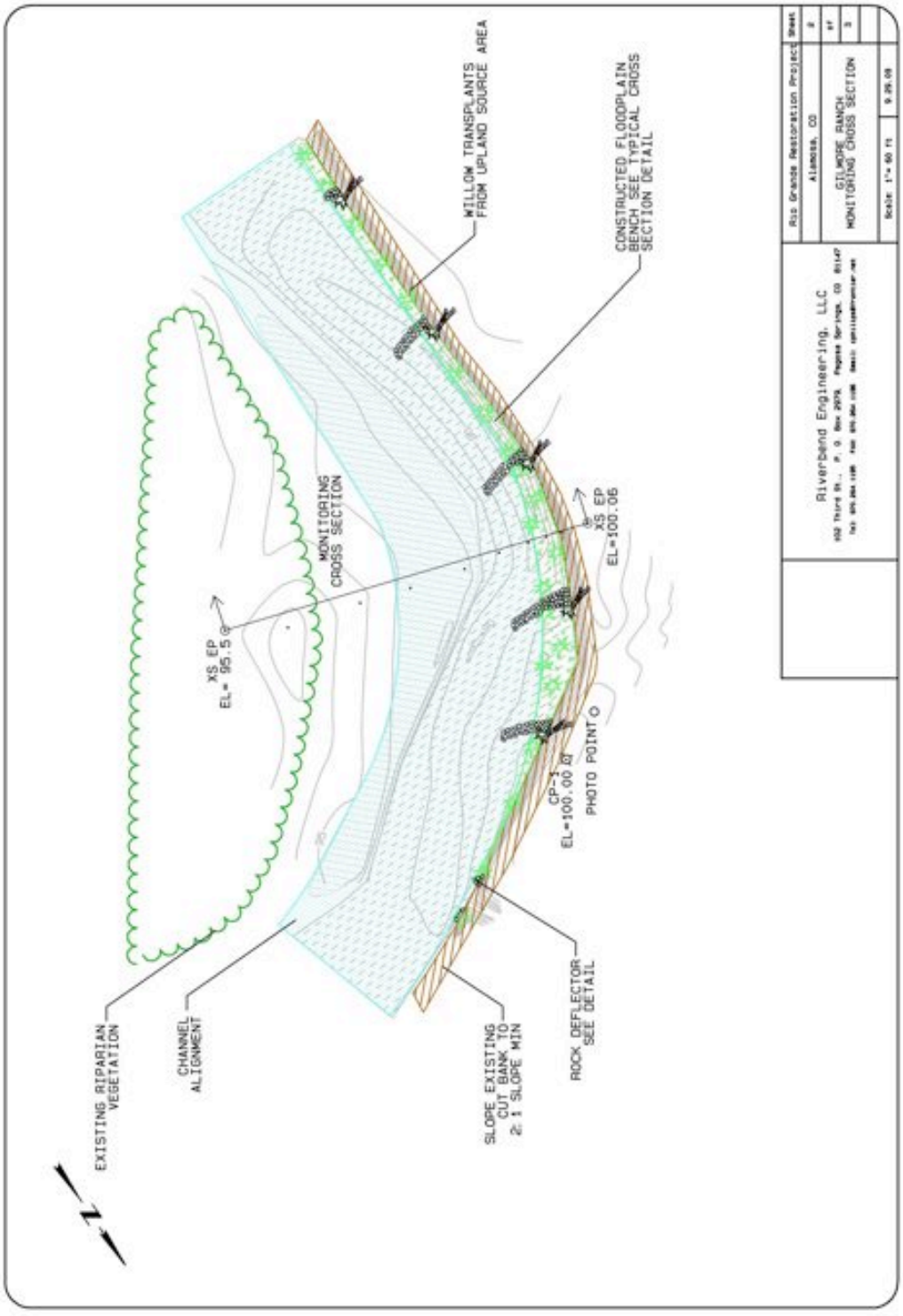

Figure 14. Gilmore Site Design, Cross Section Location, and Photopoint Location.

Before - June 2009 After - August 2012

Figure 15. Gilmore Site Photos Before and After Construction.

Table 4. Glimore Stream Visual Assessment Scores		
Assessment Category	**Preconstruction March-10**	**2012 Monitoring August-12**
Channel Condition	2	10
Hydrologic Alteration	2	7
Riparian Zone	4	8
Bank Stability	1	9
Water Appearance	7	10
Nutrient Enrichment	7	7
Barriers to Fish Movement	10	10
Instream Fish Cover	3	5
Pools	6	2
Invertebrate Habitat	3	4
Canopy Cover	1	1
Manure Presence	5	5
Salinity	N/A	N/A
Riffle Embededdness	3	5
Macroinvertebrates Observed	N/A	N/A
Overall Score	4.15	6.38

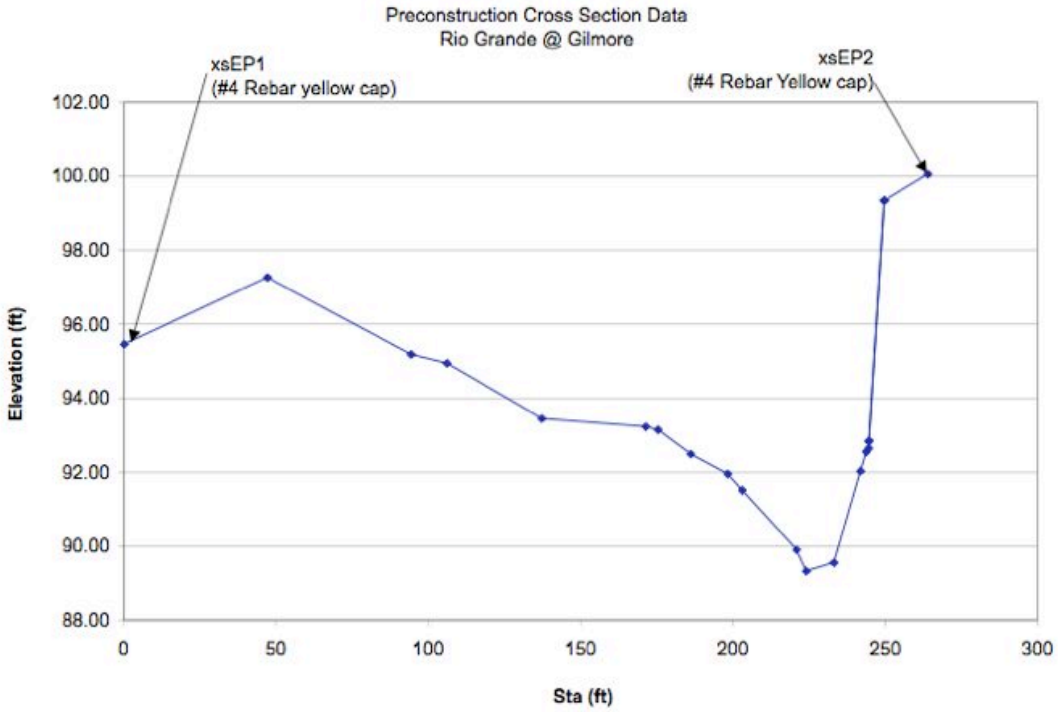

Figure 16. Gilmore Site Cross Section Data Before Construction.

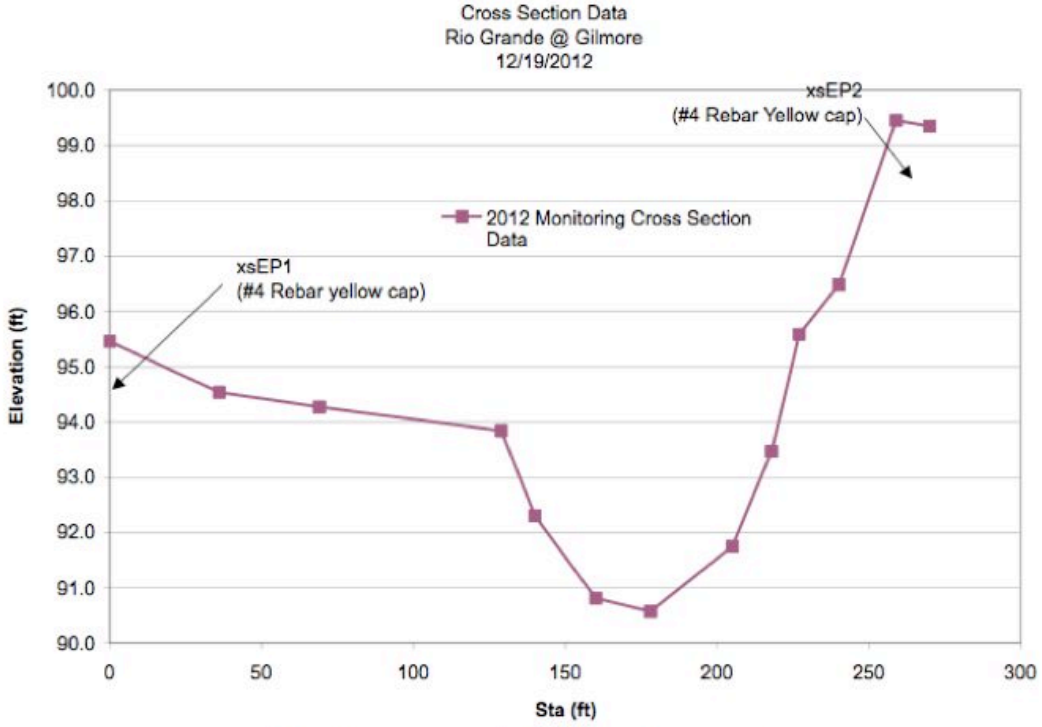

Figure 17. Gilmore Site Cross Section Data After Construction.

Russell Site: Construction in April/May 2010.

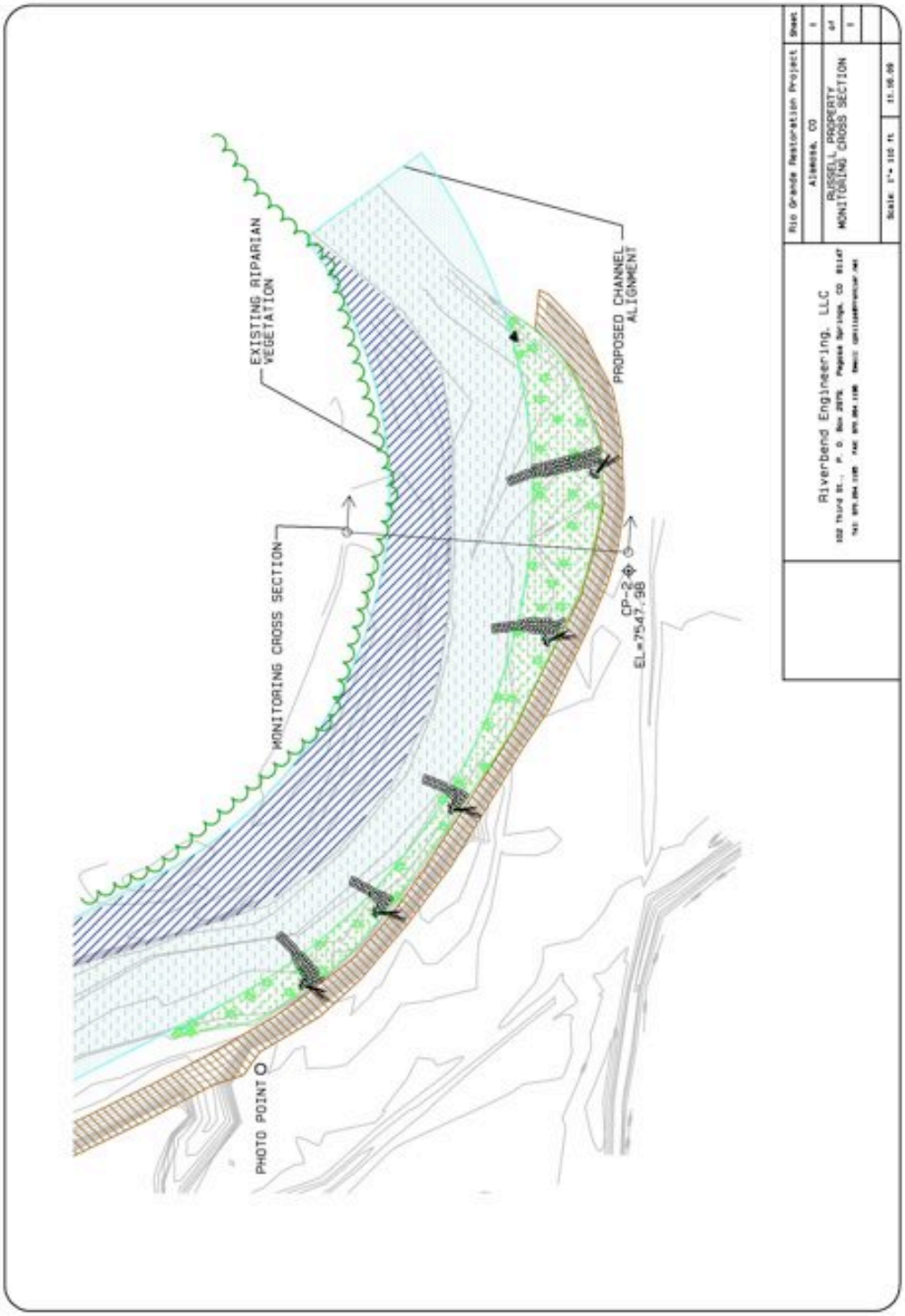

Figure 18. Russell Site Design, Cross Section Location, and Photopoint Location.

Before - June 2009 After - August 2012

Figure 19. Russell Site Photos Before and After Construction.

Table 5. Russell Stream Visual Assessment Scores		
Assessment Category	Preconstruction March-10	2012 Monitoring August-12
Channel Condition	2	10
Hydrologic Alteration	1	7
Riparian Zone	4	10
Bank Stability	1	9
Water Appearance	7	10
Nutrient Enrichment	8	7
Barriers to Fish Movement	10	10
Instream Fish Cover	3	5
Pools	6	3
Invertebrate Habitat	3	4
Canopy Cover	1	1
Manure Presence	N/A	N/A
Salinity	N/A	N/A
Riffle Embededdness	3	5
Macroinvertebrates Observed	N/A	N/A
Overall Score	4.08	6.75

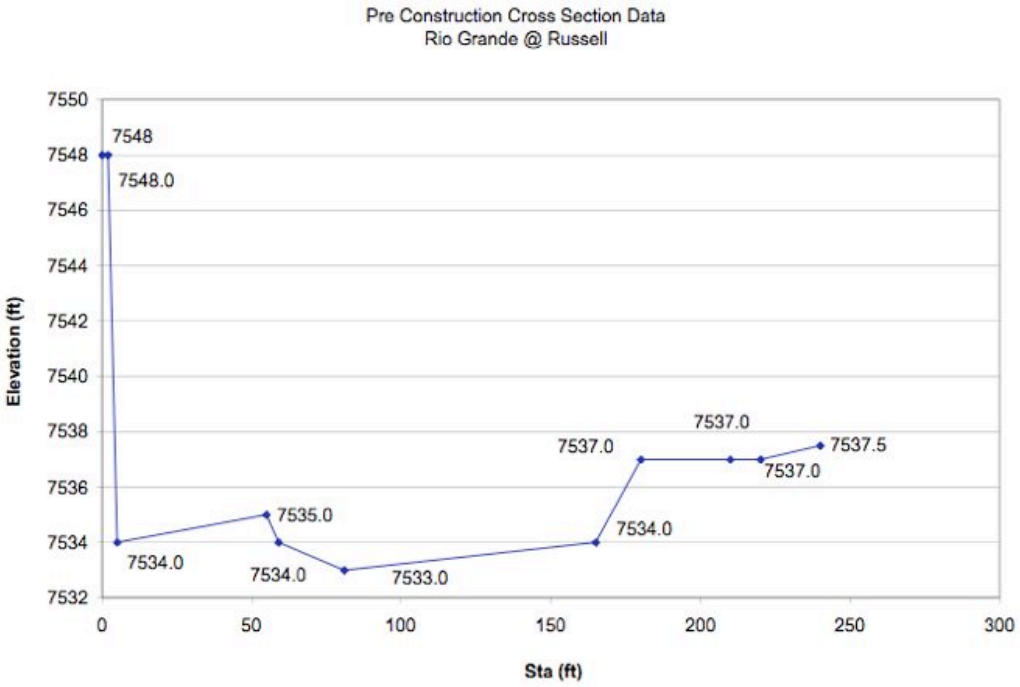

Figure 20. Russell Site Cross Section Data Before Construction.

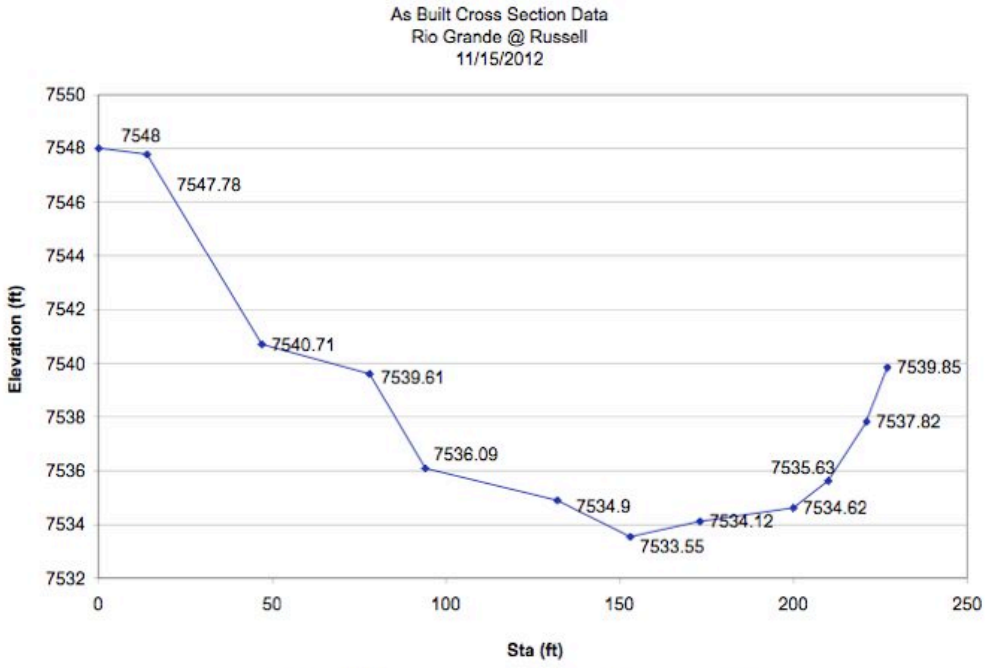

Figure 21. Russell Site Cross Section Data After Construction.

Alamosa Ranch Site: Construction in September/October 2010.

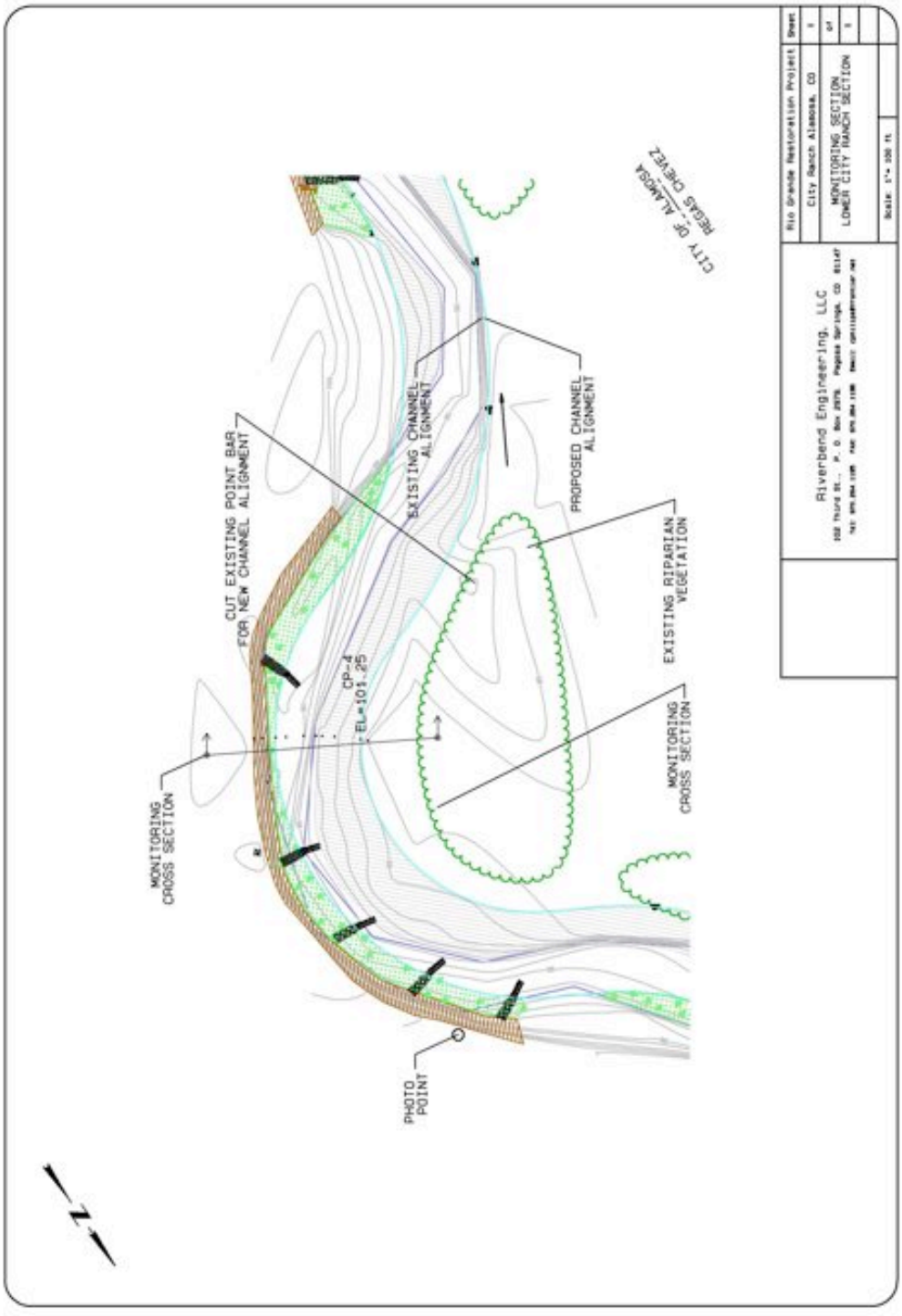

Figure 22. Alamosa City Ranch Site Design, Cross Section Location, and Photopoint Location.

Before - June 2009 After - August 2012

Figure 23. Alamosa City Ranch Site Photos Before and After Construction.

Table 6. Alamosa Ranch Stream Visual Assessment Scores		
Assessment Category	Preconstruction July-10	2012 Monitoring August-12
Channel Condition	1	10
Hydrologic Alteration	1	7
Riparian Zone	3	7
Bank Stability	1	8
Water Appearance	7	10
Nutrient Enrichment	7	8
Barriers to Fish Movement	10	10
Instream Fish Cover	3	5
Pools	5	3
Invertebrate Habitat	3	3
Canopy Cover	1	1
Manure Presence	5	5
Salinity	N/A	N/A
Riffle Embededdness	3	5
Macroinvertebrates Observed	N/A	N/A
Overall Score	3.85	6.31

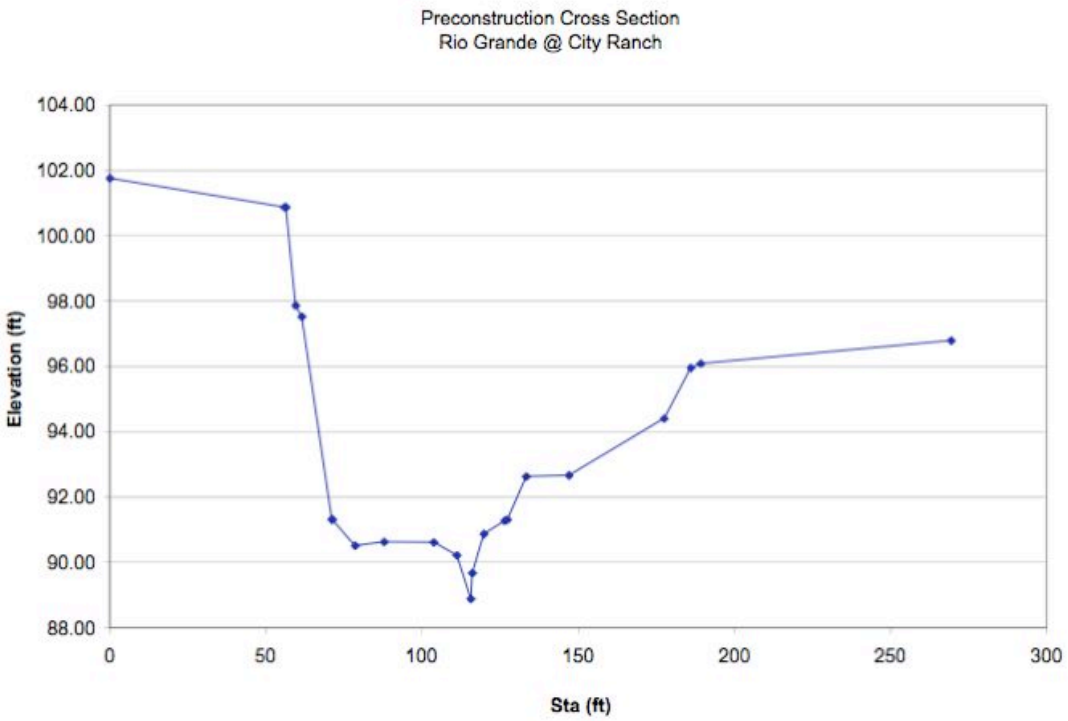

Figure 24. Alamosa City Ranch Site Cross Section Data Before Construction.

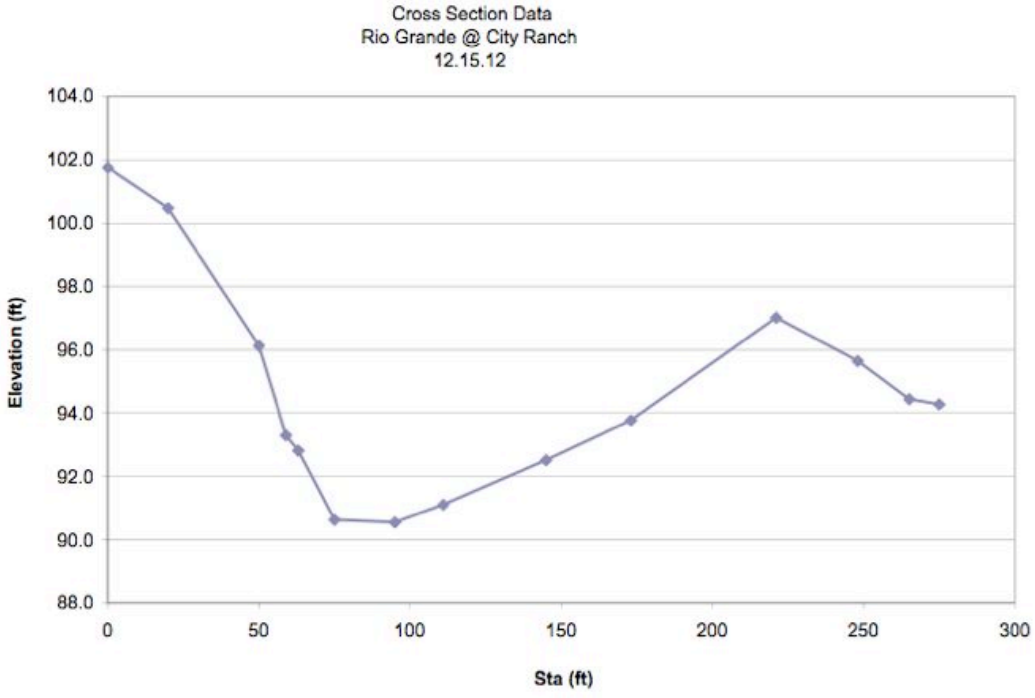

Figure 25. Alamosa City Ranch Site Cross Section Data After Construction.

Alamosa Ranch Site: Construction in September/October 2010.

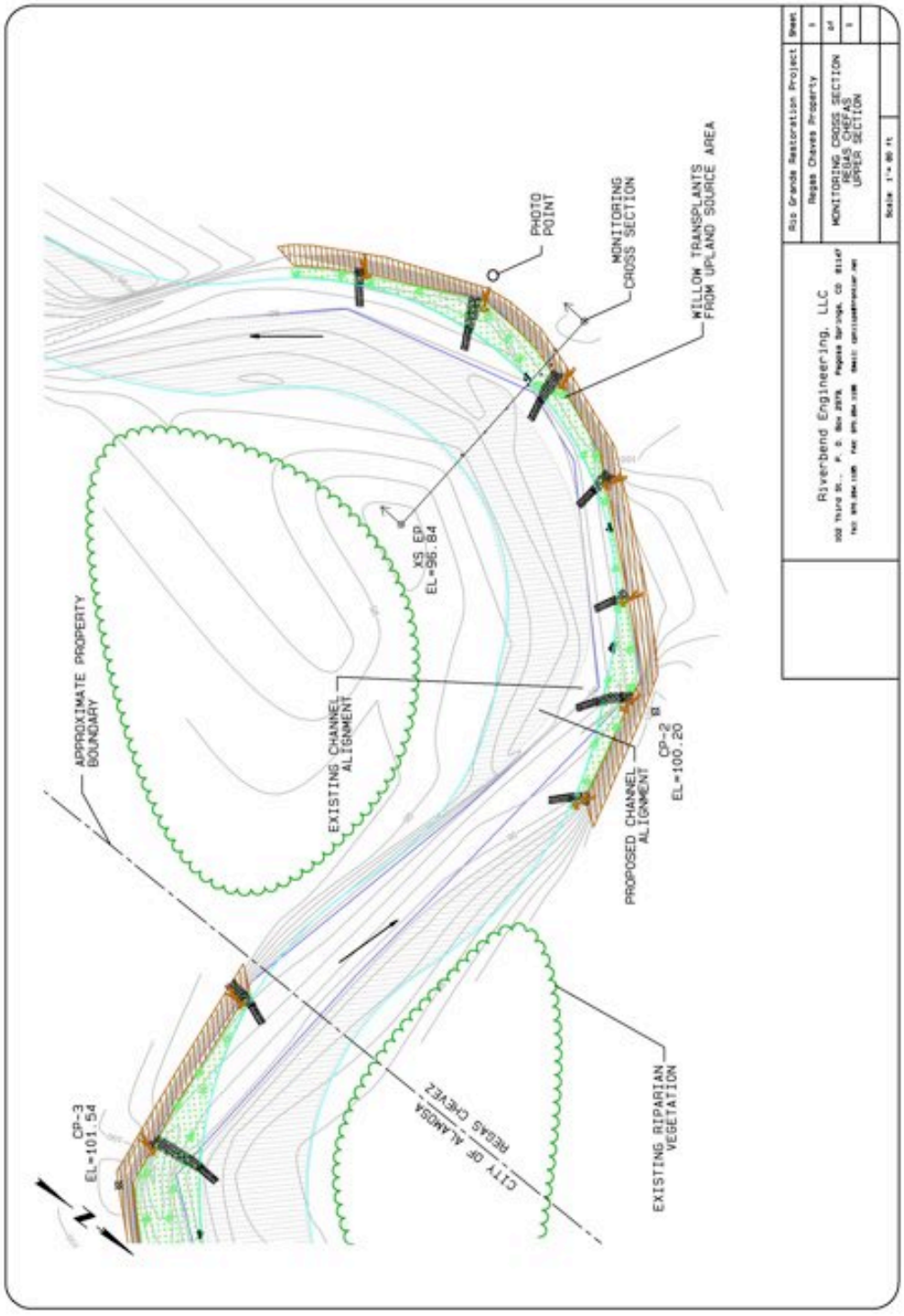

Figure 26. Chefas Site Design, Cross Section Location, and Photopoint Location.

Before - June 2010 After - September 2012

Figure 27. Chefas Site Photos Before and After Construction.

Table 7. Chefas Stream Visual Assessment Scores		
Assessment Category	Preconstruction July-10	2012 Monitoring September-12
Channel Condition	1	10
Hydrologic Alteration	1	7
Riparian Zone	3	8
Bank Stability	1	8
Water Appearance	7	10
Nutrient Enrichment	7	8
Barriers to Fish Movement	10	10
Instream Fish Cover	3	5
Pools	5	3
Invertebrate Habitat	3	3
Canopy Cover	1	1
Manure Presence	N/A	N/A
Salinity	N/A	N/A
Riffle Embededdness	3	5
Macroinvertebrates Observed	N/A	N/A
Overall Score	3.75	6.50

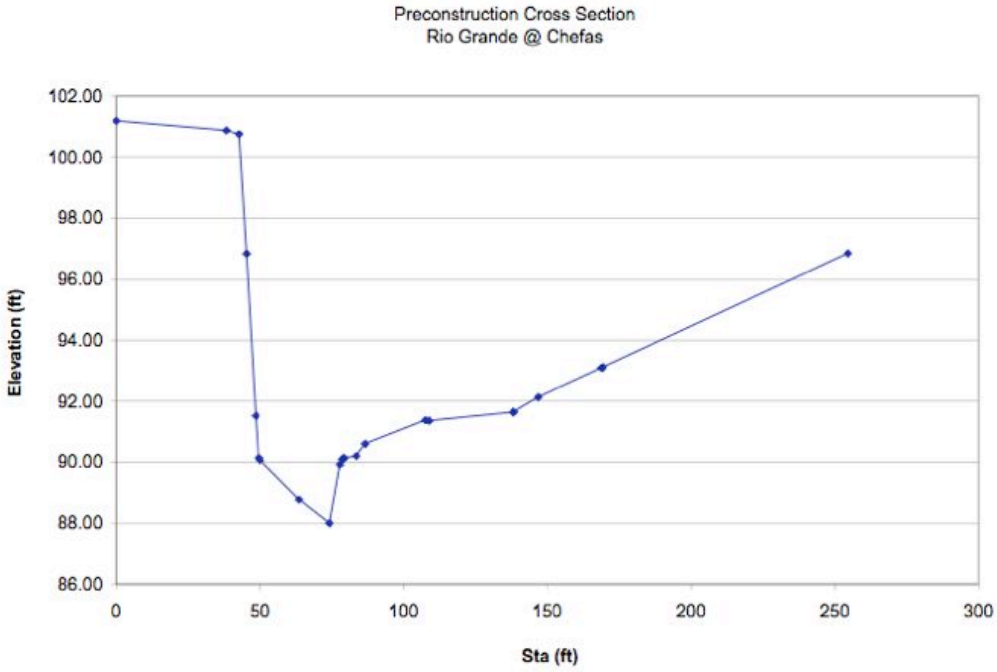

Figure 28. Chefas Site Cross Section Data Before Construction.

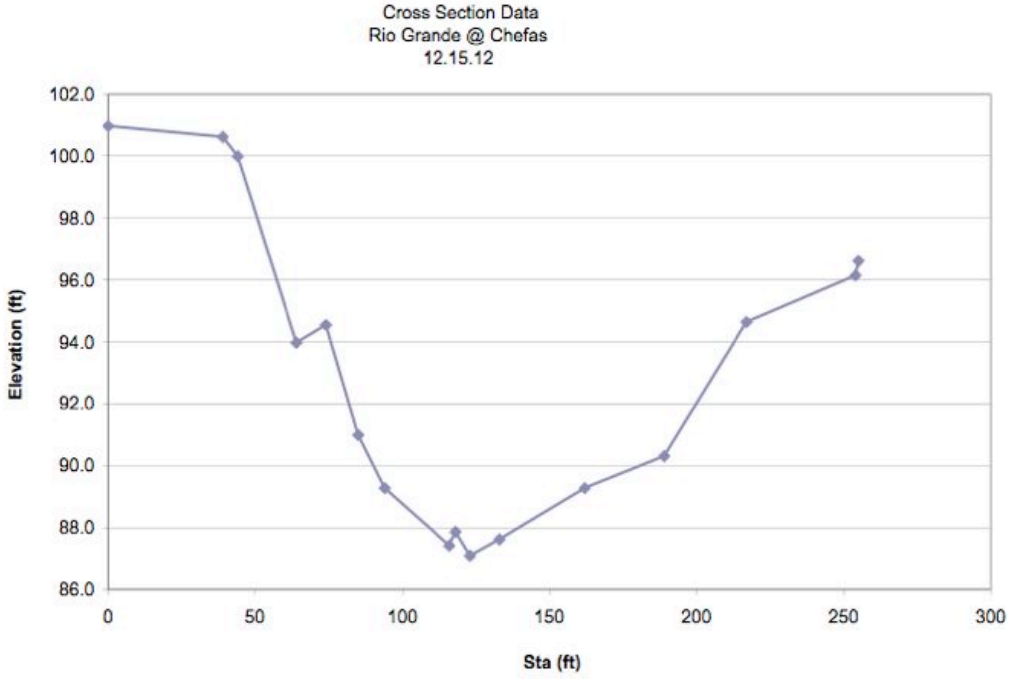

Figure 29. Chefas Site Cross Section Data After Construction.

Table 8. Grazing BMP Monitoring - August 2012		
Site	**Implementing Grazing BMPs**	**Comments**
Woodard	Yes	*Cattle are grazed in the riparian area for short duration and utilization is controlled with fencing.*
Gilmore	Yes	*Cattle are grazed in the riparian area for short duration and utilization is controlled with fencing.*
Russell	N/A	*Livestock are not grazed on the property.*
Alamosa Ranch	Yes	*Cattle are grazed in the riparian area for short duration and utilization is controlled with fencing.*
Chefas	N/A	*Livestock are not grazed on the property.*

4.1 TMDL Implementation Effectiveness

A TMDL is in place for aquatic life (provisional) in this reach. The efforts of the Project improved aquatic habitat for fish and macroinvertebrates. The in-stream rock barbs provide cover and resting locations, while revegetation of woody riparian species over time will provide shading and reduced water temperature. Additionally, conditions are improved by reduced turbidity and increased water quality as a result of lower sediment erosion.

4.2 BMP Effectiveness Evaluations

- Streambank stabilization: The methods utilized have proven effective in meeting the goals of reducing sediment input. Bank shaping and rock barb installation has stopped excessive erosion. Cross section monitoring and photo points show the banks are stable.
- Bioengineering: The methods utilized have been successful in revegetating restoration sites. Photopoint and SVAP monitoring has shown that growth on sites that did not get covered with topsoil has been slower than the topsoiled sites, but still effective.
- Grazing Management: The landowners that graze livestock on their property have implemented grazing BMPs. This has been verified with grazing BMP monitoring.

4.3 Surface Water Improvements

Physical and Habitat: Phase 3 resulted in significant reductions in sediment input in the Rio Grande. The Project sites are located in sub reaches E4 and F1, as defined by the 2001 Study. The "erosion potential index" developed in the 2001 Study for the subreaches can be multiplied by the feet of streambank affected at each project site to calculate the average annual volume of sediment deposited. The Project stabilized the streambanks and dramatically slowed erosion. The estimated reduction in sediment input is 16,750 cubic feet per year. This improves water quality, aquatic habitat, and water conveyance. The slowed erosion has been documented with monitoring cross sections, which document the channel profile. Continued monitoring will document the channel profile, stream bank stability, and erosion over time.

4.4 Ground Water Improvements
No Ground Water Improvements have been observed.

4.5 Other Monitoring
The above sections detail all of the Phase 3 Monitoring efforts.

4.6 Quality Assurance Reporting
The RGHRP is following the approved SAP, as evidenced by the included data and photos. Project sponsors can be assured these activities will continue as the RGHRP has partnered with the Colorado Measurable Results Program (MRP) to continue to monitor projects long-term.

4.7 Results of BMP Operation and Maintenance Reviews
Through monitoring and site visits, the RGHRP has reviewed the implemented BMPs and recorded the following observations:

- Bank shaping and channel configuration are stable, no movement or sagging has occurred.
- Rock barbs are in good, stable condition; limited rock movement has occurred.
- Waterline vegetation, including willows and shrubs, has experienced good growth; volunteer vegetation has colonized streambanks, further stabilizing the toe of the slope. All willow clumps were planted with roots in the water table and survival is above 90%. Bareroot shrubs that were planted by volunteers had varied success: upland species such as currents had greatest success. It is hypothesized that others were unable to tolerate the fluctuating water table.
- Upland areas disturbed during construction of Phase 3 sites were seeded with an upland seed mix. The RGHRP will continue to monitor these sites to ensure appropriate revegetation success occurs.

Section 5.0 Coordination Efforts
5.1 Coordination From Other State Agencies
The following State Agencies participated in Phase 3: The Colorado Non Point Source Program (CO NPS), Colorado Water Conservation Board (CWCB), Colorado State Forest Service (CSFS), and Colorado Parks and Wildlife (CPW). CO NPS provided grant monies for streambank stabilization and technical assistance. CWCB provided matching funds through the Water Supply Reserve Account (WSRA) and the Colorado Healthy Rivers Fund (CHRF). CWCB personnel also provided technical assistance through the technical advisory team. CSFS provided supplies and technical assistance for bareroot shrub plantings during one of the volunteer events. CSFS also granted matching funds to the RGHRP for revegetation efforts and weed management on the sites. CPW gave guidance during technical advisory team meetings.

5.2 Other State Environmental Program Coordination
RGHRP is working with the Colorado Measurable Results Program (MRP), sponsored by the Colorado Watershed Assembly and CWCB, to coordinate long-term monitoring of Project sites. RGHRP will continue to monitor sites until 2015 when MRP staff will help RGHRP transition to long-term monitoring.

5.3 Federal Coordination
Two engineers and one biologist from the Natural Resources Conservation Service (NRCS) participated in the technical advisory team. This included site visits, BMP suggestions, and design review.

5.4 USDA Programs
No USDA Programs were utilized in Phase 3.

5.5 Accomplishments of Agency Coordination Meetings
Personnel from agencies participated in meetings of the Technical Advisory Team. The Technical Advisory Team determined the most effective and cost-efficient methods for implementation at each site, and visited the sites to review the final results of on-site work and develop "lessons learned" for future efforts.

5.6 Resources/Coordination From Federal Land Management Agencies
No resources or coordination was secured from federal land management agencies.

5.7 Other Sources of Funds

Table 9. Final Expenditures of the Rio Grande Riparian Stabilization Project - Phase 3 by Source and Task

Task	Description	Cash Sources					In-kind Sources				TOTAL
		Colorado Department of Public Health and Environment (CDPHE)	Colorado Water Conservation Board (CWCB) Water Supply Reserve Account	Landowners	Xcel Energy Foundation	Colorado State Forest Service (CSFS)	Technical Team	Compost Tech	Volunteers	Landowners	
Task 1	Streambank Stabilization	$ 207,802.00	$ 224,860.42	$ 31,386.00	$ -	$ -	$ -	$ -	$ -	$ -	$ 464,048.42
Task 2	Bioengineering	$ 11,198.00	$ 58,190.03	$ -	$ 7,500.00	$ 20,000.00	$ -	$ 1,800.00	$ 6,088.20	$ -	$ 104,776.23
Task 3	Grazing Management	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,000.00	$ 2,000.00
Task 4	Monitoring	$ 11,856.49	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 11,856.49
Task 5	Outreach and Education	$ -	$ 400.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 400.00
Task 6	Technical Team	$ -	$ -	$ -	$ -	$ -	$ 2,668.80	$ -	$ -	$ -	$ 2,668.80
Task 7	Administration	$ 19,143.51	$ 1,549.55	$ -	$ -	$ -	$ -	$ -	$ 4,336.80	$ -	$ 25,029.86
	TOTAL	**$ 250,000.00**	**$ 285,000.00**	**$ 31,386.00**	**$ 7,500.00**	**$ 20,000.00**	**$ 2,668.80**	**$ 1,800.00**	**$ 10,425.00**	**$ 2,000.00**	**$ 610,779.80**
	Percent	*40.9%*	*46.7%*	*5.1%*	*1.2%*	*3.3%*	*0.4%*	*0.3%*	*1.7%*	*0.3%*	*100%*

Section 6.0 Summary of Public Participation

The public was involved in Phase 3 through participation by site landowners, educational opportunities including presentations and tours, and volunteer revegetation events. As part of the Outreach and Education Program, visual aids including information about Phase 3 were developed showing the specific sites before, during, and after treatments. Presentations about Phase 3 were made at the San Luis Valley Wetlands Area Focus Committee; Rio Grande Inter-basin Roundtable; Quarterly Board Meetings of the Rio Grande Water Conservation District; Board Meetings of the San Luis Valley Water Conservancy District; Local schools and civic groups; and public meetings. Interviews and status reports were given on local radio stations. The RGHRP organized two site tours to demonstrate the applied techniques. The presentations and tours communicated the importance of water quality, riparian health, and non-point source programs. Finally, members of the public participated in three volunteer events. The volunteer events included one morning where high school students and adult advisors planted willow bundles and transplanted sedges, a day where community members planted bare root trees and shrubs, and a morning where boy scouts and their parents planted willow bundles. In total, volunteers contributed 500 hours and planted 110 willows, 360 shrubs and trees, and 30 sedges.

Section 7.0 Aspects of the Project That Did Not Work Well

As described above, monitoring showed slow revegetation on sites with low organic matter, sandy soils, high winds, and lack of rain. The solution was stockpiling topsoil during earthwork and spreading it on completed sites. Sites without topsoil have been covered with compost and reseeded. Because of the extra time and expense required to revegetate these sites, it is not recommended to try to revegetate sandy sites without topsoil.

Another aspect of the Project that was modified was construction management. In the beginning of Project construction, meetings with the contractor were held and the Project activities were outlined. Project boundaries were staked out and plans were discussed. During construction, the contractor went out of Project boundaries on several occasions, requiring greater than planned revegetation. As such, Project management was greatly increased. During earthmoving, the Project engineer was on-site any time the contractor was working and the RGHRP coordinator visited the site at least twice a day. With this increased construction management, the final sites were constructed to Project design and disturbance was minimized. This level of oversight has been carried into additional Projects, improving overall outcomes.

Finally, the RGHRP ran into difficulties accounting for rocks. Rocks were purchased from the US Forest Service, who obtained them from blasting during road construction on Wolf Creek Pass. The RGHRP used preliminary construction estimates to determine the amount of rocks needed. Rocks were hauled to stockpiles and then used for construction. Design quantities for rock barbs were calculated in cubic yards. The contractors made their best attempt to install the correct quantity of rocks in each barb, but faced difficulty in accurately measuring yards as stockpiles contained varied sizes and loads contained rock voids. The solution, developed by the RGHRP and engineers, was to detail the number of rocks in each barb and purchase the set

number, rather than utilize the commonly used cubic yard metric. Tracking individual rocks resulted in much thorough management of resources.

Section 8.0 Future Activity Recommendations

The RGHRP is continuing to implement the recommendations of the 2001 Study, 2007 Watershed Strategic Plan, and the CO NPS Management Plan by administering additional streambank stabilization and riparian restoration efforts. The "lessons learned" in Phase 3 and other RGHRP Projects include:

- Determine Project areas by selecting highest priority reaches identified in guiding studies and reports.
- Continue to utilize the Technical Advisory Team to develop and review the designs to ensure methods have the greatest potential for success and are cost effective.
- Hire contractors with experience in river restoration and streambank stabilization projects; ensure they understand the techniques included in the design and have engineers supervise the initial technique implementation to provide needed guidance and training.
- Provide daily project management; ensure Project representatives are available during business hours and visit the site daily to observe progress and address concerns.
- Purchase a set number of rocks individually in needed sizes, rather than purchasing cubic yards or tons; this provides easier verification of accurate rock delivery.
- Stockpile topsoil when moving earth and spread on finished streambanks; do not seed directly on subsoil as revegetation will be slow due to low organic matter.
- Plant willow clumps into the water table. Trim willows after planting so the majority of energy is sent to roots rather than shoots and leaves.
- Seed in periods of adequate moisture and water seeded areas with pumps if needed (an augmentation plan is required).
- When performing annual monitoring, ensure permanent markers are present each year and replace if necessary using well-documented location information.

Colorado Rio Grande Restoration Foundation

Rio Grande Headwaters Restoration Project

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