FINAL REPORT
RIVER RESTORATION PROJECT 2009
BLANCO RIVER
NEAR PAGOSA SPRINGS, CO

Submitted To:

Colorado Water Conservation Board

July 7, 2010

Submitted By:

LOWER BLANCO PROPERTY OWNERS ASSOCIATION

RIVERBEND ENGINEERING, LLC

Lower Blanco River Restoration Project Summary
2009 Phase V

PROJECT SUMMARY:

Project Purpose:

The Lower Blanco River Restoration Project seeks to restore some of the aquatic life functions that were lost when a major portion of the river's historic flow was diverted to New Mexico to meet Colorado River Water Compact obligations

Project Statistics:

Location:	Section 32, T34N, R1W, NMPM; 37.08'45"N 106.58"26"W		
County:	Archuleta		
Water Division:	7	Water District:	29
Project Length:	10700 Linear Feet		
Adjacent Property Owners:	27		
Begin Construction:	10/1/09		
End Construction:	5/31/10		
Rock Installed:	2450 CY	*(28 Cross Vanes, 3 J hooks, 11 Short Vanes 34 Deflectors,105 Habitat Rocks,185 Sill Rocks)*	
Channel Shaping:	2000 CY		

Project Cost:

Engineering Support	$30,000.00
Construction Management	$8,000.00
Rock	$186,000.00
Construction	$118,400.00
Maintenance Contract	$10,000.00
Project Total	***$352,400.00***

Project Funding Sources:

NRCS EQIP Grant Reimbursement	$91,463
Colorado Water Conservation District *FWLRF*	$132,000
San Juan Water Conservation District *Basin*	$100,000
Lower Blanco POA	$25,000

Future Phases:

The LBPOA portion of the Lower Blanco River Valley is about 8 miles in length. The Lower Blanco Property Owners Association has completed 6 miles of restoration work and is scheduled to finish the final 2.0 miles of the restoration project in the fall of 2010.

INTRODUCTION:

The Lower Blanco River Restoration Project seeks to restore some of the aquatic life functions that were lost when a major portion of the river's historic flow was diverted to New Mexico to meet Colorado River Water Compact obligations. The San Juan-Chama Diversion project came on-line in 1971, and since that time the Lower Blanco River has been reduced to small flows in an over-wide stream bed. The river no longer has the seasonal flows to shape the channel bed, create scour pools and maintain spawning gravel beds. In many locations the mature riparian vegetation is not next to the flowing water. Wetland features at the margins of the channel are infrequent. Water temperatures are elevated in the summer months because of shallow & wide flow conditions. There is only limited habitat available for salmonids and other aquatic species.

The condition of the Lower Blanco River after the San Juan-Chama Diversion was of great concern to property owners along the river. The LBPOA was formed in 1985, and one of its early initiatives was to start looking for help to fix the River. There was little help offered by the Federal agencies administering the Diversion project, but the State of Colorado through the CWCB was forthcoming with assistance. The science of river restoration was still in its infancy, however the CWCB saw the need and was willing to provide grant funding to plan for and implement a river restoration Demonstration Project on the Lower Blanco River. A "Restoration and Fish Habitat Enhancement Plan" was prepared by Dave Rosgen in 1992, which provided a detailed analysis of the changed hydrologic and aquatic conditions in the river, and made specific recommendations on how to rehabilitate stream and aquatic functions within the limitations of a reduced hydrologic regime. Implementation of the restoration work began in 1993, and after monitoring of the work for several years, a second phase of implementation was undertaken in 1996. Phase 1, 2 and 3 were complete by 2002 and had completed work on approximately 2.75 miles of the river. After a several year hiatus where the POA continued to seek funding for the project, implementation work began again in 2007. In the Fall of 2007 a single private landowner near the bottom of the Lower Blanco valley funded restoration work on his 1.0 mile of the river. Then in 2008-2009 the LBPOA completed another 3.25 miles of river restoration (phase 4 and 5) with funding assistance from the NRCS, the SW Conservation District and the San Juan Water Conservancy District. The entire Lower Blanco River valley is about 9.5 miles in length, and there are 6.5 miles of river work completed so far and the final 3 miles scheduled for 2010.

PROJECT GOALS:

Poor aquatic habitat and severely reduced flows have impacted all aspects of the Lower Blanco River. Restoration of a healthy river means making changes to the river's cross section, so that the best use can be made of the available water. The restoration objectives defined in 1992 remain the same today.

Project goals include:

- Improve the natural stability of the Lower Blanco River
- Improve fish habitat and spawning locations
- Improve water quality
- Improve riparian and floodplain functions
- Improve visual values
- Maintain channel capacity for flood hazard reduction
- Maintain or improve domestic well water levels

PROJECT DESIGN PHILOSOPHY:

Hydrology

The completion of the Chama San Juan diversion project in the early seventies has had a significant impact on the hydrology of the Lower Blanco River. The diversion has decreased the duration and magnitude of the channel forming flows downstream. The pre-diversion "bankfull" discharge based on a stochastic analysis of peak discharges from 1935-1971 show a 1.5 year return frequency flow of 726 cfs. The post diversion peak discharge analysis of 1971-2000 gives 1.5 year return frequency flow of 463 cfs. This is 36% reduction in the 1.5 year return frequency flow value (Kurz and Rosgen 2002).

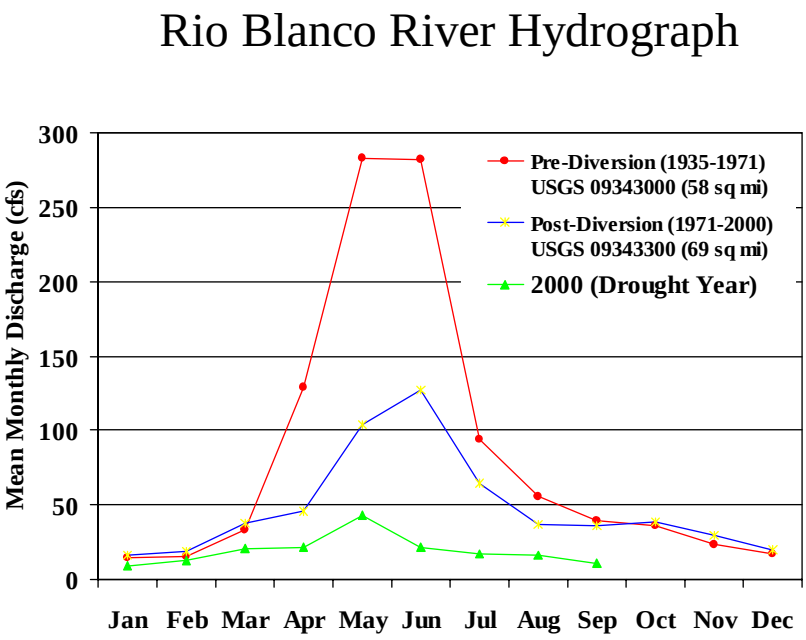
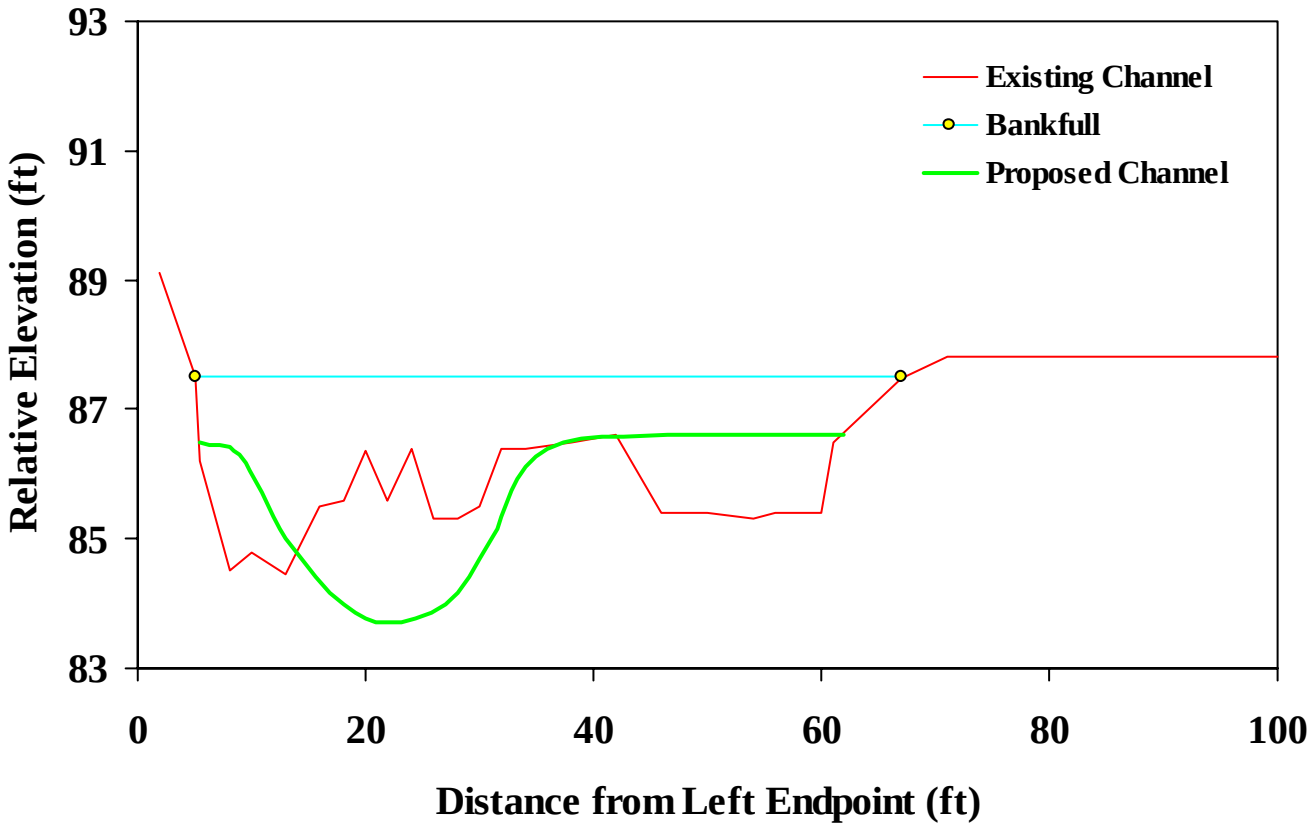


Photo 1. Typical wide shallow channel of a pre-restoration section.

The change in the river hydrology has had a significant impact on the overall health of the Blanco River system. The wide shallow channel lacks the shear stress required to move the larger sediment particles in the system. This has contributed to sediment deposition, increased erosion, and could potentially increase flood stages. The water quality is compromised by an increase in temperature due to wide shallow stream segments. Increased water temperatures lead to a decrease in dissolved oxygen. The fish habitat is negatively affected due to lack of deep cool water and the accumulation of fine sediment in potential spawning gravels during low flow. To offset the effects of the change in river hydrology and resulting changes in river form, the project design consists primarily of channel shaping and fish habitat construction.

Channel Shaping

The channel shaping will rearrange the river alluvium at locations where a deeper pool form is likely to be sustained. This could be near a rock structures convergence of flow creates a scouring condition, or where secondary currents cause by the turning of water on the outside of natural bend maintains a deeper water condition.



Typical Design Cross Section

Typical Restored Section. Photo of newly constructed point bar with dense bank vegetation. Note the rock structure and deeper water river-left, creating good fish holding potential beneath the overhanging riparian vegetation.

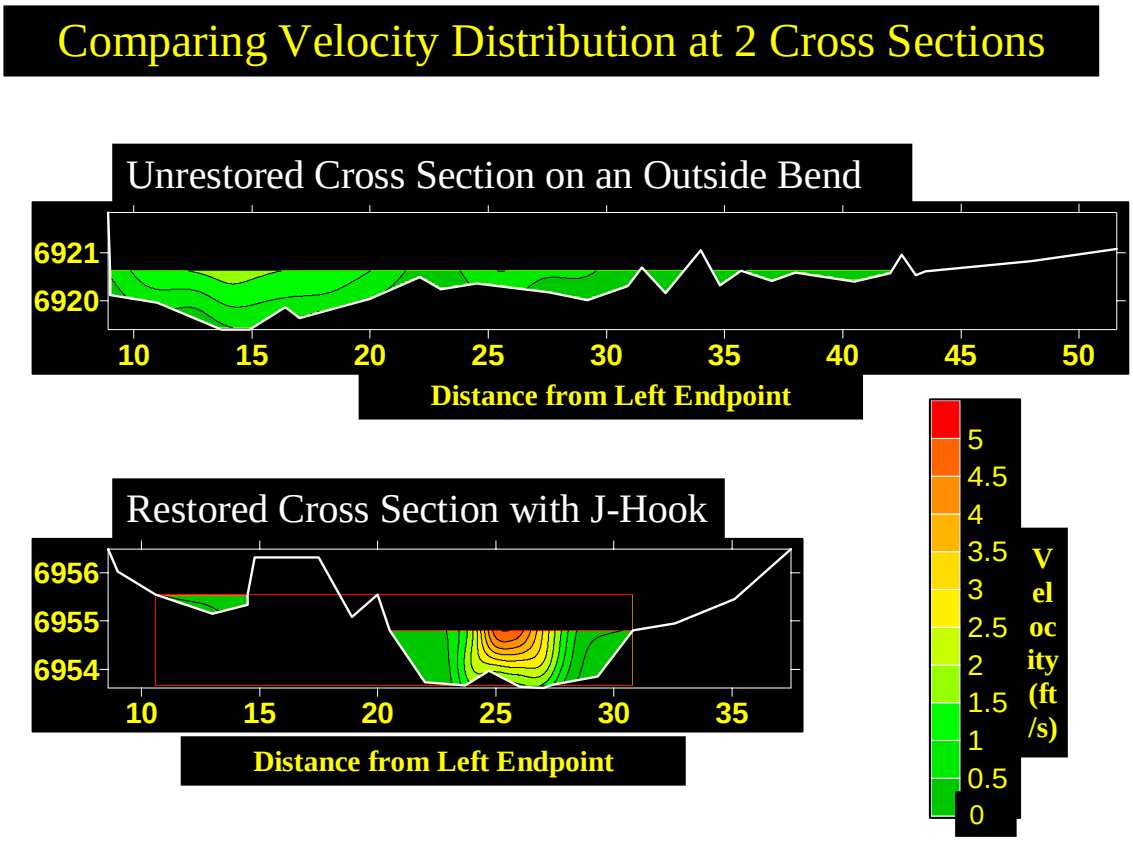


Figure 1. From Kurz & Rosgen, 2002.

Shaping of alternating side bars along the river will encourage the colonization of riparian vegetation, helping to bring improved shade to the river and improved vegetation cover that will enhance fish holding capacity. Improved fish habitat will mean improved recreation opportunities in this river. A strong riparian vegetation community means better cover for terrestrial species that use the river for water and for its riparian forage potential. Dense riparian vegetation encourages deposition of fine grained sediment for soil building, and also creates backwater areas that are the genesis of obligate wetland communities. These transitional areas along the river's margins are important habitat for amphibian species, like the spotted leopard frog (species of concern). Dense riparian vegetation also provides the cover that upland species need to feel safe when coming for water. In this manner it can be seen that the in-stream river improvements have a beneficial impact on the whole ecosystem of the Lower Blanco River valley.

Constructed Rock Habitat

The various rock structures used for erosion protection and habitat enhancement are described below:

Cross Vanes: These rock structures extend across the active channel. They create a funneling effect at higher flows that concentrates the higher velocity flow in the center of the river where a scour hole is formed and will remain deep water.

J-hooks: A rock structure on one side of the channel that starts at "bankfull" stage and extends upstream towards the invert of the channel bed. This structure reduce high shear stress along the river's bank, and concentrates that energy towards the center of the river where a smaller scour pool can be sustained.

Short Vanes: Similar to a J-Hook, but focused primarily on bank erosion mitigation, not fish habitat creation.

Rock Deflectors: A pile of large rocks placed against one bank of the river, which forces the water to flow around. Some scour can be observed at the tip of the deflector were flow convergence is greatest.

Habitat Rocks: Single large boulders or groups of 2-3 boulders placed in the active channel so that the current flows around and/or over the boulder. These rocks create complexity of currents within the river, including eddy currents behind the boulders where fish can rest mid-channel but still have easy access to the feeding lanes.

In addition to rock structures the design incorporated the use of woody debris jambs to enhance habitat for a variety of fish species including the state listed species of concern Roundtail Chub. While it has not been documented that chub inhabit Lower Blanco River, the Colorado Division of Wildlife believes it would not be unreasonable to expect these fish to use the lower portion of the stream during spawning periods or for as a resident fish.

Floodplain Considerations

Aquatic habitat improvements accomplished with this project should not adversely impact the river's ability to pass an extreme flood event. A natural river has an active floodplain that allows floodwater to move down valley and limits shear stress values in the river channel for all flows above the "bankfull" stage. The design of these river improvements will retain all of the active floodplains that existed prior to construction. We expect that flood events will occur, and expect that some repair work will be needed from time to time. This is because habitat improvement structures and channel shaping are not intended to withstand extreme flood events. Large flood events may result in some damage but rarely result in a complete loss of improvements. Natural rivers do show changes in a 100-yr event. This is a necessary component of keeping the Lower Blanco River as natural as possible.

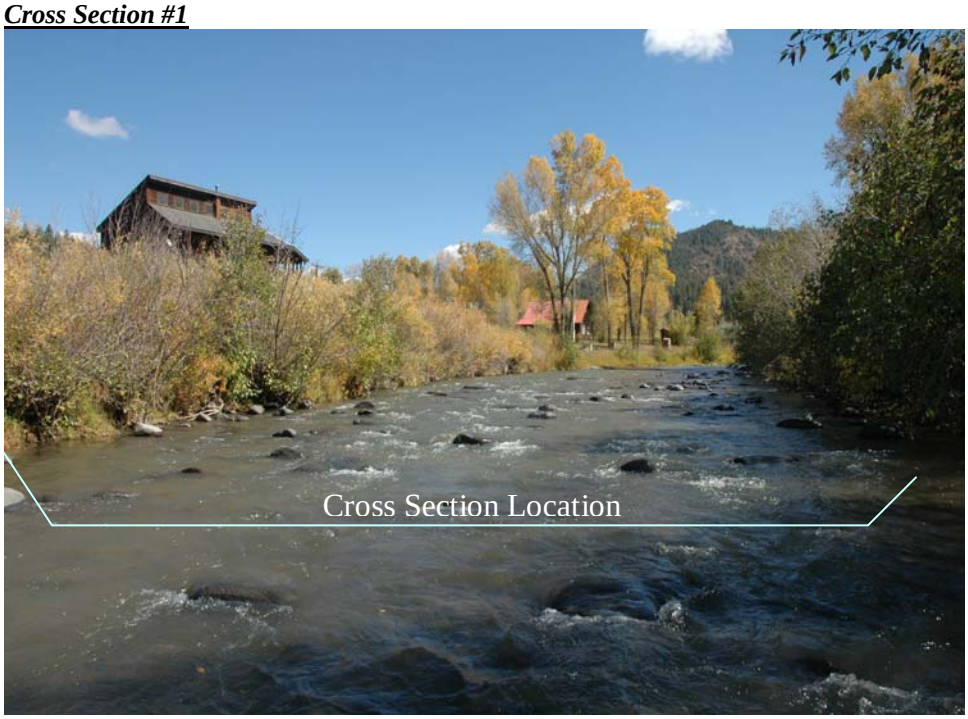
Placement of large boulders for in-stream habitat structures is offset by the removal of a similar volume of gravel where the boulders are placed. The design takes advantage of side channels at split flow locations, and converts these side channels to spawning channel habitats. At flood stage these side channels will be active conveyances for flood waters, since the inlet constraints are limited in height. Establishment of a single primary channel will ensure continuity of sediment transport down the river, and will prevent aggradation during a flood event that might exacerbate flood stages. Macro-invertebrates rely on a regular re-arrangement of bed sediments, and this restoration work will improve these conditions A macro-invertebrate survey was conducted and is included in the Appendix of this report.

2009 PROJECT DATA:

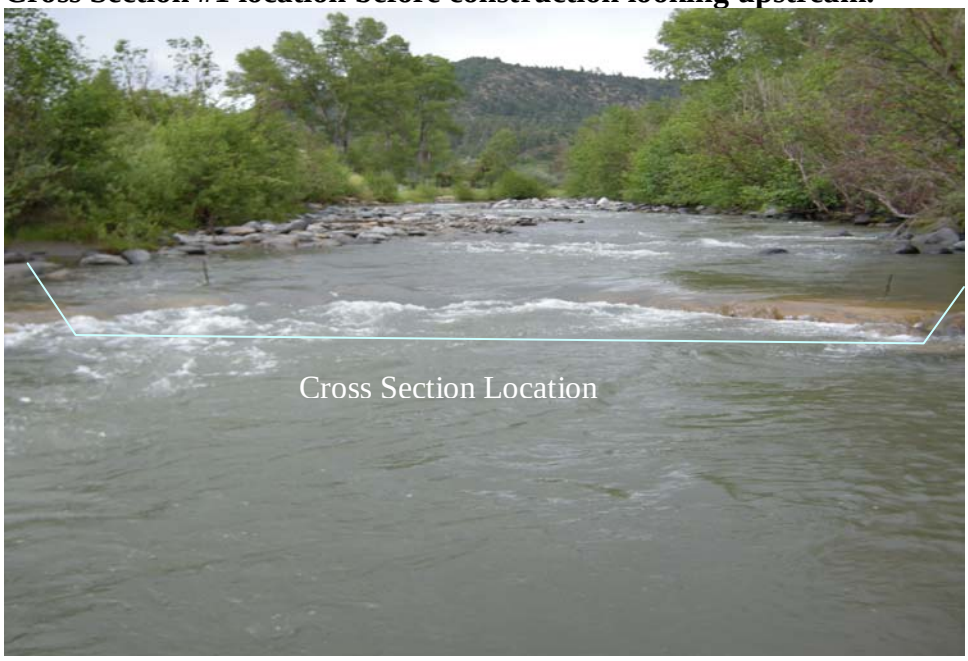
Cross Section Data

A detailed topographic survey was done in a segment of the restoration project that captured many of the restoration techniques used throughout the project. After construction was complete, the cross section locations were resurveyed and compared to the original cross sections and are presented below.

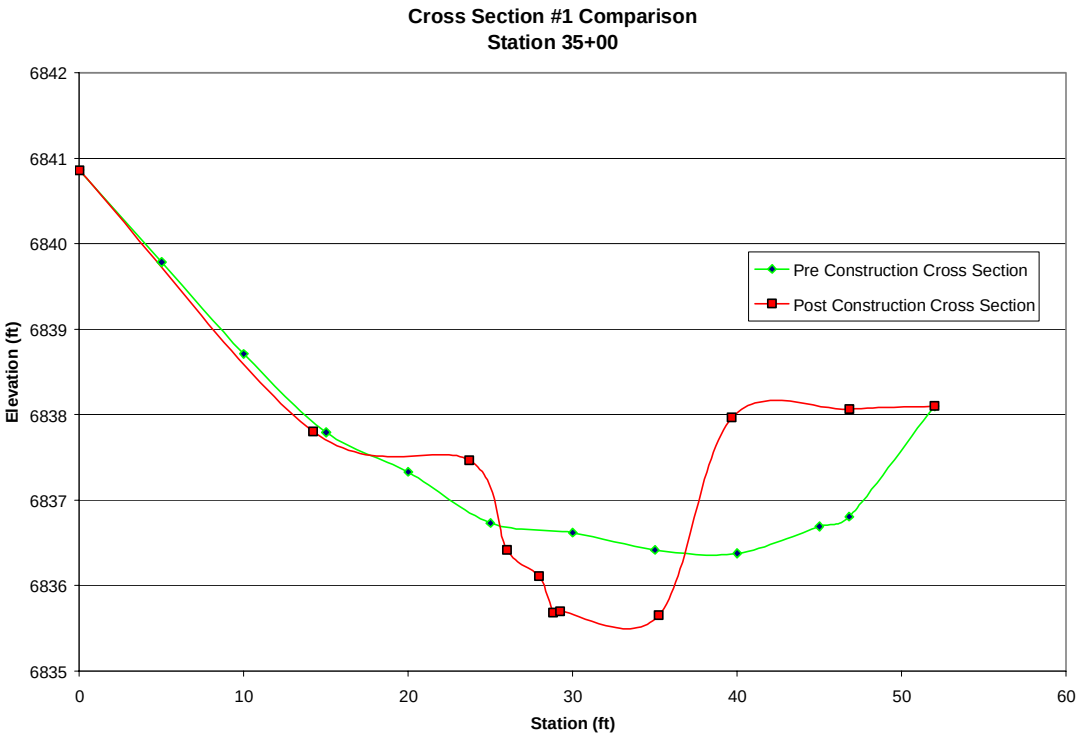
Cross Section #1



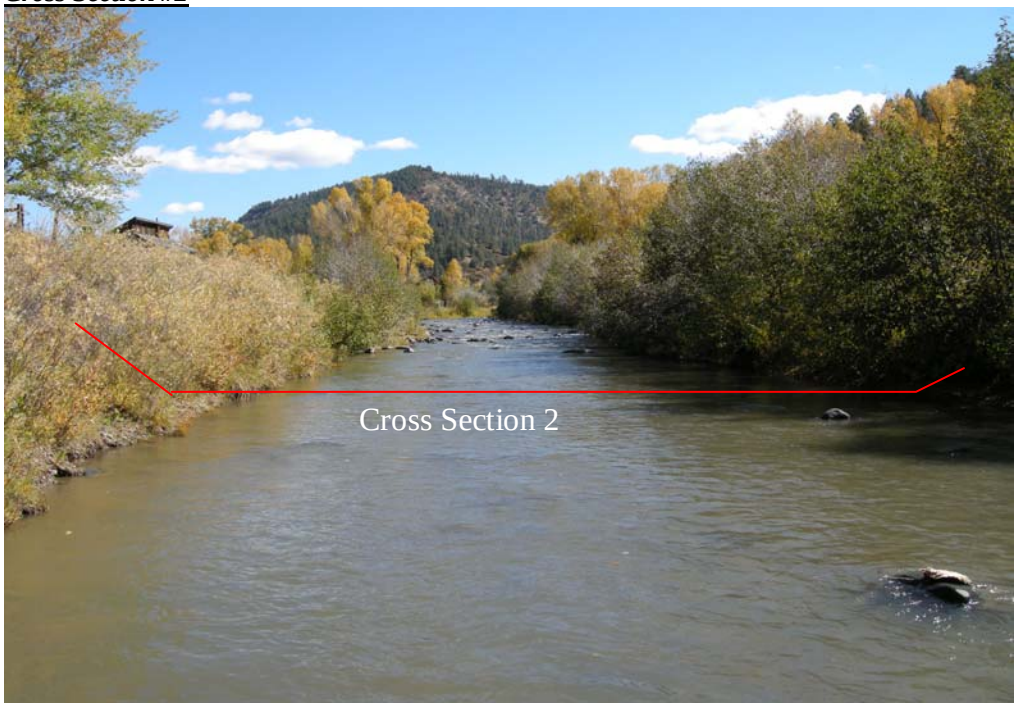
Cross Section #1 location before construction looking upstream.



Cross Section #1 location after construction of rock cross vane.

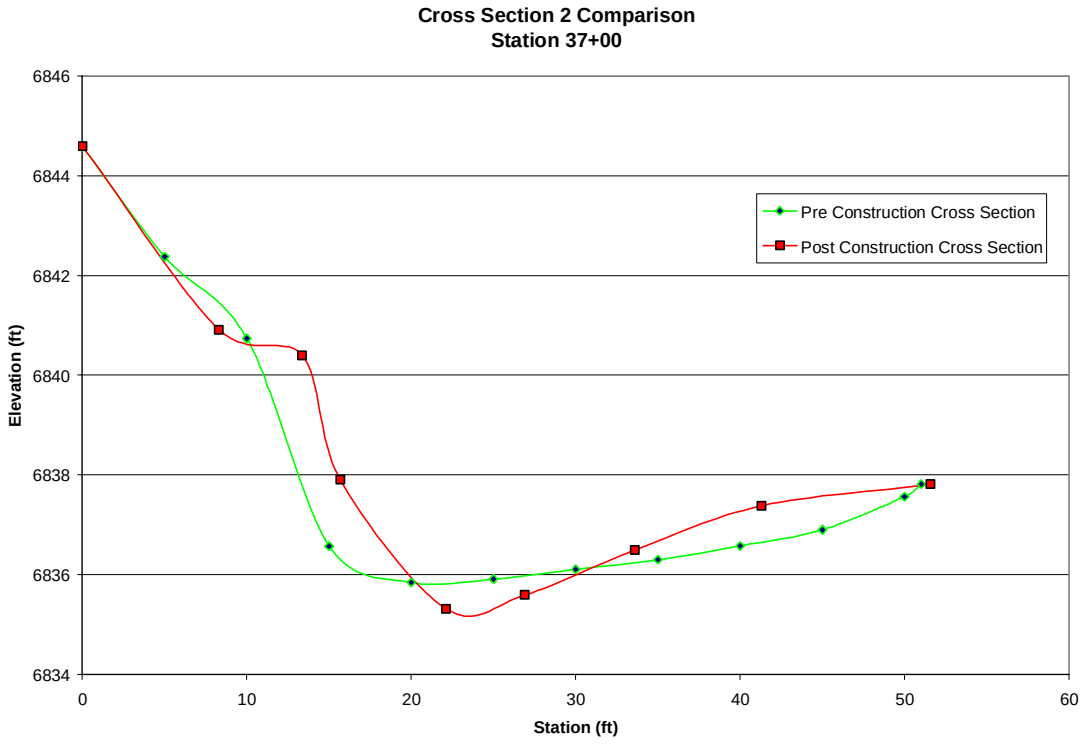


Cross Section #2

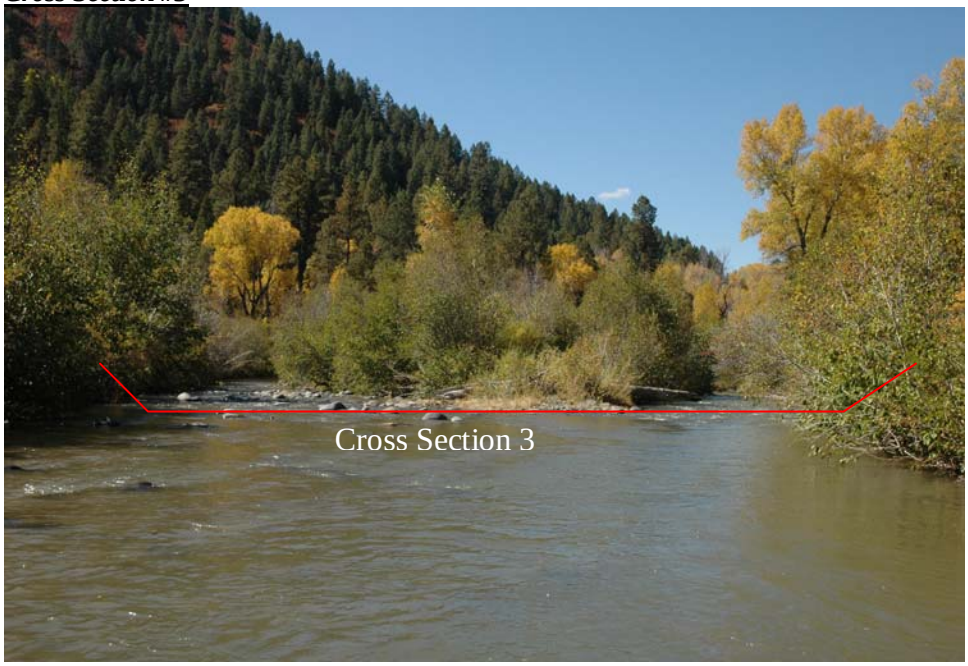


Cross Section #2 before construction looking upstream

Cross Section #2 After construction looking downstream. Newly constructed point bar river left and rock habitat clusters river right.



Cross Section #3



Cross Section 3 location before construction looking downstream.

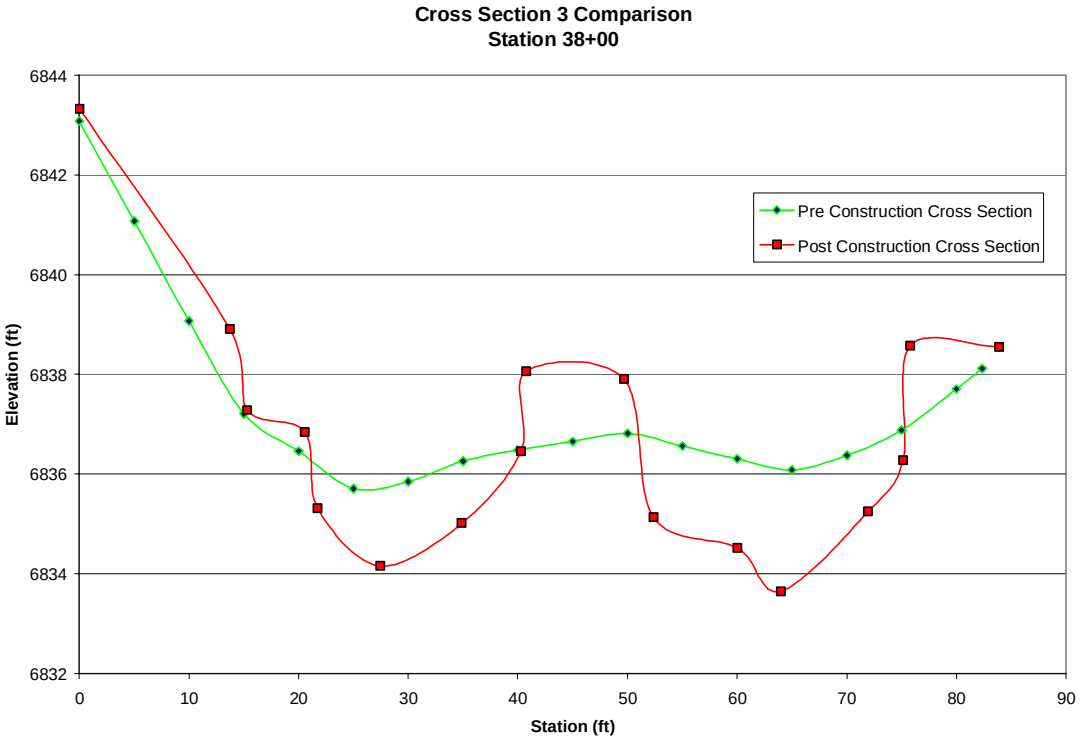


Table2 2009 Restored Section Benthic Survey

Date	6/11/2010
Project	Lbpoa Phase V
Location	River Station 50+00

Sample Rock Size 100-200mm

	Mayflies (Ephemeroptera)			Caddisflies (Trichoptera)			Stoneflies(Plecoptera)		Snails	Flies
Sample #	Baetid	Heptageniid	Ephemerellid	Limnephilid	Hydropsychid	Glossosomatid	Perlodid	Pteronarcid		Chironomid
1				2		6				
2				4		2				
3						2				
4						12				
5	1					4				
6	20					20				
7	6					12				
8						6				
9						30	1			
10	8					20				
11							2			
12						12				
13	8					15				
14	5					8	1			
15						8	1			
16	1					10				
17						7				
18	5					10	1			
19	4					10				
20	1					5	1			
Total	***59***	***0***	***0***	***6***	***0***	***199***	***7***	***0***	***0***	***0***

Both locations show a strong population of May flies and Caddis flies. Overall there appears to be a healthy benthic system in the in the restored sections of the Lower Blanco River.

Riparian Vegetation

The Lower Blanco River Basin has not had heavy grazing pressure for many years, and as a result the riparian vegetation remains very strong. As can be seen in the project photos most banks are well vegetated with Willows, Alders, Cottonwoods and Silver Buffalo Berry. Newly created gravel channel bars are collecting fine sediment and being inhabited by many volunteer riparian plant species. See photos below.

FUTURE PROJECTS:

The final phase of the Lower Blanco River restoration Project is planned for the 2010 construction season (late Summer & Fall). It is anticipated that another 2.0 miles of river will be improved. This work will begin where the Phase V project ended and will continue downstream and connect with another restoration project completed in 2006. This year it is anticipated that the Lower Blanco River, totaling nearly 10 miles, will be improved from the Highway 84 intersection to the confluence with the San Juan River.

Benthic Survey Data:

A general sampling of the benthic population was done by randomly inspecting rocks in the 100mm-200mm range. The sampling locations were rocky riffles located in the completed project area. The two areas sampled include a riffle section from the 2008 project and 2009 project.

Table 1 2008 Restored Section Benthic Survey

Date	6/11/2010
Project	Lbpoa Phase IV
Location	Upstream Durfee

Sample Rock Size 100-200mm

	Mayflies (Ephemeroptera)			Caddisflies (Trichoptera)			Stoneflies(Plecoptera)		Snails	Flies
Sample #	Baetid	Heptageniid	Ephemerellid	Limnephilid	Hydropsychid	Glossosomatid	Perlodid	Pteronarcid		Chironomid
1						40				
2			3			20				
3			5			8				
4						3				
5						7				
6		1	1			5	1			
7					1	30				
8			3			12				
9										
10						4				
11						8				
12						6	1			
13							1			
14			2							
15			4			4	2			
16						4				
17			1			4				
18			15			30				
19			20			12	1			
20						4				
Total	***0***	***1***	***54***	***0***	***1***	***201***	***6***	***0***	***0***	***0***

Appendix A
Pre-Construction Photos

Lower Blanco River Restoration Pre-Construction Photos 2009 Project

River Station 17+00. Looking upstream

River Station 24+00. Looking upstream

River Station 27+00. Looking upstream

River Station 28+00 Looking downstream

River Station 36+50. Looking upstream.

River Station 42+50. Looking upstream.

River Station 45+00. Looking upstream

River Station 45+00. Looking downstream.

River Station 48+50. Looking downstream.

River Station 51+50. Looking downstream.

River Station 57+00. Looking upstream.

River Station 57+00. Looking downstream.

River Station 61+00. Looking downstream.

River Station 66+50 Looking upstream

River Station 66+00 Looking downstream.

River Station 81+00. Looking downstream.

River Station 81+00. Looking upstream.

River Station 89+00 Looking upstream

River Station 97+00. Looking upstream

River Station 97+00 Looking downstream

River Station 106+00. Looking downstream

River Station 114+00. Looking upstream

River Station 117+00. Looking upstream

River Station 117+00. Looking downstream

Appendix B
Post-Construction Photos

Lower Blanco River Restoration Post-Construction Photos 2009 Project

River Station 17+00. Looking downstream

River Station 21+00. Looking downstream.

River Station 23+00. Looking upstream

River Station 25+00. Looking upstream

River Station 28+50. Looking upstream.

River Station 28+50. Looking downstream.

River Station 33+00. Looking downstream

River Station 35+00. Looking upstream.

River Station 41+00. Looking upstream river left channel.

River Station 41+50. Looking upstream river right channel.

River Station 42+50. Looking downstream.

River Station 44+50 Looking downstream.

River Station 45+50 Looking upstream

River Station 47+00. Looking upstream river right channel.

River Station 48+50 Looking downstream.

River Station 51+50 Looking downstream

River Station 57+50. Looking upstream.

River Station 61+00. Looking upstream.

River Station 61+00. Looking downstream.

River Station 66+50 Looking upstream

River Station 70+50. Looking upstream

River Station 75+00 Looking upstream

River Station 75+00. Looking downstream

River Station 81+00. Looking upstream

River Station 87+00. Looking upstream.

River Station 87+00. Looking downstream

River Station 90+00. Looking upstream.

River Station 90+00. Looking downstream.

River Station 95+50. Looking upstream.

River Station 95+50. Looking downstream.

River Station 99+00. Looking upstream.

River Station 99+00. Looking downstream

River Station 110+00. Looking downstream

River Station 115+00. Looking upstream

River Station 115+00. Looking downstream

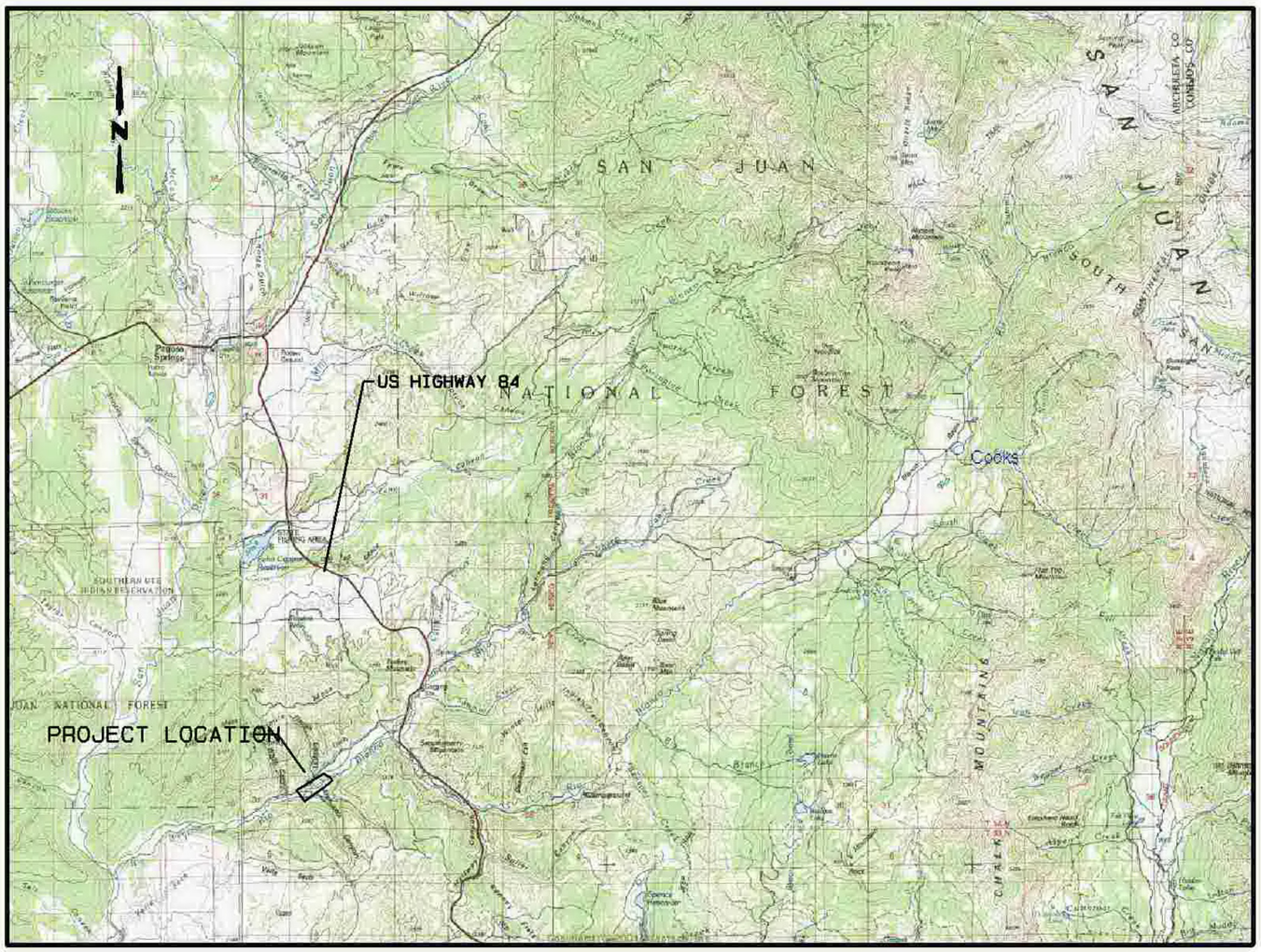
River Station 116+00. Looking upstream

River Station 118+00. Looking downstream.

Appendix C
As-Built Construction Drawings

River Restoration Plan
Lower Blanco River 2009 Construction
AS BUILT DRAWINGS

Archuleta County, Colorado



VICINITY MAP

Prepared for

LOWER BLANCO PROPERTY OWNERS ASSOCIATION

Index of Drawings

SHEET 1. Cover Sheet
SHEET 2. Layout Plan
SHEET 3. As Built Plan Sta 1+00-23+00
SHEET 4. As Built Plan Sta 23+00-41+00
SHEET 5. As Built Plan Sta 41+00-60+00
SHEET 6. As Built Plan Sta 60+00-86+00
SHEET 7. As Built Plan Sta 86+00-105+00
SHEET 8. As Built Plan Sta 105+00-119+00

AS BUILT DRAWINGS 6/2010

Riverbend Engineering, LLC
102 Third St. P.O. Box 2979 Pagosa Springs, CO 81147
Tel: 970.264.1195 FAX: 970.264.1196 Email: cphilips@frontier.net
5929 Pauline St. NM Albuquerque, NM 87107
Tel: 505.344.3315 FAX: 505.344.0696 Website: riverrestoration.com

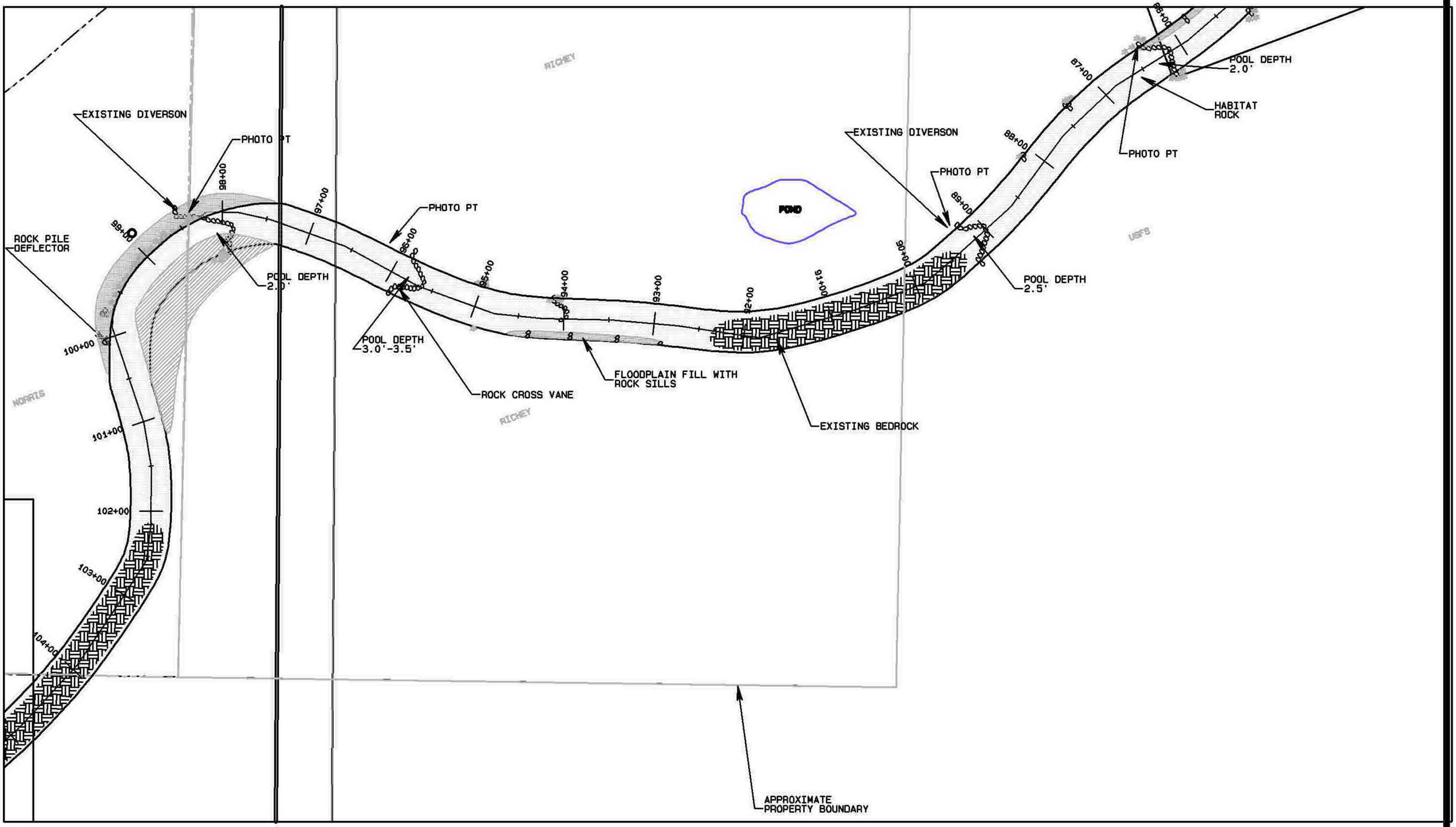
Blanco River Restoration, 2009

Lower Blanco River P.O.A.

COVER SHEET, VICINITY MAP, AND SHEET INDEX

Sheet 1 of 8

10.16.09



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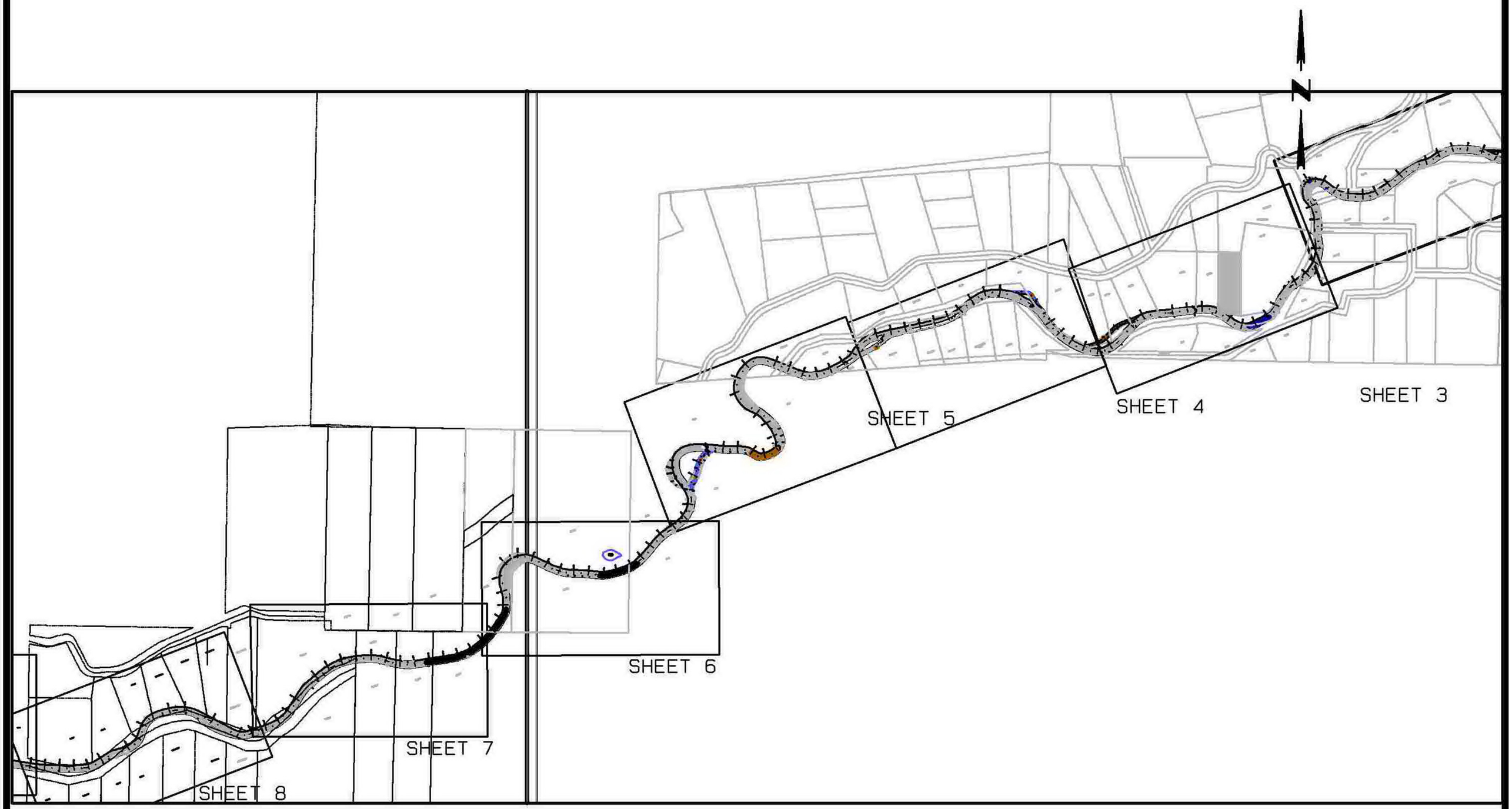
Blanco River Restoration, 2009	
Lower Blanco River P.O.A.	Sheet
PROPOSED IMPROVEMENTS STA 86+00 - 105+00	7 of 8
Scale: AS SHOWN	10-16-09



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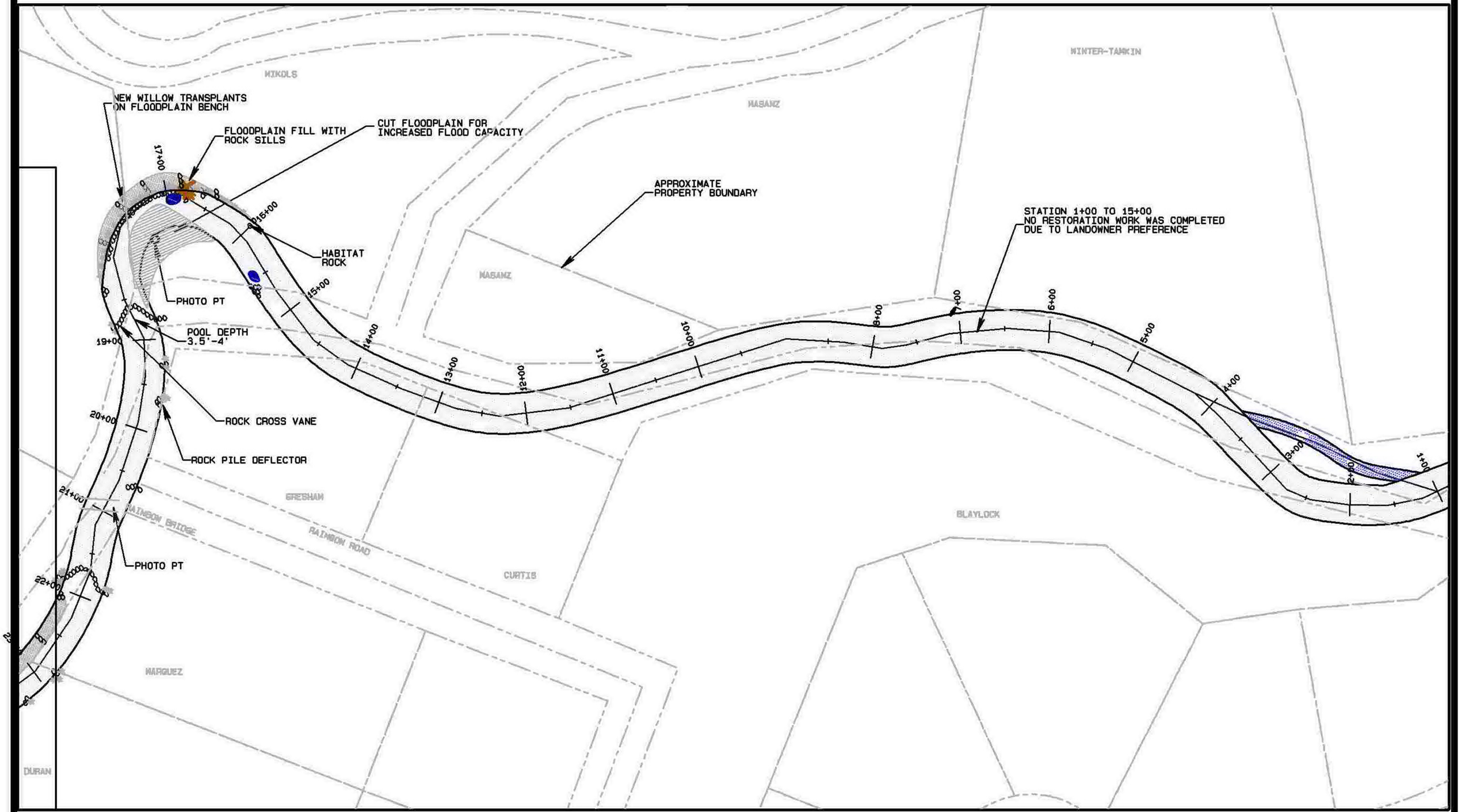
Blanco River Restoration, 2009

Lower Blanco River P.O.A.

SHEET LAYOUT PLAN

Sheet 2 of 8

Scale: 1" = 1000 ft | 10/15/09



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Blanco River Restoration, 2009

Lower Blanco River P.O.A.

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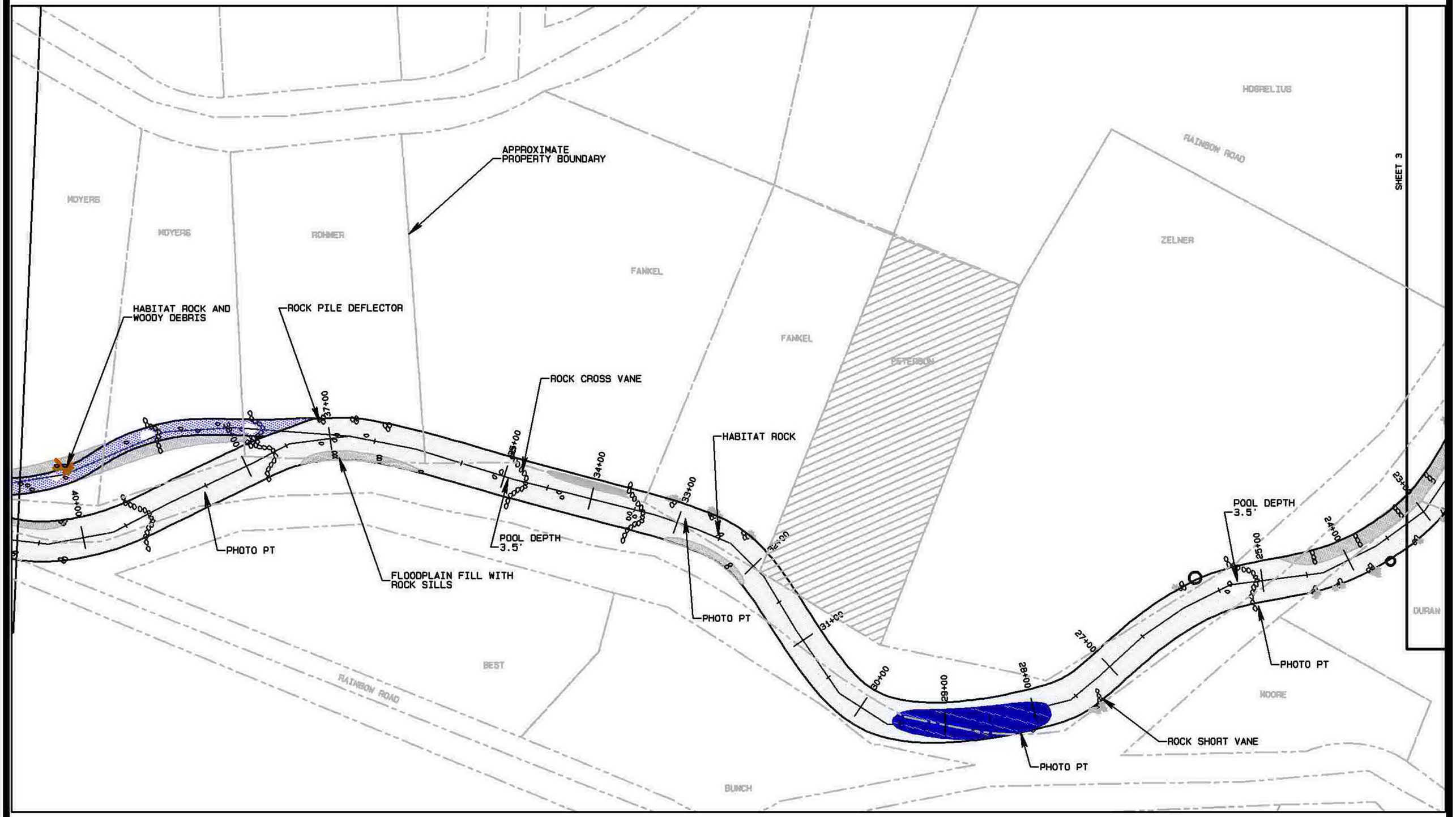
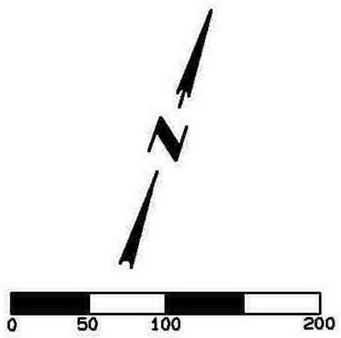
PROPOSED IMPROVEMENTS
STA 1+00 - 23+00

Scale: AS SHOWN 10-16-09





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Blanco River Restoration, 2009

Lower Blanco River P.O.A.

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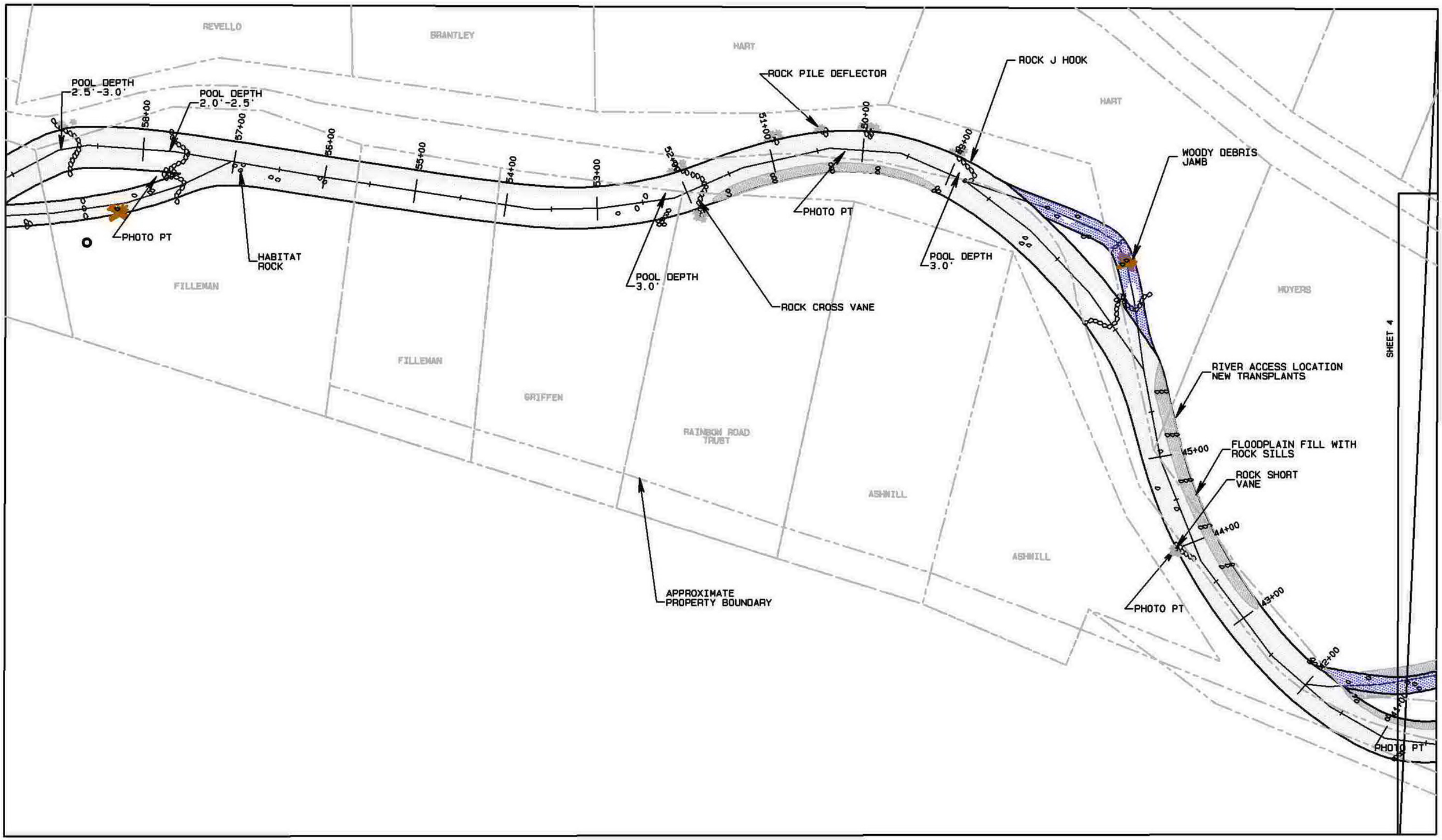
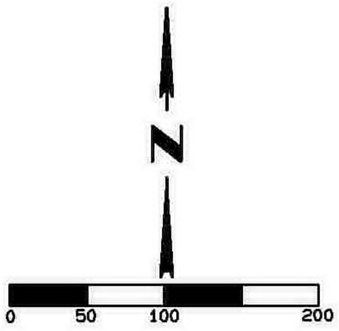
PROPOSED IMPROVEMENTS
STA 23+00 -41+00

Scale: 1" = 50 ft | 10/15/09





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Lower Blanco River P.O.A.

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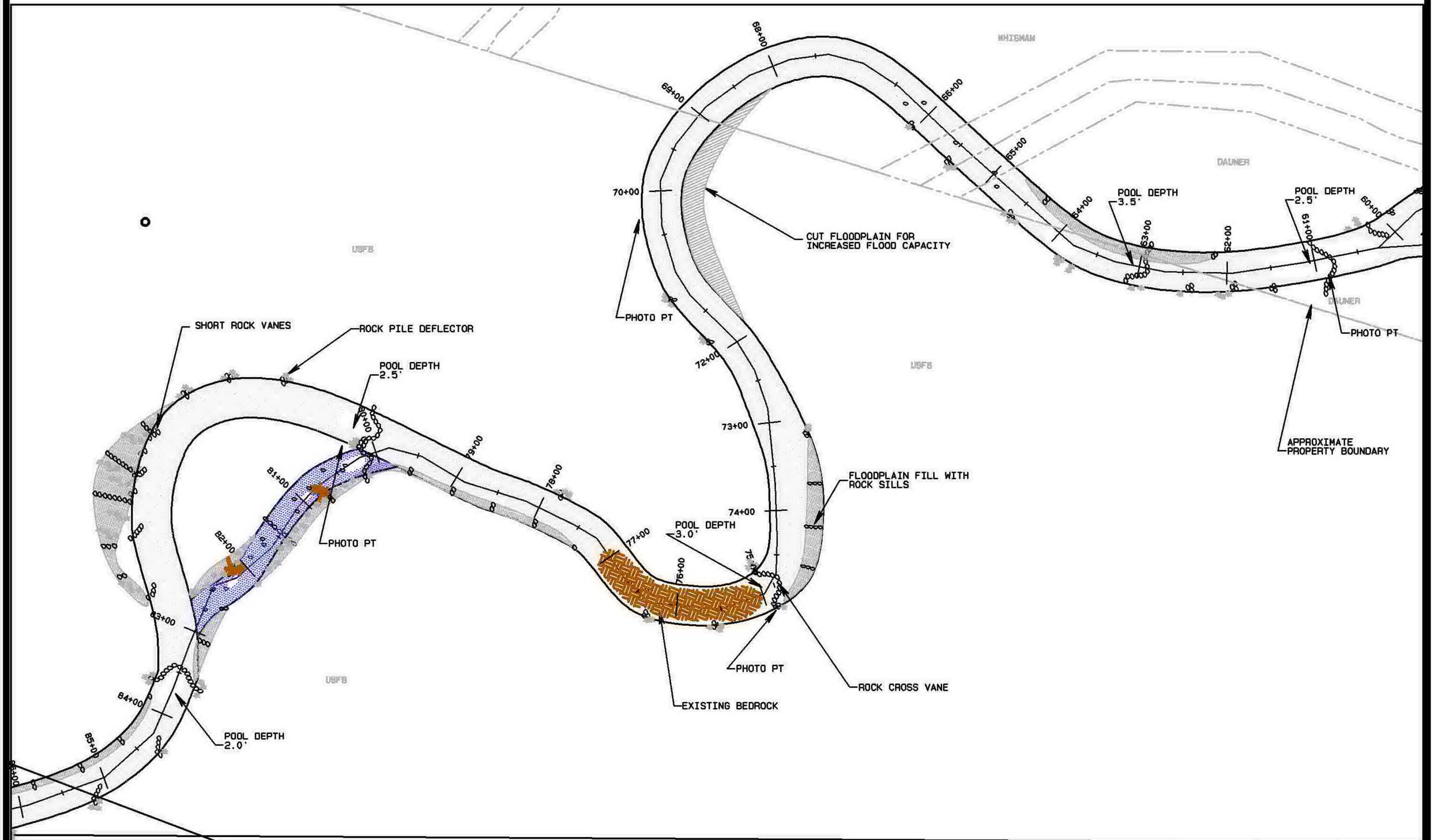
PROPOSED IMPROVEMENTS
STA 41+00 - 60+00

Scale: AS SHOWN | 10-16-09



AS BUILT DRAWINGS 6/2010

Riverbend Engineering, LLC

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Blanco River Restoration, 2009

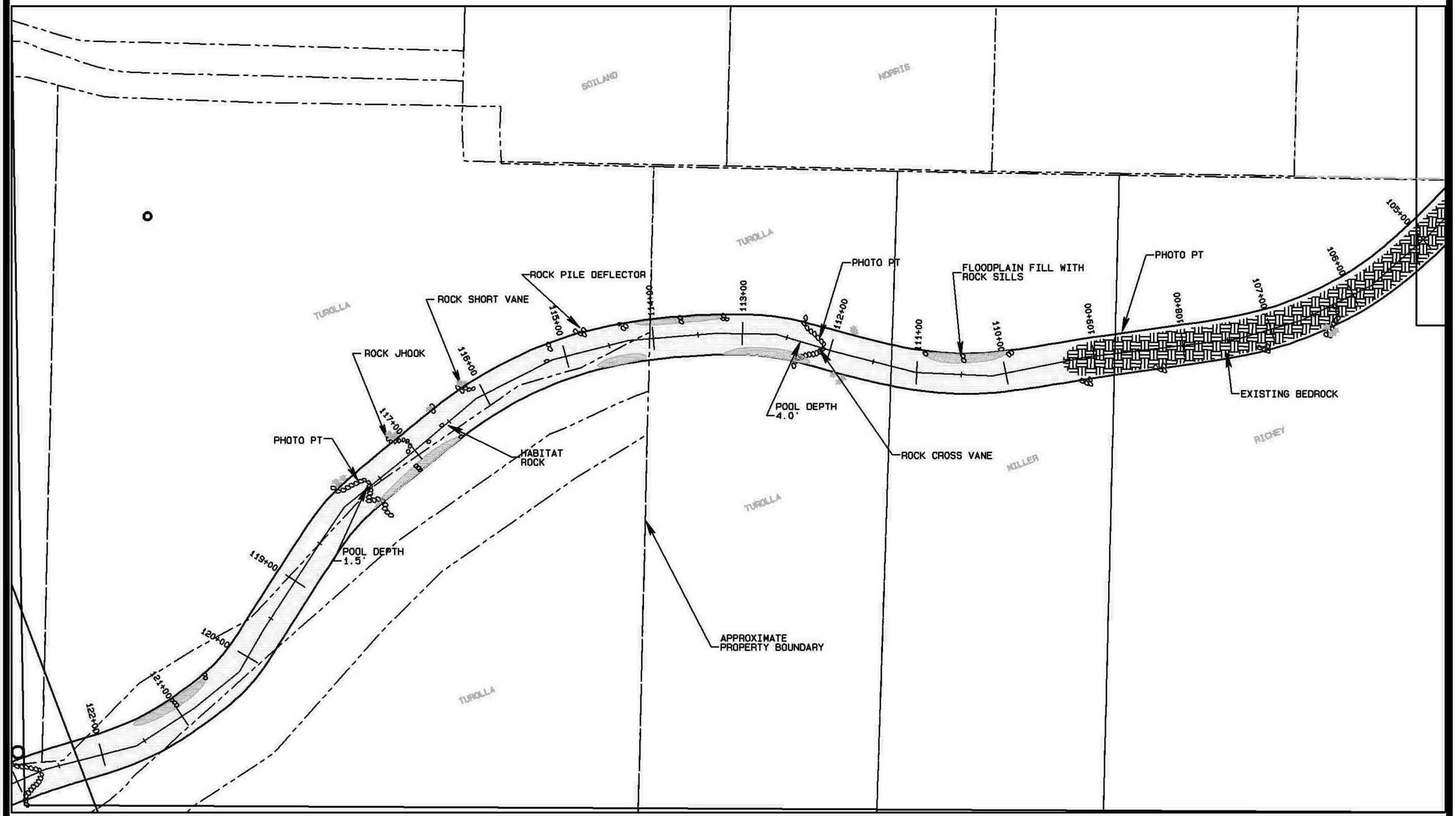
Lower Blanco River P.O.A.

Sheet 6 of 8

PROPOSED IMPROVEMENTS
STA 60+00 - 86+00

Scale: AS SHOWN

10-16-09



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Blanco River Restoration, 2009

Lower Blanco River P.O.A.

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PROPOSED IMPROVEMENTS
STA 105+00 - 119+00

Scale: AS SHOWN

10-16-09