RECLAMATION

Managing Water in the West

RIVER SURVEY ON THE RIO BLANCO

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INTRODUCTION

Two sections of the Rio Blanco were surveyed in October 2005: an upstream reach which is the 500 meter section of river immediately downstream from the Blanco Diversion Dam; and the downstream reach which constitutes approximately 6.5 kilometers (~4 miles) of river upstream from the Hwy 84 bridge crossing. The purpose of this study was to determine whether fine sediments activated during dredging activities at the diversion dam had the potential of settling downstream in gravel deposits used by spawning brown trout (*Salmo trutta*). Brown trout typically spawn in the fall by excavating a redd (nest) in gravel at the upstream end of riffles; the deposition of fine sediment in the gravel during spawning could adversely affect the trout eggs and larvae. The objectives of this study were to assess the transport potential of fine sediment in the Rio Blanco and survey the most likely locations for fine sediment deposition, the pools. Suitable spawning habitat was also evaluated.

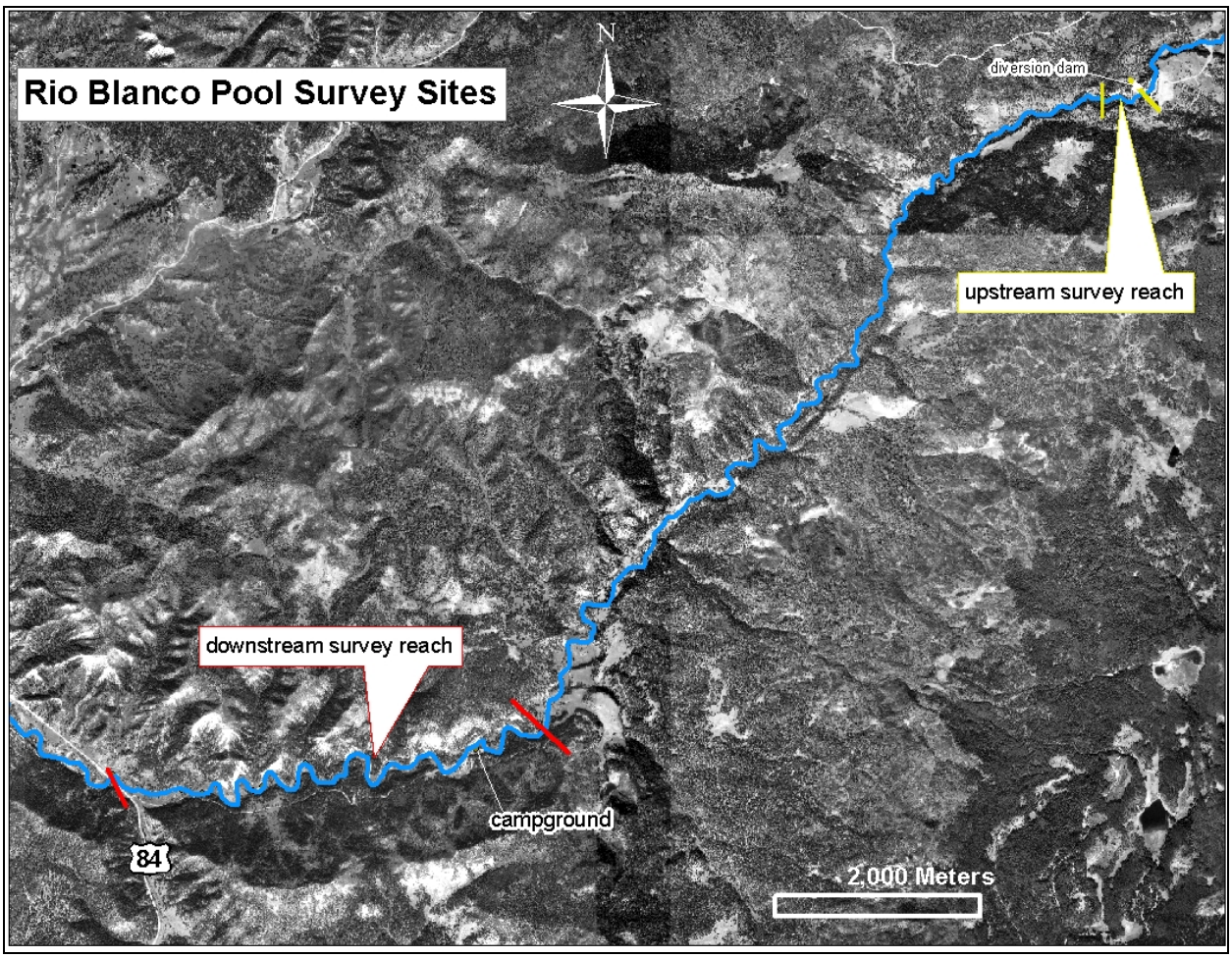


Figure 1: Site map of the Rio Blanco that was surveyed for pool and woody debris locations.

Methods employed consisted of assessing planform (i.e., cascade, pool riffle), mapping pool and wood debris locations, assessing current fine sediment deposition in the pools, and observing deposits of gravel sized sediment that could be used by a spawning trout. The pools and woody debris were mapped using a GeoXT Global Positioning System. These data were

post-processed and yielded location data with less than 1 meter accuracy. Current fine sediment deposition assessment was performed by wading into each of the pools and assessing the degree of filling by fine sediments. As no pools had significant filling, estimates of the percentage filled (V* measurements) were not performed. The type of pool (i.e., bedrock forced, wood debris forced) was noted for each pool mapped. Although several patches of gravel-sized sediment were observed in the downstream reach, each patch was associated with woody debris, so they were mapped in associated with the woody debris rather than as their own category. The high resolution orthoimagery (NAD83 UTM) was downloaded from the U.S Geological Survey website (http://seamless.usgs.gov/).

UPSTREAM REACH DESCRIPTION

The Upstream Reach, which is located immediately downstream of the diversion dam, is a relatively high gradient reach of river (0.037 m/m). This section of river is highly confined by the valley walls on both sides of the channel. In the few locations where a valley wall is not directly impinging the river channel, a tall terraced surface is confining the channel. The planform consists of both steps and cascades with sections of plainbed (run) morphology between the steps (cover photo and Figures 2-4). The grain size ranges from very large boulders to cobbles; some gravel deposits were found on top of tall bars (Figure 5). The very large boulders often formed steps and cascades with small boulders and cobbles depositing around them. The smaller boulders and cobbles were most often found along the edges of the bankline, behind the large boulder, or in the plainbed sections.

Figure 2: Large boulder forced step with downstream pool formation; Upstream Reach of the Rio Blanco about 400 meters downstream from the diversion dam.

Figure 3: Small boulder steps around large boulders in the Upstream Reach of the Rio Blanco about 200 meters downstream from the diversion dam.

Figure 4: Medium-small boulders and cobbles in a plainbed section in the Upstream Reach of the Rio Blanco about 500 meters downstream from the diversion dam.

Figure 5: Gravel and cobble deposits on top of a tall bar in the Upstream Reach of the Rio Blanco.

Gravel was predominantly absent from the sediment deposits in the river channel, however some were found on top of tall bars that appear to be above the high water mark (Figure 5). The high water mark is presumably the bankfull mark from the 2005 spring runoff as the 2005 runoff event was significantly large (pers. comm. E. Olivas, October 2005). Finer grained sediment, such as sand and silt, was completely absent in this reach of river.

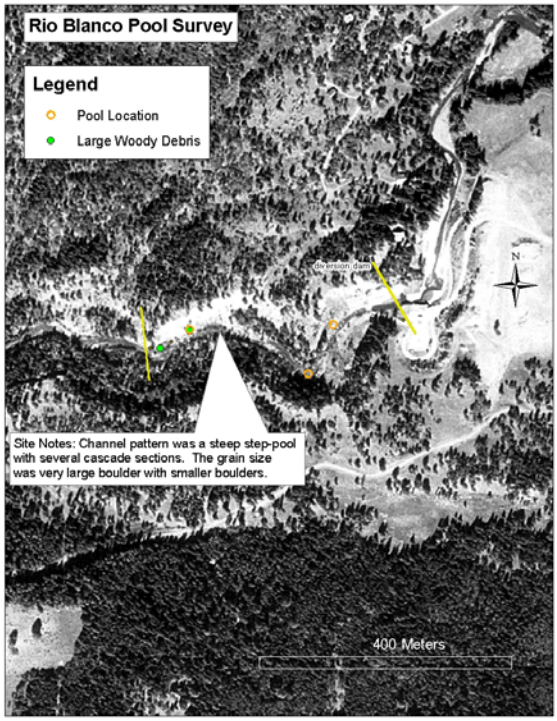


Figure 6: Site map of the Upstream Reach on the Rio Blanco, located immediately downstream from the diversion dam.

Only 3 pools were found in the upstream reach (Figure 6), and each of these pools were forced by a very large boulder step/cascade (Figure 2). Although two pieces of woody debris were mapped in this reach, neither were influencing the low-flow channel morphology (Figure

2). Fine grained sediments were not found in any of the pools nor were they observed in the sediments surrounding the woody debris.

DOWNSTREAM REACH DESCRIPTION

The Downstream Reach extends immediately upstream of the Hwy 84 bridge crossing (Figure 1) about 6.5 km (~4 miles). This section of stream is lower gradient (0.011m/m) than the Upstream Reach and appears to be more likely to be responsive to finer grained sediment inputs. The valleys walls are more set-back in this reach than upstream, however, large terraces and tributary fans fill the valley bottom to maintain a tightly confined channel reach. The planform consists mainly of a pool-riffle sequence with sections of plainbeds and braides (Figures 7-10).

Figure 7: Shallow pool in the Downstream Reach on the Rio Blanco.

Figure 8: Split channel (braid) with downstream plainbed section; Downstream Reach on the Rio Blanco.

Figure 9: Channel-spanning alluvial pool (bank forced) with steep riffle immediately upstream of the pool; Downstream Reach on the Rio Blanco.

Figure 10: Valley wall forced, long, deep bedrock pool; Downstream Reach on the Rio Blanco.

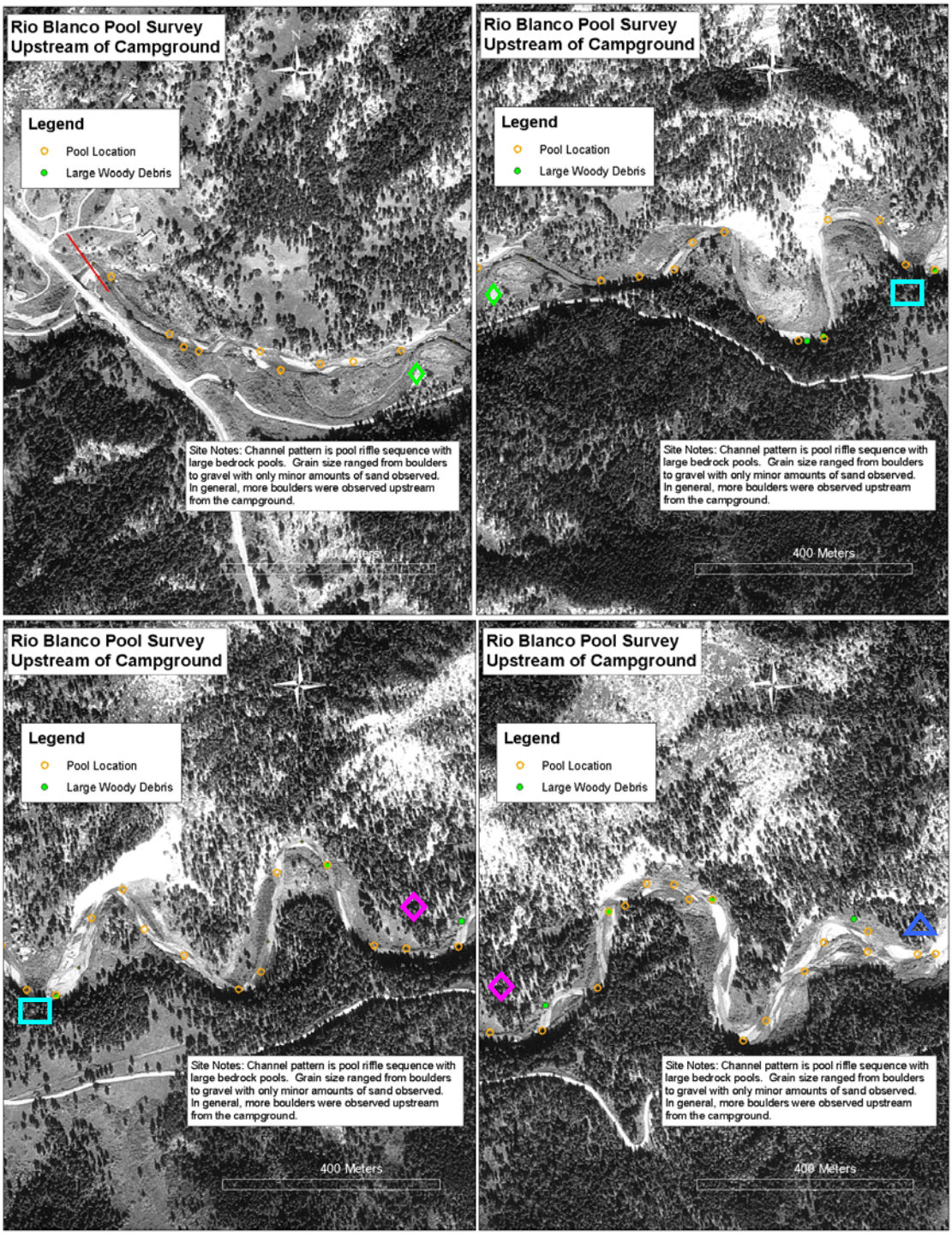
The sediment within the low-flow channel, which is mostly cobbles and boulders, is coarser than that found on the exposed bar surfaces. The bars consist primarily of cobbles and very coarse gravel (Figure 11), with some small boulders. Although pebble counts were not conducted, the plainbed sections contained sediment noticeably larger than that found in the riffles; the plainbed sections contained more boulders than observed in the riffles. Gravel is present in this reach, however, large patches of gravel were limited to hydraulic shadow zones (sheltered areas); the most common of these features (n=7) were log jams or woody debris (Figure 12).

In 2005, several shallow, rapid landslides, originating from the valley walls deposited directly in the river channel. All of the deposits contained large trees and formed log jams in the river. These log jams are channel spanning jams and have forced sediment deposition in and around the woody debris. In most cases, a large volume of gravel is present at each jam, as well as deposits of sand in the most hydraulically sheltered areas. As silt sized sediment is not found around these structures, the jams did not appear to dam the river channel during spring runoff,

but rather slowed the water enough to deposit smaller grain sizes (e.g., gravel and sand). The woody debris in these jams is also functioning at low flows, predominantly forming deep pools (1+ meter water depth).

Figure 11: Picture of cobbles and very coarse gravel deposited on a point bar; Downstream Reach on the Rio Blanco.

The pool-riffle pattern dominates this section of the Rio Blanco; 63 pools were mapped in this reach, an average of 9.7 pools/km (15.8 pools/mile). The pools were defined as features in which the water deepens with a flow velocity near zero at some location in the pool area. The minimum pool depth was approximately 20 cm water depth, with most pools 40-50 cm. Pocket pools, pools that do not span at least half the channel width, were not mapped. With few exceptions, the pools were free of fine sediment deposits, so V* measurements were not taken. The riffle crests for most of the pools were cobbles, however, the substrate at the maximum pool depth varied from bedrock to boulder/large cobble. The pools tended to be laterally forced, either by the bank/terrace or the valley wall; nearly every log jam forced at least one pool.


Rio Blanco Pool Survey
Upstream of Campground
Legend
Pool Location
Large Woody Debris
Site Notes: Channel pattern is pool riffle sequence with large bedrock pools. Grain size ranged from boulders to gravel with only minor amounts of sand observed. In general, more boulders were observed upstream from the campground.
400 Meters

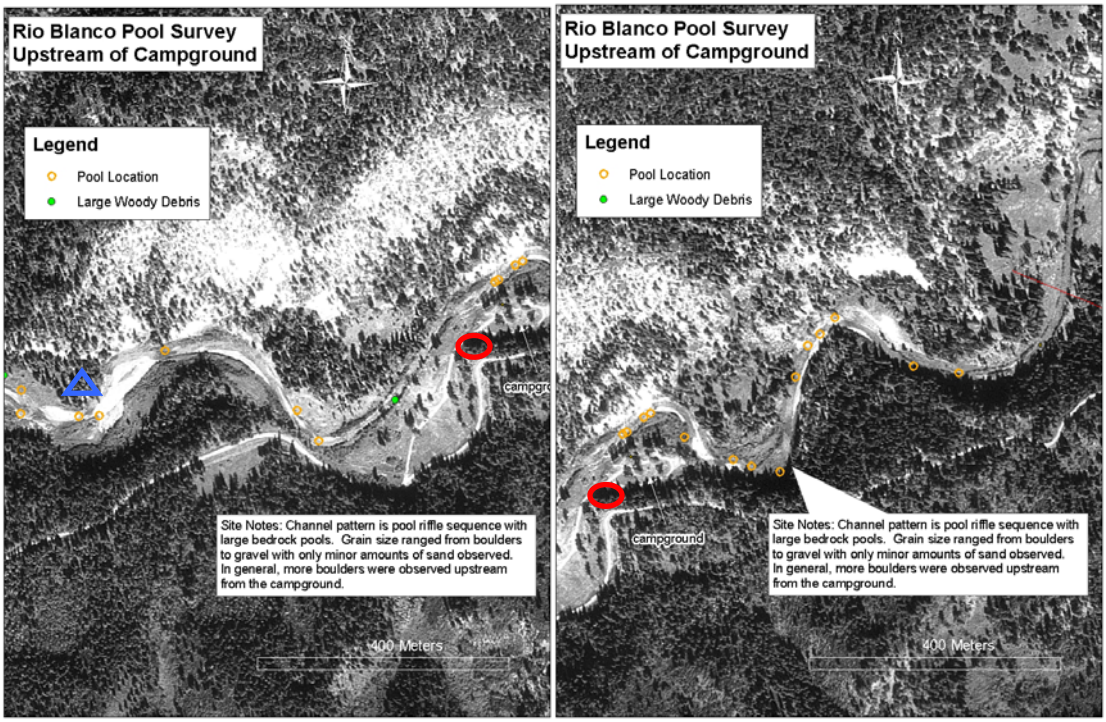


Figure 12: Spatial location of each pool and woody debris mapped; Downstream Reach on the Rio Blanco. Colored symbols are used to locate identical locations between photos.

BROWN TROUT SPAWNING HABITAT

Brown trout (*Salmo trutta*) habitat is limited in two ways: 1) the availability of spawning gravels and 2) the availability of general habitat for food production. The stream gradient produces water velocities sufficient to transport coarse and fine sediments rapidly through the area with little gravel deposition. Brown trout redds are typically found in gravel deposited at the upstream end of riffles or immediately downstream of pools. The limited amount of coarse gravel in the lower reach at the observed base flows indicates spawning areas are reduced to small patches. Logjams did create some low velocity areas where coarse / medium gravel accumulated; a single small patch of gravel was observed at the downstream end of a logjam that could serve as potential spawning habitat for brown trout. The restricted distribution of suitable spawning gravel probably limits brown trout spawning opportunities. Sedimentation at the potential spawning area is not a limiting factor on spawning success.

The alternating pool-riffle planform of the Downstream Reach of the Rio Blanco provides basic habitat for brown trout though they may prefer lower water velocities. The coarse substrate throughout the channel provides limited structure for primary (algae) and secondary (invertebrates, fish) productivity. Deposition of organic material (leaves, wood) in the wetted channel is another limiting factor for stream productivity. The limited distribution of gravel predominantly around logjams (at base flows in the Downstream Reach) indicates limited suitable substrate and habitat for primary and secondary productivity. Limited habitat for food production is likely a limiting factor for brown trout populations in the Rio Blanco.

The stepped cascade/step pool planform of the Upstream Reach has limited brown trout habitat relative to the Downstream Reach. The steep gradient and few pools provides habitat for lower numbers of brown trout compared to the Downstream Reach.

SUMMARY

Upstream Reach:

- Steep cascade/step pool planform with very large boulders controlling steps.
- No gravel suitable for brown trout redds was found in the low flow channel.
- Pools are rare.
- Fine sediment completely absent.
- Additions of fine sediment will be rapidly transported out of the reach even at low flows.

Downstream Reach:

- Pool-riffle to plainbed planform with mostly a cobble and coarse gravel substrate.
- Gravel and fine sediment are absent in the riffles and plainbed sections where brown trout would spawn.
- Most gravel deposits are located on the tops of bars which are outside the low flow channel.
- Large volumes of gravel are found around the logjams but there are few logjams (~1 per km).
- Numerous pools are present; pools are currently flushing fine sediment (no filling of sediments).

CONCLUSIONS

Based on the findings in this survey, dredging activities at the Blanco diversion dam do not appear to impact spawning brown trout in the Rio Blanco. Since no suitable spawning gravel was present in the wetted low flow channel in the Upstream Reach, there is no potential for fine sediment deposition impacts to brown trout redds in this reach. The Downstream Reach, even though it could be more responsive to fine sediment accumulation, appears to rapidly transport fines downstream. Although pools are typically the first location of fine sediment deposition, none of the pools in this reach have measurable fine sediment deposition, even the pools immediately downstream from the landslides (a point source for fine sediment). Since fine sediment is not found elsewhere in the reach, a temporary addition of fines is not likely to cause adverse affects to the pools. As gravel deposits are usually outside the low-flow channel, deposition of any fine sediment will not impact spawning gravels for the brown trout.