HEALTHY RIVERS AND STREAMS CITIZENS ADVISORY BOARD
Regular Meeting
530 E Main St - Plaza 1 Meeting Room
Aspen, CO 81611
September 19, 2013 - 4 p.m.

4:00	Board Comment	
4:05	Public Comment	
4:10	Additions/Deletions to Meeting	
4:15	Approval of Minutes June 20, 2013 August 8, 2013	
4:20	Chase Park Grants Proposal Proposal for grant application work on RICD and other projects	Tia Cavendar – Chase Park Grants LLC
4:40	Cow Stomp Funding	Dorothea Farris - Crystal Valley Environmental Protection Association
4:50	Discussion on the Coordinated Fryingpan River Assessment	Sharon Clarke– Roaring Fork Conservancy
5:15	Budget Discussion Formal Recommendations to BOCC for 2014 of potential funding items: North Star Economic Study Kayak Park Misc. Water Rights Acquisitions	
5:45	Study of conditional rights for transbasin diversions from the Roaring Fork	

<u>Upcoming meeting dates:</u>
October 17 place to be determined. Will not be in Plaza 1.
November 21
December 19

Agenda items subject to change
All times are subject to variation without notice

HEALTHY RIVERS AND STREAMS CITIZENS ADVISORY BOARD

Meeting Minutes
June 20, 2013– 3:30 p.m.
Avalanche Ranch
Redstone, CO 81623

River Board members present: Lisa Tasker, Bill Jochems, Andre Wille, Dave Nixa
Rick Neiley, Ruthie Brown

River Board members absent: Greg Poschman

Others present: Lisa MacDonald, John Ely, Dale Will

Board Comment –
Mr. Nixa attended the Grace Shehi ditch improvement meeting Tuesday, June 18th. It was an organizational meeting. SGM is managing the project and they are looking to form a ditch company which will make it easier to manage. There was discussion on how it is a watershed project. Phase I and Phase II of the feasibility study are not far out as far as completion.

Chairman Jochems noted the conference in Gunnison in July and encouraged other Board members to attend.

Public Comment - None

Additions/Deletions to Agenda –
Approval of minutes from the April 25 and May 2, 2013 meetings were added to the agenda.

Approval of the Minutes
Ms. Tasker moved to approve minutes of April 25, 2013 meeting. Mr. Wille seconded the motion. The motion passed 5/0.
Mr. Wille moved to approve minutes of May 2, 2103 meeting. Ms. Tasker seconded the motion. The motion passed 5/0.

Roaring Fork Conservancy Funding Request – Crystal River Assessment and Design Project. – Sharon Clarke
Ms. Clarke provided the Board with information on the Crystal River Assessment and Design Project for which they are seeking a $25,000 contribution from the River Board.

Mr. Nixa moved to incorporate Sharon Clarke's and Rick Neiley's comments into the submission for approval of funding for $25,000 with $12,500 to be disbursed in 2013 and $12,500 to be disbursed in 2014. Mr. Jochems seconded the motion:

Coal Basin is the worst issue in the watershed. RFC is focusing on the Crystal River, partly because it contributes so much of the water to the whole Roaring Fork. But they also see this as a prototype for how we would go about in other areas, if we can figure out how best to do some of these innovative things then when we go to other areas we can implement those with some kind of proven track record.

To the extent that the commissioners or a commissioner may feel that we've focused an undue amount of attention on this valley, we note that Pitkin County Open Space and Trails has spent millions of dollars to acquire a lot of land up there and this board has authorized the expenditure of hundreds of thousands of dollars in litigation costs to keep the water in this valley in connection with the West Divide project, which is money really well spent.

When we see a group like the conservancy. garnering a lot of support from a lot of corners of the State and bringing in significant amounts of money, we have to support it because if we don't those efforts will dissipate, those funds will go elsewhere and we won't get the results that we want in the big picture.

This is one area where the county has historically focused a lot of its open space and trails and water funds if we can improve the most degraded watershed in the county, even marginally, if we can understand it better, then we've spent the money wisely and we have fulfilled the goals and objectives of this program.

We are not focusing on this to the exclusion of other areas. but when these opportunities arise, we actually have to address them and if they fit in the parameters of the program we will gladly fund them.

The request was scored found to be complete and consistent with the program objectives. The River Board unanimously recommended approval of an expenditure from their funds of $25,000 of which $12,500 will be dispersed in 2013 and the remaining $12,500 will be dispersed in 2014.
The motion passed 4/0 with Mr. Neiley abstaining.

Ms. Brown joined the meeting at 4:44 p.m.

Roaring Fork Gorge Management Plan Background – Dale Will – Open Space & Trails Director
Mr. Will introduced the Board to the proposed Roaring Fork Gorge Management Plan process. The plan will encompass the detailed inventory, analysis and planning for six different properties: Red Butte Ranch Open Space, Airport Ranch, the Denver/Rio Grande Railroad corridor, Mills, Stein Park and Stein Riverside Park. Gold Butte and Wilton Jaffee Sr. Park are both located in the planning area and each have their own management plans with which we will be sure to coordinate with.

Open Space and Trails ("OST") staff has started the process, working with City of Aspen staff, to conduct a thorough inventory of the six properties, mapping all the existing conditions. They will meet with all the different user groups and communities that currently utilize the properties in the Gorge, (Boating, Angling, Climbing/Ice Climbing, Road biking, Mountain biking, Equestrians, Bike Rental Shops, Hiking/Running/Walking, Commuters, Nordic users, etc.), as well as the adjacent property owners and residents. The goal of the meetings is to learn and map how the groups currently use the Gorge area and to understand any requests they have for the future planning and management of this area.

Mr. Will encouraged the River Board to plan a site visit of the area with OST staff and weigh in on the plan. They will provide summary and status reports of forums as it relates to the board's mission and as biological information becomes available he will also provide that.
Staff will coordinate a site visit with OST.

Report of Financial Committee – Dave Nixa, Ruthie Brown and Rick Neiley
The financial committee has met twice and began looking at financials and how to use that data to make decisions and how we can effectively organize that data and make better decisions and have knowledge of where our resources are coming from and how we are spending that money.
The committee also looked at priorities of the Board. It was recommended to look at the entire list and focus on the highest priorities first.
Criteria was also reviewed that is used to evaluate grants and awards. There are some recommended changes in terms of adding criteria and eliminating some of the scoring approach.
The Committee will continue to work on edits to the grant criteria, priorities and budget documents.
The Committee also came up with some changes to the way the meetings are conducted. Limit public comment, have agenda start and stop times.

Stapleton Brothers Change Case and West Divide Conditional Water Rights Diligence Application Opposition – John Ely
Mr. Ely updated the Board on the Stapleton Brothers change case and the West Divide Project and asked for a motion to accept the terms of resolution of both items.

Mr. Neiley moved to endorse the settlement stipulation and final decree in the Stapleton Brothers Change of Use Water Application Augmentation of Streamflow within Maroon Creek and Roaring Fork River and forward that recommendation to the Board of County Commissioners. Mr. Wille seconded the motion. The motion passed 6/0.

Ms. Brown moved to endorse the proposed resolution of the County's opposition to the West Divide Project and forward that recommendation to the Board of County Commissioners. Mr. Wille seconded the motion. The motion passed 6/0.

Mr. Neiley moved to adjourn the meeting. Mr. Nixa seconded the motion. Motion passed 6 to 0.

Adjourn

The meeting adjourned at approximately at 7:30 p.m.

Approved:

_____

Bill Jochems – Chairman
Healthy Rivers and Streams Board

Attest:

_____

Lisa MacDonald

MINUTES
HEALTHY RIVERS AND STREAMS BOARD JOINT MEETING WITH THE
OPEN SPACE AND TRAILS BOARD
August 8, 2013
Plaza One Meeting Room: 530 E. Main St., Aspen

HRSB Present: Bill Jochems, Ruthie Brown, Lisa Tasker, Greg Poschman, Dave Nixa
HRSB Absent: Andre Wille and Rick Neiley
OSTB Present: Anne Rickenbaugh, Howie Mallory, Hawk Greenway, Tim McFlynn
OSTB Absent: Tai Jacober
Staff Present: Dale Will, Fran Soroka, Paul Holsinger, Laura Maker, John Ely, Lisa McDonald

BOCC Present: Michael Owsley, George Newman

Presenter: Amy Beatie, Colorado Water Trust

Others Present: Elizabeth Boyles, Edgar Boyles, Peter Martin

The joint meeting was called to order at 4:04 p.m. in the Plaza One Meeting Room

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Colorado Water Trust (CWT) Executive Director, Amy Beatie began her presentation with a short video that demonstrated how CWT's drought lease program works. The video followed a successful CWT drought lease purchase project with the Upper Yampha Water Conservancy District. The video demonstrated six project benefits.

- adequate flows to maintain hydropower at the dam
- formal in-stream flow protection
- recreation, aesthetic, piscatorial river benefits through the City of Steamboat
- agricultural water
- Delivering water to Tri-State (power generation plant) in late season.
- incidental in-stream flow benefits for 50 miles at 26 cfs

A copy of the video can be obtained through OST administrative office.

CWT's power point presentation 'Request for Water 2012 & 2013: How it Works' is made part of this record as 'Exhibit A'. The minutes follow the presentation by slide number and reflect additional presentation information and discussion.

Formed in 2001 the CWT is a private, nonprofit organization dedicated to protecting and restoring stream flows in Colorado through voluntary, market-based efforts. CWT does not create policy; their mission is to put projects on the ground.

Slide 6: State's in stream flow program chart. Division of Water Resources (DWR) administers water rights. Division of Water Conservation (CWCB) formed in 1937 has multiple objectives

and is home of the State's in stream flow program. Division of Water Quality (DWQ) is separate but future intention is to integrate with DWR and CWCB.

Slide 11: Types of Acquisition: Legal instruments listed in 'black type' are required go before water court. Only 'Short term leases' are not required to appear in water court. Short term leases are the CWT leasing program also known as the '3-in-10' Lease Program (Slide 12).

Slide 12 and 13: Further explanation about the '3-in-10'Lease Program: The 2002 drought prompted the creation of statutes to enable temporary water right loans and short term leases. The State's In Stream Flow (ISF) Program was uncertain if ISF had the statutory authority to receive water from water right owners. In 2003 Colorado legislature created a state statute to allow water right owners to loan water to CWCB for use as instream flows. This legislation allows the temporary quick transfer with administrative approval to move water into the State's instream flow program. This all started by a water user's interest to move his water shares into the instream program during the severe drought of 2002.
The lent water can only be used for 3 years out of a 10 year period; it may only be used for 120 days of each use year; and may only be used for instream flows within that 10 year period after which any continued use will require going to water court. The administrative approval process is a 25 day process from submission to determination consisting of 5 days for the State's ISF Program staff to determine instream flow benefit; 15 days of public notice; 5 days for Division of Water Resources to determine no injury and assure water rights would be administrable. CWCB also interprets if the instream flow is water short and can be in filled. The Lease Program can only be used within the ISF Program's identified streams.

Questions: Are guidelines followed for determining river health? For the leasing program the fact that only existing instream flow streams are watered means pre-determinations have already been defined for healthy flows, existing natural environment, and how much water is need to sustain these qualities. (R2 Cross process and other determination processes for cold water)
Leasing program participant's water rights are protected from abandonment claims and their state consumptive use records are suspended during their leasing program participation.
The leasing program maintains the health of the individual water right holder's state records.

Slide 14-23: CWT Leasing Program Background. 2012 CWT had launched a new strategic plan. 2012 Snowpack conditions were expected to be similar to 2002 drought conditions. CWT is keeping track of water conditions noting continued declines. With CWT increased staff capacity they were able to identify 21 priority basins expecting to be water short. April 23, 2012 CWT released their instream lease program. CWT created a website containing program information and forms. Deadline for applicants was May 11th. Applicants went through a multi-layer screening process and the first year 4 leases were approved and used to meet ISF water rights. West Water Research was hired to determine water rights valuation. Lease program in essence pays twice; once within 10 days of the State's approval and at the end of the irrigation season. First lease approval was the Upper Yampa Water Conservancy District (UYWCD) July 11, 2012 and the subject of the meeting's introduction film. (Slide 23) The total process condensed the previous process which would have involved multiple years in water court. Each lease is a unique contract with a non-binding term of renewable use. All applicant analysis is confidential. What CWT learned from the first year of the lease program was that community support sprung

up as inflow lease release efforts began. Community support was demonstrated by some folks not taking a second cutting and local cities deciding to manage their water rights differently to enhance the inflow release efforts.

Question: How does CWT fund the lease program and how much money is changing hands through the leasing program?
Lease examples slides 23, 25, 26 and 27. The UYWCD lease was $140,000 at a rate of $35 an acre-foot lease. Flow that was delivered to Tri-State for use at the Craig Station then was reimbursed back to CWT at $28 an acre-foot. CWT raised all instream lease program funds privately through donations or grants in three months.

Slide 28-34: Challenges, successes and applying what was learned. CWT learned the best and most accurate public relations outreach for the lease program was through CWT staff. The lease program was quickly built, funded and implemented. An outside firm was hired to audit the entire process including applicant/participant interviews, collecting feedback, concluding with an audit document and executive summary. One audit recommendation was to start the program earlier and give an application window to receive applications. Engage communities for larger flow restoration projects. The 2013 lease program was released March 6th. March 29th to May 3rd was the application window.

Slide 35: Clarifications:
Transferring diversions – The lease program is actually transferring diversions not only transferring the historical consumptive use. These transfer projects diversions can be transferred from the point of diversion to the point of return flow. Every project is a transfer of a diversion.
Payment – All entities that wanted to be paid were paid and CWT raised enough funds to keep paying for more projects went live.
Voluntary and market-based – All projects are voluntary and valuations are market-based.
Transaction costs – CWT covered all the related transaction costs enabling the projects to be transaction cost neutral.
Fallowing Impacts – Agricultural fallowed projects were not negatively impacted.
Adding flexibility and choice about how to use water: The program is adding flexibility and choice for water right holders and how they want to utilize their water rights.

Questions:
Once the water is leased is it absolute and CWT owns it until that time is up? CWT is flexible about how projects are implemented. Using irrigation water right as an example: if that water right is leased to CWT and somebody doesn't actually use the irrigation water right then CWT can use the water in the instream program. Most of the projects could have gone back to irrigating if something catastrophic had occurred. Idea behind these projects is to work collaboratively to produce the best project outcomes.

From the presented project examples, it does not appear the leasing program would be applicable for Aspen or Pitkin County because water diversions are to Twin Lakes and Turquoise Lake, the water is still going in the other direction for dedicated Front Range consumptive use. From CWT's perspective the Yampa project is a good example of immediate good faith collaboration to infill the river at 26 cfs. As a voluntary and market based program, so

whatever the local water issues are CWT works with those right holders who want to work with CWT. Leasing program approach has been passive with interested parties approaching CWT. It is not the lease program's intention to conduct basin wide changes.

Slide 36: Other tools for water restoration work. The slide expresses an array of working possibilities.

Presentation summation: Working with CWT can bring additional funding to a project and is part of the reason the Trust was established. CWT can help raise funding to assure project implementation barriers are lifted. Ms. Beatie noted that HRSB's funding ability is unique in the State of Colorado. In closing Ms. Beatie express hope that the HRSB & OSTB would take the time and affirm what each Board wants to do.

Additional comments and questions:

Pitkin County's Crystal River suffers huge water level swings and often dries, how could the lease program help? Senate Bill 19 plus willingness from local water right holders plus funding.

When looking at the Roaring Fork Watershed do you see any glaring examples of low hanging fruit? The leasing program has advanced the CWT's vision as a course to follow, the lease program is passive and not intended to purposefully scope for potential projects. At this point the leasing program has been a non-stop two year body of work. Currently CWT has been contracted to do similar type of analysis for a community foundation to assess their basin composed of community outreach and a resulting road map for the community to utilize as a funding tool. The road map will probably identify long term projects with durations of 5 to 10 years.

Question to OSTB from HRSB: Would OSTB consider fallowing open space land and lend water to streams and what factors would enter into making that decision? Pitkin County owns water rights appurtenant to agricultural lands. Understanding water option tools is an important piece of information for OSTB when formulating a water policy. The OSTB continues to seek more knowledge about water rights and is a reason to have more joint meetings with HRSB. The elected BOCC board is also in need of a consistent policy to guide their water decisions. Water considerations were included in OSTB's charter in 2006 and HRSB was formed only a couple years ago. OST easements have been revised to allow for more water considerations to leave water in rivers and streams. This is a good question, but it has not been a focus of OSTB. OSTB is charged with a larger mandate to protect and enhance agricultural lands and conservation of habitat. The water tools presented today offer water protection flexibility and opens the door to better land management which in regard to water has been a use it or loss it proposition. OSTB has not had agenda focus time to study water right conversions to instream flow. OSTB has been wondering when HRSB would come to OSTB with a joint project. Dale Will added that prior to HRSB forming OST compiled an inventory of what water rights are held at that time by OST and this inventory could be used as baseline to build upon. OST portfolio of assets encompasses a diversity of lands from habitat or scenic value to historically viable agricultural lands. Ms. Beatie contributed that CWT has suggested taking and reviewing OST's water rights inventory for appropriate transfer options and in doing that process CWT could

compile a report noting any feasible projects which may consist of a range of possibilities. So instead of approaching water rights from the policy side; the approach would be from the actual possibility of doing something. CWT offers to do this without charge.

Can these tools be applied to the protection of water rights? Answering in regard to abandonment, holder must demonstrate 'intent to abandon' to loss water right a use can be suspended.

How can Pitkin County be assessed without first assessing the Front Range communities' water diversion demands from this watershed? The Roaring Fork River's upper basin is diverted to Front Range communities creating significant impacts to this basin. (Approximately 40% of the Roaring Fork River flow is diverted) Ms. Beatie advised not to be bogged down trying to solve the big diversion problem but to start on small local problem solving and to start momentum through community engagement.

If these two Boards partnered on water improvement projects requiring physical structures, gate or gauges as examples would CWT be interested in consulting on these types of projects? Affirmative.

ADJOURN

The joint OSTB and HRSB meeting of August 8, 2013 adjourned at approximately 5:55 p.m.

Approved: Attest:

_____ _____

Bill Jochems Lisa MacDonald

Chairman

Colorado Water Trust

Request for Water 2012 & 2013: How It Works

Amy W. Beatie, Esq.
Executive Director

Colorado Water Trust

A private, nonprofit organization formed in 2001 and dedicated to protecting and restoring streamflows in Colorado through voluntary, market-based efforts.

STAFF

Amy Beatie, Executive Director
Anne Janicki, Transaction Specialist
Christine Hartman, Comms/Developm't
Zach Smith, Staff Attorney
Edalin Koziol, CCT Fellow
Alyse Greenberg, Operations

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BOARD OF DIRECTORS (emeritus)

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David Harrison

Colorado Water Trust

- Formed in 2001
- Staff of 6 (7) and Board of Directors with over two centuries of experience in Colorado Water Law
- Early years, proof of concept strategic plan. In 2011, outreach to 40 people, including Pitkin County locals. Adopted new strategic plan as a result. Strategic priorities are set through the plan.

CWT Program Areas

Acquisitions

Physical Solutions

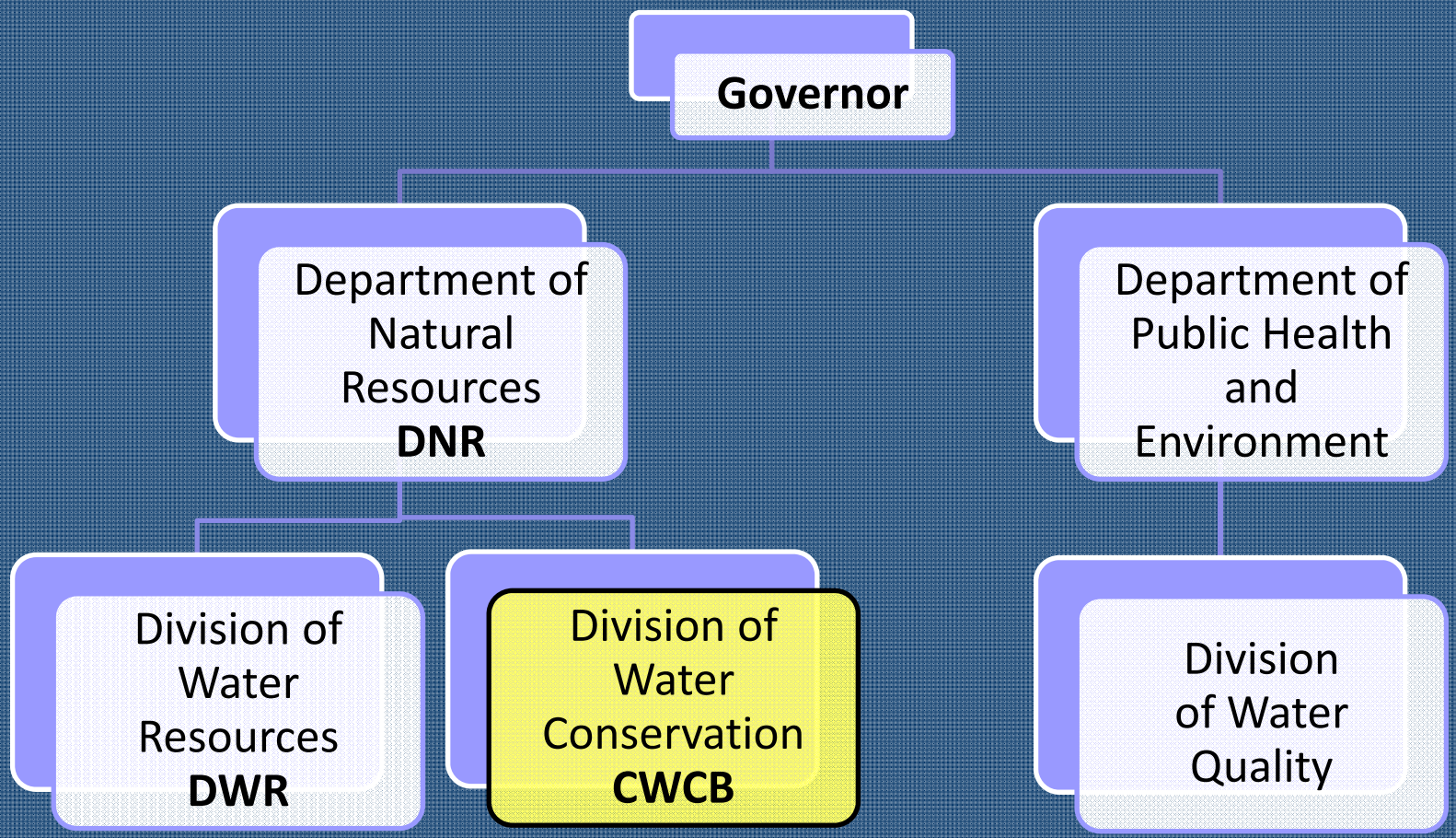
Technical Assistance For Land Trusts

What are we trying to fix?

What are we trying to fix?

Photo courtesy of Nathan Fey, American Whitewater

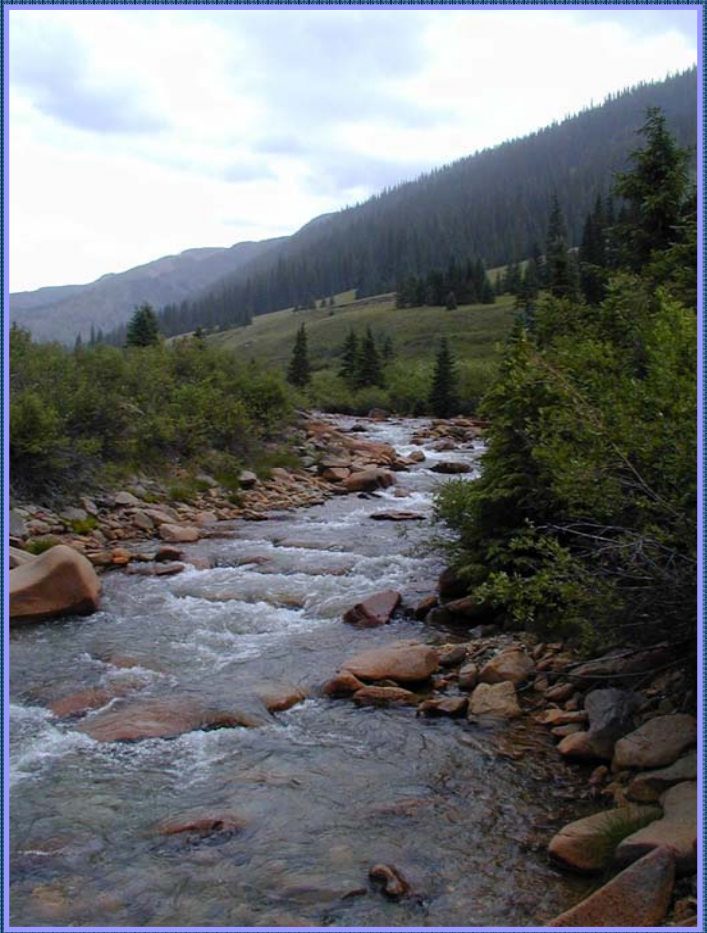
Colorado Water Conservation Board



1973
Legislature Established Colorado's ISF Program

Recognized "the need to correlate the activities of mankind with some reasonable preservation of the natural environment"

Vested the Colorado Water Conservation Board with the authority "on behalf of the people of the state of Colorado, to **appropriate** or **acquire** … such waters of natural streams and lakes as may be required to preserve the natural environment to a reasonable degree."

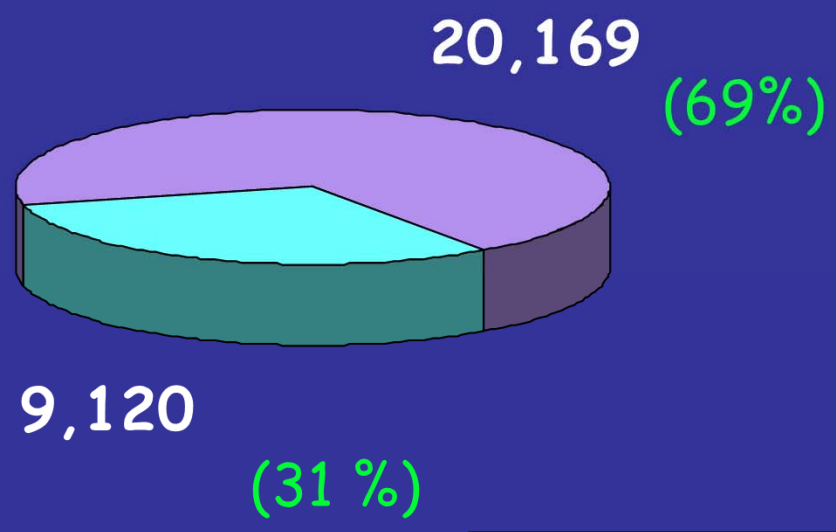


North Fork Mineral Creek

Stream and Lake Protection Section Staffers

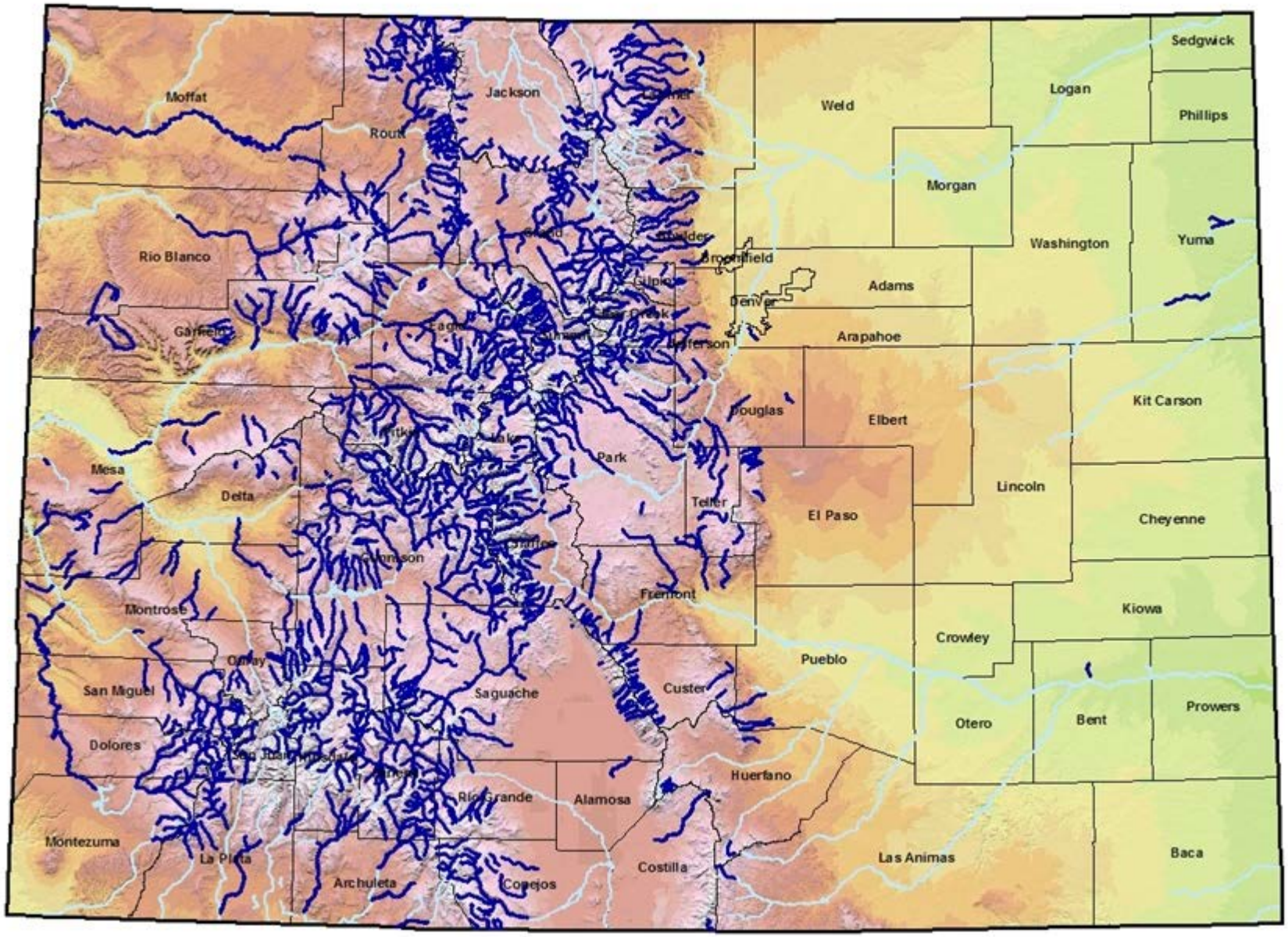
- Linda Bassi - Section Chief
- Jeff Baessler - Deputy Section Chief
- Kaylea White - Senior Water Resources Specialist
- Don West - Water Resources Engineer
- Brandy Logan – Hydrologist
- Rob Viehl - Water Resources Specialist
- Brian Epstein - Hydrologist/Hydrographer

Miles of Stream Protected by ISF Rights in Colorado



Note: *Total stream mileage is based upon CDOW estimate of 29,289 miles of perennial streams in the state (H. Vermillion, 2001)*

Streams Included in Colorado's Instream Flow Program



Types of Acquisitions

Permanent Transfers:

- *Donations*
- *Purchases*

Other interests in water:

- *Trusts*
- *Permanent Contracts*

Temporary Transfers

- *Long Term Leases*
- *Short Term Leases (3 in 10 year leases)*

General Assembly's Reaction to 2002 Drought: Temporary Loans and Short Term Leases

Section 37-83-105, C.R.S.

- In 2003, Colorado legislature created a state statute to allow water rights owners to loan water to the CWCB for use as instream flows.
- Temporary loans for instream flow use limited to a period of up to 120 days per year, and up to 3 years of use over a 10 year period (a "3-in-10" lease). Can't be used again.
- Administrative approval process—no water court change case is required. CWCB compiles information sufficient for Division and State Engineers to determine that short-term instream flow use does not injure existing decreed water rights.
- Can be used on any stream where CWCB currently holds an Instream Flow water right, up to decreed amount.

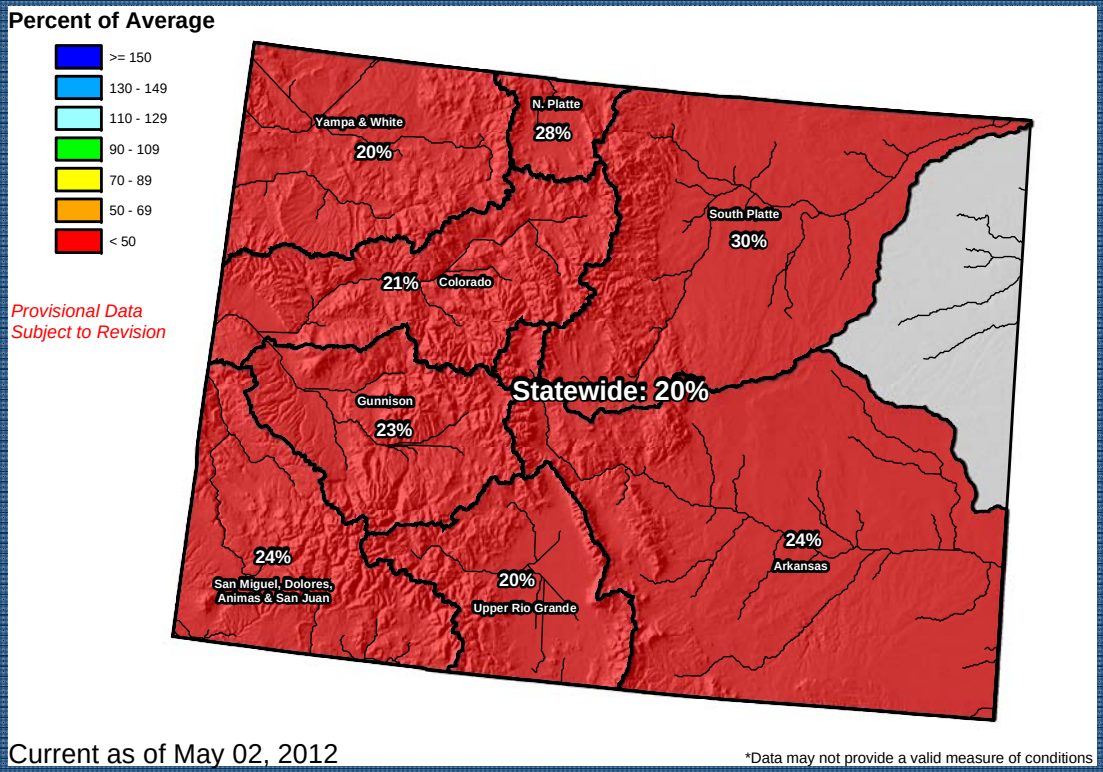
Temporary Loans and Short Term Leases

Section 37-83-105, C.R.S.

- Recent legislation provided significant protections for water right owners:
  - Excluded all periods of time during which CWCB uses a leased/loaned water right for instream flow from any future historical consumptive use (HCU) analysis of the water right
  - Water rights leased or loaned into the Instream Flow Program are protected from abandonment

Early May 2012 Snowpack Conditions Suggested Low Spring Flows and Shorter Runoff Period

Colorado SNOTEL Snowpack Update Map



Cochetopa Creek – July 2002

Stream Conditions Expected to be Similar to 2002

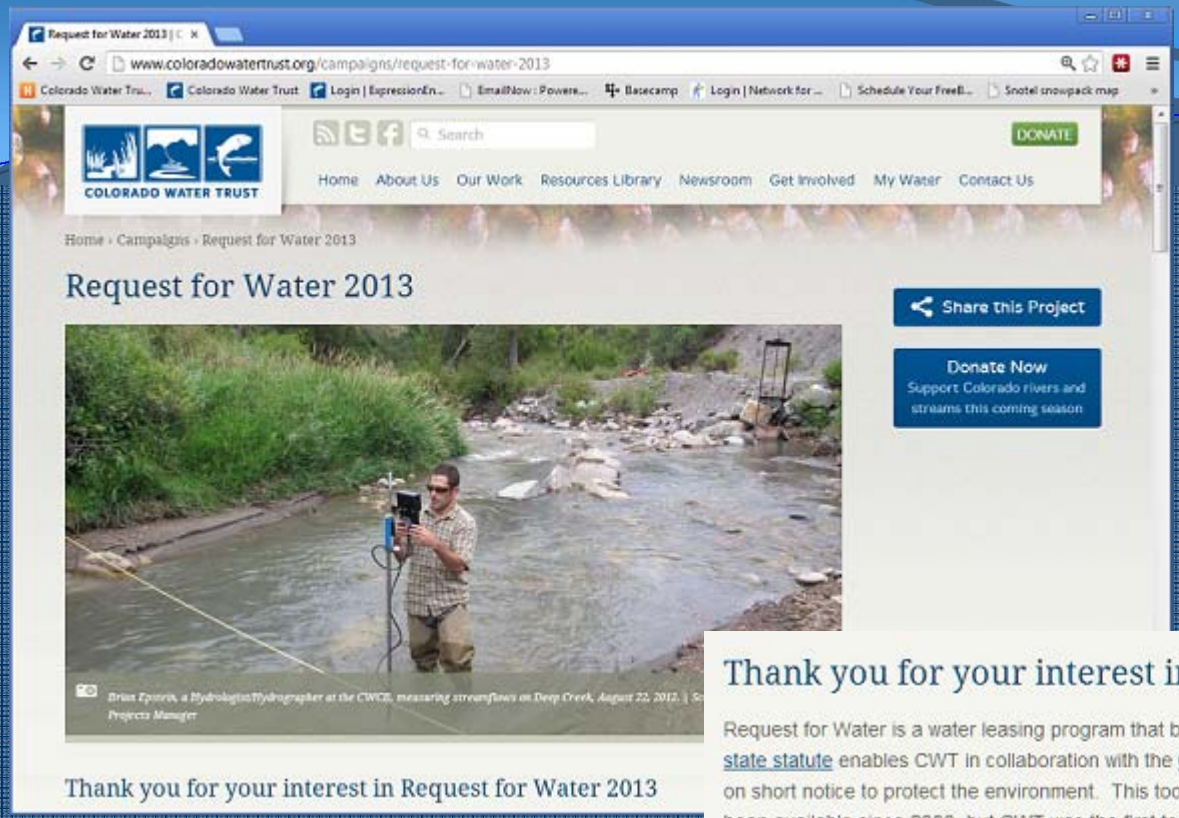
CWT began by identifying 21 Priority Basins where ISF rights were expected to be short

- Reviewed existing data for water short ISF segments during 2002 (Wildlife Drought Task Force)
- Reviewed CWCB ISF Call Records from 2002 and subsequent years

~Request for Water~
Released April 23, 2012

Outreach

- Press release
- CWCB, CWT, many other email lists
- Personal contacts to federal, state and local water users
- Dedicated Web page with application/ Initial Offer Form and program details



All information about the Request for Water 2013 program is available on this dedicated webpage.

All necessary forms can be found in the "Documents" section →

Thank you for your interest in Request for Water 2013

Request for Water is a water leasing program that benefits both water users and the environment. A 2003 Colorado state statute enables CWT in collaboration with the Colorado Water Conservation Board (CWCB) to lease water for streams on short notice to protect the environment. This tool for rewatering streams under Colorado's Instream Flow Program has been available since 2003, but CWT was the first to use the statute to add water to streams during drought conditions in 2012. CWT intends to lease water for environmental benefits again this year; the March 1st snow report indicates that snowpack is again below average. Many rivers and streams may see shortages for a second year in a row and for some in Colorado, the dry spell has been much longer. Request for Water also addresses the financial needs of Colorado's water users by compensating owners for the temporary use of their water rights. We are excited to offer water users the opportunity to both protect Colorado's natural heritage and generate revenue—lease your water for instream flow use, receive compensation, and grow a crop of fish habitat.

Documents:

- Start here: The case for Request for Water 2013
- Terms and Conditions
- Offer Form
- Offer Form Guide
- Frequently Asked Questions

Initial Response

- Local and statewide newspaper coverage *(front page of Denver Post)*
- Radio interviews and coverage
- 34 entities/individuals contacted CWT to inquire about the program
- 19 entities/individuals submitted formal lease offers
- Total of 87 water rights offered in 6 Water Divisions

Final Statistics

- 56 water rights from 13 offers passed CWT screening process
- 13 water rights from 7 offers passed engineering review
- 4 lease offers approved and used to meet ISF water rights

PROCESS/TIMELINE

Deadline for Lease Offers May 11

CWT Screening

Engineering

Valuation

Lease

CWCB Review

SWSP Notice/ Public Comment

SEO/ DWR Approval

CWCB Accept & ISF Use Begins

Monitor/ Reporting

5 Days

15 Days

5 Days

$

Due Diligence,
Evidence of ownership,
Technical analysis
(function within ISF program,
administrability, physical barriers, diversion history, relative priority),
Field Visit

"Reasonable Estimate of Historic Consumptive Use", potential injury, return flows

First Lease Approved (UYWCD)
July 11, 2012

Each lease is a unique contract, subject to negotiation

TEMPORARY WATER LEASE AGREEMENT:
CWT REQUEST FOR WATER 2012

This water lease agreement ("Lease") is entered into by and between the COLORADO WATER CONSERVATION BOARD ("CWCB"), an agency of the State of Colorado; the COLORADO WATER TRUST ("CWT"), a Colorado nonprofit corporation; and COYOTE RIVER RANCH, LLC, a Colorado limited liability company ("Lessor"), collectively, the Parties.

RECITALS

A. Section 37-92-102(3), C.R.S. (2011) authorizes CWCB to acquire by lease or other contractual agreement such water, water rights, or interests in water as CWCB determines may preserve and improve the natural environment to a reasonable degree.

B. CWT is a Colorado nonprofit dedicated to protecting and restoring streamflows in Colorado through voluntary, market-based efforts. CWT works within CWCB's acquisition program to accomplish this mission. This Lease supports that mission.

C. Section 37-83-105(2) authorizes water rights owners to lease or loan water to CWCB for instream flow use pursuant to a decreed instream flow water right held by CWCB and administrative approval, subject to certain conditions and procedures ("Short Term Lease Program").

D. Under the Short Term Lease Program, a lease may have a term for up to ten years, but may only be used for instream flows for three of those ten years. For each year the water right is used in the Short Term Lease Program, it may only be used for instream flows up to 120 days in that calendar year.

E. Colorado snowpack totals for the spring of 2012 are similar to those of the drought year of 2002. That year, many CWCB decreed instream flows were not satisfied and the lack of water negatively impacted the state's aquatic ecosystems. This year, CWT and CWCB anticipate many decreed instream flows will not be met again. However, CWT and CWCB will use the Short Term Lease Program - not available in 2002 - to supply water to those decreed, but not met, instream flows to protect Colorado's aquatic ecosystems.

F. CWT issued a statewide "Request for Water" to solicit water rights to lease into the Short Term Lease Program on April 23, 2012. This Lease is a result of that effort.

G. Lessor owns a water right in the Yost Ditch on Deep Creek, tributary to the Colorado River ("Water Right"). Lessor wishes to lease the Water Right to CWCB for instream flow use in Deep Creek, pursuant to the procedures and subject to the conditions set forth herein, in Section 37-83-105(2), and in CWCB Rule 6(k) of the Rules Concerning the Colorado Instream Flow and Natural Lake Level Program.

H. CWCB holds an instream flow water right on Deep Creek ("Instream Flow"), decreed in Case No. 5-80CW312 for 14 cfs (May 1 to September 30) and 8 cfs (October 1 to April 30), in the reach of Deep Creek extending from its headwaters to the Colorado River.

I. Subject to the terms of this Lease, Lessor will lease to CWCB the Water Right for instream flow purposes. CWCB will use the Water Right to maintain the Instream Flow for a period not to exceed one hundred twenty days in one calendar year.

J. Subject to the terms of this Lease, CWT will pay Lessor for the use of the Water Right in the Short Term Lease Program.

K. The Water Right to be leased is not currently decreed for instream flow use. The use of the Water Right by CWCB for instream flow purposes will require State and Division Engineer approval and final ratification by CWCB Board of Directors, pursuant to section 37-83-105(2).

L. The amount of water to be used by CWCB under this Lease will not exceed the amount of water decreed to the Instream Flow.

NOW THEREFORE, in consideration of the mutual agreements contained herein and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, CWCB, CWT, and Lessor agree as follows:

LEASE OF WATER RIGHT

1. Term.

   a. The term of this Lease shall be from July 1, 2012, until June 30, 2022 ("Ten-Year Term"), pursuant to section 37-83-105(2).

   b. The Lease is only implemented this year, from July 1, 2012, until June 31, 2013 ("Implementation Term").

   c. The Parties agreed in good faith to consult on or before April 1 of each year during the Ten-Year Term to determine if the Lease shall be implemented.

Approval from Division of Water Resources

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF WATER RESOURCES

John W. Hickenlooper
Governor

Mike King
Executive Director

Dick Wolfe, P.E.
Director/State Engineer

Alan C. Martellaro, P.E.
Division Engineer

August 2, 2012

Ms. Linda J. Bassi
Colorado Water Conservation Board
1313 Sherman Street, Room 721
Denver, Colorado 80203

Re: Temporary Loan of Water Rights for Colorado Water Conservation Board for Instream Flow
Pursuant to Section 37-83-105, C.R.S.
Yost Ditch, Section 29, T 4 S, R 86, 6TH P.M.
Water Division 5, Water District 53, Eagle County

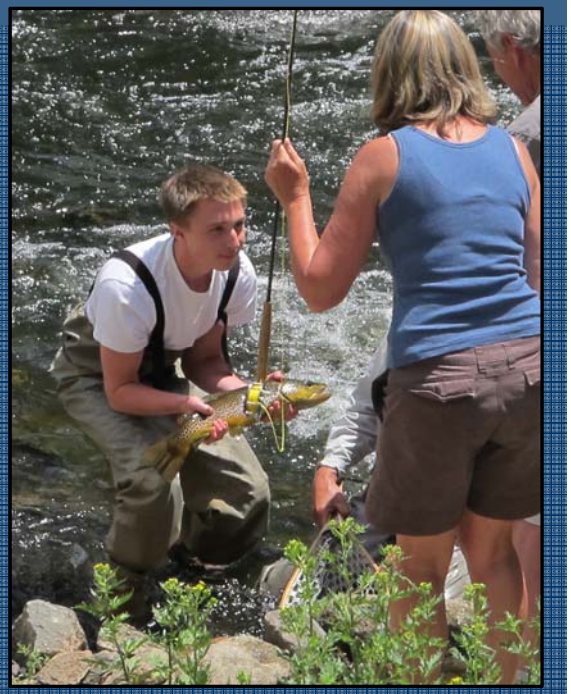
Approval Period: August 2, 2012 through June 30, 2022
Contact Phone Number for Ms. Linda J. Bassi: 303-866-3441

Dear Ms. Bassi:

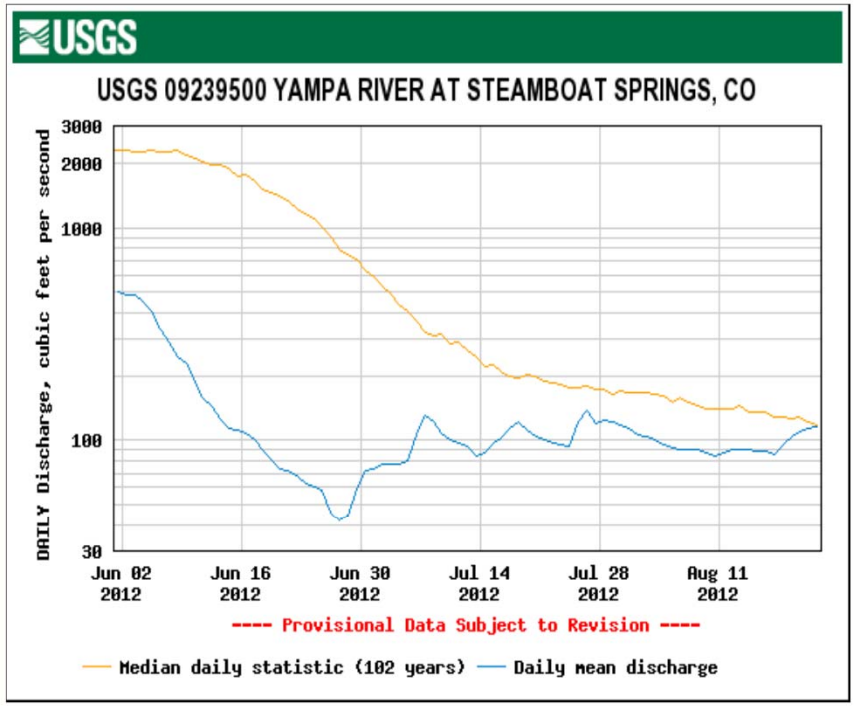
We have reviewed your letter dated July 13, 2012 in which you request approval of a temporary loan of water pursuant to Section 37-83-105, C.R.S., for the Colorado Water Conservation Board ("CWCB" or "Applicant") for instream flow ("ISF") use. As required by § 37-83-105(2)(b)(II), C.R.S., written notice of the request for approval of a temporary loan of water was provided on July 13, 2012 to all parties who have subscribed to the Division 5 Substitute Water Supply Plan ("SWSP") Notification List. The Division of Water Resources ("DWR") did not receive comments during the statutory 15-day comment period. The statutory $100 filing fee (receipt no. 3656148) was submitted with this request.

Upper Yampa Water Conservancy District

Water Right: Stagecoach Reservoir Storage Right
ISF Right: Yampa River
Lease Amount: 4,000 acre-feet ; (26.6 cfs for 75 days)
Uses: Hydropower, then ISF, then incidental ISF, then power generation through separate contract with Tri-State
Benefitted ISF: 5.4 miles, other streamflow benefits 40-50 miles
Lease Term: One Year
Price: $140,000 - based on UY contract rate
Status: Approved 7/11. Lease Complete.
Other: CWT receives $28 an acre-foot from Tri-State for whatever they use at Craig Station of these releases



8/23/12 waterdata.usgs.gov/nwis/dv/?dd_cd=04_00060_00003&format=img_stats&site_no=09239500&begin_...



Yampa River streamflow increased to levels that allowed the river to re-open for recreational uses

Aspen Shorefox, LLC

Water Right: Bunte Highline Ditch, 3 priorities out of Willow Creek
ISF Right: Colorado River (4 segments Willow Creek to Blue River)
Lease Amount: 40 cfs
Uses: ISF, Groundwater Recharge
Benefitted ISF: 30 miles
Lease Term: 10 years
Price: $83,452 - based on full season irrigation net revenue plus 10%
Status: Approved 7/27. Currently being used to meet ISF needs.

Colorado Parks & Wildlife

Water Right:	Big Beaver Reservoir
ISF Right:	White River
Lease Amount:	up to 3,000 AF; up to 20 cfs
Uses:	ISF
Benefitted ISF:	about 40 miles
Lease Term:	10 years
Price:	N/A
Status:	Approved 7/17
Other:	CWT initiated discussions with CPW and CWCB; State agencies ultimately decided to pursue the transaction through an inter-agency agreement

Coyote River Ranch

Water Right:	Yost Ditch
ISF Right:	Deep Creek, tributary to the Colorado River near Dotsero
Lease Amount:	2 cfs
Uses:	ISF
Benefitted ISF:	0.5 mile
Lease Term:	10 years
Price:	$3,321 - based on full season irrigation net revenue
Status:	Approved 8/2. Currently being used to sustain Deep Creek's ISF.

A few challenges along the way……

 # 1 – Getting the word out accurately - to everyone from a municipal water manager to a high-mountain rancher

 # 2 – Maintaining the Expedited Process intended by the statute!

 # 3 – Technical Issues:

- Defining "Reasonable Estimate of HCU" (Water Court or SWSP standards, or simpler analysis?)
- Split Season Leases – issue of first impression for DWR
- Injury Analysis – return flows, HCU and refill for reservoirs
- Administration of non-consumptive ISF rights – HUP issues
- Level of monitoring required (gages? piezometers?)

 # 4 – Implementation and Monitoring

- Beavers and infrastructure issues
- Developing a monitoring plan, staffing, record keeping, reporting

Successes, too (the 2012 FT Factor)

Streamflows and water temperatures expected to improve on White River, Colorado River, and other streams.

Variety of program participants – private owners, corporations, state, federal, local governments – with continued interest in the program.

Implemented a 10-year old statute that had never been used, and developed new processes and standards.

Audited the process: Did we move the needle this summer in terms of increasing streamflow awareness and tools available to fix it?

Applying what we learned to2013

- Another dry, dry winter and lots of calls asking if we'd do the program again—if not you, then who?
- From audit: start earlier, give a window to come into the program, not a single date
- From audit: engage a community to do intentional, larger scale flow restoration
- From audit: have more of a local presence, do more outreach

- We did these things, and more, when releasing the program in 2013

RFW 2013

Launched on: Wednesday, March 6

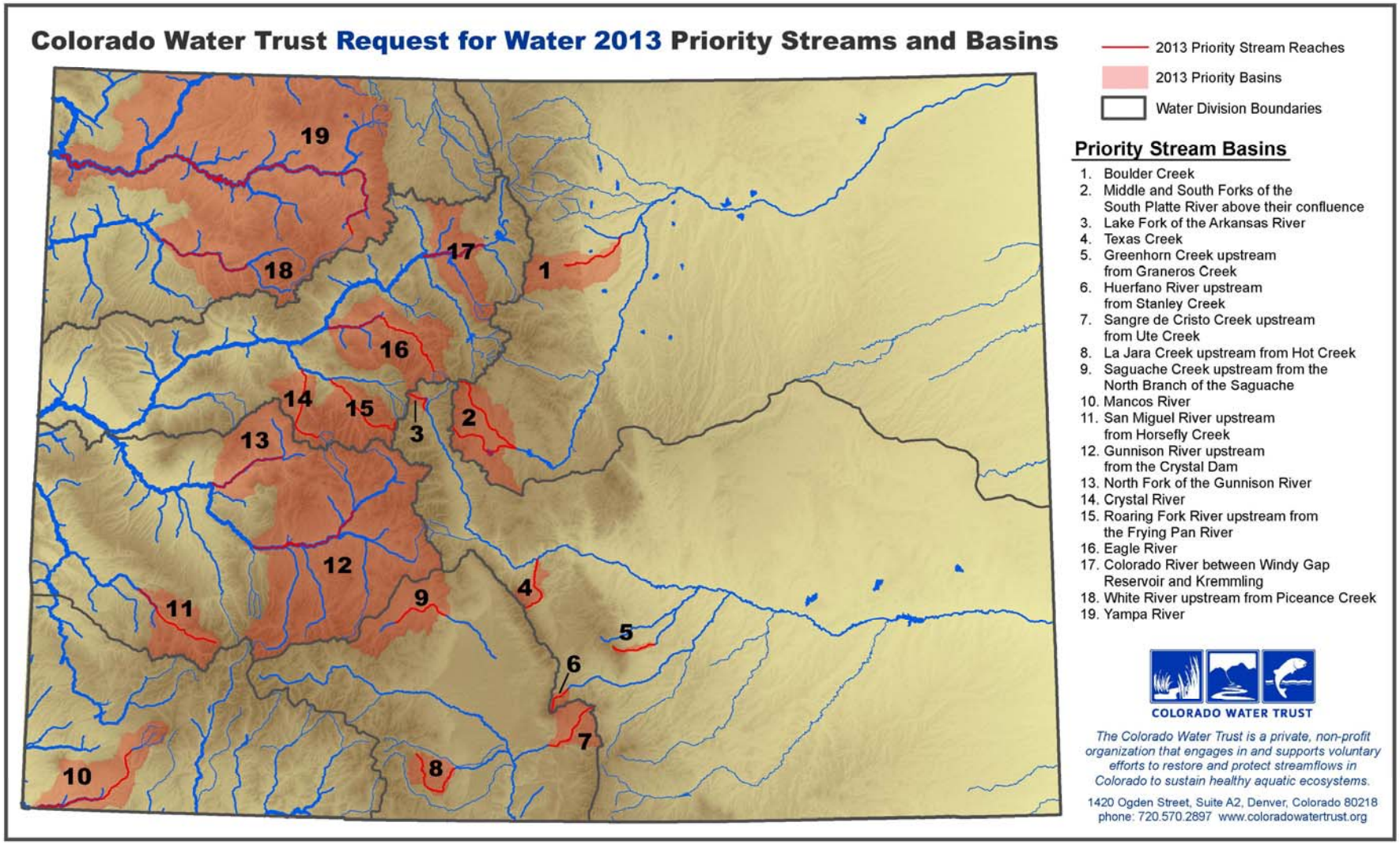
Outreach:

- RFW 2013 website
- Press strategy
- Two webinars
- Five public town-hall style meetings (2 cancelled due to weather)

First deadline: Friday, March 29

Final deadline: Friday, May 3

Generally, the same priority basins as last year…



Offers received by first deadline: **12**

Offers received since first deadline: **7**

Total offers received to date: **19**

Number of leases from 2012 that are being activated again in 2013: **1** (Bunte)

Number of water rights offered for lease: **124**

- Number of these rights that were leased in 2012: **3 (Bunte)**
- Most of these are typically used for irrigation

Offers from **4** divisions

- Division 1
- Division 4
- Division 5
- Division 6

Live projects:

- **Aspen Shorefox**, Bunte Highline Ditch (approved 2012, not yet being used for ISF in 2013)
- **City of Aspen NDA**, Wheeler Ditch (approved 6/13, already bolstering flows through Aspen by as much as 4.6 cfs from early July to 7/25)
- **Winter Park Ranch**, Tyron/Tryon and Hammond No. 2 Ditches (approved 7/16, not yet being used for ISF)
- **UYWCD**, Stagecoach Reservoir (releasing since 7/23, currently releasing at 30 cfs although not approved yet by SEO)
- **McKinley Ditch**, making its way through approval process but implementation already occurring

Number of other offers we are pursuing: 9 (50 water rights)

- Now waiting for engineering analysis if needed, site visit, and discussion with water commissioner to determine whether rights are appropriate for RFW Program.
- Some will fill in late season and winter shortages, some will be used next summer

CLARIFICATIONS

- Transferring diversions
- Payment
- Voluntary and market-based
- Transaction costs
- Fallowing impacts
- Adding flexibility and choice about how to use water

Other work & tools

- Physical solutions—low flow channels, diversion structure modifications, reservoir operations, fish ladders, source switches
- Habitat restoration
- Shade trees
- Permanent projects
- Non-market-based tools: new appropriations, W&S, litigation, advocacy, policy changes (these are not CWT tools, but are out there)

Food for thought

Questions ?

http://www.coloradowatertrust.org/campaigns/request-for-water-2013

Colorado Water Trust
1420 Ogden Street, Suite A2
Denver, CO 80218

720-570-2897

Agenda Item Summary
September 19, 2013

TO: River Board

FROM: Lisa MacDonald

SUBJECT: Proposal for grant application research work on kayak park and future projects

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Information: Chase Park Grants (CPG) is a national research firm specializing in creative funding solutions for capital and infrastructure projects.

Pitkin County has entered into a contract with CPG for research assessment related to capital improvement projects. Various county staff recently met with Tia Cavendar of CPG and it was suggested she meet with HRS staff to review the kayak park project as well.

With the Board's interest to move forward on several of its priorities and its desire to initiate new projects taking advantage of CPG's expertise may be appropriate.

CPG has a working knowledge of the valley and has worked with the following:
Roaring Fork Community Development Corporation (Basalt)
Roaring Fork Conservancy (Basalt)
DHM Design (Carbondale)
City of Aspen, Town of Basalt and Pitkin County

Attached is CPG's proposal for technical assistance services as it relates to the kayak project by task and a future work option. As a reminder, costs for outside assistance for the 2010 kayak park Great Outdoors Colorado grant application was $6744.

Requested Board Action: Motion to authorize expenditure of funds at the level supported by the Board.

Attachments: Proposal from Chase Park Grants

September 13, 2013

Lisa MacDonald
Pitkin County Attorney's Office
530 E. Main Street; Suite 302
Aspen, CO 81611

RE: Proposal for Technical Assistance Services – Pitkin County Healthy Rivers and Streams Program

Dear Lisa:

Thank you for inviting Chase Park Grants to submit this proposal for specialized services. We would be pleased to help Pitkin County and the Healthy Rivers and Streams Citizen Advisory Board (Board) advance its grant-seeking efforts for the Pitkin County Kayak Park in Basalt.

In response to your request, we have assembled a proposed scope and strategy. Our qualified team of grant professionals is *ready* and *available* to begin work immediately—an important step if the Board would like to pursue funding from government sources in 2014 or 2015.

As a national research firm that specializes in government grant seeking for capital projects, Chase Park is uniquely qualified to provide these specialized services on behalf of the Board. Together, we can successfully secure external funding to help pay for the construction of the new Kayak Park.

I look forward to presenting this information in person to the Board next week. Please let me know if you have any questions in the meantime.

Respectfully,

Tia Cavender, MA, GPC
President, Chase Park Grants, LLC

PROPOSAL FOR TECHNICAL ASSISTANCE SERVICES

PREPARED BY: CHASE PARK GRANTS, LLC
PREPARED FOR: LISA MACDONALD, PITKIN COUNTY AND THE HEALTHY RIVERS AND STREAMS CITIZEN ADVISORY BOARD
9/13/2013

PROJECT APPROACH AND UNDERSTANDING

The following section outlines our recommended approach to helping the Board secure funding to construct the planned Pitkin County Kayak Park in Basalt, Colorado.

First, we suggest revising the Board's previous grant application to Great Outdoors Colorado (GOCO) for submission to the Spring 2014 funding cycle of the Local Government Grant Program.

Although the Board's original grant application was not approved, the score received (75/100) and feedback provided by the funder indicate that a technical revision of the original application could potentially increase the project score enough to get funded in a future funding cycle (i.e., 87 or higher).

Chase Park will build upon the material originally submitted in 2010, and will make improvements based upon feedback collected from GOCO. Together, our industry expertise combined with our working relationship with GOCO staff, will help the Board craft a winning application for funding the Pitkin County Kayak Park.

Second, we will compile a comprehensive inventory of alternative funding programs that could support the Kayak Park construction. The resulting prospect list will not only help increase the competitiveness of the GOCO application by increasing points for sustainability and matching funds, but will also identify which funding prospects hold the best potential for the Board to pursue in 2014.

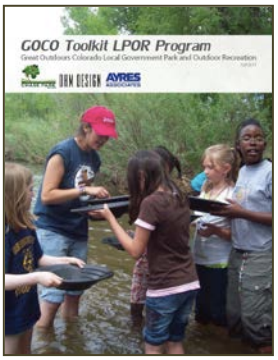
By partnering with Chase Park, the Healthy Rivers Citizen Advisory Board will gain access to a one-of-a-kind database of more than 3,100 capital grants.

This phase will also help inform what other funding potential exists for the Board's planned capital improvements, which will allow for holistic and tactical planning rather than the traditional "reactive" approach to grant seeking most often used in capital planning.

The following provides a detailed list of project activities and deliverables involved in our proposed approach.

Task 1: Revise and resubmit GOCO Local Government Grant application

Approach:



- Correspond with the funding agency on behalf of the Board.
- Collect feedback from GOCO program officers.
- Obtain copies of the reviewer comment sheets.
- Incorporate feedback into new narrative content.
- Prepare new narrative content and assist the County in preparing auxiliary materials.
- Facilitate planning meetings and coordinate with consultants.
- Make improvements to auxiliary application materials (i.e., letters of support, budget justification, photos and diagrams).
- Identify additional ways to maximize competitiveness and increase overall funding score.

Task 1 deliverables will include: 1) new narrative content for the grant application, 2) revised letters of support, and 3) revised budget documents.

Task 2: Collect and evaluate relevant funding opportunities

Approach:

- Develop and refine grant category inclusion and exclusion criteria.
- Conduct iterative queries of the Chase Park database of capital funding programs, including government grants (federal, state, and local), low-interest loan programs, and private funders (e.g., corporate foundations).
- Compile, organize and evaluate a comprehensive list of viable funding options.
- Evaluate identified grant opportunities to determine fit with project scope, eligibility, grant purpose, deadline, and budget.
- Categorize and prioritize funding prospects.
- Summarize findings and make recommendations.

Task 2 deliverable will be a *Prospect Report*. The Prospect Report will include a comprehensive list of funding programs that can help guide the Board's grant seeking efforts for the Kayak Park in 2014 and beyond. The report will include details about the top prospects identified – such as funding agency, program name, purpose, deadline, maximum grant amount – information that will help the Board determine which options fit best with its mission.

Optional on-call services

The Board may instead opt to engage Chase Park under a one-year retainer contract. With this option, Chase Park would provide the services outlined in Tasks 1 and 2 above for pursuing a GOCO grant, as well as any other appropriate funding opportunities identified in the Prospect Report for the Kayak Park project or other water quality/water quantity projects. Furthermore, the Board will have access to the following additional services:

Approach:

- Compile comprehensive research data (i.e., grant application materials, guidance documents, list of past awards, technical assistance materials) of top funding prospects for Kayak Park or other relevant water quality/water quantity projects the Board has identified.
- Collect, identify, and share "inside scoop" guidance not made publicly available, particularly for top funding prospects with upcoming deadlines.
- Interview program officers to gather insight about targeted programs.
- Interview key informants (e.g., successful awardees, grant program) to gather information to help maximize the competitiveness of the Board's grant applications.
- Identify leverage opportunities and ways to maximize competitiveness.
- Respond to technical assistance requests on grant-related matters.
- Help establish and cultivate relationships with key prospects (including grant-making organizations and individual donor prospects).
- Participate in planning meetings with Board members and engineering team.
- Explore strategies to raise capital funds (i.e., designing a demonstration project, identifying corporate sponsorship opportunities).

PROJECT TIMELINE AND WORKPLAN

The projected timeline is for a period of six (6) months, beginning 10/1/2013 and ending on 3/31/2014, based on the general scope outlined below. This timeline does not encompass any Task 3, optional on-call services retained.

PROPOSED COST OF SERVICES

Based on our proposed approach and methodology, the cost to conduct work for Tasks 1 and 2 is $15,900, which reflects a flat-fee project rate ($12,000 for Task 1 and $3,900 for Task 2). Work associated with the optional on-call services contract is $60,000 and are, as stated above, inclusive of Tasks 1 and 2 above and extend Chase Park's availability to the Board to one year rather than six months.

Fees are payable in three installments (one-third at project initiation, one-third at mid-point, and one-third upon completion of project), or the County can pay 100% of total fees up-front to qualify for a 2% discount.

ORGANIZATION AND CONSULTANT TEAM QUALIFICATIONS

Chase Park Grants (Chase Park) is a national research firm that specializes in government grant seeking for capital and infrastructure projects.

We have assembled a qualified team of grant professionals and technical advisors to help the Board secure funding for its planned Kayak Park project. The following section describes the Consultant Team and the expertise they will bring to Pitkin County.

Tia A. Cavender, MA, GPC, President

As president and lead strategist for Chase Park Grants, Tia counsels municipal agencies, developers, and engineering firms on innovative ways to secure external funding and diversify funding sources. Before forming Chase Park, Tia was president and co-founder of BOCA Grants Solutions, an evaluator at the University of Colorado Denver, and Grants Director at Metro Health Hospital in Michigan. A frequent presenter at professional conferences, Tia has designed and led numerous grant-specific workshops, seminars, and professional presentations. She is a Certified Grants Professional (GPC) and member of the Grants Professionals Association (GPA). Tia holds two master's degrees from the University of Colorado in Industrial Psychology and Clinical Psychology.

Jennifer Waltz, Senior Grant Strategist

For the past ten years, Jen has provided research and analysis services in a variety of settings, and has managed projects related to program evaluation, research funding, and information technology. Jen excels in mixed-methods analysis and evaluation, as well as summarizing qualitative and quantitative results into clear and concise written format that all readers can understand. Her wide-range of experience brings a multi-disciplinary edge to Chase Park Grants, and a progressive approach to grant-seeking and analysis.

Jen Shumar, MPA, Operations Manager

Jen is a highly-organized project manager and researcher with more than a decade of managing teams and projects. She leads the operational and marketing aspects of the business, and supports the research for all projects. Jen earned a Master's of Public Administration and a B.S. in History from Ball State University.

Alex Barth, Research Assistant

Our newest addition to the Denver research team, Alex provides administrative and research support for the strategist team. His quick and savvy Internet research skills make him a strong asset to our business, and he brings a fresh and eager outlook to building the grants profession. Alex is currently working towards his undergraduate degree, and recently relocated to Denver from Grand Rapids, Michigan.

Agenda Item Summary
September 19, 2013

TO: River Board

FROM: Dorothea Farris - Crystal Valley Environmental Protection Assoc. Inc.

SUBJECT: Cow Stomp Pilot Study Project Funding

Information: Crystal Valley Environmental Protection Assoc. Inc. ("CVEPA") is requesting $10,000 towards the final year of the Cow Stomp Pilot Project located in Coal Basin. Funds will enable selection of a larger area of treatment and data collection.

Staff has reviewed the request and deems it complete and appropriate for Board review.

Requested Board Action: Motion to authorize expenditure of funds of $10,000 for the third and final year of study and documentation of the Cow Stomp Pilot Program.

Attachments: Request from CVEPA

PITKIN COUNTY HEALTHY RIVER AND STREAMS BOARD
MONETARY GRANT AWARD APPLICATION

Viability of Project:
The 'Cow Stomp' pilot study project with the USFS, White River National Forest in Coal Basin will complete the 3rd and final year of study and documentation after the 2014 season. The request for $10,000 from the Healthy Rivers and Streams Board of Pitkin County will be the final request for funding for the study. Information gained from the project is already being incorporated in specific projects.

Public Accessibility:
The project is located on public land in the White River National Forest, adjacent to a public road that is open to pedestrian and bicycle travel. It can be seen only by those who run, bike, cross country ski or hike in Coal Basin, but the general public will benefit from the value of the study. The goal is to stabilize the soil, encourage water retention, provide appropriate seeding for that soil and elevation, determine acceptable levels of cattle grazing activity, and determine other sites needing this type of intervention in order to foster restoration of degraded lands. These improvements will protect the watershed for the Crystal Valley, Roaring Fork River and beyond!

Goals of River Board:
The project meets the objectives for the fund by improving the conditions in the Coal Basin areas so degraded by a century of mining activity. Coal Creek flows into the Crystal River at Redstone, into the Roaring Fork in Carbondale, and into the Colorado River in Glenwood Springs. This watershed depends on both quality and quantity to protect river health, to provide wild life habitat, to insure domestic water needs, and to meet agricultural demands.
The goal is to define clearly the processes needed to improve conditions that ensure ecological health of the watershed, preserve recreational opportunities, protect and enhance wildlife and riparian habitat, and determine processes that can be used on other sites in the Coal Basin drainage that have been severely degraded by mining.
Determination of optimum soil mixture with biochar and compost, appropriate seeding mixtures for high elevation sites and difficult soil conditions, optimum moisture content, and appropriate cattle grazing will enable USFS management plans for the White River National Forest to be more successful in reclamation and restoration efforts. Information, management plans, and implementation activities are already being shared with industry on sites in northwest Colorado.

Prospect of Repetition of Project:
The 2014 season will complete, for peer review, the recommendations based on results of the 3 year pilot study project. Already, the "Cow Stomp" project has generated an article in High Country News, and has been recognized by 'free lance' writers for its value in addressing the reclamation needs of disturbed lands, and for the cooperation of such diverse groups as ranchers, cattlemen, environmentalists, wildlife habitat advocates, political jurisdictions, plant and soil scientists, and public agencies.

History of the Requesting Party:
The Crystal Valley Environmental Protection Association, Inc. (CVEPA), a non-profit, member supported, 501 c(3) organization, was founded in 1972 to investigate and, if necessary, prevent the development of a ski resort in Marble, Colorado. Michael Mechau and other residents of the Crystal River Valley founded the organization.
Members include both year-round and part time residents of the Crystal River Valley. These members support the organization with their dues. CVEPA has approximately 100 members.
The mission of CVEPA is "the protection and preservation of the natural environment and its scenic resources; protection of wilderness, wildlife, forests, and streams; restoration of the natural environment; maintenance of the integrity of local ecosystems."
There is no paid staff. All work is done by volunteers. CVEPA has a 9 member Board of Directors.

CVEPA supported the following projects in 2013:
Restoration in Redstone (Elk Park, Coke Ovens) Worked with Pitkin County, Redstone Community Association and associated agencies.
Coal Basin Reclamation and Restoration (on going with USFS and Cattlemen's Association, state agencies)
Most Endangered River status for the Crystal River. Worked with Pitkin County, American Rivers, and Roaring Fork Conservancy
Removal of Placita and Osgood Dams from consideration in the Crystal River Drainage, Worked with Pitkin County
Support of Thompson Divide Coalition goal to protect the Crystal River watershed from inappropriate development. Valley wide cooperation, state and national involvement, discussions with industry, consultants.
Gathering information and community input regarding consideration of Crystal River for Wild and Scenic River status. Discussions with individuals and local community groups.

Participation by Other Parties:
The project involves cooperation among the following:
USFS, White River National Forest (Administration, management, staff, soils and vegetation scientists)
Coal Basin Cattlemen's Association (cows and advice!)
Crystal Valley Environmental Protection Association (funding)

Proposed Project Budget:
In 2013, CVEPA received grants for the "Cow Stomp" Restoration Project from the following:
Aspen: $2000
Basalt: $2000
Carbondale: $2000
Garfield County: $5000
Pitkin County Healthy Rivers and Streams: $10,000
Heartland Environmental Services: $2000
Snowmass Village and Glenwood Springs were unable to contribute in 2013, but they and the above agencies have received a 2014 request for funding. In addition, Alpine Bank has contributed $500 toward the 2014 project, and CVEPA is waiting to hear from Wells Fargo and Patagonia.
The White River National Forest provided staff and necessary materials.
The Coal Basin Cattlemen's Association provided cows!
Hay, straw, biochar, and compost were purchased with CVEPA funding ($23,000)

BUDGET INFORMATION

2013 basic budget and 2014 Proposed Budget				actual	anticipated
	USFS	In-service time	Contrib.	TOTALS: 2013	2014
salaries/labor	$6,550	$2,000		$8,550	$8,550
travel	$0			$0	$0
equipment	$1,800			$1,800	$1,800
supplies/materials	$1,000		$23,000	$24,000	$47,000
printing				$0	$0
other				$0	$0
overhead costs	$748			$748	$748
subtotal	$10,098	$2,000	$23,000	$35,098	$58,098
total	$10,098	$2,000	$23,000	$35,098	$55,598

Contributions 2013 (actual)		Contributions 2014	(Requested)	
Carbondale	$2,000	Carbondale	$2,000	
Basalt	$2,000	Basalt	$2,000	
Aspen	$2,000	Aspen	$2,000	
Heartland Env. Serv.	$2,000	Heartland Env. Serv.	$2,000	
Pitkin Healthy Rivers	$10,000	Pitkin Healthy Rivers	$10,000	
Garfield County	$5,000	Garfield County	$5,000	
		Snowmass Village	$2,000	
Grants: 2013 total	$23,000	Glenwood Springs	$2,000	
		Alpine Bank	$500	rec'd
		Wells Fargo	$1,000	
		Patagonia	$15,000	
		WalMart	$2,500	

Additional funding from CVEPA for 2014 of $23,000 will enable selection of a larger area for treatment and data collection. Compost, biochar, hay, and straw are funded with CVEPA contribution. $46,000

ROARING FORK CONSERVANCY
Bringing People Together to Protect Our Rivers

September 12, 2013

Pitkin County Healthy Rivers and Streams -River Board
Courthouse Plaza
530 E. Main Street, 3rd Floor
Aspen, CO 81611

Re: Comprehensive Lower Fryingpan River Assessment

Ladies & Gentlemen:

Roaring Fork Conservancy (RFC) and Ruedi Water and Power Authority (RWAPA) have requested time on the agenda for your September 19th meeting to update you on the Lower Fryingpan River. In response to residents and anglers concerns we initiated the Comprehensive Lower Fryingpan River Assessment. To provide background on the project we will give a 20 minute PowerPoint presentation on this project and then we can have a conversation to determine your interest in being involved with the project as it progresses.

Attached is a copy of the study plan for your review.

Sincerely,

Sharon Clarke
Watershed Action Director

Rick Lofaro on behalf of Mark Fuller
Executive Director (RWAPA)

Attachment

P.O. Box 3349 Basalt, Colorado 81621 | 970.927.1290 | www.roaringfork.org

ROARING FORK CONSERVANCY

Comprehensive Lower Fryingpan River Assessment 2013-2015

Summary

Given current concerns over the health of the Fryingpan River and fishery, Roaring Fork Conservancy is pursuing a comprehensive study to better understand the current state of the Fryingpan, and create a long-term monitoring plan to track trends over time. Roaring Fork Conservancy's initial aquatic studies will examine macroinvertebrates, flows, and water temperatures. In addition, we may conduct an assessment of the American dipper population, the extent of *Didymosphenia Geminata*, and repeat a 2002 Economic Study to evaluate the role of the river in community vitality. Roaring Fork Conservancy will also work with Ruedi Water and Power Authority, Bureau of Reclamation, and Colorado River Water Conservation District, U.S. Fish and Wildlife Service to investigate how new and existing contracts for Ruedi Reservoir water can be managed to ensure river and associated economic health.

Upon completion of these studies, Roaring Fork Conservancy will disseminate the findings to federal, state and local government agencies and residents of the Fryingpan River Valley.

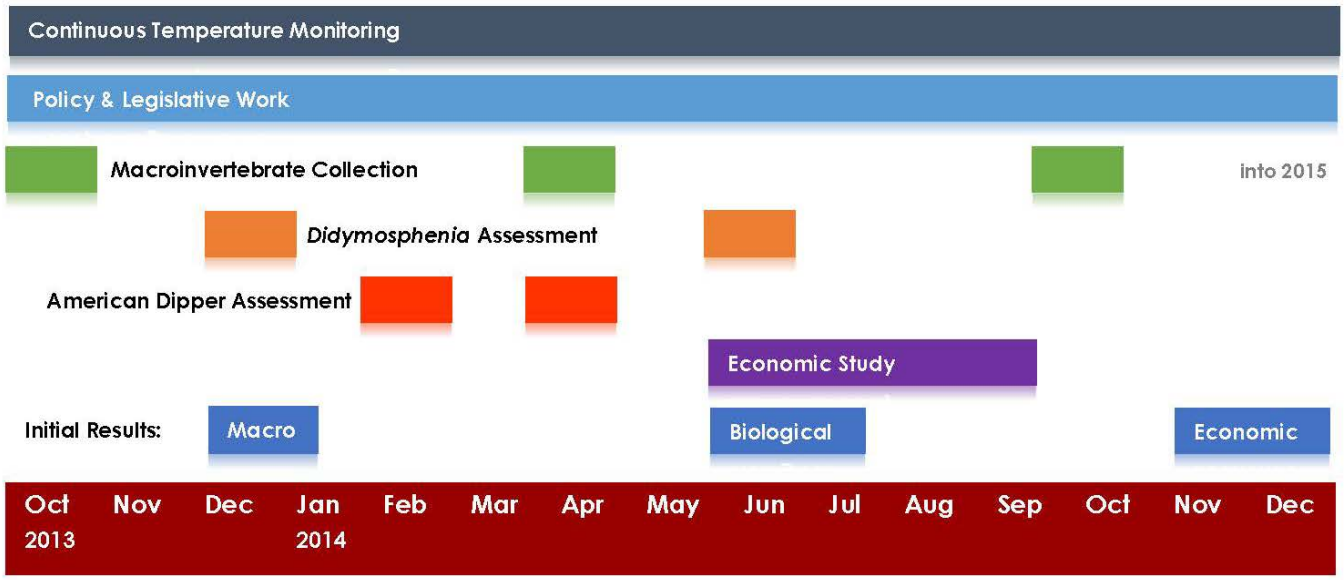
Goal

To ensure the environment and economical sustainability of the Lower Fryingpan River, including its designation as a "*Gold Medal Fishery*".

Objectives

- Assess the current biological health of the Lower Fryingpan River and if impaired identify potential causal factors and solutions.
- Recommend a long-term monitoring strategy for the Fryingpan River.
- Update Roaring Fork Conservancy's *2002 Fryingpan River Economic Study*.
- Determine and pursue voluntary and if necessary policy/legislative solutions for managing releases from Ruedi Reservoir to prevent negative economic and environmental impacts.

Components & Time Frame



BACKGROUND

The headwaters of the Fryingpan Sub-watershed drain westward from the Continental Divide into the Fryingpan River, which meets the Roaring Fork River at Basalt. The Fryingpan-Arkansas (Fry-Ark) Project, constructed in the 1960s, is a large transmountain diversion project whose infrastructure is evident throughout the sub-watershed's headwaters in the form of diversion tunnels and Ruedi Reservoir, which was built to compensate the West Slope for the Fry-Ark Project's water depletions. The Fryingpan River Valley serves as a popular destination for outdoor recreation including reservoir-based activities. One of the largest issues in this sub-watershed has been how management of Ruedi Reservoir affects stream flows, the aquatic ecosystem, and angling activities in the lower Fryingpan River.

The Fryingpan River below Ruedi Reservoir to the confluence with Roaring Fork River and the Roaring Fork River down to the confluence of the Colorado River is classified as Gold Medal. Gold Medal Trout standards designate waters that provide the greatest potential for trophy trout and angling success. The criteria specify that a stream provides at least 60 pounds per acre of trout and more than 12 trout greater than 14 inches per acre. This status is supported by the high productivity of wild brown trout. The Roaring Fork Watershed has the longest contiguous section of Gold Medal water in the state, extending along 14 miles of the Fryingpan River and 28 miles of the Roaring Fork. Only 168 miles (approximately 2%) of Colorado's 9,000 miles of trout streams carry the Gold Medal signature.

Given the lower Fryingpan River's dam-influenced flow regime, several studies have looked specifically at the effects of Ruedi Reservoir operations on the aquatic ecosystem. A study by Miller Ecological Consultants, Inc. (Ptacek et al., 2003) characterized the instream habitat and flow, macroinvertebrate community, spawning, trout populations, thermal regime, and hydrology for the lower Fryingpan and Roaring Fork rivers. Main conclusions from the study specific to the lower Fryingpan River include the following:

- The amount of suitable trout habitat has increased with post-dam conditions as compared to habitat available before the construction of the Ruedi Dam.
- Hypolimnetic releases and regulated flows in the Fryingpan River are responsible for maintaining extraordinarily high densities and biomass of macroinvertebrates. Densities were highest immediately below Ruedi Dam.
- Rainbow trout spawning success is temperature-limited and may be further reduced by whirling disease.
- Relative abundance of brown trout has significantly increased over the past 20 years and maximum size and overall biomass of brown trout have increased dramatically since installation of the dam.
- The annual maximum temperature of the thermal regime has shifted from late summer (pre-dam) to late fall/early winter (post-dam). Water released is warmer than normal in the fall and winter and cooler than normal in the late spring and summer.
- Since dam construction, base flows are augmented by reservoir releases and spring peak flows are reduced. Since 1989, reservoir releases have been significantly increased during the late summer/fall (August through October).
- Extreme fluctuations in reservoir releases on hourly and daily levels occur fairly frequently.

One of the key outcomes of this main study was a hypothesis that erratic changes in discharge have a negative impact on benthic macroinvertebrates. Therefore, a supplemental study undertaken collected enough information to suggest that the flow regime may have an important physical influence on benthic macroinvertebrate communities (Rees et al., 2003). An additional follow-up study evaluated potential impacts associated specifically with low winter flows (Miller Ecological Consultants, Inc., 2006). This study concluded that the impact to the macroinvertebrate community at the Basalt site from anchor ice appears to be influenced more by ambient air conditions than Ruedi-influenced base flow releases. The study's results also indicated that macroinvertebrate diversity and evenness appear to recover in one to two years after severe anchor ice formation if winter flows remain greater than 70 cfs, and that flows greater than 70 cfs seem to result in less anchor ice in the upper half of the river than do flows around 40 cfs.

Current Conditions

In the summer of 2013, several long-time anglers familiar with the Fryingpan River and residents along the river reported seeing lower fish numbers, including fewer large trout; decreased numbers of macroinvertebrates and some questioned the distribution pattern; fewer birds, including dippers; and increased presence of *Didymosphenia Germinata* (Didymo). These conditions followed a particularly dry year, leaving Ruedi Reservoir lower than average (Ruedi went down to 61,000 acre feet this spring, its lowest level since 2008, when it went down to 55,000 acre feet). Roaring Fork Conservancy received many reports of extensive and long-lasting anchor ice. Flows in the Lower Fryingpan River hovered around 40 cfs for almost four months. These low flows were not typical but were instituted by the Bureau of Reclamation to keep more water in the Reservoir and assure that it would come as close as possible to filling in the summer of 2013. The Bureau's operating procedures generally call for winter releases in the 70-100 cfs range but drought conditions in 2012 and the winter of 2013 led them to reduce these flows. Future drought conditions resulting from climate change and increased demands on Ruedi may lead to increased instances of low winter flows in the future.

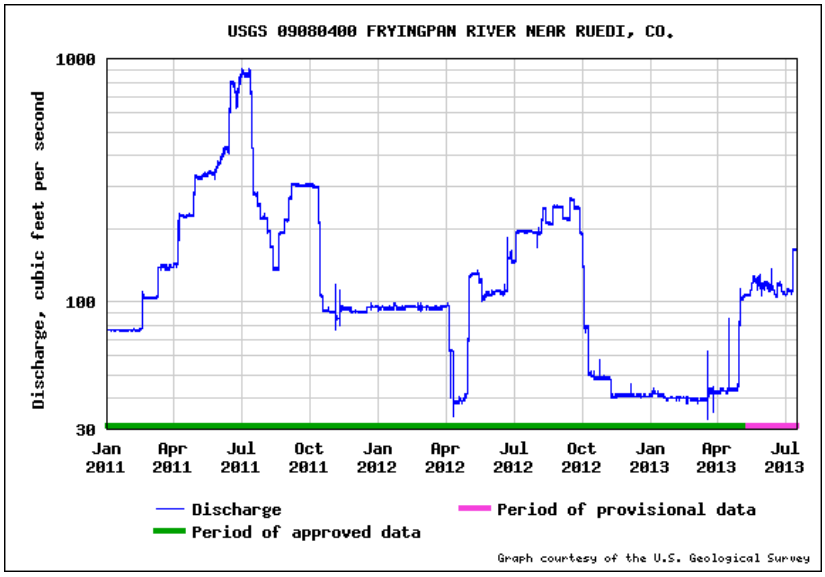


Figure 1. Flows below Ruedi Reservoir Jan. 2011-July 2013. Graph show prolonged period of low flows in the winter of 2012/2013.

Future Threats

Concurrently, Roaring Fork Conservancy provided comments on Bureau of Reclamation's Ruedi Reservoir Round II Water Marketing Program-Repayment Contracts on 19,585.5 acre feet, Ruedi Dam and Reservoir, Fryingpan-Arkansas Project Draft Environmental Assessment (Draft EA). Roaring Fork Conservancy expressed concerns about the potential detrimental effects of the Proposed Action Alternative to the aquatic life and recreational economy in the Fryingpan River and requested that the contracts be awarded with stipulations or conditions that protect the aquatic resources of the Fryingpan River. Specifically, we were concerned that

> *"A decrease in average winter flows on the Fryingpan River will likely increase the formation of anchor ice, which creates the potential for adverse effects on aquatic vegetation, macroinvertebrate populations and fish populations, both directly and indirectly because of habitat alteration and scouring events."*

and,

> "*The potential exists for the lower Fryingpan River serving as a conduit for all contracted Ruedi Reservoir releases to see significantly higher flows in the late summer/early fall, increasing the hydrologic alteration in both the Lower Fryingpan and Roaring Fork Rivers".*

On August 2, 2013, the U.S. Bureau of Reclamation released the Final Environmental Assessment for Ruedi Contracting and the Finding of No Significant Impact. They found that the contracts for water:

> *"would not result in a significant impact to the human environment, or natural or cultural resources that were not already analyzed in the Final Record of Decision for Ruedi Reservoir Round II Water Marketing Program Final Supplement to the Environmental Statement (RRII FES)."*

PROPOSED ASSESSMENTS

In response to these reports and potential additional alteration to flows, Roaring Fork Conservancy proposes to conduct a macroinvertebrate and temperature assessment and potentially dipper and Didymo assessment as well as a repeat of our 2002 Economic Study. Data from Roaring Fork Conservancy's ongoing water quality monitoring program on the Fryingpan River and stream flow data from Colorado Division of Water Resources and USGS gages on the river will be used to help interpret these data. These studies will quantify existing conditions and the value of the resource to the surrounding communities; provide guidance for ongoing monitoring; inform discussions with water contractors and the BOR, the administrator of these contacts, regarding use of this contracted water for piscatorial purposes; and determine if there is a need to modify the Fryingpan-Arkansas Operating Principles.

Macroinvertebrates and Temperature Assessments

Macroinvertebrates are aquatic insects large enough to be seen without a microscope. Some common macroinvertebrates that exist in high quality waters are the larval life stage of mayflies, caddisflies and stoneflies. Macroinvertebrates are an ideal bioindicator because of their limited mobility, relatively long aquatic life stage, high population densities, and sensitivity to disturbance. To understand existing conditions, Miller Ecological Consultants will conduct a macroinvertebrate assessment similar to the study they conducted in 2003-2004. They will work with Roaring Fork Conservancy to collect macroinvertebrates at three sites (downstream from the reservoir, near Taylor Creek, and in Basalt. These three sites will be sampled fall and spring for two consecutive years. Concurrently, Roaring Fork Conservancy will continue to collect water quality data at two sites on the Fryingpan- one above Ruedi Reservoir (near Meredith) and the other below-Baetis Bridge. Continuous temperature monitors will be placed in the river at these three sites as well as two additional sites, based on anecdotal evidence of anchor ice formation and with landowner permission. The temperature monitors will be placed near the stream bottom where anchor ice is likely to form. Any hourly occurrence with a water temperature less than 32° F will be identified as an anchor ice occurrence. Analysis will include comparison of temperature, macroinvertebrate, and flow data as well as comparison to the previous study.

***Didymosphenia Geminata* (Didymo) Assessment**

The third component of the aquatic study would document *Didymo*, a single celled alga also known as "rock snot" that can have potentially detrimental effects on macroinvertebrates, and therefore fish. It can dominate stream surfaces by covering up to 100% of substrate with thicknesses of greater than 20 cm, greatly altering physical and biological conditions within streams. Macroinvertebrate species that consume *Didymo* are expected to be favored over those species that don't eat *Didymo* and species that require exposed sediment are expected to be negatively impacted by extensive coverage of *Didymo.* It thrives in sustained low flows and is often spread by the boots of anglers. High density blooms are frequent in rivers directly below impoundments. Large floods that scour the river bed can return biomass to a low level. However, in order to reduce cell biomass, floods must be high enough to cause the rocks on the streambed to mobilize, scouring the cells from rock surfaces. Understanding its extent and rate of spread will give a clearer picture of the threat it poses.

We are evaluating several methods for assessing the presence and extent of *Didymo*. One proposed method is, with landowner permission, to walk the length of the river, document/georeference each occurrence, measure the size of each colony, and produce a map of its occurrence. Further research is needed to determine if this is the best methodology to quantify the extent in the Lower Fryingpan River and then obtain cost estimates for the best strategy. The resultant report will propose a long term monitoring strategy to assess its spread; discuss the relationship to water quality parameters such as pH, nitrogen, phosphorus and dissolved oxygen and to flow; and propose management solutions.

American Dipper (*Cinclus mexicanus*) Assessment

The American dipper is a good indicator of stream habitat quality. It is an aquatic song bird that has evolved to a top-level predator-specialist in fast-flowing mountain streams of western North America. Dippers use several environmental characteristics to select suitable nesting sites, including water quality, stream habitat quality, and riparian habitat quality. Prey abundance, foraging ease, and nesting habitat are dependent on

these environmental variables, and if any of these variables are impaired dippers will reject the site. Although dippers can compensate for a degraded resource by increasing territory size, at a certain point energetics dictate against selecting an impaired territory. The dipper diet consists almost exclusively of macroinvertebrates and fish. Dippers prey selectively on caddisfly and mayfly nymphs and dipper abundance has been strongly correlated with the abundance of these insects. Members of both of these macroinvertebrate groups are generally intolerant of pollution or extreme ecological conditions. Pollution or sedimentation can destroy macroinvertebrate populations causing dippers to abandon the site.

With landowner permission, a local ecologist familiar with dipper surveys and the Fryingpan River will walk the Lower Fryingpan and conduct a pre-breeding survey (~ Feb. 2014) to determine territories, find nests, and determine number of breeding pairs. A second survey will be conducted after breeding to determine nest success.

Economic Study

Understanding the rivers economic impacts on the town of Basalt and the Roaring Fork Valley will aid in an overall view of the importance of keeping the river healthy, beyond biological needs. The proposed economic study would echo the work done nearly a decade ago by Roaring Fork Conservancy staff. The outline and budget for this prior work is included as Attachment 1. We are researching how to revise this study using updated methods.

The Fryingpan Valley Economic Study (Crandall, 2002) revealed a wide range of information about the lower Fryingpan River, including specific results of economic impacts related to recreation activities. Some of the findings:

- The 7.5 miles of publicly-accessible river on the lower Fryingpan River represent a significant tourist destination with related impacts on the local economy. Based on the study's data (collected from November 2000 through October 2001), the Fryingpan Valley's recreation activities contributed an estimated $1.8 million annually in total economic output to Basalt's economy.
- A majority of Fryingpan River visitors come from outside of the Roaring Fork Watershed specifically to fish on the Fryingpan River. The study discovered that these visitors tended to spend nights in commercial accommodations, resulting in total direct spending as high as $135 per visitor per day.
- Based on the study's data, commercial lodging represented an important component of lower Fryingpan River visitors' expenditure patterns, especially as a proportion of Basalt's total lodging sales.
- Based on visitor counts done as part of the study, the lower Fryingpan River supports an estimated 34,200 visitor days per year - attributable mainly to fly-fishing activities on the river. 70% of these visitor days occurred during the summer season and the other 30% during the off-season (Oct.-May).
- The study identified that lower Fryingpan River recreation supports sources of income and a number of jobs across several economic sectors both in the Basalt/El Jebel area and throughout the broader Roaring Fork Watershed.
- For the study period, although about half of the economic activity related to Fryingpan Valley recreation activities was felt in the Basalt area, spending by Fryingpan Valley visitors occurred throughout the Roaring Fork Watershed, as exemplified by the various towns in which visitors stayed overnight in commercial accommodations.
- Comments made by visitor survey respondents were wide-ranging, but a few common opinions emerged. A number of survey respondents stated their desire to return to the Fryingpan Valley.

Other comments noted lack of public access to the lower Fryingpan River, and the problem of overcrowding. Through this research, Roaring Fork Conservancy hopes to gain a better understanding of the current state of the Fryingpan River and enhance our ability to be the best stewards possible of this resource.

As we gain a better understanding of the potential issues and causes, we will be working on identifying and pursuing creative options to manage Ruedi Reservoir to maintain the environmental and economic asset the

Lower Fryingpan River has become for the region. This could entail a mix of policy and legislative options discussed below.

Policy and Legislative Options

The final piece of the overall study will involve investigating options for supplementing stream flow in the Fryingpan when necessary. One option to accomplish this may be arrangements with entities that have contracted for the delivery of water from Ruedi for the release of some of that water for piscatorial purposes. There are procedural, financial and legal implications to such arrangements that need to be investigated and analyzed. Pending board approval, RFC will be partnering with RWAPA for this portion of the study.

The most recent round of contracts for Ruedi water allow for the use of contracted water for piscatorial purposes but arranging for such a use would involve negotiations both with contractors and the Bureau of Reclamation. The first step in this process will be to contact contractors and determine their ability and willingness to make water available to augment stream flows. Piscatorial water would need to be secured through a sub-contract and the terms of those contracts could involve purchase or lease of water. The sub-contracts would also need to meet the Bureau of Reclamation's criteria and would need formal approval from the Bureau.

A second, more involved option would be the amendment of previous Ruedi contracts to also allow for piscatorial use of contracted water. This would make another several thousand acre-feet of potential supplemental water available but that water would then need to be secured through the same process outlined above.

A final strategy would be to amend the Ruedi Operating Principles to acknowledge the need for maintaining adequate stream flows in the Fryingpan and the value of the Fryingpan and Roaring Fork fisheries. Amendments could include specific requirements for minimum and maximum stream flows, the addition of maintaining local fisheries as one of Ruedi's operational goals, and requirements for ongoing evaluation of fishery health and adaptation of operations to respond to fishery needs. Ruedi's operating principles are based in Congressional documents that were adopted in conjunction with the authorization of the Fryingpan-Arkansas Project over 50 years ago, so revising or amending those documents would require action at the Federal level and might also require new legislation authorizing such amendments. This would be a long-term option that could be undertaken simultaneously with those described above.

One of the strategies that has been discussed is a challenge to the recently-released Environmental Assessment (EA) associated with the sale of Ruedi water. This is not recommended for the following reasons:

- The EA examines recent sales of Ruedi water and its conclusions mirror those of the previous EIS on Ruedi water sales. Neither document addressed low winter flows due to drought which is the presumed cause of last winter's anchor ice and this summer's observations of lower macroinvertebrate levels. Therefore a challenge based on low flows due to drought would not necessarily be accepted as relevant to EA's purpose, methods or conclusions.
- Because this summer's concerns were not included in any specific way in previous comments on the EA, they may not be accepted as a timely basis for challenge.
- Even if a challenge to the EA were successful, the result would be a revision to the EA to incorporate and analyze more data, with no guarantee that the EA's conclusions would change.
- A challenge to the EA would be seen as a threat to those entities who have been working to secure contracts for Ruedi water and, through that process, to settle a number of outstanding issues associated with Ruedi, like the final repayment of the debt on Ruedi construction and the finalization of Ruedi's annual obligation of water for endangered fish species. A challenge to the EA would be opposed both by the Bureau and by those other entities which include many agencies and governments in the Colorado River Valley. The challenge process would be controversial, prolonged, expensive and possibly inconclusive.

Northstar documents

Final Letter Report – Geomorphic Assessment of the Roaring Fork River and Impacts of Groundwater Changes on Wetlands, North Star Nature Preserve, Pitkin County, Colorado

Prepared For:
Mr. John Ely
Pitkin County
Contract # 137-2011

Prepared By:

Miller Ecological Consultants, Inc.
And
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Fort Collins, CO
December 14, 2011

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Executive Summary

The objective of this report was to conduct a geomorphic assessment of the impacts of groundwater changes on the wetlands and grasslands along the valley floor and evaluate the current characteristics of the Roaring Fork River within the North Star Nature Preserve upstream of the City of Aspen, Pitkin County, Colorado. The assessment used existing literature, aerial photographs, topographic mapping and a field evaluation to complete the analysis.

The study area on the North Star Nature Preserve extended from the Smith Open Space downstream to near Highway 82 and Stillwater Road. There is approximately 4900 feet of Roaring Fork River in the study area. In addition there is a large wetland, a small pond and marsh and several old river oxbows that support wetland plant communities.

The large wetland in the northwest section of the North Star is maintained mainly by surface runoff from the hill slope and groundwater. The water flows from the wetland to the river during most months of the year. Two main ditches connecting the wetlands to the river were examined in the field. One of the ditches extends from the northeastern corner of the wetlands and one extends from the middle of the wetlands. The northern ditch appears to be two ditches that join a short distance from the wetlands. The ditch is relatively small and shallow at the western end, but deepens and narrows slightly toward the river. There is a significant drop in the bed elevation of the ditch between the wetlands and the river. The southern ditch is significantly larger than the northern ditch.

Several of the reports reviewed for this study indicated that the river was channelized after John H. Smith purchased the property in 1949. The historical maps and aerial photography show that the rivers relatively straight channel was present as far back as 1893 and that the oxbows were disconnected at least that long ago. The river channel has remained in nearly the same location for the past century. The river is now adjusted to a much different flow and sediment regime than with historical flow conditions since trans basin diversions have reduced the peak flows.

The entire length of the Roaring Fork River in the North Star was walked during the site visit. Several instream structures were observed during the field visit. Although it is unclear what the purpose of the structures was, it is likely that they were constructed either as grade control to counter the perceived channel degradation associated with assumed channel straightening or as some sort of feature that would create additional fish habitat. Regardless, it is apparent that these structures are no longer functional and are, instead, causing upstream low flow backwatering and sediment aggradation at their respective locations and, thus, may have actually reduced the amount of usable aquatic habitat at those locations.

Other riverine features within the project reach that were examined include three primary abandoned meander bends on the floodplain in the center of the valley along the west side of the river that were likely the result of meander cutoffs that took place before the mining and settlement of the valley. There are also a number of meander scars on the valley floor that are significantly older and of less significance than the three primary cutoffs.

Recommendations

There are a number of recommendations for maintaining water levels within the project area wetlands and for maintaining and increasing the usable aquatic and riparian habitat along the project reach of the Roaring Fork River.

In order to help maintain ground water levels within the main wetlands and marsh lands in the northwest corner of the North Star Nature Preserve, we would recommend the following:

- Every attempt should be made to actively discourage any activity that would result in draining of the wetlands.
- The current headgates on the ditches that connect the wetlands to the river as well as the headgate at the diversion between the wetlands and the Stillwater Ranch ponds should remain closed.
- If possible, replace the existing old headgates and dams on the connecting ditches with impermeable dams and new headgates or overflow structures. The new dams should be low enough to allow overflow from the river into the ditches and wetlands during high flow, but should be high enough that the water level in the wetlands remains at a constant level that is optimal for the health of the wetlands. The overflow height should be determined from surveys of water surface elevations during normal high and low flow conditions. The structure height should be several inches lower than normal river high flow to allow the wetland to fill from river flow. The structure should be set to maintain the wetland water surface approximately 1.0 to 1.5 feet higher than low flow river conditions. The actual height should be determined from field conditions. A continuous base flow from the wetlands into the river should be maintained and can be done by balancing the outflow to the river with the inflow to the wetlands from the hillslopes and regional groundwater system. This balance can be determined through monitoring of the water level within the wetlands over time and adjusting the outflow to the river as necessary.

The water levels in the wetlands and the marsh lands associated with the cutoff meander bends are tied to the shallow groundwater table as well as from inputs from the river. As with the main wetlands, the shallow groundwater table around the cutoffs is maintained by surface and surface spring runoff from the nearby hillslopes, by the regional groundwater table, and by overbank and subsurface inputs from the river during spring runoff. During high spring flows on the river, surface flow from the river could spill over into the lower portions of the cutoff meanders if there were no man-made berms across their confluences. Therefore, we recommend that any artificial berms placed across the confluences of the lower limbs of the three cutoff meanders be removed such that even moderate flows are able to into the lower limbs of the cutoff meander bends. The height of the connection at the confluence should be determined by field measurement during high, mid and low flow conditions. Removal of the man-made berms would also allow for some reconnection of the river with its floodplain. The reconnection with the river would allow water to move from the river to the meanders during high flow. This would help to maintain and promote wetland vegetation in the cutoff meanders. The infiltration of the water into the soil as flows recede could add to the ground water and late summer river recharge.

Some of the reviewed literature for this project recommends reestablishing the cutoff meander bends on the valley floor. This would be extremely problematic, especially considering that these meander bends were active during a period when the hydrology of the valley and sediment transport conditions in the river were significantly different from those of today. Given the current impaired hydrology of the valley, the current sediment load of the river, and the flat slope of the river through the North Star Nature Preserve reach, increasing the channel length by restoring one or more meanders would result in a very flat slope of the river at that site. This would, in turn, induce localized flooding and excessive aggradation within and upstream of the restoration site and, more importantly, could destabilize the river upstream.

There are a number of recommendations that can be made to assist in restoring, creating, and increasing riparian and aquatic habitat along the project Reach of the Roaring Fork River:

- Remove all cross-channel rock structures that are currently present in the channel. These cross channel structures appear to be remnants of an earlier restoration effort and due to changes over time no longer function as originally installed. The rocks from these structures could be placed in well spaced clusters within the channel. These well spaced clusters would not induce significant upstream degradation like the previous structures. Instead, the formation of flow separation around the boulders leads to the formation of eddies or vortices in their wake. These vortices diffuse sunlight and create overhead cover for fish. They also generate scour that develops pockets of deeper water and associated coarse substrate that add to the physical diversity of a stream reach. Fischenich and Seal (2000) provide guidance on the planning, design, and construction of these types of features.

- In addition, the rocks from the removed cross-channel structures could be used to anchor large woody debris strategically placed along the river channel. Several of the documents reviewed for this report noted the lack of large woody debris along the river in the project reach and its impact on aquatic habitat. Large woody debris provides significant habitat for fish, including areas of cover, refuge, and forage. Large woody debris, in the form of small to moderate sized native trees, both with and without leaves could be placed along the banks of the river in areas where good aquatic habitat is minimal or degraded, such as in long, straight reaches. Fischenich and Marrow (2000), Sylte and Fischenich (2000), and NRCS (2007) provide guidance on the use of large woody debris (LWD) to stabilize streambanks and enhance streambank habitat. We would also recommend that loose woody debris be placed randomly along the river to provide additional aquatic habitat.

- There are a number of places along the river that are devoid of any woody vegetation. Several of these areas have banks that appear raw as a result of active erosion. In those areas that do contain actively eroding streambanks, the lower banks are usually composed of unconsolidated, noncohesive sand and gravel which are overlain by fine-grained, cohesive floodplain soils. Since the lower bank consists of noncohesive sand and gravel, it is very difficult for vegetation to become established and remainestablished in those areas. Therefore, we recommend that in those areas, the bank toe be stabilized using natural materials such as logs placed along the bank toe, and that the upper

bank be stabilized using natural components such as fabric encapsulated soil that can be sprigged with live willow stakes. Sotir and Fischenich (2007) and NRCS (2007) provide guidance on live stake and joint planting for streambank erosion control. This method of bank stabilization uses natural materials that will not only stabilize the bank, but will ultimately reestablish bankline riparian vegetation which, in turn, will provide additional riparian and aquatic habitat.

Although these recommendations would likely require a significant budget as well as appropriate permitting to accomplish, the upfront costs should be offset and mitigated by the long-term advantages of maintain the existing wetlands and restoring in-stream and floodplain habitat at the locations described above.

We suggest that Pitkin County, through its Healthy Rivers and Streams Board, initiate discussions with the appropriate city, county, and private entities regarding the above recommendations to maintain the existing wetlands, reestablish pre-agricultural riparian conditions along the river and on the floodplain, and enhance stream channel function of the Roaring Fork River within the North Star Nature Preserve. These initial discussions could assist these groups to: 1) prioritize the recommended habitat restoration strategies in this report; 2) begin the process for habitat restoration and wetlands maintenance; and 3) develop a long term strategy for maintaining river and wetlands health and function.

FINAL REPORT
Geomorphic Assessment of the Roaring Fork River and Impacts of Groundwater Changes on Wetlands, North Star Nature Preserve, Pitkin County, Colorado

OBJECTIVE

Through a sub-agreement with Miller Ecological Consultants Inc. (MEC), Pitkin County (County) requested that Ayres Associates Inc. (Ayres) conduct a geomorphic assessment of the impacts of groundwater changes on the wetlands and grasslands along the valley floor and evaluate the current characteristics of the Roaring Fork River within the North Star Nature Preserve upstream of the City of Aspen, Pitkin County, Colorado. It is our understanding that the level of the shallow groundwater table that maintains the valley floor wetlands within the North Star Nature Preserve has been slowly dropping, causing the wetlands in the open space to recede and partially dry up. In addition, it is our understanding that the character and morphology of the channel of the Roaring Fork River along the project reach is perceived to have changed over time, both naturally and artificially, and currently provides minimal or degraded aquatic habitat. This assessment is conducted in support of the Healthy Rivers and Streams Program (http://www.aspenpitkin.com/Departments/Attorney-Pitkin-County/Healthy-Rivers-and-Streams/).

PROJECT AREA

The area to be assessed is primarily contained within the North Star Nature Preserve, which is a 175 acre tract of open space land that is generally bound by the edge of the valley floor to the west, the Roaring Fork River and State Highway 82 to the east, and extending about a mile from the Stillwater Ranch development (moraine area) on the north to the James H. Smith North Star Open Space on the south. The preserve also includes approximately 4,900 feet of the Roaring Fork River. **Figure 1** shows the project area.

BACKGROUND

As indicated in the SOW, the first task was to conduct a brief review of available literature, maps, and data pertinent to the project reach and geomorphic conditions therein. This included obtaining and reviewing existing aerial photography and topographic maps covering the project reach. Historical aerial imagery and USGS topographic maps that were available using Google Earth Pro (http://www.google.com/earth/businesses/) were also obtained and examined. Additional data was made available by the City of Aspen/Pitkin County GIS department (http://www.aspenpitkin.com/Departments/GIS-Mapping/) including 2008 and 2010 aerial imagery covering the project area. The available 2008 1-ft contour mapping that is available for the Aspen area does not cover the project area. The only available mapping of the project area is 10-ft contour mapping, which is not of sufficient detail to be useful.

Background information and other material relevant to the project reach are available primarily from the Roaring Fork Conservancy website (http://www.roaringfork.org/). One of the principal documents reviewed was the “State of the Roaring Fork Watershed” report (Clarke et al. 2008). As stated in the Executive Summary of the report, it “illustrates the current status of the Roaring Fork Watershed in terms of water quality and quantity and its water dependent eco-systems.” Detailed information for the Upper Roaring Fork Sub-Watershed, which includes the project reach, is provided in Chapter 4 of the document (http://www.roaringfork.org/pub/collaborative/4.1_URF.pdf).

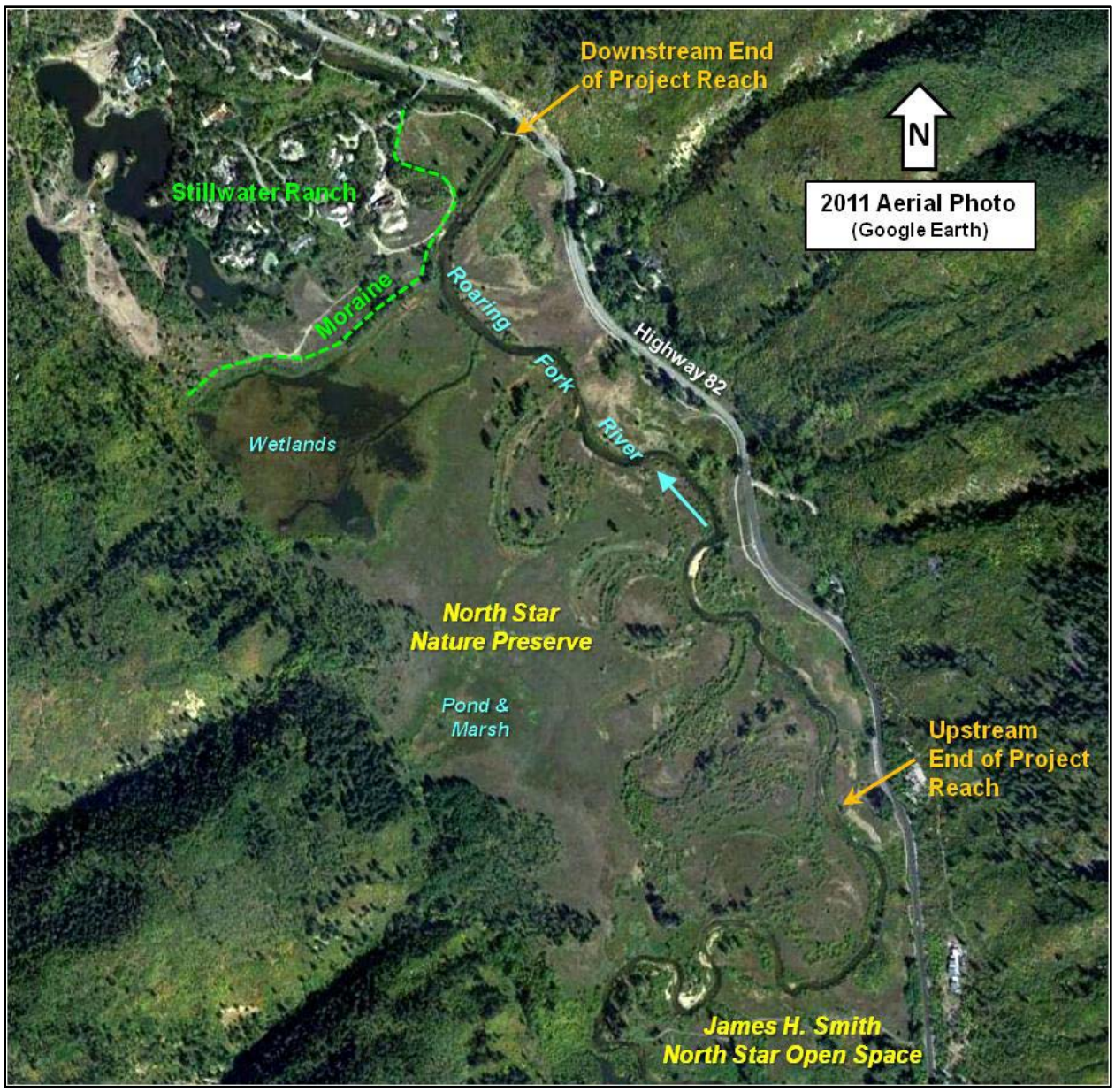

Figure 1. Location map of the North Star Nature Preserve project area including the Roaring Fork River near Aspen, Colorado. Flow is from lower right (SE) to upper left (NW).

Clark et al. (2008) and Malone and Emerick (2007) indicate that the in-stream and riparian habitat quality along this reach of the river (identified as RF3-11) is considered severely degraded. The poor quality of the habitat is attributed primarily to altered hydrologic conditions associated with in-basin and trans-mountain diversions, apparent local channelization of the Roaring Fork River with associated downcutting and bank erosion, degradation of riparian plant communities along the river, and conversion of riparian habitat on the floodplain to hay meadows.

Two documents specific to the North Star Preserve that were reviewed included the 2000 Resource Management Plan (Pitkin County Commissioners 2000) and the hydrologic and

biologic characterization conducted by Hickey et al. (2000). The Resource Management Plan provides a good description of the morphology of the preserve and provides recommendations on management actions that can be undertaken to preserve those high quality characteristics that exist within the preserve as well as actions that will improve degraded conditions. The characterization of the preserve conducted by Hickey et al. (2000) defines the hydrologic characteristics of the project area that maintain the shallow groundwater conditions that are so important to the wetlands within the preserve.

It should be noted that several of the reviewed documents indicate that degradation and erosion along the project reach of the Roaring Fork River is attributable, in large part, to the cutting off of stream meanders along the river following the purchase of the property in 1949 by James H. Smith (see Hickey et al. 2000, Malone and Emerick 2007, Clarke et al. 2008). These documents state that the apparent cutoffs, which tended to straighten the river channel, consequently resulted in channel downcutting that contributed to drying out of much of the adjacent floodplain. However, as will be shown in the following discussion, a number of lines of evidence tend to dispute these apparent assumptions of recent channel straightening and consequent degradation of the river within the project area.

MAP AND AERIAL PHOTO ANALYSIS

As part of the review for this project, a number of historic topographic maps and historic aerial photography were obtained and used to evaluate long-term changes to the Roaring Fork River and its floodplain within the North Star Nature Preserve. Historic (1893, 1958) and current (1983) topographic maps were obtained from the USGS's Historical Topographic Map Collection website (http://nationalmap.gov/historical/) and its US Topo website (http://nationalmap.gov/ustopo/), respectively. Digitally registered historic aerial photography dated 9-7-1999, 9-29-2004, 10-23-2005, 8-31-2006, and 9-23-2011 covering the project reach is available from Google Earth Pro. Relatively high resolution (1:37,400) aerial photography dated 7/8/1951 covering the project site was available from the USGS via the EarthExplorer website (http://edcsns17.cr.usgs.gov/NewEarthExplorer/).

Figure 2 shows a comparison of the valley and river planform characteristics for approximately the same area using the topo maps and aerial photos from 1893, 1951, 1958, 1983, 1999, and 2011. An examination of the valley floor and planform of the Roaring Fork River within the North Star Nature Preserve over this time period indicates that the river planform has remained relatively unchanged since 1893 and the meander scars and cutoffs on the floodplain are older than 1893.

Therefore, the sequence of historic maps and aerial photos would tend to dispute the claim found in many of the reviewed reports that the meander scars and oxbows on the floodplain within the North Star Nature Preserve are the result of manmade cutoffs that occurred following the purchase of the property by James H. Smith in 1949. Additionally, the claim within those same reports that the cutoffs induced subsequent channel degradation and erosion that may still be ongoing can also be disputed. Based on the 1893 topo map, it can be concluded that the meander scars and oxbows currently seen on the floodplain occurred more than 120 years ago. It is possible, although unlikely, that one or more meander bends may have been cutoff artificially during the dozen or so years of silver mining in the valley prior to completion of the 1893 topo map. Regardless, it can also be concluded that the current channel has already adjusted to any cutoffs that may have occurred over 120 years ago. Current conditions along the project reach of the river, as documented during the site reconnaissance conducted for this project, would also tend to support this conclusion.

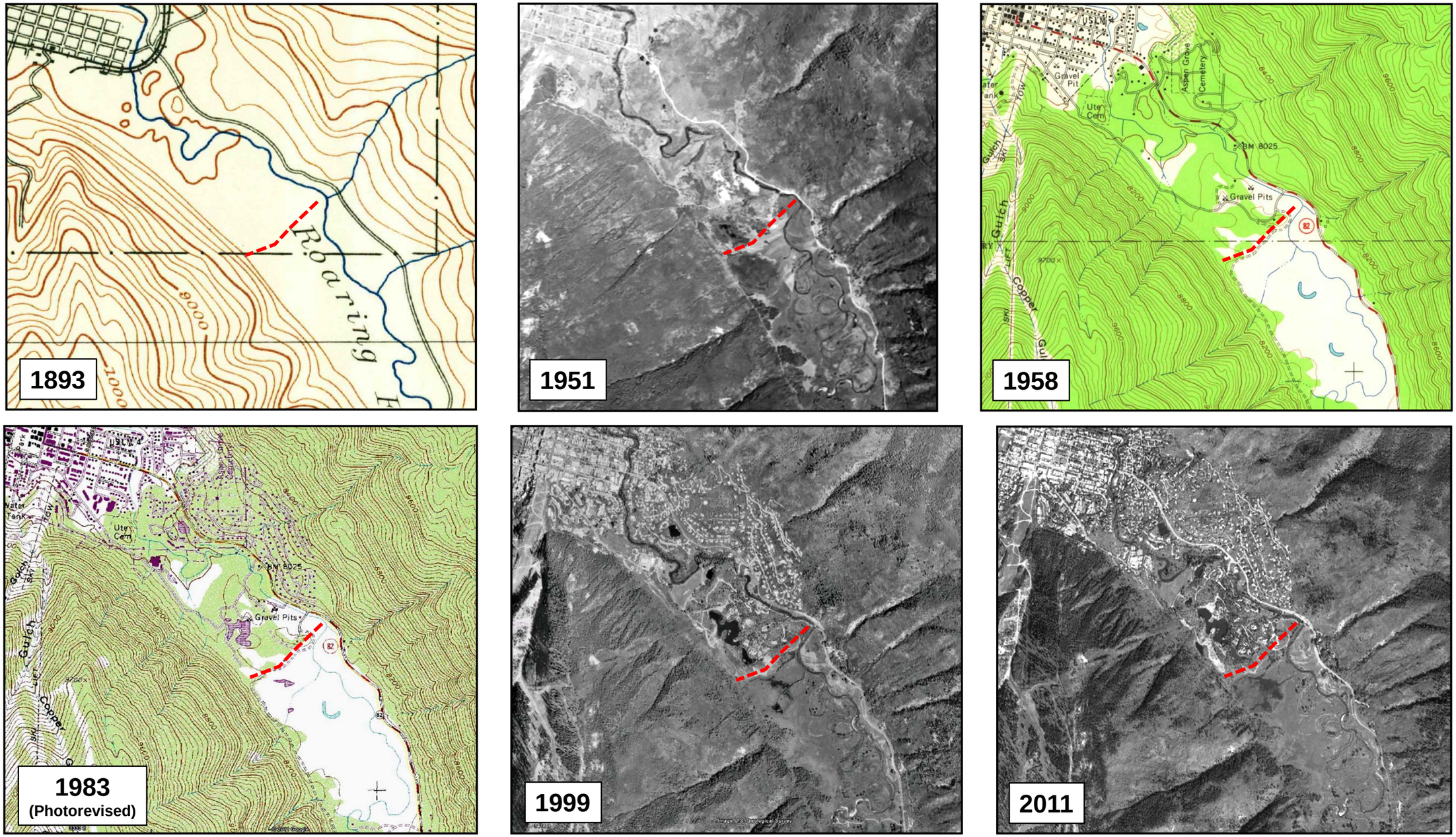

Figure 2. Comparison of the Roaring Fork River planform in 1893, 1951, 1958, 1983, 1999, and 2011. Red dashed line represent the approximate southern boundary of the Stillwater moraine.

HYDROLOGIC CHARACTERIZATION

A preliminary hydrologic characterization of the North Star Nature Preserve was conducted by Hickey et al. (2000). There are three components to the North Star hydrologic system, the regional ground water system, localized riverine recharge by the Roaring Fork River during spring runoff, and surface and shallow subsurface hillslope runoff to the valley bottom.

It is likely that the Roaring Fork River contributed to the maintenance of the North Star wetlands prior to the man-made hydrologic changes within the watershed over the last 100 years. During the spring, overbank flooding of the valley bottom may have been a regular occurrence as a result of unregulated spring floods. However, these man-made modifications to the watershed hydrology have resulted in a significant decrease in the number, size, and duration of spring floods on the river that are able to produce overbank flows. Thus, the river today contributes little to the maintenance of the valley bottom wetlands and its contribution is probably limited to partial recharge of the riverine wetlands within nearby cutoff meander bends that are at least still partially connected to the river.

According to Hickey et al. (2000): "The regional ground water system provides subsurface flow and also functions as a ground water reservoir. In this capacity, the regional system mediates and sustains water flow to the overlying valley bottom aquifer. The valley bottom aquifer also functions as a flow system and reservoir, and helps sustain flow in the Roaring Fork River. In essence, North Star is a principal ground water discharge area for a large part of the upper watershed, transmitting water from the hill slopes and regional system to the river. These inflows to, and outflows from, the valley bottom are important for several reasons: 1) they provide a relatively constant flow of water to maintain the wetlands of North Star; 2) they may attenuate peak flows of the river during periods of snowmelt and high runoff; 3) they may store water for the wetland ecosystem; and 4) they provide base flow to the Roaring Fork River."

Hickey et al. (2000) noted, based on modeling efforts, that shallow subsurface flow through unconsolidated sediments on nearby hillslopes is one of the most significant components of runoff in the Roaring Fork watershed and contributes significantly to the North Star system. They conclude that the surface and shallow ground water from the surrounding hillslopes, particularly during the snowmelt runoff period in the spring, is the main factor sustaining the wetlands along the northeast and southwest margins of North Star, and that flows are from the hillslopes through the wetland areas across North Star to the river, where they contribute to the base flow of the river during dry periods.

SITE RECONNAISSANCE AND ASSESSMENT

A site visit to assess the current conditions of the Roaring Fork River and the North Star Nature Preserve was conducted by the Ayres Project Geomorphologist, Mr. William Spitz, PG, on Monday, September 12, and Tuesday, September 13, 2011. Mr. Spitz was accompanied by Dr. William Miller of MEC. The site reconnaissance was conducted by walking and observing much of the valley floor and river within the North Star Nature Preserve as well as along the northern end of the James H. Smith North Star Open Space. The conditions and geomorphic characteristics of the Roaring Fork River, its floodplain, the North Star Nature Preserve wetlands and marshes, and the alluvial fan areas on the west side of the valley at the foot of Richmond Hill were documented through the use of field notes and photographs. Flow on the Roaring Fork River at the USGS gage (09073400) just upstream of the Stillwater Drive bridge during the site visit was 40 cfs.

James H. Smith North Star Open Space

Prior to assessing conditions along the river and floodplain within the North Star Nature Preserve, a brief reconnaissance was made of the sinuous reach of the river at the north end of the James H. Smith North Star Open Space. This area of the river was examined in order to make a comparison of conditions and characteristics of the river along the open space with those of the river within the nature preserve to determine if there is any significant difference between the reaches. As can be seen in **Figure 3**, the river at the north end of the open space is fairly sinuous, contains active bank erosion (**Figure 4**) associated with active meander bend migration processes, well developed point (**Figure 5**) and mid-channel sand and gravel bars, and in-channel sedimentation (**Figure 6**) consisting of a wide range of material from silt to gravel.

Figure 3. Google Earth 2010 image of the Roaring Fork River at the north end of the James H. Smith North Star Open Space.

Bank heights of the river in the open space reach are generally about 5 to 6 feet. In many places, the banks are composed of unconsolidated and non-cohesive sand and gravel in the lower bank position overlain by cohesive, fine grained floodplain soils (**Figure 7**). Erosion of the underlying non-cohesive sand and gravel results in the slumping or cantilever failure of the overlying soil blocks as seen in Figures 4. Depending on the timing, magnitude, and duration of subsequent high flows, these failed soil blocks may partially or completely protect the erodible toe of the bank for a period of time.

Figure 4. View upstream showing bank erosion along the outer bank of a meander bend of the Roaring Fork River at the north end of the James H. Smith North Star Open Space.

Figure 5. View of a sand and gravel point bar along the inner bank of a meander bend of the Roaring Fork River at the north end of the James H. Smith North Star Open Space.

Figure 6. View downstream showing sedimentation along and within the channel of the Roaring Fork River at the north end of the James H. Smith North Star Open Space.

Figure 7. View of the eroding left bank of the channel of the Roaring Fork River at the north end of the James H. Smith North Star Open Space. The lower bank consists of non-cohesive sand and gravel which is overlain by fine grained, relatively cohesive floodplain soils.

North Star Nature Preserve

The North Star Nature Preserve represents the primary area of focus of this assessment. Within this area are 3 individual features that will be discussed: 1) the Roaring Fork River; 2) the

abandoned meanders along the valley floor on the west side of the river; and 3) the wetlands at the northwestern corner of the preserve.

Roaring Fork River

Following the examination of the north end of the James H. Smith North Star Open Space, an assessment was made of the Roaring Fork River within the North Star Nature Preserve. Channel conditions along the Roaring Fork River within the nature preserve are comparable to those within the open space. Bank heights are similar, generally ranging from 4 to 6 feet. The bank strata is similar in that in many places, the lower bank consists of unconsolidated, non-cohesive sand and gravel overlain by fine grained, cohesive floodplain soils that fail as blocks along the bank when the underlying sediments are eroded away (**Figure 8**).

Figure 8. View downstream along the eroding right bank of the channel of the Roaring Fork River within the North Star Nature Preserve. The lower bank consists of non-cohesive sand and gravel which is overlain by fine grained, relatively cohesive floodplain soils.

The river channel along the nature preserve reach is generally stable with little bank erosion present except along the outer banks of some well developed meander bends. The bank erosion that is occurring along the outer banks of most meander bends is slow as indicated by the lack of significant meander bend movement noted in the historic aerial photo and map comparison (see Figure 2). Apparent bank erosion in other locations is, likewise, very slow. **Figure 9** shows the channel, generally stable outer bank, and the sand and gravel point bar at a well developed meander bend located at about the middle of the project reach.

Figure 9. View looking upstream showing the generally stable left bank and well developed right bank point bar along a meander bend of the Roaring Fork River at about the middle of the project reach of the North Star Nature Preserve.

In some locations along the river, a very fine grained, highly cohesive unit crops out intermittently along the lower part of the banks of the river (**Figure 10**). This unit is fairly resistant to erosion, and, where exposed, especially along the outer bank of a bend, creates a deep pool due to scour along the toe of the cohesive bank. This cohesive unit may be the remnants of sediment deposition in a lake that may have formed upstream of the Stillwater end moraine prior to breaching of the moraine by the river. The Stillwater end moraine and the possible development of the lake upstream of the moraine are briefly discussed by Spurr (1898) and Bryant (1979). If the lake did exist, coarser sediments would have been deposited in a delta at the upstream end of the lake while the very finest fractions would have been transported further downstream and deposited near the moraine. Depending on how long the lake was present, a fairly thick lacustrian (i.e., fine grained lake sediment) deposit could have formed. Once the lake was breached, this lacustrian unit would have been partially eroded as the river became reestablished and the remaining part of the lacustrian unit would have been buried by valley sedimentation and floodplain development. Depending on whether it exists, how extensive it is, and how deep it is in the subsurface, it is possible that this lacustrian unit may be assisting in maintaining the shallow ground water table within the North Star Nature Preserve.

Figure 10. View looking downstream showing a discontinuous outcrop of fine grained, highly cohesive sediments, possibly lacustrian in nature, along the right bank of the Roaring Fork River within the North Star Nature Preserve.

There are 7 man-made rock structures placed within the river throughout the project reach, the locations of which are shown in **Figure 11**. The structures generally appear to be weir-like structures consisting of a linear pile of large rocks placed in a line straight across the channel or slightly arched upstream. In most cases, the top of the structures appear to either be or were lower near the middle and sloped upward toward the ends. In most cases, the structures are slightly to heavily damaged as a result of excessive scour on the downstream side near the low point in the structure and displacement of several of the structural rocks in the downstream direction. **Figure 12** shows one of the damaged structures. In addition, most have induced excessive aggradation on their upstream sides, which is resulting in a significant decrease in flow velocity (i.e. backwatering) in the upstream channel under low flow conditions. At least 2 of the structures, one at the upstream end and one at the downstream end of the project reach, have short segments of rock riprap bank protection associated with them.

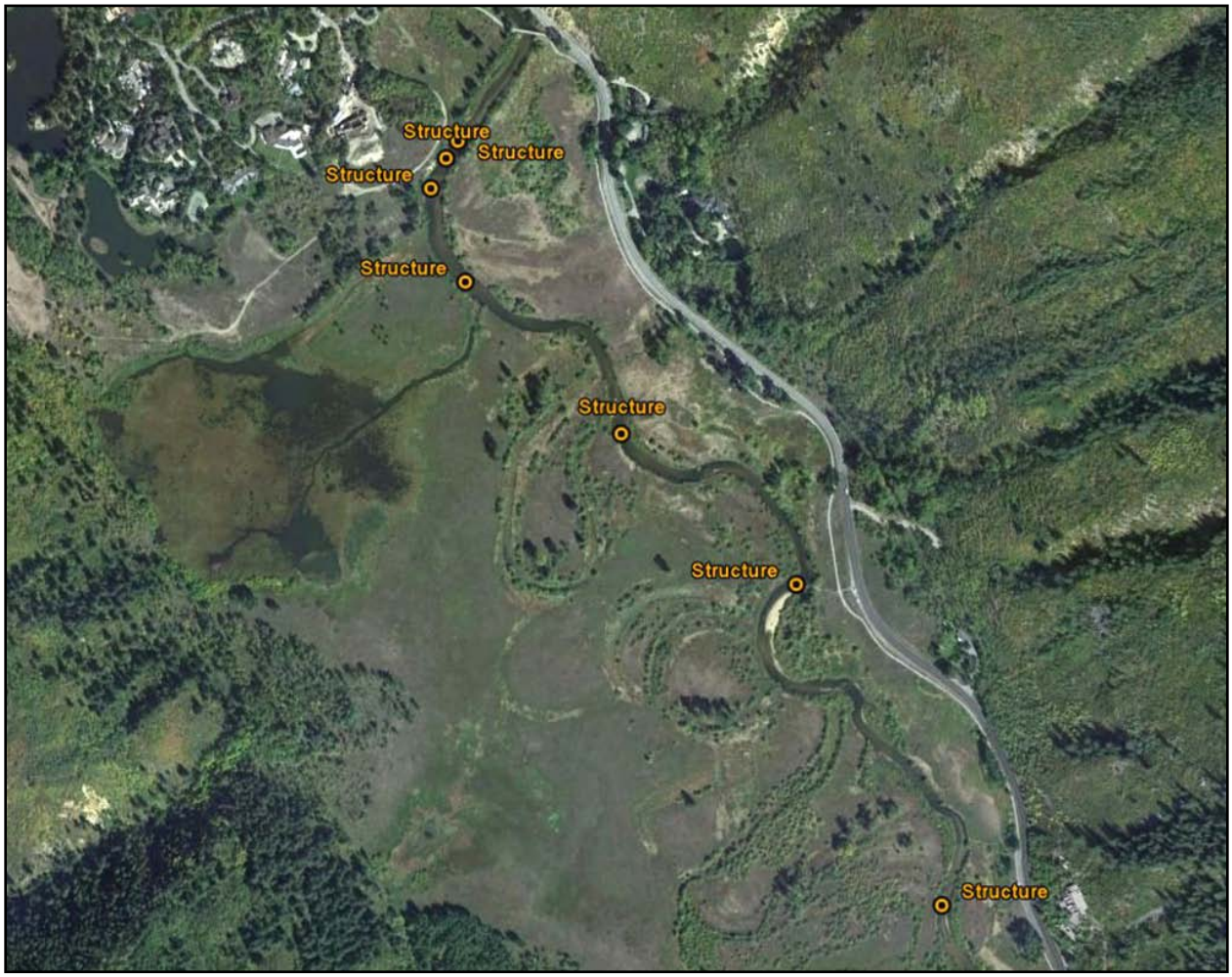

Figure 11. View of the North Star Nature Preserve reach of the Roaring Fork River showing the locations of rock structures placed in the channel.

Figure 12. View looking downstream from the right bank of the Roaring Fork River, showing one of the damaged weir-like rock structures within the project reach of the river.

It is not known when the structures were placed in the river, but they appear to be present in the 1999 Google Earth aerial photography. Although it is unclear what the purpose of the structures was, it is likely that they were constructed either as grade control to counter the perceived channel degradation associated with assumed channel straightening or as some sort of feature that would create additional fish habitat. Regardless, it is apparent that these structures are no longer functional and are, instead, causing upstream low flow backwatering and sediment aggradation at their respective locations and, thus, may have actually reduced the amount of usable aquatic habitat at those locations.

Abandoned Meander Bends (Cutoffs)

Other riverine features within the project reach that were examined include three primary abandoned meander bends on the floodplain in the center of the valley along the west side of the river (**Figure 13**) that were likely the result of meander cutoffs that took place before the mining and settlement of the valley. There are also a number of meander scars on the valley floor that are significantly older and of less significance than the three primary cutoffs.

It appears that the upstream limbs of the three cutoff bends have sufficiently filled with sediment that they appear dry most of the time, whereas portions of the bend apex and downstream limbs of the three bends are still deep enough that they are tied partially to the shallow ground water table and partially to the flow in the river. These lower lying areas contain marshy ground and marsh vegetation and, depending on spring runoff and flow in the river, are sometimes partially filled with water as can be seen in the 2010 aerial photos. Although the downstream limbs of these cutoffs are sufficiently low enough that spring flows from the river could access them, man-made berms have been placed across their confluences. These berms were likely put in place within the last 100 years in an effort to drain the areas for agricultural purposes. Regardless of the placement of the berms, water levels in the limbs of the cutoffs still fluctuate with fluctuations in the shallow ground water table and river level.

Figure 13. Aerial view of the three primary abandoned meander bends (blue lines) and other meander scars on the valley floor within the North Star Nature Preserve.

Wetlands

The third, and probably the most important component of the North Star Nature Preserve are the major wetlands in the northwest corner of the preserve and the pond and associated marsh land to the south of the wetlands between the two west side alluvial fans (see Figure 1). The main wetlands at the northeast corner of the preserve encompasses about 16.5 acres, whereas the pond and associated marsh land to the south encompasses an area of about 6-7 acres.

As part of the reconnaissance, a traverse of the northern and eastern boundary of the main wetlands was conducted to assess the extent and character of the wetlands. The current areal extent of the wetlands is shown in **Figure 14**. **Figure 15** shows part of the wetlands on the north side and the water level at the time of the site visit.

Figure 14. Google Earth 2011 aerial view of the main wetlands and connecting ditches at the northwest corner of the North Star Nature Preserve.

Figure 15. View to the southeast from the Stillwater moraine showing the main wetlands of the North Star Nature Preserve.

Two main ditches connecting the wetlands to the river were examined in the field and can be seen in Figure 14. One of the ditches extends from the northeastern corner of the wetlands and one extends from the middle of the wetlands. The northern ditch appears to be two ditches that coalesce a short distance from the wetlands. The ditch is relatively small (~3-5 feet wide) and shallow (<1 ft) at the western end, but deepens and narrows slightly toward the river. Although no headgate was evident along the northern ditch, the density of vegetation along the ditch may have obscured it from view. Regardless, there is a significant drop in the bed elevation of the ditch between the wetlands and the river. A small amount of flow from the wetlands to the river was noted at the time of the reconnaissance.

The southern ditch is significantly larger than the northern ditch as seen in Figure 14. This ditch is about 20-25 ft wide and, although the depth was not observed, it's likely that it could be as much as 3-4 feet depending on the proximity to the river and wetlands. At the time of the site visit, the water level in the main wetlands appeared to be between 1 and 2 feet above the flow level in the Roaring Fork River. This is based on the fact that the water level upstream of the dam and headgate of the southern ditch at its confluence with the river at the time of the site visit was about 1.5-2 feet above the water level in the river. Given that the confluence of the ditch is not perched, it is likely that the current bed elevation of the river at the confluence has been at that elevation since at least the time of the construction of the ditch. **Figure 16** shows the ditch upstream of the dam and headgate and **Figure 17** shows the confluence of the ditch with the river. There was visible outflow (approx. 2-3 few gallons per minute) from the ditch outfall pipe as well as significant underflow below the pipe into the river at the time of the site visit (**Figure 18**).

Figure 16. View to west showing the channel of the southern ditch upstream of the dam and headgate at the confluence with the Roaring Fork River.

Figure 17. View to east showing the confluence of the southern ditch with the Roaring Fork River just downstream of the dam and headgate.

Figure 18. View of seepage flow from and below the outfall pipe at the dam located on the southern ditch near the confluence with the Roaring fork river. The flow is returned to the river.

One of these two ditches connecting the wetlands to the river was discussed in a 2005 Aspen Times newspaper article by Morgan Smith (Smith 2005), the son of James H. Smith. In the interview, Morgan Smith talks about the construction of the ditch following the purchase of the North Star property by his father in 1949:

> "*The other drainage project was the swamp (now wetlands) about a half-mile from our house. We worked fanatically to complete a ditch from it to the Roaring Fork, repeatedly getting our tractor stuck, fighting mosquitoes, cursing the thick, gooey mud. The Barraillers watched, bemused, and occasionally pulled the tractor out with their team of horses. What they knew - and my father refused to recognize - was that the swamp was the same level as the river. It wouldn't drain, no matter how deep the ditch was.*"

Additionally, the wetlands are tied to the Stillwater ponds to the north via a diversion structure located at the north side of the wetlands and situated along the south margin of the Stillwater moraine (see Figure 14). This is a relatively new diversion structure that is controlled by a major headgate (**Figure 19**) and outfall pipe. Water released from the wetlands via the diversion structure passes down a short drainage into ponds located within the Stillwater Ranch development. The surface elevation of these ponds appears to be substantially lower than the surface elevation of the wetlands.

Figure 19. View to south showing major diversion structure and headgate in the Stillwater moraine used to control outflow from the wetlands into the Stillwater Ranch ponds.

Another major feature of the North Star Nature Preserve is the pond and marsh area just south of the wetlands along the west side of the valley (see Figure 1). The pond, which is shown in

Figure 20, may be the one described by Morgan Smith in his 2005 Aspen Times newspaper article (Smith 2005):

> "*Although my father had no real ranching experience, he had plenty of ideas, including draining certain fields to produce more hay. So for $1 a week, my first job was to empty a beaver pond that would in turn drain the field above it. This seemed like a good deal. Yank out the beaver dam, let the pond and the field above it drain, and rake in $1 a week for the rest of the summer. Little did I know that beavers rebuild their dams every night!*"

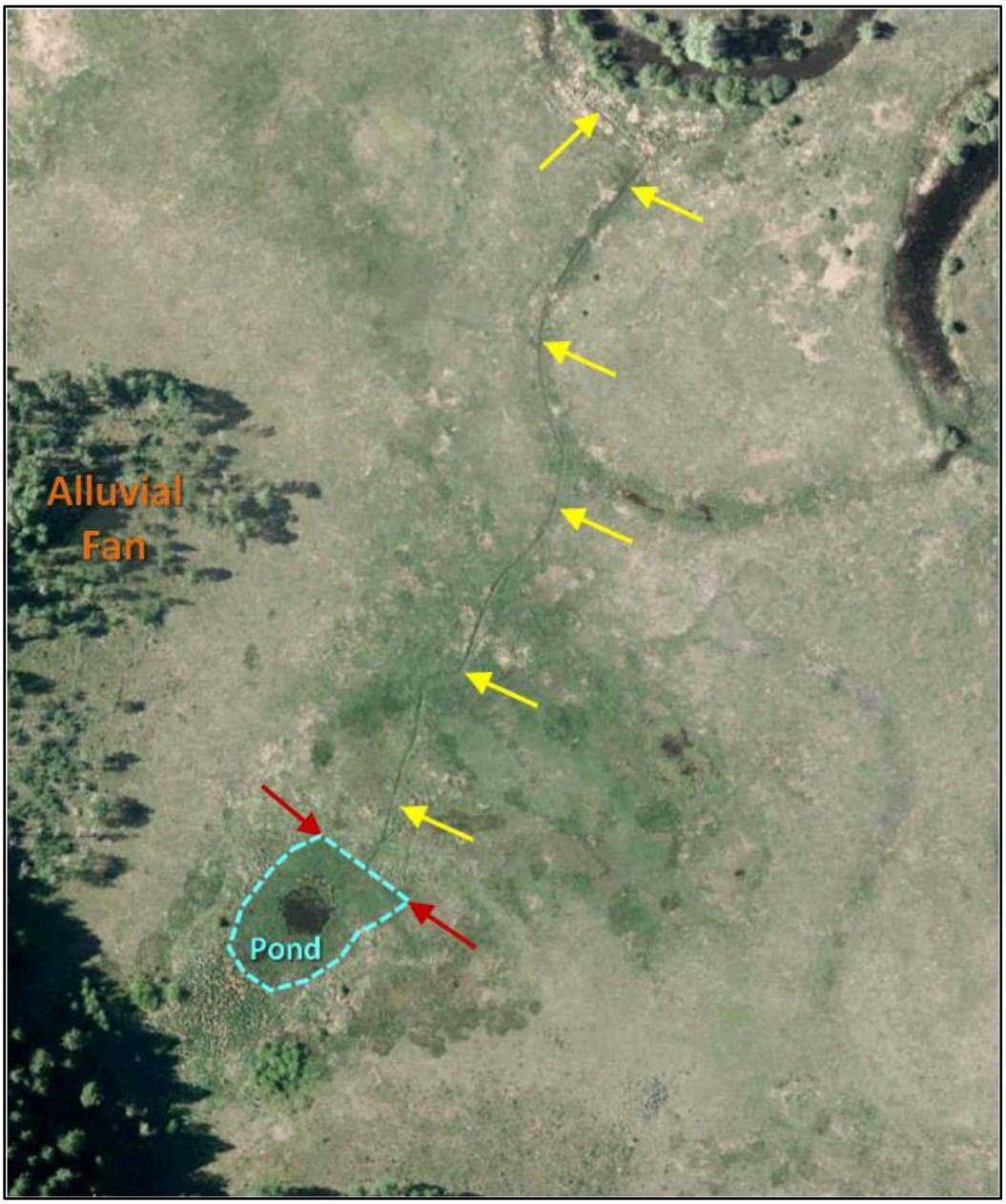

Figure 19. Aerial photo taken in 2010 showing the extent of the pond and marsh land located between the west side alluvial fans at about the North Star Nature Preserve.

The linear northeastern edge of the marsh as defined by the red arrows in Figure 20 may be representative of the location of the beaver dam, and the linear ditch defined by the yellow arrows in Figure 20 may be the ditch that was dug and maintained by Morgan Smith. Only a small remnant of the pond remains in Figure 20, while the pond and surrounding marsh land is dry in the late summer of 2011 as seen in the 2011 Google Earth images. Thus, the pond and surrounding marsh land is currently a transitory feature dependent on, among other things, the amount and duration of spring runoff from nearby hillslopes.

SUMMARY AND CONCLUSIONS

As described above, the Roaring Fork River is and has been relatively stable for more than 100 years. Although there are a number of cutoff meander bends on the floodplain within the North Star Nature Preserve project area, these cutoffs are not contemporary. Instead, they likely occurred well over a century ago or longer as determined from historic maps and aerial photos. Although the upper (upstream) limbs of these cutoffs have become naturally disconnected from the river, the lower (downstream) limbs still have a minor connection to the river and its higher flows even though there are man-made berms across their confluences.

The characteristics of the Roaring Fork River, such as width, depth, bar development, bed and bar sedimentation, and bank erosion within the North Star Nature Preserve are little different from those seen on the river within the north end of the James H. Smith North Star Open Space. Bank erosion within the project reach is not significant and, based on the map and aerial photo analysis, it can be concluded that the river is not actively migrating. Current conditions suggest that the river may be slightly aggradational as a result of the significant change in the hydrology of the watershed (e.g. reduced frequency, magnitude, and duration of spring flood flows; reduced summer base flows) as well as the increase in sediment load resulting from the erosion of roadside drains, erosion and runoff of sediment from dirt roads and driveways, and from sanding operations within the valley.

As indicated by Hickey et al. (2000), the formation, distribution, and maintenance of the main wetlands and marsh lands in the project area are the direct result of surface and shallow groundwater flow from the hillslopes of the mountains on the west side of the valley during spring runoff. The wetlands also receive secondary input from the regional groundwater system, while infrequent overbank flows from the Roaring Fork River during spring runoff may contribute a minimal amount to the system. Instead, flow from the wetlands to the river occurs for much of the summer providing a base flow to the river during normal years and a buffering flow to the river during dry years.

RECOMMENDATIONS

There are a number of recommendations for maintaining water levels within the project area wetlands and for maintaining and increasing the usable aquatic and riparian habitat along the project reach of the Roaring Fork River.

In order to help maintain ground water levels within the main wetlands and marsh lands in the northwest corner of the North Star Nature Preserve, we would recommend the following:

- Every attempt should be made to actively discourage any activity that would result in draining of the wetlands.

- The headgates on the ditches that connect the wetlands to the river as well as the headgate at the diversion between the wetlands and the Stillwater Ranch ponds should remain closed.
- If possible, replace the existing old headgates and dams on the connecting ditches with impermeable dams and new headgates or overflow structures. The new dams should be low enough to allow overflow from the river into the ditches and wetlands during high flow, but should be high enough that the water level in the wetlands remains at a constant level that is optimal for the health of the wetlands. A continuous base flow from the wetlands into the river should be maintained and can be done by balancing the outflow to the river with the inflow to the wetlands from the hillslopes and regional groundwater system. This balance can be determined through monitoring of the water level within the wetlands over time and adjusting the outflow to the river as necessary.

The water levels in the wetlands and the marsh lands associated with the cutoff meander bends are tied to the shallow groundwater table as well as from inputs from the river. As with the main wetlands, the shallow groundwater table around the cutoffs is maintained by surface and surface spring runoff from the nearby hillslopes, by the regional groundwater table, and by overbank and subsurface inputs from the river during spring runoff. During high spring flows on the river, surface flow from the river could spill over into the lower limbs of the cutoffs if there were no man-made berms across their confluences. Therefore, we would recommend that any artificial berms placed across the confluences of the lower limbs of the 3 cutoffs shown in Figure 13 be removed such that even moderate flows are able to into the lower limbs of the cutoff meander bends. This would also allow for some reconnection of the river with its floodplain.

Some of the reviewed literature for this project recommends reestablishing the cutoff meander bends on the valley floor. This would be extremely problematic, especially considering that these meander bends were active during a period when the hydrology of the valley and sediment transport conditions in the river were significantly different from those of today. Given the current impaired hydrology of the valley, the current sediment load of the river, and the flat slope (~0.0005 ft/ft or 2.6 ft/mi) of the river through the North Star Nature Preserve reach, increasing the channel length by restoring one or meanders would result in a very flat slope of the river at that site. This would, in turn, induce localized flooding and excessive aggradation within and upstream of the restoration site and, more importantly, could destabilize the river upstream.

There are a number of recommendations that can be made to assist in restoring, creating, and increasing riparian and aquatic habitat along the project Reach of the Roaring Fork River:

- Remove all cross-channel rock structures that are currently present in the channel. The rocks from these structures could be placed in well spaced clusters within the channel. These well spaced clusters would not induce significant upstream degradation like the previous structures. Instead, the formation of flow separation around the boulders leads to the formation of eddies or vortices in their wake. These vortices diffuse sunlight and create overhead cover for fish. They also generate scour that develops pockets of deeper water and associated coarse substrate that add to the physical diversity of a stream reach. Fischenich and Seal (2000) provide guidance on the planning, design, and construction of these types of features.
- In addition, the rocks from the removed cross-channel structures could be used to anchor large woody debris strategically placed along the river channel. Several of the documents reviewed for this report noted the lack of large woody debris along the river

in the project reach and its impact on aquatic habitat. Large woody debris provides significant habitat for fish, including areas of cover, refuge, and forage. Large woody debris, in the form of small to moderate sized native trees, both with and without leaves could be placed along the banks of the river in areas where good aquatic habitat is minimal or degraded, such as in long, straight reaches. Fischenich and Marrow (2000), Sylte and Fischenich (2000), and NRCS (2007) provide guidance on the use of large woody debris (LWD) to stabilize streambanks and enhance streambank habitat. We would also recommend that loose woody debris be placed randomly along the river to provide additional aquatic habitat.

- There are a number of places along the river that are devoid of any woody vegetation. Several of these areas have banks that appear raw as a result of active erosion. In those areas that do contain actively eroding streambanks, the lower banks are usually composed of unconsolidated, noncohesive sand and gravel which are overlain by fine-grained, cohesive floodplain soils. Since the lower bank consists of noncohesive sand and gravel, it is very difficult for vegetation to become established and remain established in those areas. Therefore, we recommend that in those areas, the bank toe be stabilized using natural materials such as logs placed along the bank toe, and that the upper bank be stabilized using natural components such as fabric encapsulated soil that can be sprigged with live willow stakes. Sotir and Fischenich (2007) and NRCS (2007) provide guidance on live stake and joint planting for streambank erosion control. This method of bank stabilization uses natural materials that will not only stabilize the bank, but will ultimately reestablish bankline riparian vegetation which, in turn, will provide additional riparian and aquatic habitat.

Although these recommendations would likely require a significant budget as well as appropriate permitting to accomplish, the upfront costs should be offset and mitigated by the long-term advantages of maintain the existing wetlands and restoring in-stream and floodplain habitat at the locations described above.

We suggest that Pitkin County, through its Healthy Rivers and Streams Board, initiate discussions with the appropriate city, county, and private entities regarding the above recommendations to maintain the existing wetlands, reestablish pre-agricultural riparian conditions along the river and on the floodplain, and enhance stream channel function of the Roaring Fork River within the North Star Nature Preserve. These initial discussions could assist these groups to: 1) prioritize the recommended habitat restoration strategies in this report; 2) begin the process for habitat restoration and wetlands maintenance; and 3) develop a long term strategy for maintaining river and wetlands health and function.

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Economic Study documents

REQUEST FOR PROPOSALS

For the study of the relationship between the value of the residential real estate in Pitkin County and the Roaring Fork River
Contract #140-2012

I. INTRODUCTION

Pitkin County will accept proposals from interested parties for the study of the relationship between the value of the residential real estate in Pitkin County and the Roaring Fork River

II. SCOPE OF WORK

Pitkin County is seeking qualified individuals or firms to conduct an economic analysis of the relationship between residential real estate values and the Roaring Fork River.

The study will include research to support the relationship between healthy river systems and real estate values such as the following:

- Review the literature of previous economic impact studies of rivers in Pitkin County and describe the gap in these studies related to the real estate sector.
- Apply a statistically valid and accepted method for quantitatively assessing the relationship between the Roaring Fork River (and its major tributaries) and residential real estate values in Pitkin County
- Identify and test the influence of river flow related variables on residential real estate values.
- Describe potential future diversions of native river flow from the Roaring Fork River headwaters.
- Describe the economic effects that future diversions would have on residential property values associated with the Roaring Fork River.

Responsibilities of the Consultant

The consultant shall:

1. Conduct a review of prior economic impact and value studies of water based resources in Pitkin County, and summarize what is known to date on how these water resources benefit Pitkin County. Particular note should be made of any effects on real estate values.
2. Develop a refined study design specifying a desired sample size and sampling design. Work with county staff to develop the data/variables to be requested of Pitkin County (see example of that type of data below).
3. Assemble data provided by the County plus other data deemed appropriate by the consultant to conduct a statistical analysis of the relationship between the Roaring Fork River and its major tributaries and residential real estate prices in Pitkin County.
4. Conduct statistical analysis modeling and report results of the effects of the Roaring Fork River on residential property prices. Where statistically significant influences exist, quantify the monetary effect of proximity to river and river conditions on residential property prices.

5. Provide a draft summary report describing steps #1-4 to Pitkin County for review and comment.
6. Revise statistical analysis and draft summary report to address comments and suggestions to the extent possible within the time and budget available.
7. Research and document potential future diversions along the Roaring Fork River and its major tributaries. Where possible estimate a range of reductions in flows associated with these diversions.
8. Describe the economic effects on residential real estate prices of these reduced flows. Where possible calculate the monetary effect of these losses to residential real estate along the Roaring Fork River in Pitkin County.
9. Provide a complete draft project report on the project to Pitkin County for Review and Comment.
10. Provide a final project report reflecting responses to County comments and to the extent possible within the time and budget available requested revisions to analysis.

Planning Assumptions

The scope of work is predicated on assumptions regarding the provision of the raw data by Pitkin County.

Data provided by the county

A. House, Townhome and Condominium sales and appraisal data:

Access to property sales data going back to the year 2000. This data includes details of:

sale (e.g., day, month, year),

- current appraised value,
- structure (e.g., square footage, bedrooms, bathrooms), lot size, water source, sewage connection, and other features of the home (e.g., pool, fireplace).
- Neighborhood the parcel is located in

B. Data would also include distances to:

- the nearest stream, name of that stream,
- nearest ski area
- town of Aspen

C. Locations of DNR, Bureau of Reclamation and USGS gauging stations

Time Schedule for Project

1. Kick off meeting in Aspen to meet with County staff, tour Roaring Fork River, and meet with real estate professionals.
2. Monthly conference calls will be held between the Consultant and County to discuss status of the work.
3. Preliminary data request to the county will be due 30 days after the kick off meeting. This data request may be revised after any feedback from the County on feasibility of this request.
4. Summary Draft report is due 90 days after the County has provided data agreed upon by the Consultant and the County.
5. Complete Draft Project Report is due 90 days after the Summary Draft Report.
6. Final project report is due 30 days after receiving comments from the County.

AGENDA ITEM SUMMARY

WORK SESSION DATE: August 7, 2012

AGENDA ITEM TITLE: Discussion of Hedonic Method of Valuation

STAFF RESPONSIBLE: John Ely, Pitkin County Attorney

ISSUE STATEMENT: Work Session discussion for information purposes only regarding a potential study of the effect of healthy rivers on the real estate economy in Pitkin County.

BACKGROUND OF THE ISSUE: The idea of relating healthy river flows to economic vitality is an idea that has been around for quite a few years in the Roaring Fork Valley. The essential concept is to protect instream flows by recognizing the economic value of the water resource here on the west slope. Front range water users, by comparison, have long been able to relate the water diverted across the continental divide to precise economic benefits, whether those benefits are expressed in terms of job growth or tax generation. The logic of this analysis is that some water must be left on the west slope or our local economies will suffer.

Two studies have been done previously regarding the economic value of water on the west slope generally. In 2002, the Roaring Fork Conservancy conducted an initial analysis of economic benefits associated with the Frying Pan River and most recently in 2011, the NWCOG's Water Quantity and Quality Division conducted an economic analysis of water on the west slope by an examination of the economies associated with mining, agriculture and tourism activities. These previous efforts looked only at the traditional economies associated with west slope communities and did not evaluate at all the strongest economy present in Pitkin County, real estate development.

If the strength of the Pitkin County real estate economy can be attributed in part to a healthy environment and in particular healthy rivers, then the potential economic value of the water resource present in Pitkin County is dramatically increased beyond simply analyzing the sales tax generation for recreational activities such as fishing and rafting. With this type of data, the argument potentially becomes not how much native flow should remain, but what is the appropriate measure of mitigation for the permanent loss of the resource. For example, if healthy rivers in our community contribute only two points to inherent land value in the Pitkin County portion of the Roaring Fork Valley, then the effect of its loss could reasonable be worth more than $500 million. By comparison, the execution of the Colorado River Cooperative Agreement realized only $25 million for the communities of Summit and Grand Counties and water users along the Colorado River all the way down to Mesa County.

Although it is intrinsically obvious that a healthy river and a healthy environment contribute to the value of real estate in Pitkin County, we all know and appreciate the many different

variables within our community that also contribute to this valuation. Whether or not the singular component of a healthy river can be isolated from the other many variables as a distinct contributing factor to property value is the first objective of a potential study to analyze the economic benefit of our rivers and streams.

The Pitkin County Healthy Rivers and Stream Board has unanimously approved funding for this type of analysis. The BOCC has previously expressed hesitation with going forward with such an economic study. In order to assist the BOCC in determining whether or not to go forward with this type of study, Dr. John Loomis, an economics professor and researcher with Colorado State University has been invited to describe for the Board the Hedonic Method of Property Valuation.

RECOMMENDED BOCC ACTION: No action expected or requested by the BOCC, informational only.

ATTACHMENTS:
Resume of Dr. John Loomis
Study - Estimating the Benefits of Urban Stream Restoration Using the Hedonic Price Method

Faculty

JOHN B. LOOMIS

Professor
Ph.D.: Colorado State University

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Research Interests:
John Loomis performs research in the economic valuation of non-marketed natural resources such as rivers, recreational fisheries, public lands, endangered species, water quality, and forest fire management. His research methods include the use of surveys, and involve techniques such as the travel cost, contingent valuation and hedonic property methods. The research is performed for state and federal agencies throughout the U.S., and with colleagues in Chile, China, Spain and Vietnam.

Courses:

AREC/ECON 346 - Economics of Outdoor Recreation
AREC/ECON 541 - Environmental Economics
AREC 547 - Public Lands Management
AREC 570 - Research Methods
AREC 740 - Advanced Resource and Environmental Economics
AREC 792 - Seminar - Natural Resources

Selected Publications, Presentations and Projects:

Books
Loomis, John. *Integrated Public Lands Management: Principles and Applications to National Forests, Parks and Wildlife Refuges, and BLM Lands*. Columbia University Press, New York, NY. 1993. 2nd Edition. 2002.

Loomis, John and Richard Walsh. *Recreation Economic Decisions: Comparing Benefits and Costs*. 2nd, Edition. Venture Publishing, State College, PA. 1997.

Loomis, John and Gloria Helfand. *Environmental Policy Analysis for Decision Making*. Kluwer Academic Publishers, 2001.

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The Role of Ethnicity and Language in Contingent Valuation Analysis: A Fire Prevention Policy Application. *Am. J. of Economics and Sociology* 65(3): 559-587. With L. Ellingson, A. Gonzalez-Caban & A. Seidl. 2006.

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Estimating the Benefits of Urban Stream Restoration Using the Hedonic Price Method

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ABSTRACT: The hedonic price method was used to estimate residents' willingness to pay for improvements in urban streams. This study examined California's Department of Water Resources Urban Stream Restoration Program to determine the economic value of stream restoration measures such as reducing flood damage and improving fish habitat. Seven projects from three counties—Contra Costa, Santa Cruz, and Solano—were pooled for analysis. Property prices in areas with restored streams were found to increase by $4,500 to $19,000 due to stabilizing streambanks and acquiring land for education trails. This represents from 3 to 13% of the mean property price in the study. Recommendations for facilitating further analysis are made and implications for quantifying the benefits of similar programs in other states are provided.

KEY WORDS: Nonmarket valuation, property values, water quality, willingness to pay.

INTRODUCTION

Urban streams can be assets to a community, yet flooding, erosion, streambank instabilities, and basic environmental degradation along urban creek channels pose significant problems to landowners adjacent to these creeks. Problems with urban streams arise from a change in natural stream corridor characteristics, often brought about by urbanization itself. Some properties and buildings are endangered by such processes, and despite individuals' efforts to remedy the effects, problems can recur or can cause damage farther downstream from the site.

Flooding, erosion, and streambank instability also deteriorate the natural values of streams. Historically, structural solutions such as concrete channels were typically constructed to stabilize streambanks and protect properties.

Currently, the trend is toward restoration of the natural attributes of the stream as well as structural improvements. Some structures that incorporate revegetation are wood crib walls, live fascines (which are bundles of live cuttings anchored into the streambank) and other live cuttings, and brush matting or brush layering. All are designed to slow the velocity of the stream and prevent bank instability. These methods as well as others, such as check walls, rock or stone walls, and wood plank walls, are recommended for aesthetic and functional purposes alike. Many characteristics

of a natural stream are restored using such methods, but benefits provided by these more natural methods have not been measured.

URBAN STREAM RESTORATION PROGRAMS

For some communities in California, local and state agencies have realized the need for a program to mitigate the adverse affects of flooding, erosion, and bank instability. California's Department of Water Resources (DWR) initiated the Urban Stream Restoration Program in 1985 to assist communities in reducing damages from flooding and streambank instability as well as to restore environmental and aesthetic values of urban stream channels. By encouraging the involvement of local agencies and citizens' groups, both paid and volunteer, the DWR hopes to promote stewardship and maintenance of streams by community members.

An urban stream restoration program can result in a variety of benefits, both to individual property owners and to communities as a whole. These can be grouped into two broad categories: reduction in property damages, and restoration of the natural values of the stream itself.

Damages to adjacent properties can be reduced by mitigating the effects of flooding, erosion, and streambank instability through various restoration measures. The benefits accruing to property owners are intact yards, minimal damages to trees, structures, and landscaping, and healthier streamside parks.

Benefits of returning a stream to its more natural state are more stable streambanks, restoration of the riffle-pool sequences enhancing fish habitat and other aquatic habitats, and a more aesthetically pleasing ecosystem with riparian vegetation restored and wildlife habitats protected. These benefits are identifiable yet difficult to quantify in dollar terms comparable to the cost. Measuring homeowners' value of such benefits is important in documenting the economic contribution of an urban stream restoration program and allowing comparison to the costs of such a program (U.S. Water Resources Council 1983).

Estimating residents' willingness to pay (WTP) for improvements in urban streams can be accomplished by using the hedonic price method (HPM). Hedonic pricing uses residential property value differentials to measure changes in WTP for environmental amenities in two stages. The slope of the first stage hedonic equation measures how the value of the property changes with a small change in the level of an attribute. The second stage hedonic measures the demand for larger changes in the levels of that attribute, allowing calculation of the residents' WTP for that change. In this study, we used the first stage hedonic function to measure a discrete value resulting from performing a specific stream restoration measure. We hypothesized that properties along streams that have been restored will exhibit higher property values than areas that have not been restored, if buyers perceive restored streams as an amenity. Price differentials between the two areas can be statistically related to stream improvements via multiple regression analysis.

BASICS OF THE HEDONIC PRICE METHOD (HPM)

The theory behind the HPM, as explained by Palmquist (1991), lies in differentiated consumer products. Houses that are single commodities differ in environmental attributes at their location. Consumers select properties for the number and quality of characteristics that are present at the site. Housing price differentials, therefore, reflect differences in housing characteristics (Freeman 1993).

The basic hedonic property model is presented by Freeman (1993) as the price of a property as a function of its structural, neighborhood, and environmental characteristics, or:

$$P_i = f(S_i, N_i, Q_i) \qquad (1)$$

where P_i = price of property i
S_i = structural characteristics of i

N_i = neighborhood characteristics of i

Q_i = environmental quality characteristics of i

Both Freeman (1993) and Palmquist (1991) agree that the above equation should be nonlinear based on the fact that in the housing market, "repackaging" of property characteristics is unlikely. That is to say, individual characteristics of each property cannot be varied independently. In a particular property's "bundle," a consumer cannot trade two rooms for better air quality. Thus, consumers must choose a "bundle" that best meets their needs. The marginal implicit price of a characteristic is the partial derivative of the first stage hedonic price function in equation (1) with respect to a marginal change in Q_i or "the additional amount that must be paid by any household to move to a bundle with a higher level of that characteristic, all other things being equal" (Freeman 1993). A nonlinear hedonic function yields a marginal implicit price for a characteristic that depends on the level of that particular attribute and on the level of other characteristics as well. In the second stage hedonic, estimates of residents' WTP for different levels of each attribute can be obtained.

Specifying the Hedonic Pricing Model

The dependent variable of a hedonic price function is the full price of house and land, which is regressed against the expected determinants of property price. Freeman (1993) maintains that data on actual market transactions are preferred, but if professional assessors' values are used, care must be taken to assure that they approximate actual sales value. Data for the explanatory variables can be obtained through county tax-assessors' records and census data.

As noted above, both Freeman (1993) and Palmquist (1991) suggest that a nonlinear functional form is appropriate. Freeman and Palmquist agree that a Box-Cox Transformation works well in selecting the appropriate functional form.

In general, the Box-Cox Transformation takes the form (Johnston 1984):

$$Y^{(\lambda 1)} = \alpha_n + \beta X^{(\lambda 2)} + u \qquad (2)$$

Depending on the estimated values for λ_1 and λ_2, the best functional form can be determined. For example, if $\lambda_1 = \lambda_2 = 0$, the form would be a log-log model.

Hedonic Price Analysis for Urban Water Issues

Early studies using the hedonic price approach have focused on air quality issues, yet the method is equally applicable to water quality issues. Dornbusch and Barrager (1973) used multiple regression analysis to estimate the benefit of water pollution abatement. They concluded that property values of single family residences on waterfront lots increased from 8 to 25% with water pollution control.

In 1980, Feenberg and Mills also conducted a study to measure the benefits of water pollution abatement using property data. They found that the determinants of demand were water quality at the nearest beach and number of people per dwelling. The authors concluded that the willingness to pay for slightly cleaner water rises rapidly as water becomes dirtier.

To determine the impact of degraded water quality on the value of seasonal residential properties, Young and Teti (1984) studied the shoreline properties of St. Albans' Bay in Vermont. Their main objectives were to use a hedonic model to provide a measure of water quality's influences on property values and to estimate the benefits from water quality improvements. Young and Teti concluded that the largest impact of water pollution in St. Albans' Bay affected residents and recreationists. The benefits of water quality improvements, therefore, would be higher property values and enhanced recreation, as well as improved wildlife habitat and environmental aesthetics. One significant insight from this study is that property value data reflect only those benefits to property owners. When evaluating the benefits of water quality improvements, it is critical to include other potential benefits as well.

A more recent paper dealing with urban water management problems is a study by Kriesel et al. (1993) of the benefits of shore erosion protection in Ohio's Lake Erie housing market. The purpose of their study was to measure the discount of erosion-prone lakeshore properties using hedonic

price analysis. They point out that determining the benefits of erosion protection is difficult because private and social benefits differ and market information is lacking. Their objectives were to determine how erosion and protection devices affect property prices and to calculate the benefits of such measures. The authors concluded that an average erosion control device lasting 8 years would raise property value by $5,500 from an initial time of 20 years to setback (years until shoreline property is eroded up to the house), while a device lasting 20 years would add $11,000 to property value. These benefits accrue to private property owners. Other social benefits are not mentioned; thus, total benefits of erosion protection may be understated.

DATA ANALYSIS

Creating the Data Set

Data for estimating the economic benefits of California's Urban Stream Restoration Program consist of property transactions, property characteristics, stream project characteristics, and demographics of the residents living in the area. The DWR compiled the data, beginning with the pairing of unfunded and funded projects according to similar locations, demographics, and project characteristics. A total of 7 project pairs were pooled for analysis. Initially 12 projects were selected to reflect a geographic mix throughout California, and to represent urban, suburban, and rural stream restoration projects. Funded projects similar in location were paired with unfunded projects in an attempt to control for location specific elements that might be difficult to quantify in a regression. This was done because we were not certain if we could pool the sample across projects in different locations due to the possibility that they might have different regression coefficients. Unfortunately, several projects had to be dropped because data on sales transactions or characteristics of the unfunded project were not available.

Two pairs were from Santa Cruz County, four from Contra Costa (near the San Francisco Bay area) and one from Solano County in northern California. The streams involved in the funded projects averaged a flow of about 500 cfs during storms and ranged from 2,000 to 3,000 cfs during peak winter flows. Each pair of projects contained an average of 80 properties adjacent to a funded project and 70 properties near an unfunded proposed project. The majority of the properties were single family residences (see Streiner 1995 for more details).

Each project, whether funded or unfunded, contained at least 50 properties located within 1,100 ft of the creek and 45 properties greater than 1,100 ft from the creek. Total sample size included 521 properties for the funded projects and 478 for the unfunded projects. Property data were obtained from the respective county assessor's office. These data list the lot number, type of residence, sale date, sale amount, assessed value, lot size, improvement size, number of rooms, bedrooms, and baths, and existence of a garage. Any information missing from the reports was researched by the DWR. Groups of properties were traced to the census maps to determine the census tract and the census block. This matched each property with its respective demographic characteristics.

Organizations that received funding from the DWR submitted a survey to the department detailing the completed project. Groups that failed to receive funding, and consequently did not carry out the proposed project, were interviewed by phone to determine their planned objectives, goals, and projected costs.

All data came from property sales between 1983 and 1993. Sales prices and assessed values were adjusted by fixed weights from the U.S. residential price index found in the Survey of Current Business (U.S. Dept. of Commerce 1995). Ideally, a California or San Francisco Bay area specific price index would have been used but we could not locate one. Percent changes in the price index were used to convert property values to a base year, 1982, for comparison over time without the influence of inflation or a characteristic increase in property prices in California's housing market.

To correctly account for changes in stream attributes, properties that were sold before the restoration projects began were coded with zeroes for the restoration mea-

TABLE 1
Correlation matrixes for restoration packages

	Fish habitat	Acquire land	Education trail
Restoration package A			
Fish habitat	1.0000	0.8273	0.8273
Acquire land	0.8273	1.0000	1.0000
Education trail	0.8273	1.0000	1.0000

Restoration package B	Stabilize	Redfldam	Cleanup	Clrobs	Reveg	Aesthetics
Stabilize	1.0000	0.6383	0.6562	0.7481	0.6996	0.6026
Reduce flood damage	0.6383	1.0000	0.6743	0.8532	0.6805	0.5019
Clean up	0.6562	0.6743	1.0000	0.8771	0.6996	0.7665
Clear obstructions	0.7481	0.8532	0.8771	1.0000	0.7977	0.6591
Revegetate	0.6996	0.6805	0.6996	0.7977	1.0000	0.9128
Aesthetics	0.6026	0.5019	0.7665	0.6591	0.9128	1.0000

sures. Of the seven funded projects in the sample, all but one were initiated in summer 1989. On average, restoration projects were completed in 1½ years.

Estimating the Hedonic Equation

As shown in equation (1), a hedonic equation is specified as a function of structural, neighborhood, and environmental variables. We chose variables that represented each of the three categories. In our data set, many of these variables within each category were correlated with each other. Therefore, the first step in variable selection is to conduct an analysis for multicollinearity among the candidate explanatory variables. A correlation matrix was calculated using Econometric Views (Lilien et al. 1994). Many of the stream characteristic variables are highly correlated with each other, having correlation coefficients greater than 0.80. In addition, many of the property and demographic characteristics are highly correlated. To avoid high sampling variances and low t-statistics, variables must be chosen to minimize the effect of multicollinearity.

The second step was to conduct regression analyses on groups of independent variables to calculate partial R^2's. Results from this test should indicate which variables in each of the three groups (property, stream, and demographic characteristics) are most influenced by the others. Independent variables with low partial R^2's within the three groups of projects are preferred to minimize multicollinearity.

The stream measures were grouped into "packages" according to each variable's correlation with the others. The packages and correlations are shown in Table 1. A correlation coefficient of one indicated that the two variables were always carried out in the restoration projects together and, therefore, were exactly the same in the regression, and, in fact, influence each other. For example, because both "acquire land" and "establish an education trail" variables were needed together; the correlation between those measures is one.

Based on the review of the literature and the partial R^2's, a subset of the variables in each package was selected as candidate variables that were most likely to determine the value owners place on a property. Omitting a stream restoration variable that is correlated with an included restoration variable may lead to mis-specification and bias in the included variables. We recognize this problem and consider the estimated coefficient on the included stream restoration variable to reflect the joint effect of all the stream restoration variables that it is correlated with in its package. The robustness of using different stream restoration variables from the same package in the hedonic regression is then tested by comparing the resulting sign, size, and statistical significance of the coefficients in Table 2 and the resulting marginal values in Table 3.

TABLE 2
Box-Cox nonlinear regression models

Mean of Assessed Property Price = $144,085

	Joint Model		Edtrail		Stabilize		Acqland		Fishab		Redfldam	
Variable[a]	Coeff.	*t*-stat	Coeff.	*t*-stat	Coeff.	*t*-stat	Coeff.	*t*-stat	Coeff.	*t*-stat	Coeff.	*t*-stat
Impsize	0.0104	6.94	0.0106	4.18	0.0104	4.33	0.0114	4.21	0.0112	4.24	0.0104	4.31
Lotsize	0.0002	7.22	0.0002	3.57	0.0002	3.69	0.0002	3.59	0.0002	3.62	0.0002	3.67
Year	0.2504	1.57	0.4434	2.53	0.1855	1.26	0.3902	2.22	0.3782	2.22	0.2527	1.72
Garage	2.0347	2.80	2.1222	2.51	2.1556	2.70	2.0530	2.32	2.1594	2.47	2.6866	3.04
Ckdist	−0.0006	−2.03	−0.0007	−1.92	−0.0005	−1.56	−0.0006	−1.68	−0.0006	−1.70	−0.0005	−1.63
Pcinc89	0.0010	8.76	0.0010	4.14	0.0009	4.27	0.0011	4.14	0.0011	4.18	0.0010	4.28
Travelt	−0.4419	−6.24	−0.4671	−3.58	−0.5246	−3.87	−0.5367	−3.67	−0.5323	−3.71	−0.5052	−3.79
Meanage	0.2280	3.64	0.2544	2.96	0.2014	2.74	0.2595	2.87	0.2509	2.88	0.2264	2.91
Unemprt	−0.2138	3.22	−0.2621	−3.31	−0.2242	−3.11	−0.2707	−3.22	−0.2591	−3.20	−0.2133	−2.96
Edtrail	7.1364	2.17	9.5990	2.79								
Stabilize	3.0184	3.00			2.6617	2.59						
Acqland							10.596	2.83				
Fishab									8.8092	2.88		
Redfldam											4.6474	2.98
Constant	−5.8401	−0.40	−21.883	−1.42	3.1560	0.24	−15.062	−0.97	−14.307	−0.96	−5.0554	−0.39
Lambda	0.7169	15.81	0.7230	15.86	0.7047	16.07	0.7375	16.27	0.7309	16.27	0.7097	16.15
N =	1,055		1,055		1,077		1,077		1,077		1,077	
R^2 =	0.553		0.549		0.534		0.540		0.539		0.537	

[a] where Impsize is house size, Lotsize is property size, Year is the year in which the property was sold, Garage is presence of a garage, Ckdist is distance from creek, Pcinc89 is per capita income in 1989, Travelt is travel time to work in minutes, Meanage is the mean age of the population in the sample, Unemprt is the unemployment rate, Stabilize is stabilize stream banks, Edtrail is establish an education trail, Acqland is acquire land, Fishab is fish habitat, Redfldam is reduce flood damage and Lambda is the exponent to which the dependent variable is raised.

The dependent variable in the regressions is the assessed value of the properties at the time of sale. It is not significantly different from the actual sale value. This is not surprising because with California's Proposition 13, assessed property values are updated to the new market price at the time of sale. A Box-Cox transformation was employed to determine the functional form that fits the data and the variables that best explained the variation in the dependent variable (the assessed value in real terms).

To conduct multiple regression analysis, the question of functional form was addressed using the Box-Cox transformation method (Greene 1992). This method allows the transformation of both the dependent and independent variables. The Box-Cox transformation indicated a nonlinear functional form to fit the data. This model was used in the multiple regression analysis. The Box-Cox transformation method allows transformations of both the left-hand-side and right-hand-side variables in a regression equation, depending on the nature of the data and the interaction of the independent and dependent variables. Preliminary regressions were attempted using all four possible Box-Cox specifications: transformation of the dependent variable by lambda, the independent variables by lambda, both independent and dependent variables by lambda, and transforming the dependent variable by theta and the independent variables by lambda. Using LIMDEP (Greene 1992), the model chosen for this data set, transforms only the dependent variable: assessed property value. Based on the minimum value of the log-likelihood value, preliminary regressions indicated this transformation was best. Lambda represents the exponent to which the dependent variable is raised. The model is nonlinear, as suggested by the hedonic price theory reviewed previously.

White's general test for heteroskedasticity was performed on the final regression model. A positive result indicates large variances. Weighted least squares could be used to correct for this, but there were several possible variables that might be appropriate as the weight. However, only one variable can be used as the weight. Thus, to avoid this problem, we corrected for heteroskedasticity by using White's Heteroskedasticity-Consistent Standard Errors and Covariance (Lilien et al. 1994), which reduces the standard errors and makes the t-statistics more accurate. Table 2 reports the t-statistics after the standard errors are corrected. R^2's for each of the regressions were calculated by an ordinary least squares estimation procedure using the transformation of the independent variable by lambda.

STATISTICAL AND PROPERTY VALUE RESULTS

Statistical Results

The final regression equation contains three property variables that have minimal correlations among each other, three neighborhood or locational variables, three demographic variables, and two stream improvement variables, one from each restoration "package." This can be found in the first column of Table 2. Stream restoration measures in Tables 1 and 2 are simply dummy variables for whether or not that measure was performed in the project. For all the regression results in Table 2, improvement size, lot size, garage, per capita income, travel time to work, mean age, unemployment rate, and lambda are significant at least at the 5% level. Coefficients on the nonstream variables remain stable even when different stream variables are used in the regression. Creek distance is significant at least at the 10% level. The stability of restoration measures is indicated by the coefficients on education trail, stabilize streambanks, fish habitat, acquire land, and reduce flood damage, which are each significant at the 5% level in their respective regressions. Whereas the year of sale is not significant at the 10% level, it has a t-statistic of greater than one and is included in the model to account for possible increases in real property prices over the time frame of the study.

Table 2 shows regression coefficients for the models with two measures that are grouped together in a restoration package. Both "reduce flood damage" and "stabilize streambanks" are by themselves positive

and significant. As shown in Table 2, "stabilize streambanks" and "education trail" are both significant when included together. Both "reduce flood damage" and "education trail," however, were not significant when included together in the model.

Property Value Results

The individual values for the stream improvement measures can be calculated from the coefficients estimated by the model. The method evaluates the change in property price due to the measure itself, holding all other variables constant at zero. The following equation from Greene (1992) for the Box-Cox nonlinear regression model was used to calculate the individual values.

$$y = [(\lambda^{*}\beta X) + 1]^{1/\lambda} \qquad (3)$$

As an example of this calculation, the value of the fish habitat variable is set equal to one. This indicates the completion of that measure. If the other variables are held constant at zero, the equation becomes:

$$\text{Change in property price} = (0.7309^{*}8.8092 + 1)^{1/0.7309}$$

The result is 15.571, or $15,571 change per property in the area where the restoration project improved fish habitat.

When both an education trail and bank stabilization are carried out together in the projects, property values increase $19,078 over properties without these measures. These restoration measures include other aspects that were generally carried out in the sample projects, such as clearing obstructions, revegetating, acquiring land, and making other improvements.

Values for the restoration "packages" that contain stream restoration measures that can be grouped together according to each variable's correlation with each other are presented in Table 3. From Package A holding all other variables at zero, establishing an education trail is perceived by buyers to contribute $17,560 to the price of a property. When compared to the mean property value of the sample, this makes up 12% of the property value. Maintaining fish habitat was perceived to be worth $15,571, and acquiring land was valued at $19,123 per property. Similar values (each is within $2,000 to $4,000 of each other) and their high correlations with each other indicate that these measures are not independent of each other but, in fact, appear to measure the joint effect. Establishing an education trail and acquiring land are perfectly correlated. This follows because, to establish a trail, land is needed along the riparian area. The end result is that the value for an education trail calculated from the sample of projects also includes the value of acquiring land and maintaining fish habitat.

TABLE 3
Value of restoration packages

	Absolute amount	Percent of property value
Restoration package A[a]		
Fish habitat	$15,571	11
Acquire land	$19,123	13
Education trail	$17,560	12
Restoration package B[a]		
Stabilize	$ 4,488	3
Reduce flood damage	$ 7,804	5
Joint model		
Package A (Edtrail)		
Package B (Stabilize)		
Total	$19,078	13

[a] NOTE: The individual measures cannot be added together because they are simply alternative measures of the joint effect of all these variables in the package.

Both "stabilize" and "reduce flood damage" enter into the regression equation positively and their values are also listed in Table 3. Stabilize has a value of $4,488 per property and reduce flood damage contributes $7,804 or 5% of property value. Individually, it appears as though stabilizing streambanks does not add as much to property value as does reducing flood damage and the measures in Package A. The values reflect buyers' perceptions at the time of purchase; perhaps education trails and less damaged banks are more visually important to home buyers than the technical details of bank stabilization.

Reducing flood damage is highly correlated with other stream measures, such

TABLE 4

Linear feet of stream restoration regressions

Mean of Assessed Property Price = 144,085

	Education trail			Fish habitat			Reduce flood damage		
Variable	Coeff.	t-Ratio	Mean of X	Coeff.	t-Ratio	Mean of X	Coeff.	t-Ratio	Mean of X
Impsize	0.0106	4.189	1,456.3	0.0113	4.231	1,455.9	0.0110	4.260	1,455.9
Lotsize	0.0002	3.578	7,471.3	0.0002	3.614	7,518.7	0.0002	3.643	7,518.7
Year	0.4434	2.538	88.87	0.3810	2.220	88.91	0.3027	1.890	88.91
Garage	2.1222	2.512	0.627	2.1314	2.428	0.635	2.4266	2.714	0.635
Ckdist	−0.0007	−1.920	1,188.1	−0.0006	−1.70	1,181.3	−0.0006	−1.633	1,181.3
Pcinc89	0.0010	4.145	17,378	0.0011	4.173	17,431	0.0011	4.218	17,431
Travelt	−0.467	−3.581	28.278	−0.532	−3.696	28.27	−0.512	−3.690	28.37
Meanage	0.2544	2.965	33.129	0.2541	2.886	33.162	0.2479	2.901	33.162
Unemprt	−0.2621	−3.317	5.99	−0.2608	−3.189	5.92	−0.2285	−2.952	5.92
Trailfeet	0.0383	2.796	6.16						
Fishfeet				0.0382	2.899	7.335			
Damagefeet							0.0381	3.113	11.64
Constant	−21.88	−1.42		−14.56	−0.965		−9.19	−0.645	
Lambda	0.7230	15.861		0.7334	16.289		0.7283	16.336	
N =	1,055			1,077			1,077		
R^2 =	0.549			0.540			0.541		

as stabilizing streambanks, clearing obstructions, and revegetating the riparian area. The value obtained for reduced flood damage, therefore, cannot be entirely attributed to that individual measure.

It is important to remember that the values for each measure do not take into account the costs of performing that measure. The benefit differential among measures may be offset by a differential in the costs of restoration. In other words, deciding to acquire land solely because it produces the greatest gross benefit is not an adequate reason. The higher cost of acquiring land may far outweigh the benefits of the measures, thus reducing the net benefit (benefit-cost) of the measure.

Maximizing net benefits, therefore, would be a better objective in deciding which restoration measures to carry out in a project. The benefits must be weighed against the costs. For instance, the following hypothetical example illustrates the proper analysis:

The benefit of acquiring land has been determined to be $19,123 per property. The benefit of stabilizing streambanks is $4,488. If costs of acquiring land, however, are $18,000 per parcel of land in a project, and it costs only $400 to stabilize the same area of streambank, the net benefit of acquiring land is only $1,123 while the net benefit of stabilizing is $4,088.

Performing bank stabilization and establishing an education trail together yield a total value of $19,078, or 13% of mean property value. It must be kept in mind that because each variable in a package contains the influence of the other variables, only one variable from each package can be chosen to calculate total value. In addition, individual measures from A cannot be added to individual measures from B to determine the total value because of the nonlinear functional form of the hedonic equation.

Continuous Measures of Restoration Activities

Where the previous values have been discrete measures, values for certain restoration activities can be represented in an alternative fashion, in terms of linear feet restored. Regression results are reported in Table 4. Changes in the value of property with different amounts of restoration, measured in linear feet, are determined for establishing an education trail, improving fish habitat, and reducing flood damage. The values for a change in property value as the linear feet of an education trail along a creek are expanded are valid for restoration between one and 250 linear ft. These values are based on the range of our data and are approximately $1,000 to $17,560 per property. Note this value of $17,560 is the same value determined using the dummy variable approach for establishing an education trail.

The property value changes with increasing linear feet of fish habitat maintained are relevant from one to 250 linear ft of restoration. The values for improving fish habitat range from $1,000 for one linear ft to $15,000 for the mean amount of restoration (225 linear ft). Again, these values are based on the range of the data in the sample. Changes in property values from $1,000 for one linear ft to $11,350 for 175 linear ft of reduced flood damage are determined from the model. These values represent a continuous measure of the value of restoration activities.

CONCLUSION

The hedonic pricing method proved applicable to measuring the benefits of selected urban stream measures. The Box-Cox nonlinear regression model provided an equation for which the coefficients of stream restoration variables could be estimated. From the regression coefficients, property value changes were calculated and the value of restoration measures determined. These increases in property values were attributed to specific stream restoration measures, yet the high correlation among measures indicates that generally more than one measure is reflected in the value of any one individual measure.

For measures such as establishing an education trail, maintaining fish habitat, and acquiring land and/or easements along a stream, the one time increase in property value ranges from about $15,570 to $19,120

per single family residence. For stabilizing streambanks (which includes cleaning obstructions, revegetating streambanks, and cleaning up the stream) and reducing flood damage, property values increase about $4,480 to $7,800 per single family residence. These values are specific to our sample of projects, which reflects the San Francisco Bay area and Santa Cruz. It may not be appropriate to generalize these values to other geographic areas. However, the basic method would be applicable.

To alleviate the problem of multicollinearity among project measures, it would be useful to have information on the amount of restoration done, such as the number of linear feet. Three measures of this type—linear feet of fish habitat maintained, education trail established, and flood damage reduced—produced changes in property prices from $1,000 to $17,560, depending on the number of linear feet restored. It is important for analysis to have all projects report the amount of restoration completed for valid calculation of values.

Another recommendation for alleviating the correlation among stream variables is to define measures more specifically. If one objective can be accomplished by performing another, then the objective is too broadly defined and increases the difficulty of computing a separate value for each measure.

The benefit of these increases in property values also benefits communities as a whole. In California, using the Proposition 13 tax rate of 1.25% of property value, an increase in property value of $19,078 would provide about $240 per house in additional property tax to the community annually. When added up over the large number of single family homes in the funded areas, the present value of the added tax money over the life of the restoration project is likely to contribute far more revenue than the program costs (which in our study has a median value of $34,920).

Based on our research, the basic hedonic property approach appears to be useful for evaluating the benefits of a wide variety of urban stream restoration programs.

Acknowledgments

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Kayak Park documents

PITKIN COUNTY
WHITEWATER PARK FACILITY
BASALT, CO
JULY, 2010

DRAWING INDEX

LEGEND

- Ordinary High Water Line
- Existing Rip Rap Limits
- Base Line for X-Sections
- Spot Elevation
- Phase Delineation
- Silt Fence
- Scattered Trees
- X-Section Line
- Placed Boulders
- Existing Boulders
- Proposed Grade
- Pre-cast
- Permeable Turbidity Curtain
- Coffer Structure Jersey Barrier
- Coffer Structure CMP Diversion
- Limits of Willows

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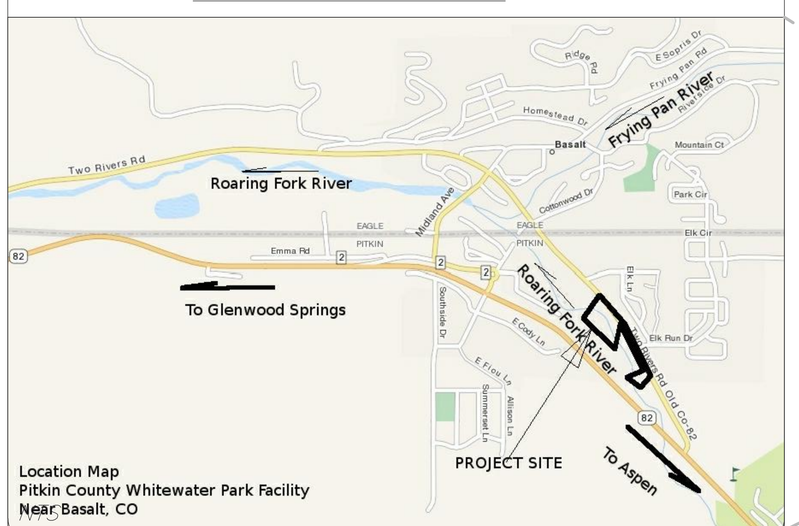
(970)-947-2924

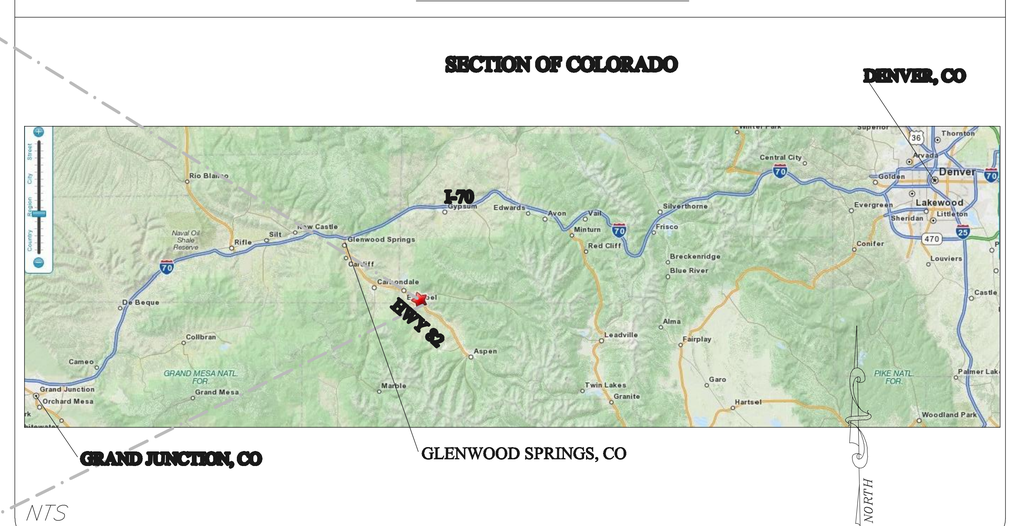
4. Mr. Larry Thompson P.E.
Town Engineer
Town of Basalt
(970)-927-4703

LOCATION MAP



Location Map
Pitkin County Whitewater Park Facility
Near Basalt, CO
NTS

VICINITY MAP



NTS

General Notes

Pitkin County
Whitewater Park Facility
PRELIMINARY DESIGN
VICINITY MAP, DRAWING INDEX, LEGEND

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Project Name and Address
Pitkin County
Whitewater Park Facility

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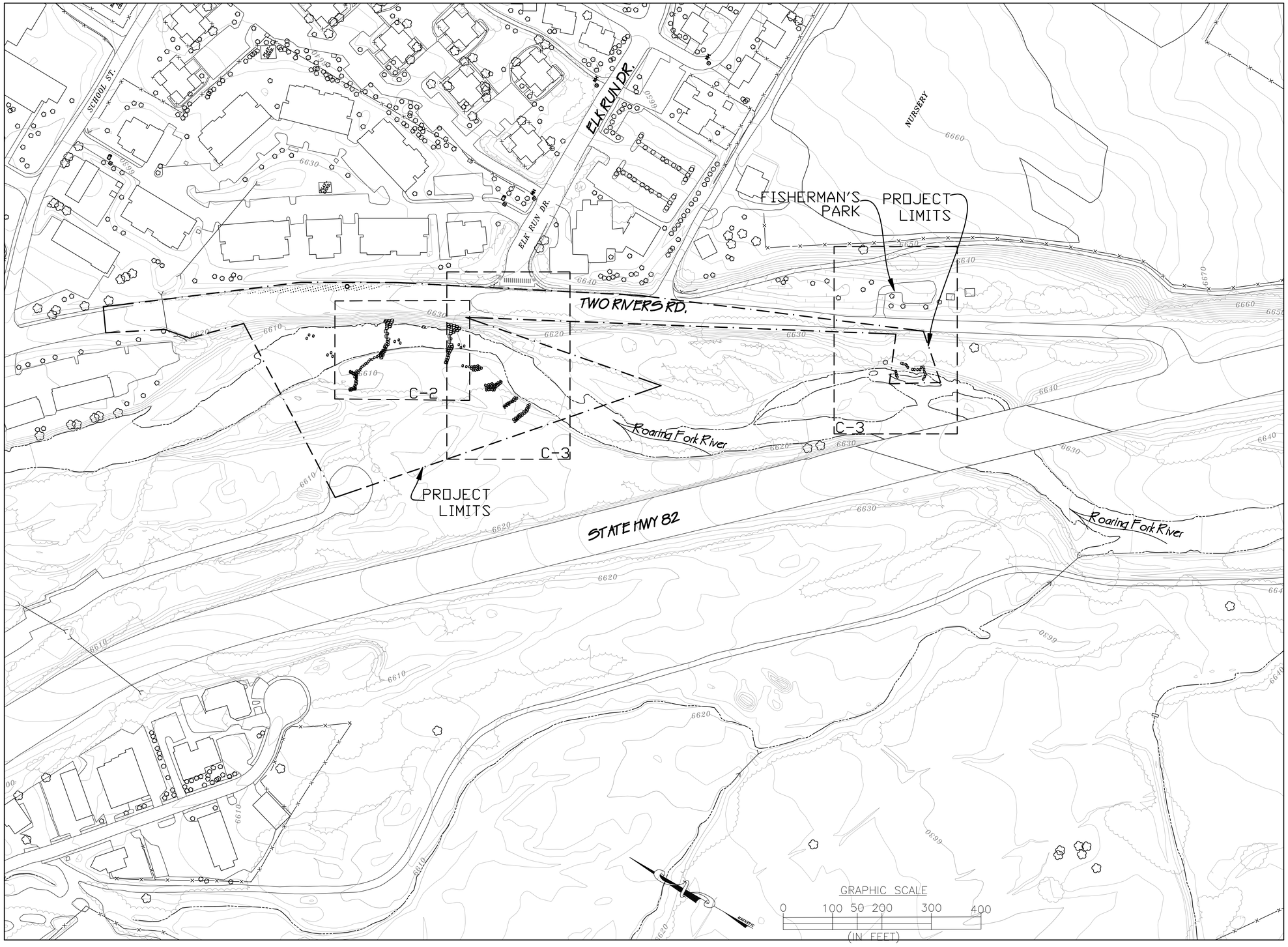

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Project: Basalt WWP

Date: 06-13-2010

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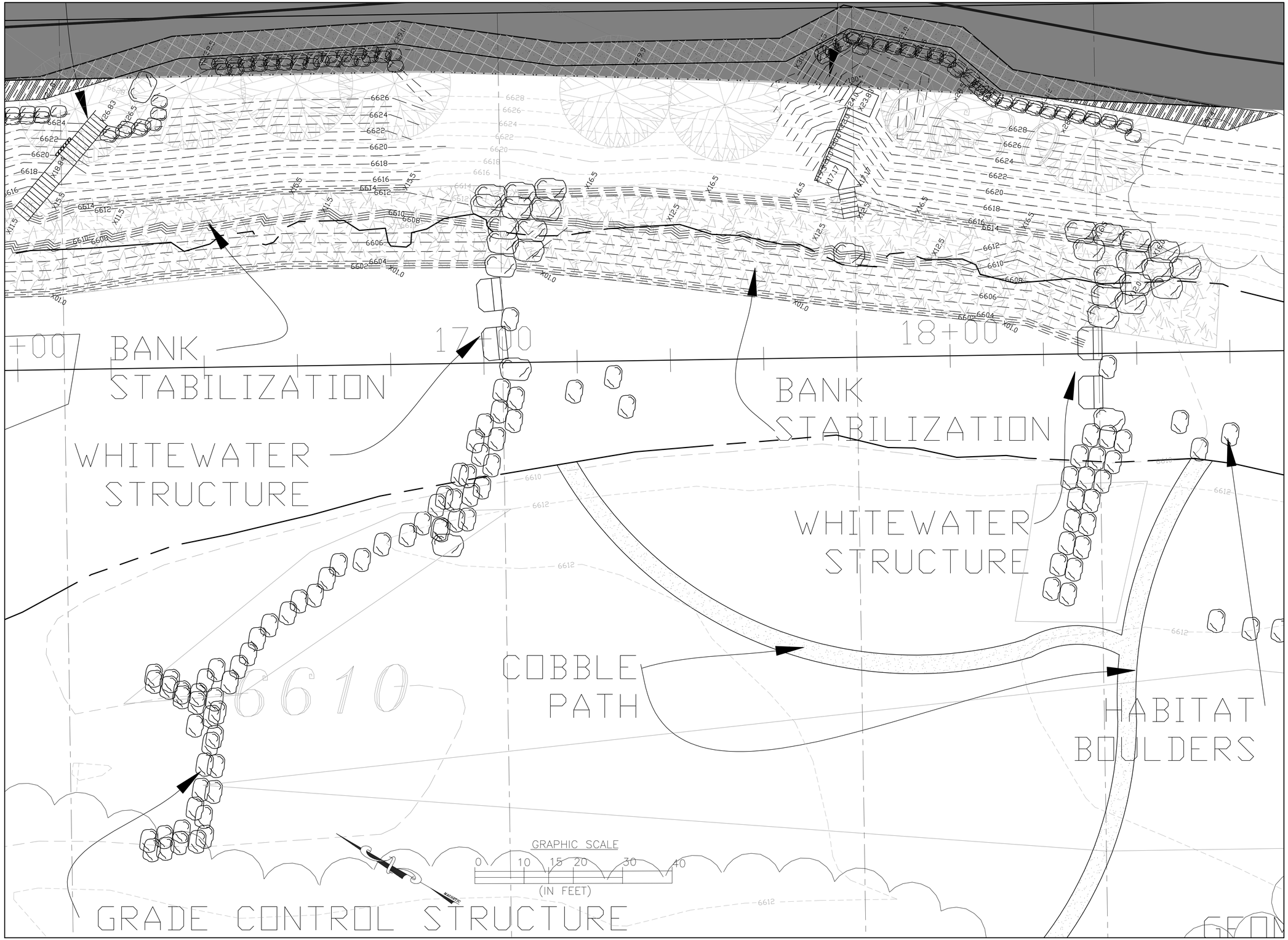

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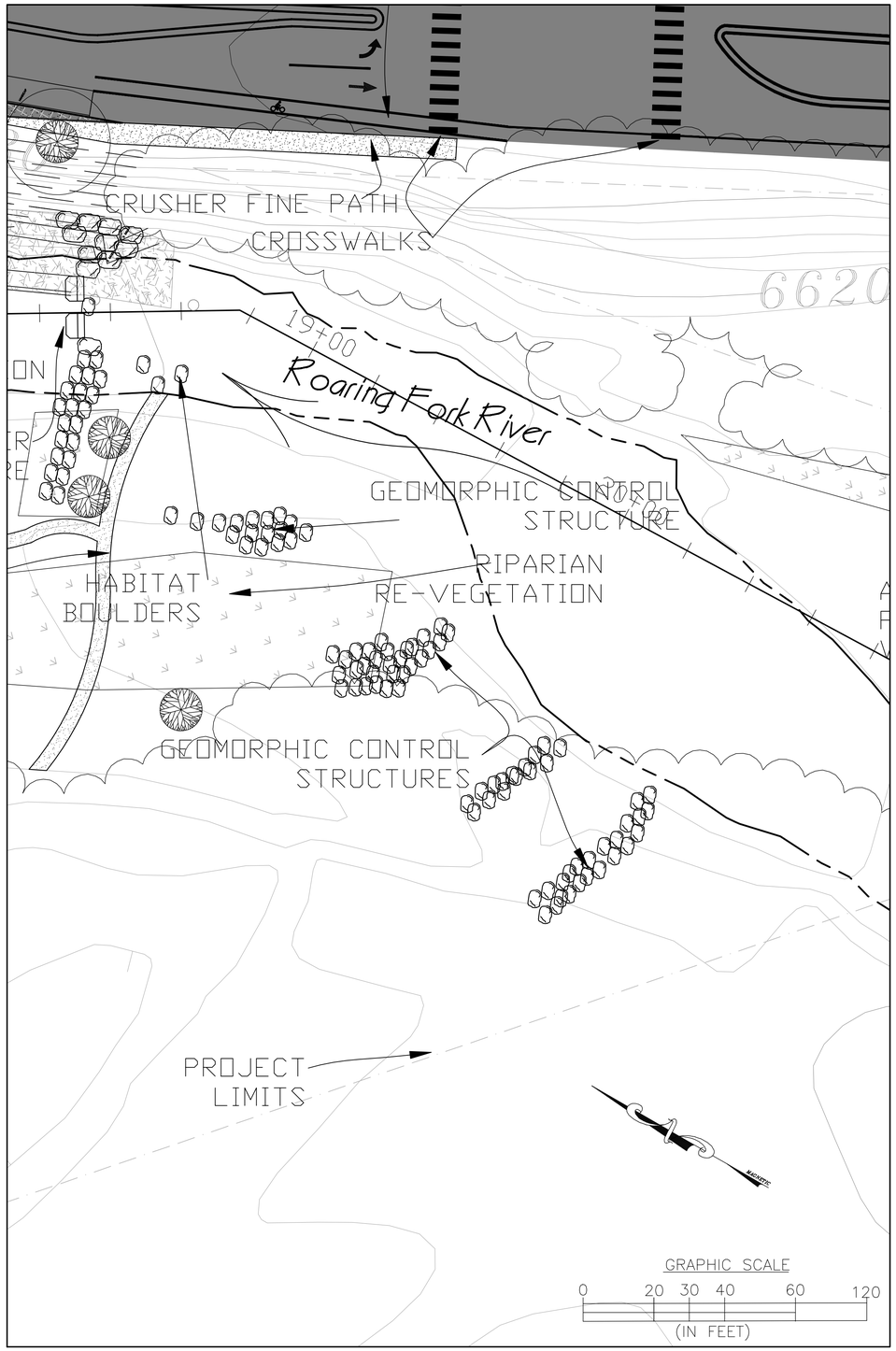

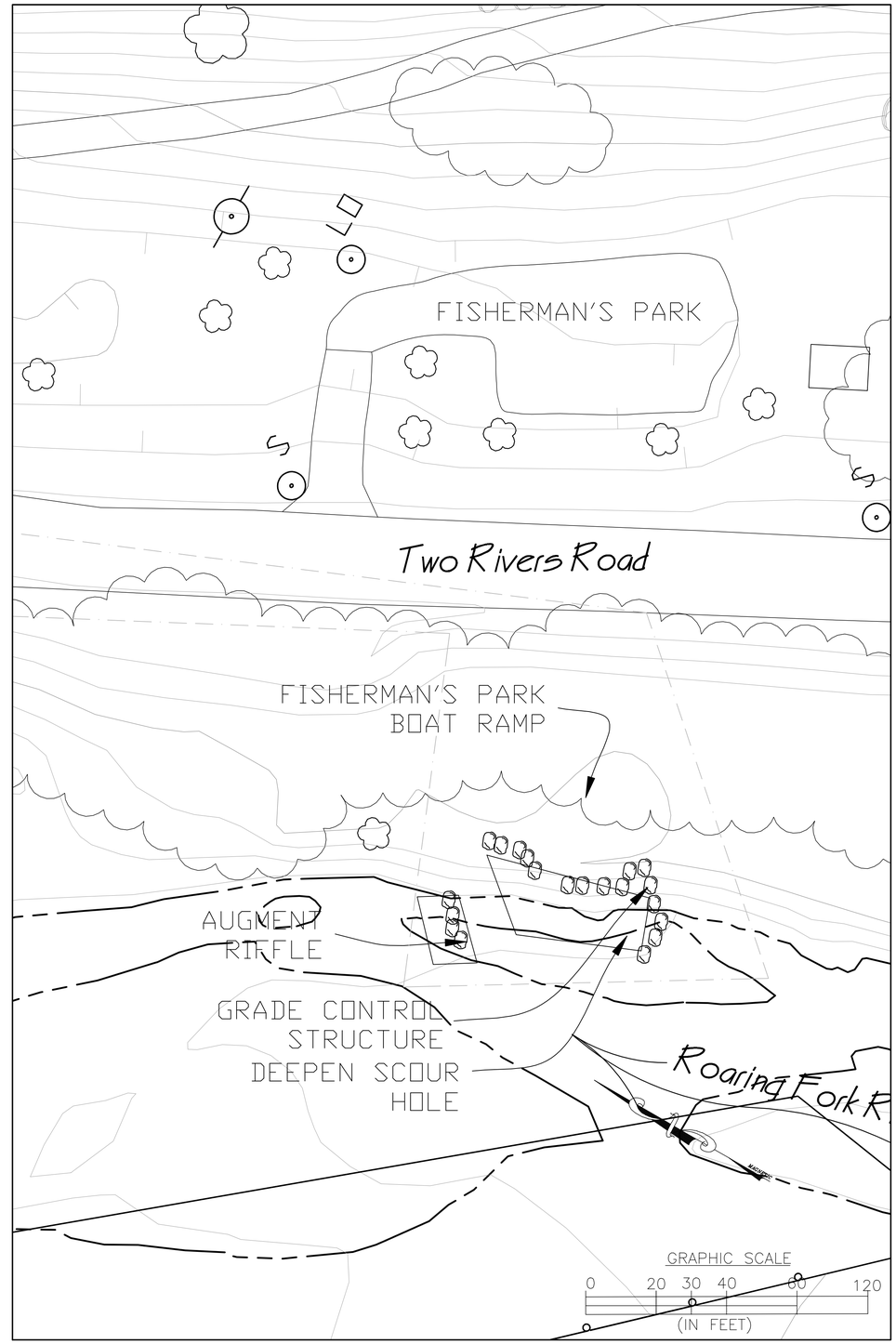

General Notes

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Project: Pitkin WWP

Date: 05-20-2010

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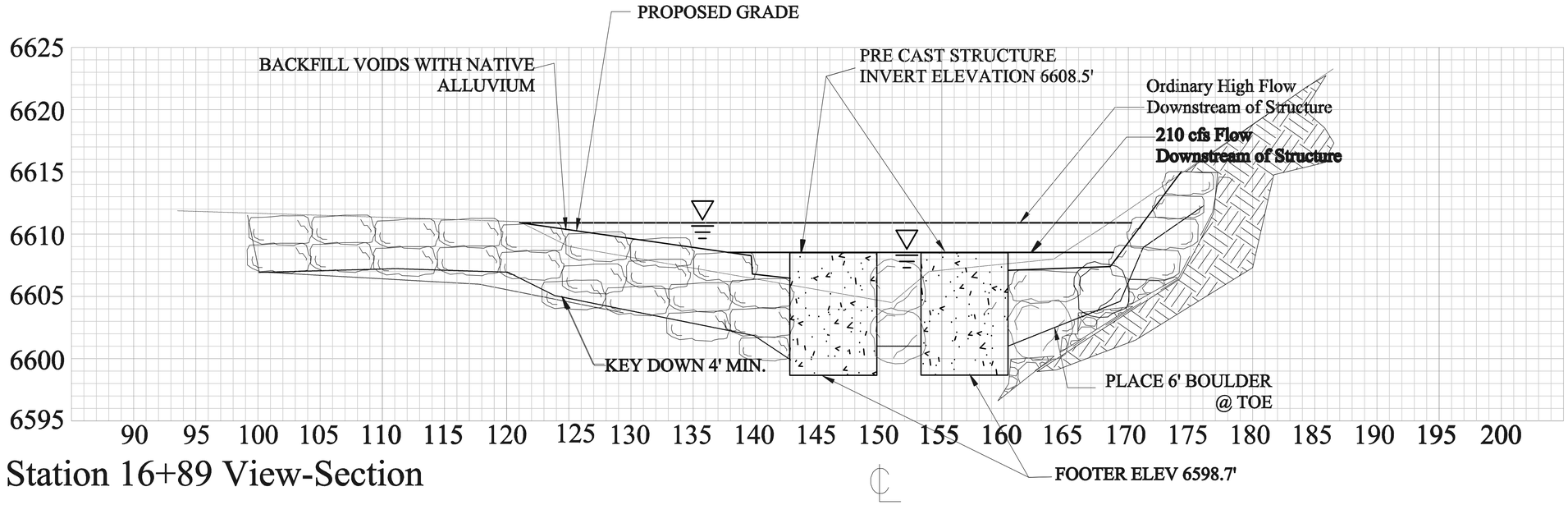
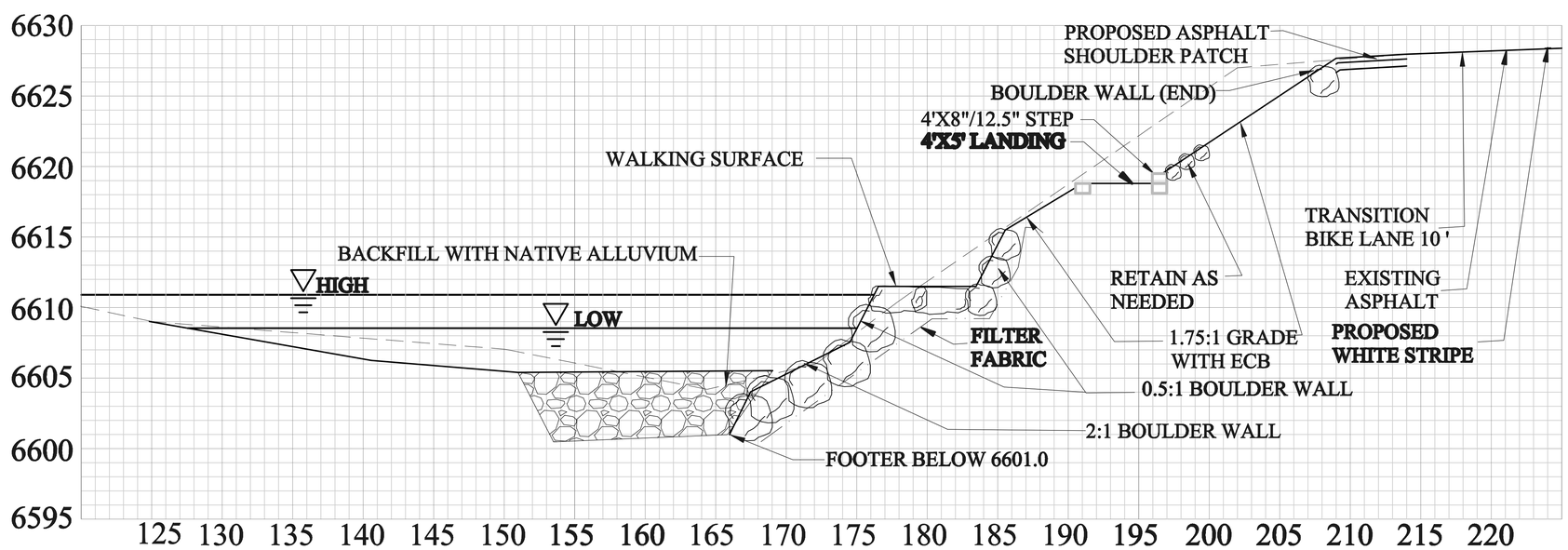


Station 16+89 View-Section



Station 16+10 View-Section

PRE-CAST STRUCTURE

BOULDER PLACEMENT

PROPOSED GRADE

EXISTING GRADE

MINIMUM DEPTH

FILTER FABRIC

General Notes

PITKIN COUNTY
WHITEWATER PARK FACILITY
PRELIMINARY DESIGN
SECTIONS 1

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ROARING FORK RIVER

Project: PITKIN WWP
Date: 07-02-2010
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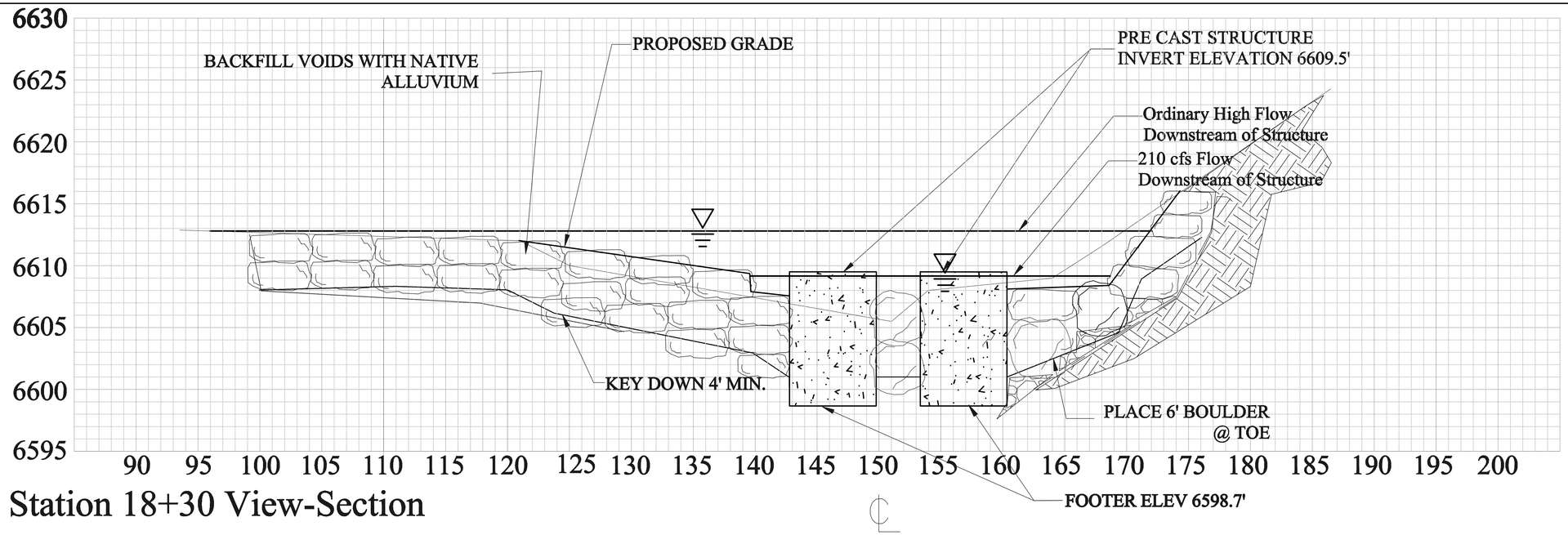
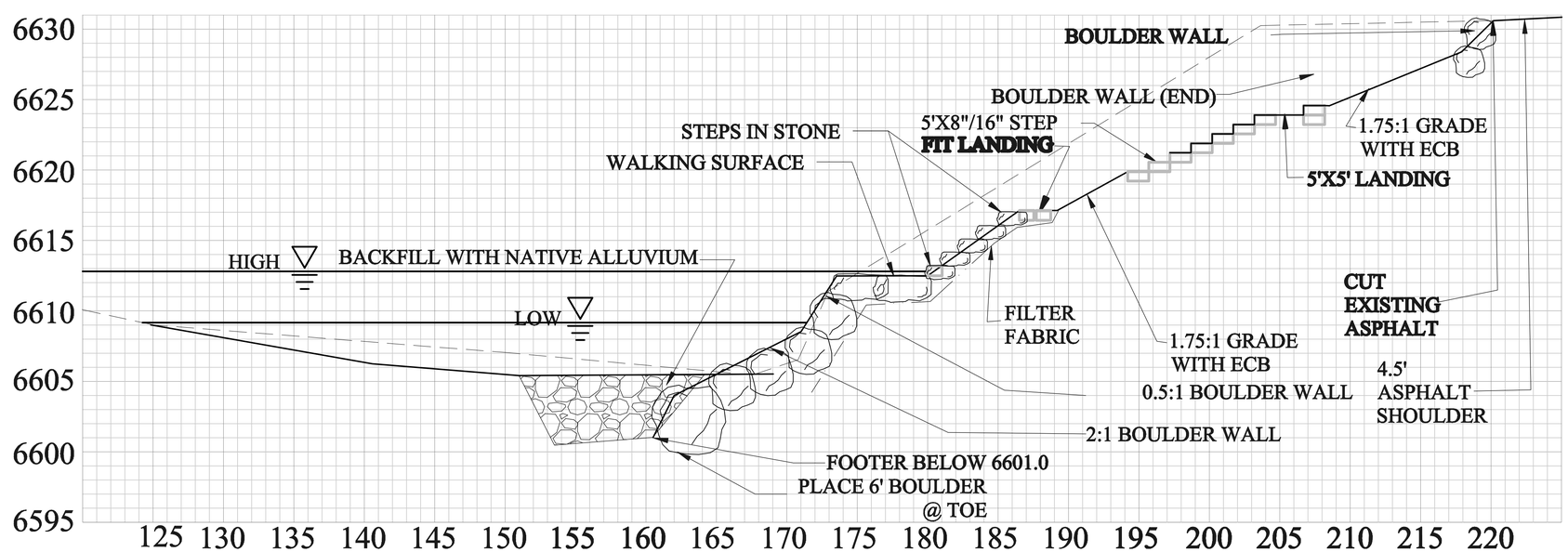


Station 18+30 View-Section



Station 17+80 View-Section

PRE-CAST STRUCTURE

BOULDER PLACEMENT

PROPOSED GRADE

EXISTING GRADE

MINIMUM DEPTH

FILTER FABRIC

General Notes

PITKIN COUNTY
WHITEWATER PARK FACILITY
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Project: PITKIN WWP
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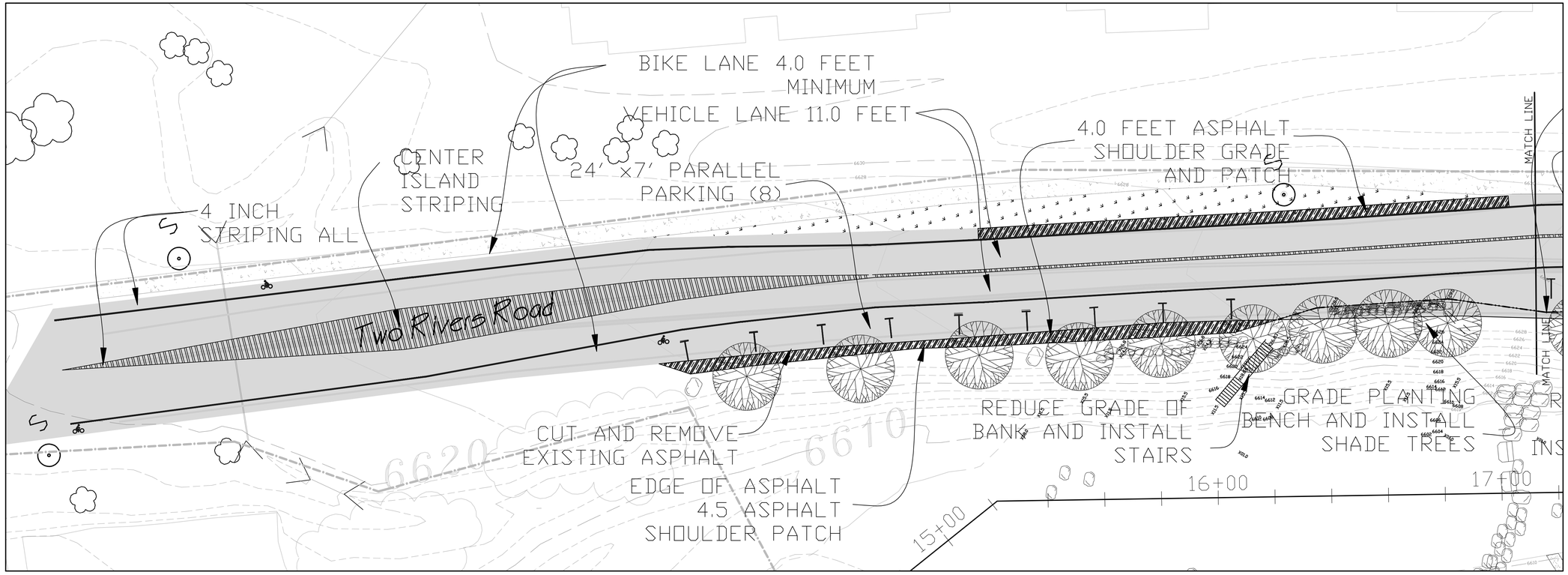

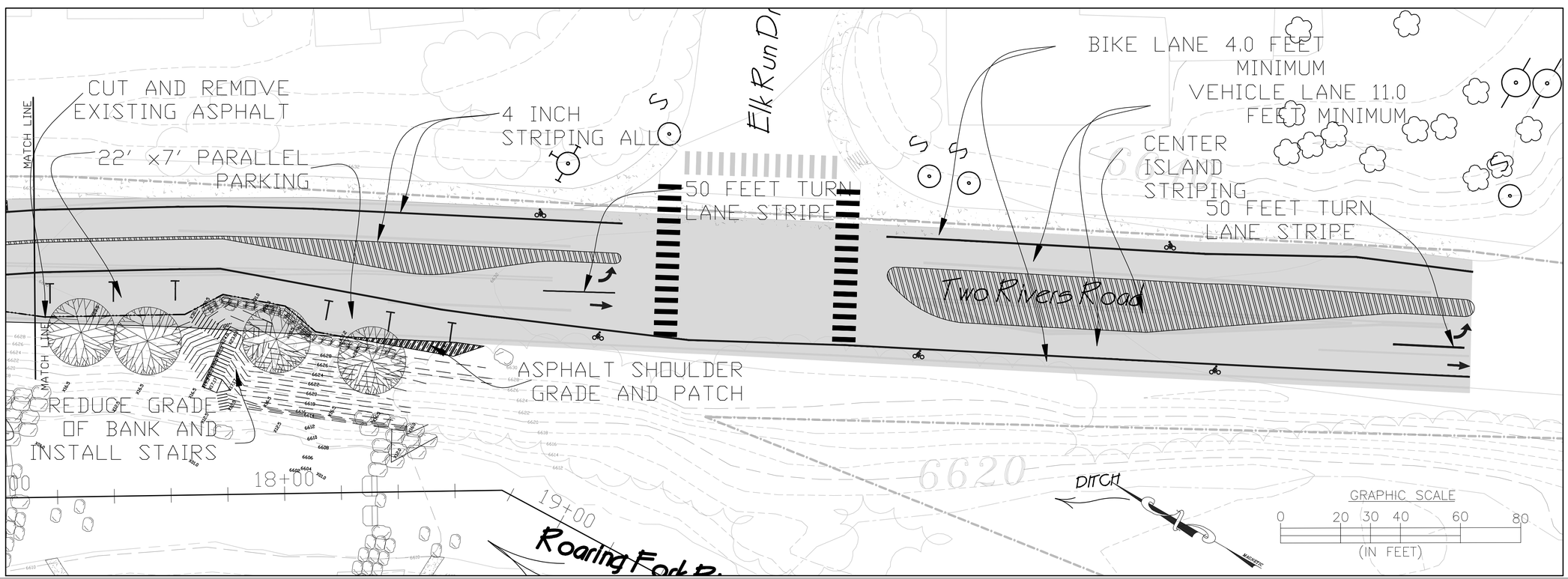

General Notes

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Project: Pitkin WWP

Date: 06-23-2010

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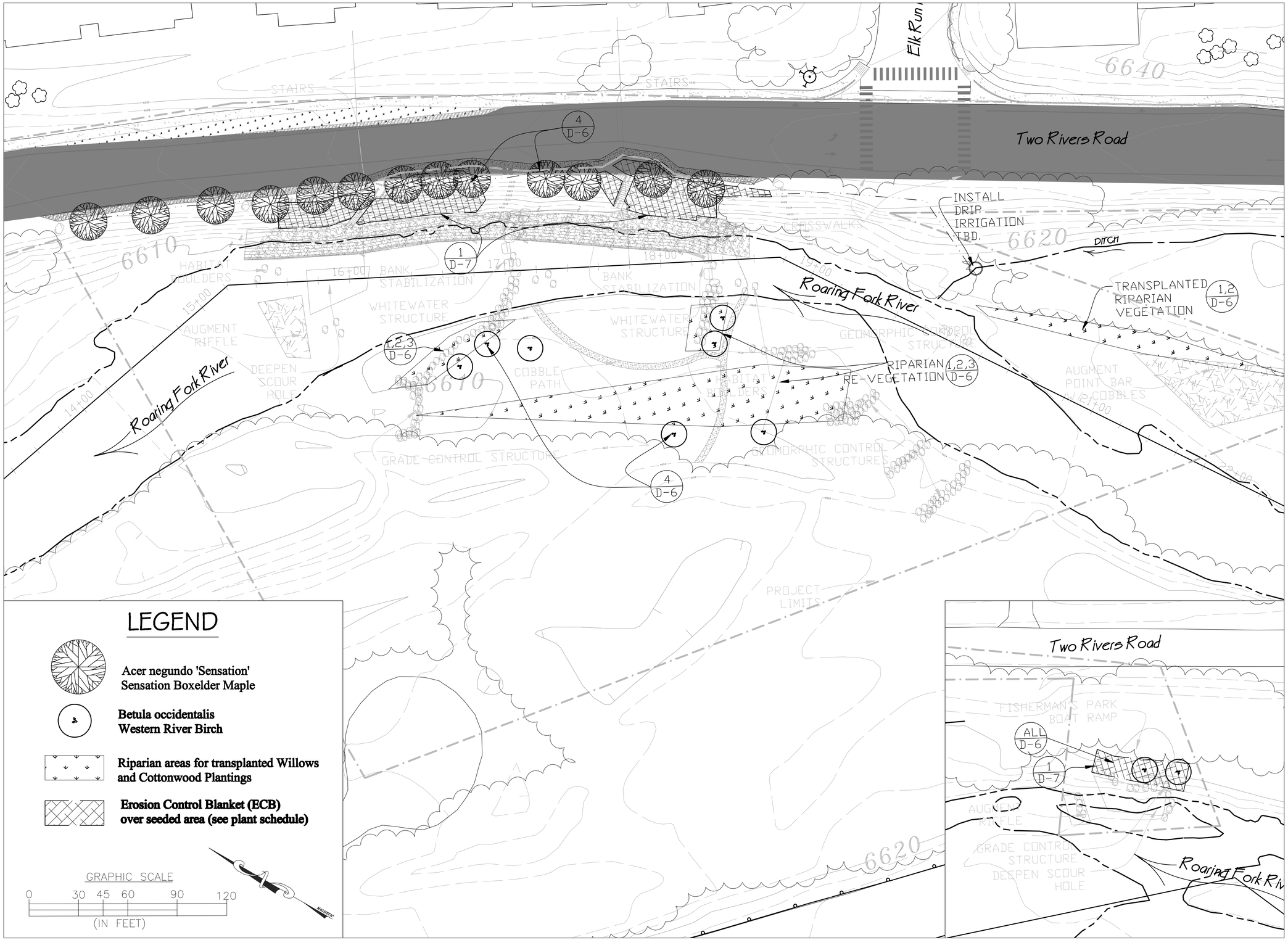

General Notes

PITKIN COUNTY
WHITEWATER PARK FACILITY
PRELIMINARY DESIGN
PLANTING PLAN

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ROARING FORK RIVER

Project: PITKIN WWP	Sheet: C-7
Date: 07-02-2010	
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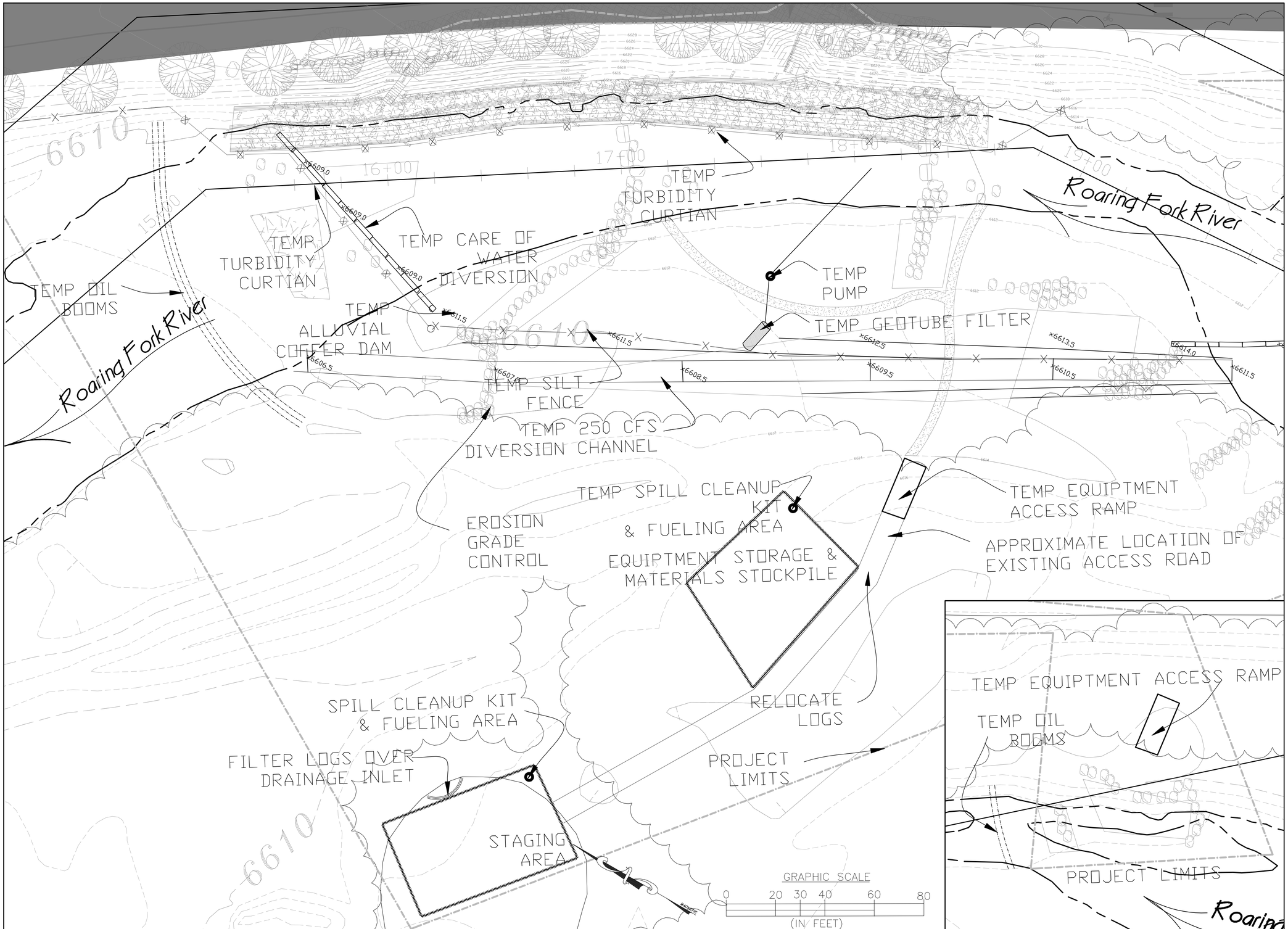


General Notes

PITKIN COUNTY WHITEWATER PARK FACILITY PRELIMINARY DESIGN CONSTRUCTION BMP's (TYP)

NOT FOR CONSTRUCTION

No.	Revision/Issue	Date

Firm Name and Address

RIVER RESTORATION.ORG

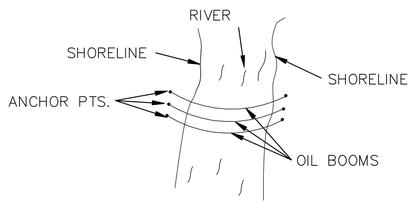
P.O. Box 2123
Glenwood Springs, CO 81602
www.RiverRestoration.org

Project Name and Address

Pitkin County Whitewater Park Facility

Project: PITKIN WWP	Sheet: C-8
Date: 05-21-2010	
Scale: 1" = 40'	

TYPICAL LAYOUT FOR STREAMS AND RIVERS
TO BE PLACED DOWNSTREAM OF ANY EQUIPMENT WORKING IN THE WET

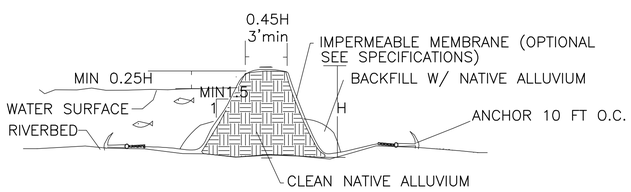


OIL BOOM (TYPICAL)

PLAN VIEW - NTS

1 / D1

SECTION VIEW

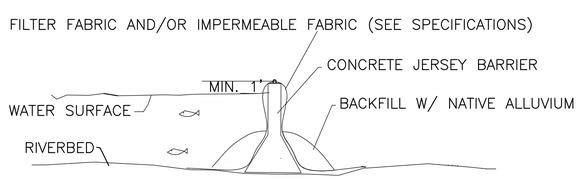


ALLUVIAL COFFER (TYPICAL)

NTS

2 / D1

SECTION VIEW



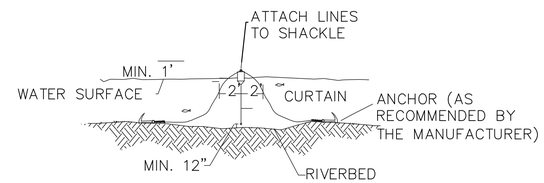
TEMP. JERSEY BARRIER COFFER (TYPICAL)

NTS

3 / D1

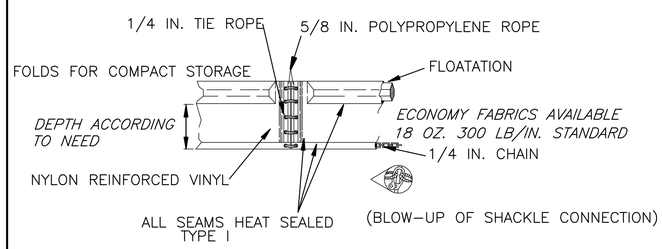
NOTE: ANCHORING WITH BUOYS, AS SHOWN, REMOVES ALL VERTICAL FORCES FROM THE CURTAIN. HENCE, THE CURTAIN WILL NOT SINK FROM WIND OR CURRENT LOADS.

ORIENTATION WHEN INSTALLED



TURBIDITY CURTAIN SECTION (TYPICAL)

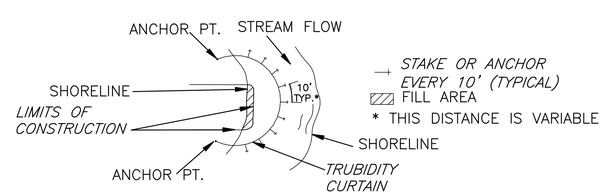
NTS



TURBIDITY CURTAIN (TYPICAL)

NTS

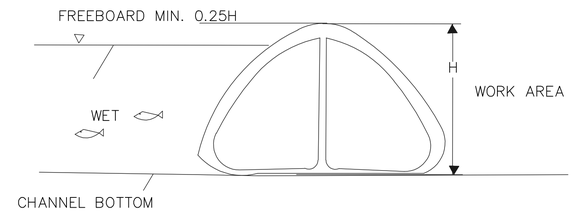
TYPICAL LAYOUTS
STREAMS, PONDS, AND LAKES (PROTECTED AND NON-TIDAL)



TURBIDITY CURTAIN (TYPICAL)

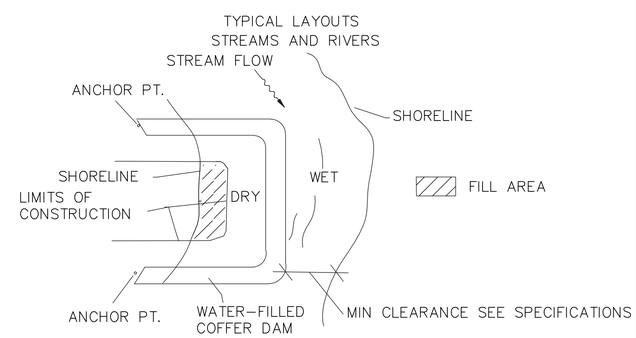
NTS

4 / D1



WATER-FILLED COFFER DAM (TYPICAL)

SECTION VIEW - NTS



WATER-FILLED COFFER DAM (TYPICAL)

PLAN VIEW - NTS

5 / D1

General Notes

PITKIN COUNTY
WHITEWATER PARK FACILITY
PRELIMINARY DESIGN
CARE OF WATER DETAILS

NOT FOR CONSTRUCTION

No.	Revision/Issue	Date

Firm Name and Address

RIVER RESTORATION.ORG

P.O. Box 2123
Glenwood Springs, CO 81602
www.RiverRestoration.org

Project Name and Address

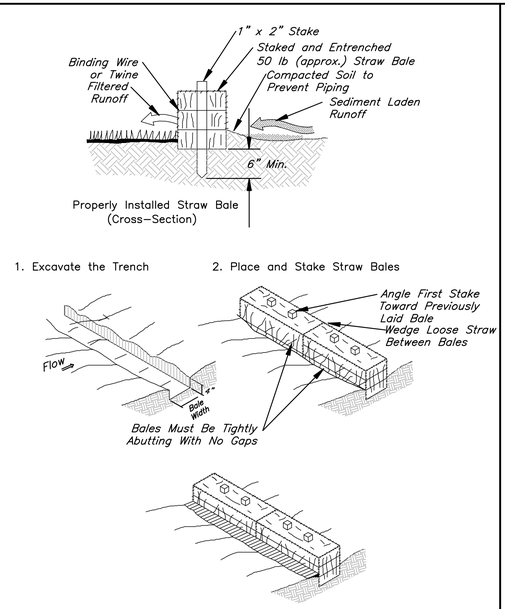
PITKIN COUNTY
ROARING FORK RIVER

Project *PITKIN WWP*

Date *07-02-2010*

Scale *NTS*

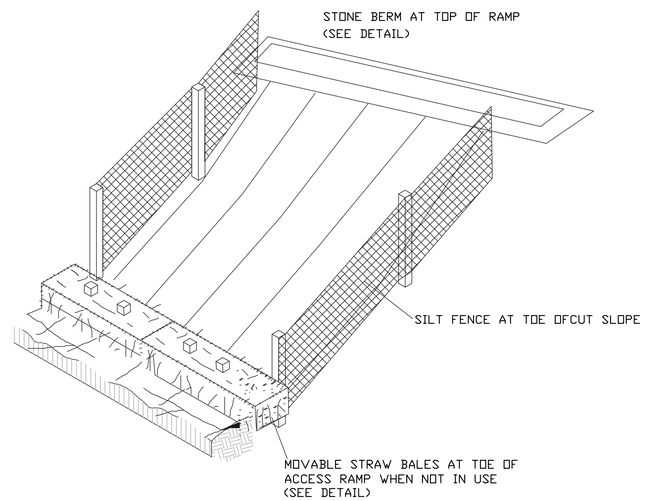
Sheet *D-1*



STRAW BALE (TYPICAL)

NTS

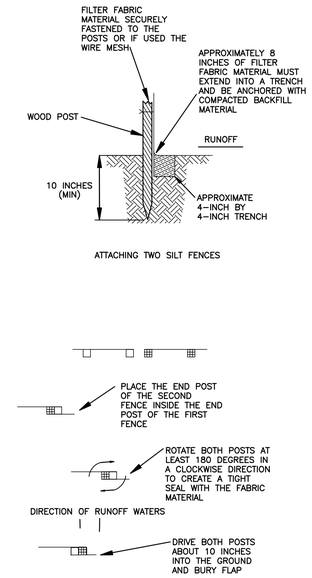
1
D2

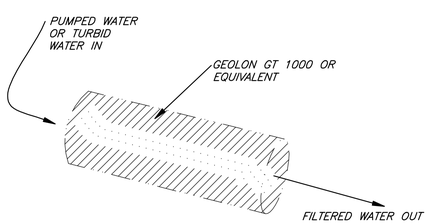


TEMPORARY EQUIPMENT ACCESS (TYPICAL)

NTS

4
D2



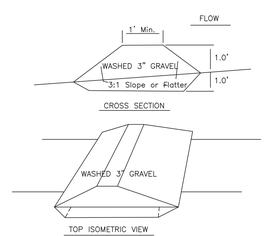


TO BE USED TO FILTER ALL PUMPED WATER

GEO-TUBEFILTER (TYPICAL)

NTS

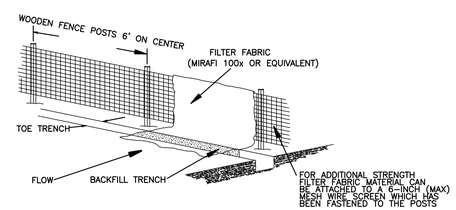
2
D2



STONE BERM

NTS

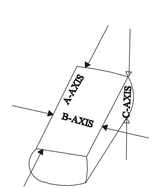
5
D2



SILT FENCE (TYPICAL)

NTS

6
D2



B-AXIS (OVERTURNING AXIS) BOULDER DETAIL

NTS

3
D2

General Notes

PITKIN COUNTY
WHITEWATER PARK FACILITY
PRELIMINARY DESIGN
NON-POINT SOURCE POLLUTION CNTRL.

NOT FOR CONSTRUCTION

No.	Revision/Issue	Date

Firm Name and Address

RIVER RESTORATION.ORG

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Project Name and Address

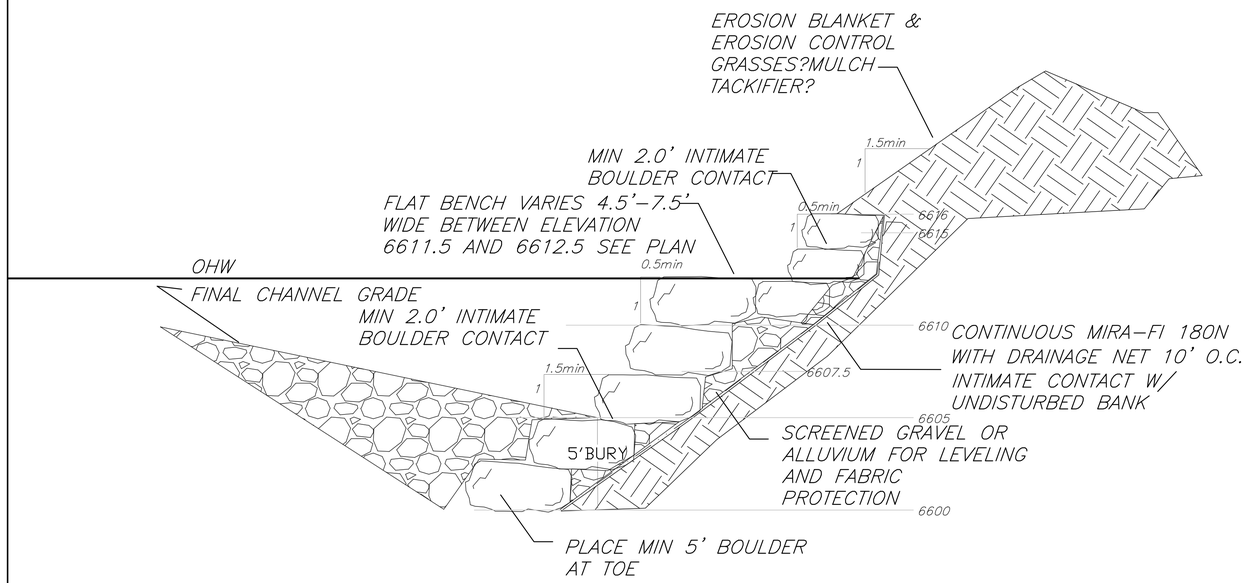
PITKIN COUNTY
ROARING FORK RIVER

Project: PITKIN WWP

Date: 07-02-2010

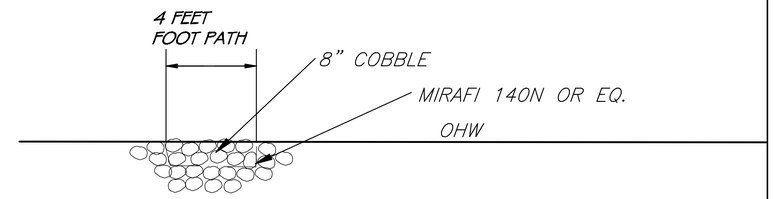
Scale: NTS

Sheet: D-2



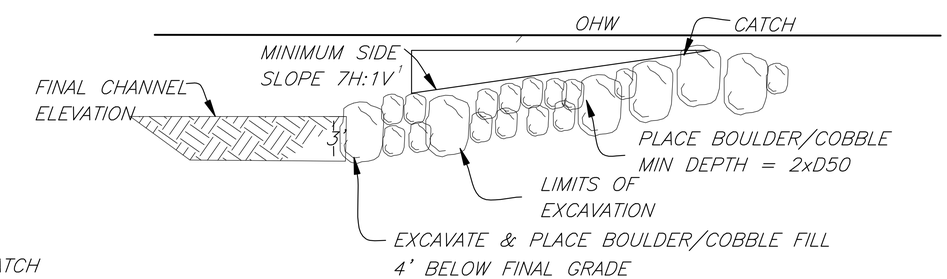
STATION 15+50 TO 18+50 STONE TOE PROTECTION

NTS

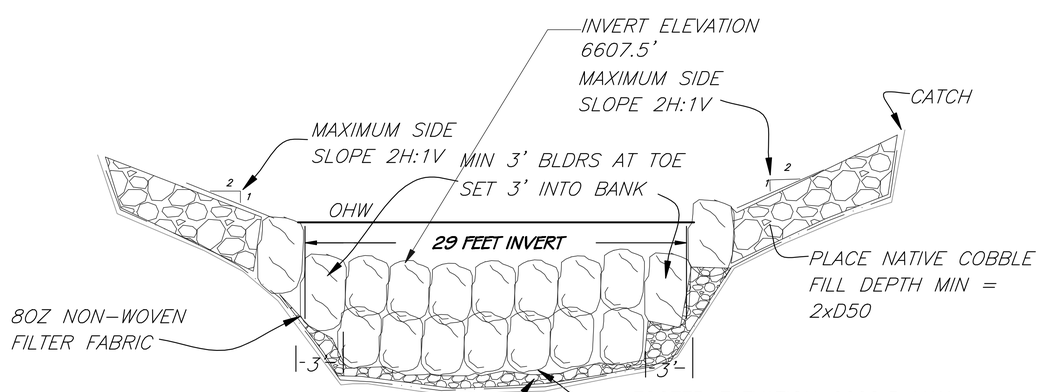


COBBLE PATH (TYPICAL)

NTS



GEOMORPHIC CONTROL STRUCTURE (AUGMENTED BAR)



DIVERSION CHANNEL GRADE CONTROL (TYPICAL)

NTS

General Notes

PITKIN COUNTY
WHITEWATER PARK FACILITY
PRELIMINARY DESIGN
BOULDER STRUCTURES

NOT FOR CONSTRUCTION

No.	Revision/Issue	Date

Firm Name and Address

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Project Name and Address

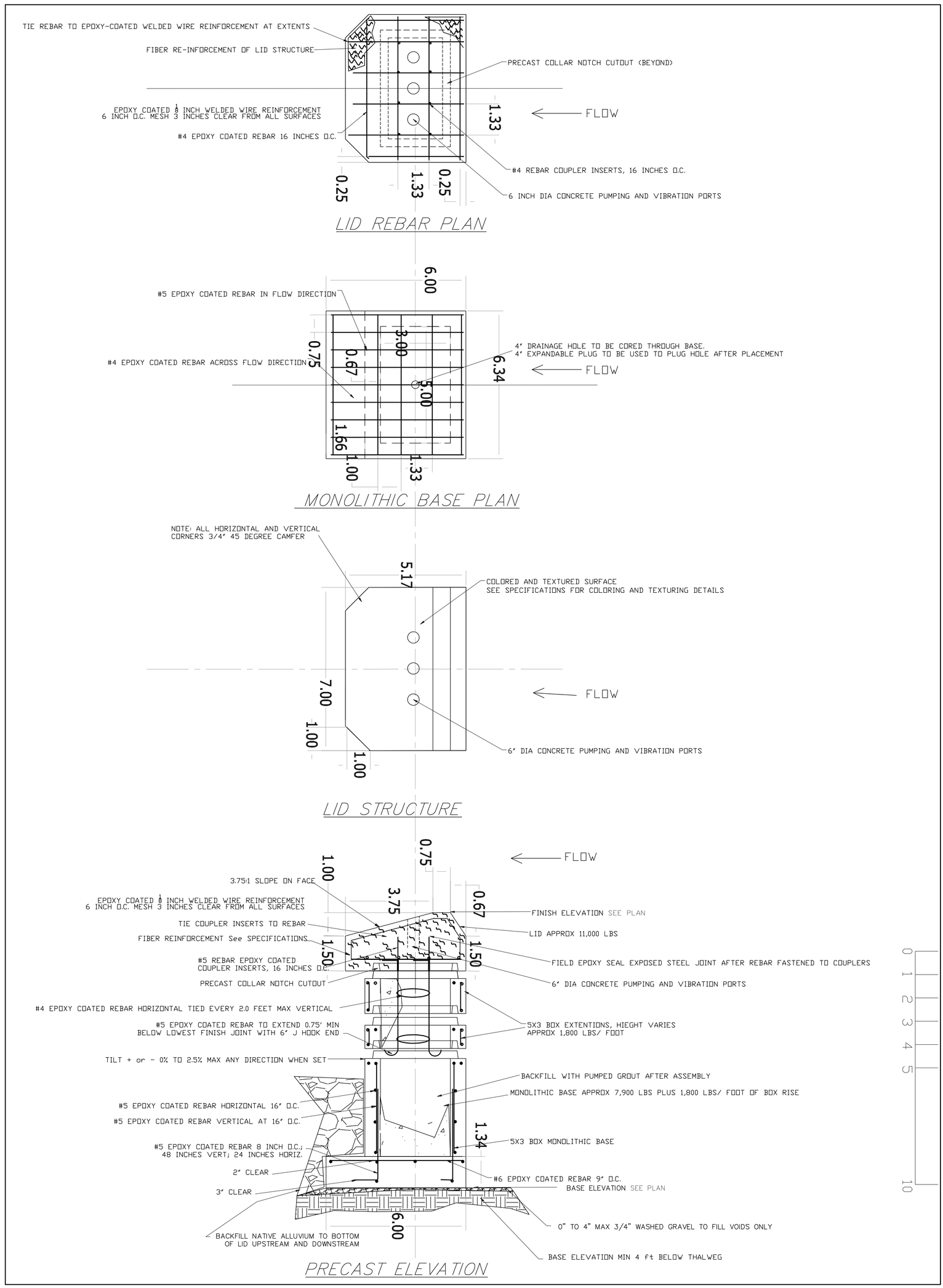
PITKIN COUNTY
ROARING FORK RIVER

Project: PITKIN WWP

Date: 07-02-2010

Scale: NTS

Sheet: D-3



Project: PITKIN WWP
Date: 07-02-2010
Scale: 1"=2'
Sheet: D-4

Project Name and Address
PITKIN COUNTY
ROARING FORK RIVER

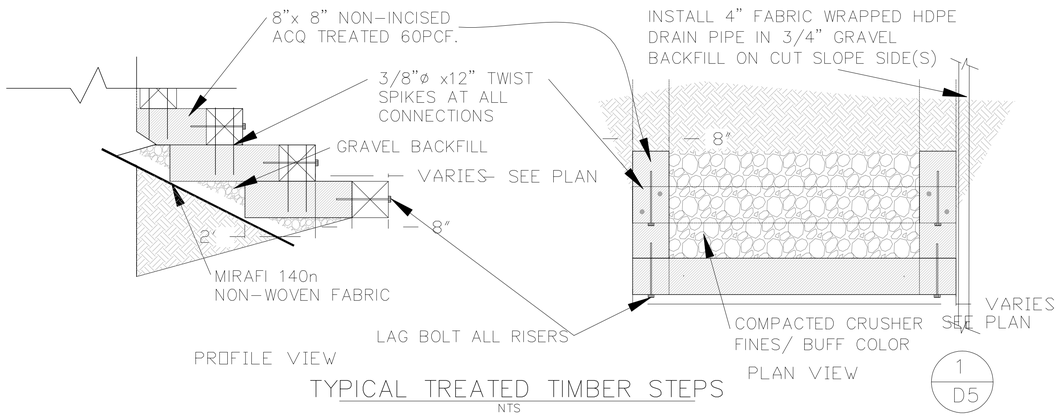
Firm Name and Address
RIVER RESTORATION CORP
P.O. Box 2123
Glenwood Springs, CO 81602
www.riverrestoration.org

No.	Revision/Issue	Date

NOT FOR CONSTRUCTION

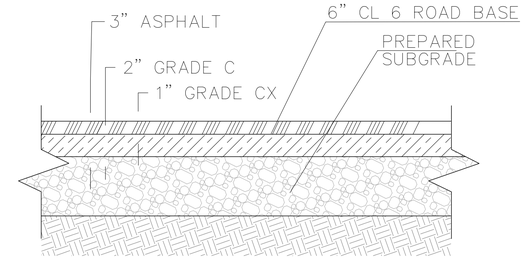
PITKIN COUNTY
WHITEWATER PARK FACILITY
PRELIMINARY DESIGN
PRE-CAST CONCRETE STRUCTURES

General Notes



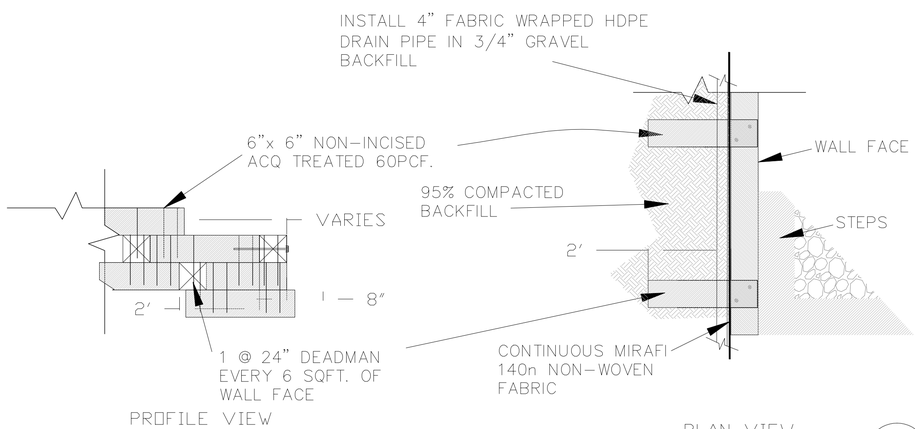
TYPICAL TREATED TIMBER STEPS
NTS

1
D5



SHOULDER PATCH PAVEMENT SECTION
NTS

3
D5



TIMBER STEPS STEM WALL
NTS

2
D5

General Notes

PITKIN COUNTY
WHITEWATER PARK FACILITY
PRELIMINARY DESIGN
PATH STRUCTURES

NOT FOR CONSTRUCTION

No.	Revision/Issue	Date

Firm Name and Address

RIVER RESTORATION.ORG

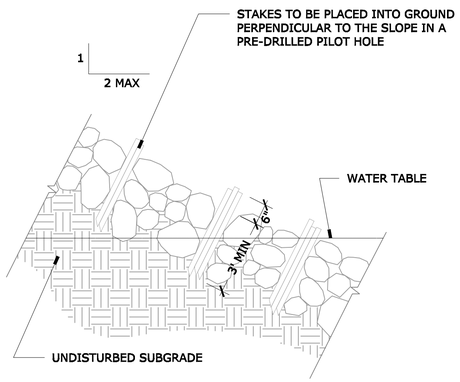
P.O. Box 2123
Glenwood Springs, CO 81602
www.RiverRestoration.org

Project Name and Address

PITKIN COUNTY
ROARING FORK RIVER

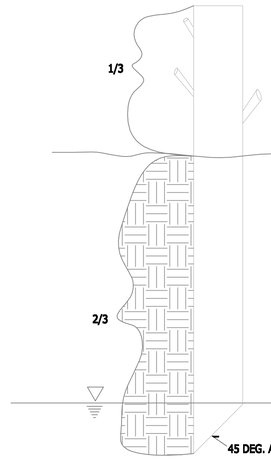
Project: PITKIN
Date: 07-02-2010
Scale: NTS
Sheet: D-5

NOTE: STAKES SHOULD BE PLACED RANDOMLY AT A RATE OF 2 HOLES PER SQUARE YARD. INSTALL 3 LIVE STAKES (WHERE POSSIBLE) PER HOLE.



1 / D6 POLE STAKING

NTS



1. SEE SPECIFICATIONS

2. CUTTINGS SHALL BE COLLECTED WHILE DORMANT, WHEN THE LEAVES HAVE FALLEN, AND NIGHT TEMPERATURES ARE FREEZING.

3. CUTTINGS OF WILOWS SHALL BE 0.75"-1.5" IN DIAMETER, AND 3-6' IN LENGTH. COTTONWOOD CUTTINGS SHALL BE 2"-3" IN DIAMETER, AND 6' MINIMUM IN LENGTH.

4.CUTTING SHALL BE TAKET FROM THE BASE OF THE STEMS. CUT THE BOTTOMS AT A 45 DEG. ANGLE AND THE TOPS FLAT.

5. CUTTINGS SHALL BE STRIPPED OF LEADERS, AND LONG BRANCHES TO AVOID EXCESS DRYING.

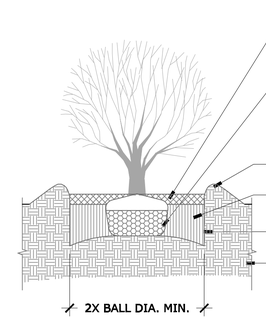
6. CUTTINGS SHOULD BE STORED IN WATER AND SHADE FOR UP TO 24 HOURS BEFORE PLANTING.

7. PLANT THE CUTTINGS WITH THEIR BASES AT OR NEAR THE 200 CFS WATER ELEVATION.

8. LIGHTLY PAINT THE EXPOSED CUTS OF THE COTTONWOOD POLES WITH 50/50 MIX OF LATEX PAINT AND WATER TO REDUCE WATER LOSS.

2 / D6 STAKE/TREE POLE PLANTING

NTS



2" SHREDDED MULCH FROM FELLED TREES; REFER TO SPECIFICATIONS FOR TYPE AND TREATMENT. HOLD MULCH 6".

FOR B&B: ROPES @ THE TOP OF THE BALL SHALL BE CUT. REMOVE TOP 1/3 OF BURLAP. REMOVE TOP 1/3 OF BASKET & ALL TWINE. FOR CONTAINER: REMOVE CONTAINER AND LOOSEN ROOTS SLIGHTLY BY SCRATCHING SIDES OF ROOTBALL BEFORE PLANTING.

CREATE SAUCER W/ TOPSOIL (3" MAX.) EXCEPT IN DRIP IRRIGATED AREAS

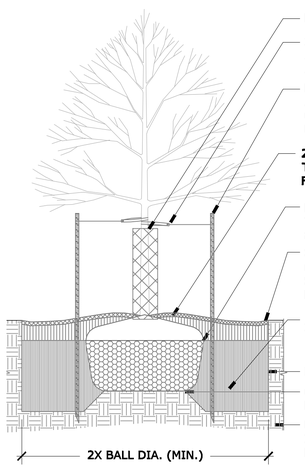
ADD SLOW RELEASE GRANULAR FERTILIZER. REFER TO SPECIFICATIONS.

SCARIFY SIDES OF HOLE PRIOR TO PLANTING

UNDISTURBED SOIL - DIG PIT TO PROPER DEPTH. IF OVEREXCAVATION OCCURS RE-ESTABLISH DESIRED ELEVATION WITH 95% COMPACTED FILL.

3 / D6 SHRUB PLANTING

NTS



BEAVER SCREEN; REFER TO SPECIFICATIONS

1" BIODEGRADABLE STRAP AROUND TREE TRUNK AND FEED WIRE LINE THROUGH GROMMETS AND ATTACH TO POST

MIN. 2"x2"x7' HARDWOOD STAKES OR OTHER APPROVED STAKE MATERIAL. STAKE TO BE DRIVEN OUTSIDE OF EDGE OF ROOT BALL INTO UNDISTURBED SUBGRADE.

2" SHREDDED MULCH FROM FALLEN TREES; REFER TO OGDEN RIVER RESTORATION SPECIFICATIONS FOR TYPE AND TREATMENT. HOLD MULCH 6".

ROPES @ TOP OF BALL SHALL BE CUT. REMOVE TOP 1/3 OF BURLAP. REMOVE TOP 1/3 OF BASKET & ALL TWINE.

3" MAX SAUCER (MAX.) FIRMLY FORMED SAUCER (USE TOPSOIL). ANGLE OF REPOSE VARIES WITH STEEPNESS OF SLOPE AND SOIL TYPE (WHERE DIRECTED ONLY).

ADD SLOW RELEASE GRANULAR FERTILIZER. REFER TO SPECIFICATIONS.

ROUGHEN SIDES OF PIT.

CORNER OF ROOT SYSTEM TO BE AT LINE OF PROPOSED GRADE

UNDISTURBED SOIL - DIG PIT TO PROPER DEPTH. IF OVEREXCAVATION OCCURS RE-ESTABLISH DESIRED ELEVATION WITH 95% COMPACTED FILL.

4 / D6 DECIDUOUS TREE PLANTING

NTS

Pitkin County Whitewater Park Plant List

Transitional Seed Mix

species	common name	percent	notes
Dechampsia caespitosa	Tufted Hairgrass vns	10	Seed should be planted into straw mat at a rate of 32 lb PLS/ac through broadcast seeding
Elymus lanceolatus ssp. lanceolatus	Thickspike Wheatgrass 'Critana'	15	
Elymus lanceolatus ssp. psammophilus	Streambank Wheatgrass 'Sodar'	20	
Elytrigia intermedia ssp. intermedia	Slender Wheatgrass 'San Luis'	10	
Pascopyron smithii	Western Wheatgrass 'Arriba'	35	
Poa palustris	Fowl Bluegrass vns	10	

Trees and Shrubs

species	common name	quantity	size	spacing
Acer negundo 'Sensation'	Sensation Boxelder	12	2.5" B&B	35' o.c.
Betula oocidentalis	Western River Birch	7	5'	15-20' o.c.

Riparian Shrubs		percent			
Salix exigua	Coyote Willow	70	177	#5	6' o.c.
Salix lutea	Yellow Willow	30	22	#5	10' o.c.

General Notes

PITKIN COUNTY
WHITEWATER PARK FACILITY
PRELIMINARY DESIGN
VEGETATION INSTALLATION

NOT FOR CONSTRUCTION

No.	Revision/Issue	Date

Firm Name and Address
RIVER RESTORATION.ORG
P.O. Box 2123
Glenwood Springs, CO 81602
www.RiverRestoration.org

Project Name and Address
PITKIN COUNTY
ROARING FORK RIVER

Project: PITKIN
Date: 07-02-2010
Scale: NTS
Sheet: D-6

Notes:

1. Contractor Shall Use All Natural 100% Biodegradable Erosion Control Blankets, Type 1, Type 2, Type 3.

2. Stake Blanket In Place, Cut Holes Through The Layers, Then Dig The Planting Holes In The Soil. Staple Around Plant Every 1'.

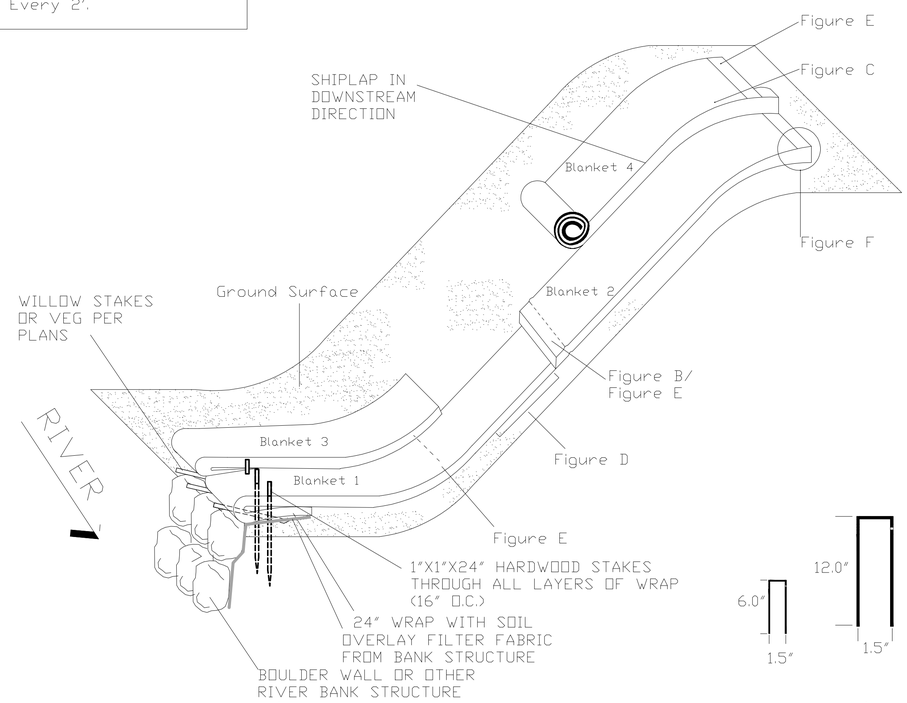
3. Erosion Control Material Must Be Placed Loosely Over Ground Surface. Do Not Stretch.

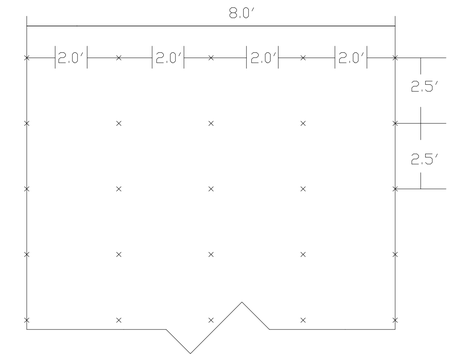
4. Excavate A 6" Wide By 6" Deep Trench Along The Top Of The Slope. The Trench Shall Run Along The Length Of The Installation. Staple Blanket Along Bottom Of Trench, Fill With Compacted Soil, Overlap Blanket Towards Toe Of Slope, And Secure With Staples Every 2'.

*Approximately 200 Staples Per 8.0' Roll.

Drawings Not To Scale

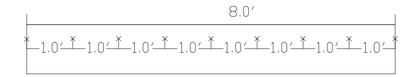
8.0' Wide Blanket Shown





× Denotes Staple Location

Figure D- Plan View



× Denotes Staple Location

Figure E- Plan View

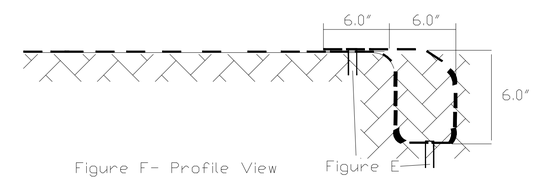


Figure F- Profile View

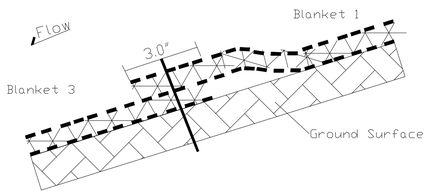


Figure B- Profile View

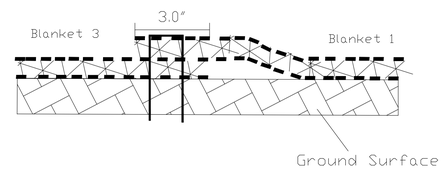


Figure C- Cross Section View

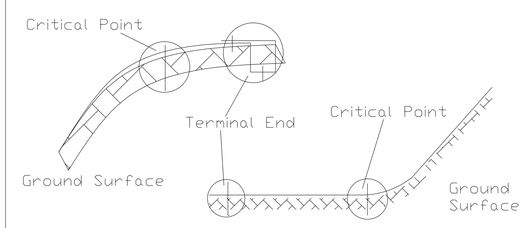


Figure G- Critical Point Securing

EROSION CONTROL BLANKET (ECB) INSTALLATION

NTS

1
D7

General Notes

PITKIN COUNTY
WHITEWATER PARK FACILITY
PRELIMINARY DESIGN
EROSION CONTROL BLANKETS

NOT FOR CONSTRUCTION

No.	Revision/Issue	Date

Firm Name and Address

RIVER RESTORATION.ORG

P.O. Box 2123
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www.RiverRestoration.org

Project Name and Address

PITKIN COUNTY
ROARING FORK RIVER

Project: PITKIN

Date: 07-02-2010

Scale: NTS

Sheet: D-7

DRAFT ENGINEER'S OPINION OF PROBABLE COSTS, June 20, 2010
PITKIN COUNTY WHITEWATER PARK FACILITY

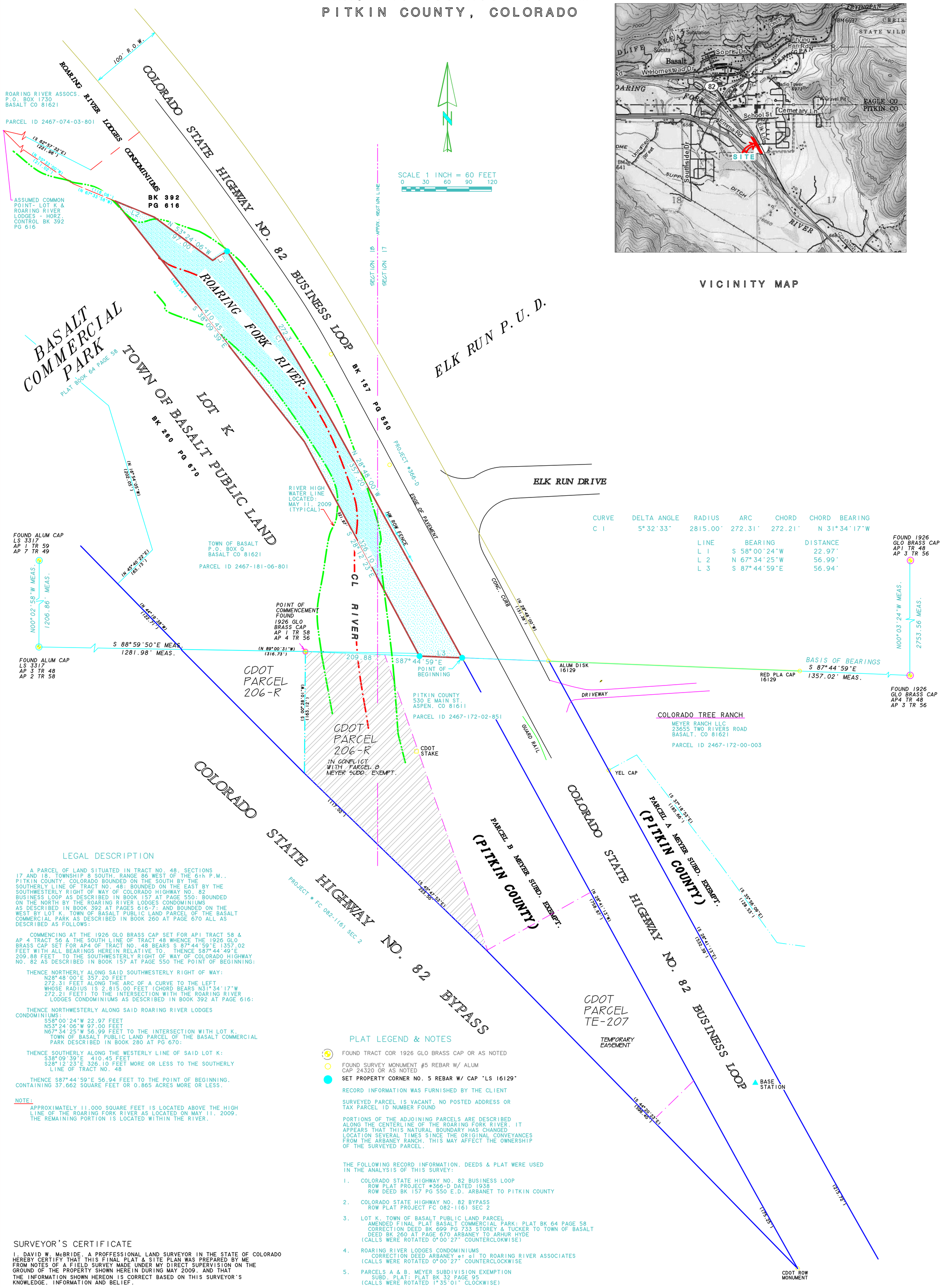
Item #	Description	Quantity	Unit	Unit Cost	Total Cost	Totals
0	**Site Setup**					
	Mobilization/demobilization/Bonding/Insurance	1	LS	$49,937	$49,937	
	Construction Survey and Stake	1	LS	$5,961	$5,961	
0a	**Best Management Practices**					
	Traffic Control Other	1	LS	$6,000	$6,000	
	Construction Signage/Staging Fence	1	LS	$5,000	$1,000	
	BMPs other	1	LS	$5,000	$5,000	
	Protect in Place	1	LS	$10,000	$5,000	
					Sub Total:	**$72,898**
1	**Diversion Channel and Access**					
	Transplant Willows and Sm Cottonwoods	6,500	SF	$1	$6,500	
	Stockpile Topsoil	0	CY	$6	$0	
	Silt Fences	50	LF	$1	$50	
	Erosion Logs	100	LF	$10	$950	
	Plant Native E.C. Grass with mulch/tackifier	0.00	AC	$3,500	$0	
	Plant Native Riparian Shrubs	250	EA	$50	$12,500	
	Grade Alluvium Pool/Riffle 15+50	32	CY	$16	$512	
	Diversion Structure 100'X4'	2	MO	$12,000	$24,000	
	Diversion Structure 130'X3'	2	MO	$9,000	$18,000	
	Boulder Grade Control (Imported)	90	Tons	$75	$6,750	
	Excavation Grade Control Structure	83	CY	$6	$498	
	Backfill Grade Control Structure	42	CY	$6	$252	
	Filter Fabric/ Staked	720	SF	$1	$360	
	Excavate Diversion Channel	400	CY	$6	$2,400	
	Backfill Diversion Channel	580	CY	$6	$3,480	
	Pumping	60	Days	$184	$11,040	
	Filtering	1	LS	$1,200	$1,200	
	Filter Disposal	10	CY	$40	$400	
	Sub-Grade Boulder Structure (Onsite replacement)	285	Tons	$20	$5,700	
	Excavation Sub-Grade Boulder Structure	199	CY	$6	$1,194	
	Backfill Sub-Grade Boulder Structure	60	CY	$6	$360	
	Place Habitat Boulders	40	Tons	$60	$2,400	
	Crossing/ Channel Maintenance	1	LS	$7,500	$7,500	
	Oil Boom	1	LS	$2,500	$2,500	
	Fish Removal	4	hrs	$200	$800	
	20X6mil reinforced visquene	350	LF	$3	$875	
					Sub Total:	**$110,221**
2	**Right Bank Stone Toe Protection (300 feet)**					
	Boulder Excavation	600	Tons	$16	$9,600	
	Onsite Boulder Re-Placement	184	Tons	$30	$5,520	
	Augment Boulder Bank18+50 to 19+50	93	Tons	$20	$1,860	
	Excavation Bank Material	200	CY	$12	$2,400	
	Excavation Haul-off	100	CY	$30	$3,000	
	Excavation Backfill	100	CY	$12	$1,200	
	5-ft Boulders, delivered & placed	1,108	Tons	$60	$66,480	
	4-ft Boulders, delivered & placed	277	Tons	$60	$16,620	
	Filter Fabric/ Staked	720	SF	$1	$360	
	3" Minus Screened Gravel Bedding	400	CY	$30	$12,000	
	Drainage Net 4' wide	600	LF	$3	$1,800	
	Silt Fences	600	LF	$1	$600	
	Turbidity Curtain	200	LF	$10	$2,000	
					Sub Total:	**$123,440**
3	**Structural Facilities and Sitework**					
	Stairs	365	SF	$20	$7,300	
	Boulders Landscaping	20	Tons	$75	$1,500	
	Boulder retaining wall	120	Tons	$75	$9,000	
	Compacted Subgrade	75	CY	$35	$2,625	
	Erosion Control Blankets	515	SY	$10	$5,150	
	Excavation & Hauloff	150	CY	$40	$6,000	
					Sub Total:	**$31,575**
4	**Left Wing at Lower Feature**					
	Channel Alluvium and Boulder Excavation	90	CY	$16	$1,440	
	Excavation Backfill	37	CY	$10	$370	
	Excavation Haul-off	53	CY	$35	$1,855	
	4-ft Boulders, delivered & placed	150	Tons	$60	$9,000	
	5-ft Boulders, delivered & placed	150	Tons	$60	$9,000	
	6-ft Boulders, delivered & placed	60	Tons	$60	$3,600	
					Sub Total:	**$25,265**
5	**Left and Right Wing at Upper Feature**					
	Channel Alluvium and Boulder Excavation	90	CY	$16	$1,440	
	Excavated Alluvium Backfill	37	CY	$10	$370	
	Excavation Haul-off	53	CY	$35	$1,855	
	4-ft Boulders, delivered & placed	150	Tons	$60	$9,000	
	5-ft Boulders, delivered & placed	150	Tons	$60	$9,000	
	6-ft Boulders, delivered & placed	60	Tons	$60	$3,600	
					Sub Total:	**$25,265**

6	**Lower Feature Pre-cast Structure**					
	Channel Alluvium Excavation	35	CY	$10	$350	
	Excavation Backfill	12	CY	$10	$120	
	Excavation Haul-off	23	CY	$35	$805	
	Pre-cast Concrete structure Delivered	2	LS	$8,200	$16,400	
	Pre-cast Concrete structure Placed	2	LS	$3,000	$6,000	
	Concrete Pumping	8	CY	$220	$1,716	
	Screened 3/4" Gravel Bedding	2	CY	$30	$60	
	Care of Water (Pumping & Coffer)	1	Days	$500	$500	
	Care of Water (Filter)	1	Days	$120	$120	
					Sub Total:	**$26,071**
7	**Upper Feature Pre-cast Structure**					
	Channel Alluvium Excavation	35	CY	$10	$350	
	Excavation Backfill	12	CY	$20	$240	
	Excavation Haul-off	23	CY	$35	$805	
	Pre-cast Concrete structure Delivered	2	LS	$8,200	$16,400	
	Pre-cast Concrete structure Placed	2	LS	$3,000	$6,000	
	Concrete Pumping	7	CY	$220	$1,474	
	Screened 3/4" Gravel Bedding	2	CY	$30	$60	
	Care of Water (Pumping & Coffer)	1	Days	$500	$500	
	Care of Water (Filter)	1	Days	$120	$120	
					Sub Total:	**$25,949**
8	**Landscaping**					
	Erosion Blanket	800	SY	$6	$4,800	
	Erosion Control Logs	800	LF	$7	$5,600	
	Plant Native Riparian Grass/Forb Mix	8.7	MSF	$900	$7,830	
	Plant Native Riparian Stakes	900.0	EA	$3	$2,700	
	Plant Native Riparian Shrubs 1 qt	400	EA	$16	$6,400	
	Plant Native Riparian Shrubs #5	100	EA	$40	$4,000	
	Plant Native Cottonwoods (3" caliper)	7	EA	$600	$4,200	
	Plant Street Trees (3" caliper)	13	EA	$600	$7,800	
	Topsoil and plant pit mix/ soil conditioners	150	CY	$30	$4,500	
	Cobble Path w/ Filter Fabric	1,500	SF	$1	$1,500	
	Irrigation	1	LS	$3,200	$3,200	
					Sub Total:	**$52,530**
9	**Fishermans Park Boat Ramp**					
	Erosion Blanket	40	SY	$6	$240	
	Plant Native Riparian Stakes	90.0	EA	$3	$270	
	Plant Native Riparian Shrubs 1 qt	40	EA	$16	$640	
	Plant Native Cottonwoods (3" caliper)	2	EA	$600	$1,200	
	Channel Alluvium Excavation	60	CY	$10	$600	
	Excavation Backfill	25	CY	$20	$500	
	Excavation Haul-off	35	CY	$35	$1,225	
	4-ft Boulders, delivered & placed	150	Tons	$60	$9,000	
					Sub Total:	**$13,675**
10	**Road Improvements**					
	Traffic Control	80	hrs	$200	$16,000	
	Pavement Demolition and Removal	110	SY	$5	$495	
	Cutting Asphalt	210	LF	$4	$840	
	4" Asphalt Shoulder Patch w/ 6" roadbase	1,700	SF	$7	$11,475	
	Pavement Disposal	20	CY	$30	$600	
	Crosswalk	2	EA	$180	$360	
	Parking Stalls	120	LF	$2	$240	
	Double Yellow Striping	1,469	LF	$2	$2,350	
	Single White Striping	1,275	LF	$2	$2,550	
	Traffic Signs	3	EA	$79	$237	
	Topsoil fill	20	CY	$30	$600	
	Existing Striping Demolition	5,264	LF	$2	$12,634	
					Sub Total:	**$48,381**
	ITEMIZED CONSTRUCTION SUBTOTAL				$555,270	$555,270
	85% Design Level Factor				$83,291	
	CONSTRUCTION BUDGET SUBTOTAL				$638,561	
	Construction Monitoring Services (ENGINEER)				$11,092	

TOTAL CONSTRUCTION COST OPINION	$649,700

ARBANEY RANCH RIVER PARCEL

SECTIONS 17 AND 18
TRACT 48 T8S R86W 6th PM
PITKIN COUNTY, COLORADO



VICINITY MAP

CURVE	DELTA ANGLE	RADIUS	ARC	CHORD	CHORD BEARING
C 1	5°32'33"	2815.00'	272.31'	272.21'	N 31°34'17"W

LINE	BEARING	DISTANCE
L 1	S 58°00'24"W	22.97'
L 2	N 67°34'25"W	56.99'
L 3	S 87°44'59"E	56.94'

LEGAL DESCRIPTION

A PARCEL OF LAND SITUATED IN TRACT NO. 48, SECTIONS 17 AND 18, TOWNSHIP 8 SOUTH, RANGE 86 WEST OF THE 6th P.M., PITKIN COUNTY, COLORADO BOUNDED ON THE SOUTH BY THE SOUTHERLY LINE OF TRACT NO. 48: BOUNDED ON THE EAST BY THE SOUTHWESTERLY RIGHT OF WAY OF COLORADO HIGHWAY NO. 82 BUSINESS LOOP AS DESCRIBED IN BOOK 157 AT PAGE 550: BOUNDED ON THE NORTH BY THE ROARING RIVER LODGES CONDOMINIUMS AS DESCRIBED IN BOOK 392 AT PAGES 616-7: AND BOUNDED ON THE WEST BY LOT K, TOWN OF BASALT PUBLIC LAND PARCEL OF THE BASALT COMMERCIAL PARK AS DESCRIBED IN BOOK 260 AT PAGE 670 ALL AS DESCRIBED AS FOLLOWS:

COMMENCING AT THE 1926 GLO BRASS CAP SET FOR API TRACT 58 & AP 4 TRACT 56 & THE SOUTH LINE OF TRACT 48 WHENCE THE 1926 GLO BRASS CAP SET FOR AP4 OF TRACT NO. 48 BEARS S 87°44'59"E 1357.02 FEET WITH ALL BEARINGS HEREIN RELATIVE TO. THENCE S87°44'49"E 209.88 FEET TO THE SOUTHWESTERLY RIGHT OF WAY OF COLORADO HIGHWAY NO. 82 AS DESCRIBED IN BOOK 157 AT PAGE 550 THE POINT OF BEGINNING:

THENCE NORTHERLY ALONG SAID SOUTHWESTERLY RIGHT OF WAY:
N28°48'00"E 357.20 FEET
272.31 FEET ALONG THE ARC OF A CURVE TO THE LEFT WHOSE RADIUS IS 2,815.00 FEET (CHORD BEARS N31°34'17"W 272.21 FEET) TO THE INTERSECTION WITH THE ROARING RIVER LODGES CONDOMINIUMS AS DESCRIBED IN BOOK 392 AT PAGE 616:

THENCE NORTHWESTERLY ALONG SAID ROARING RIVER LODGES CONDOMINIUMS:
S58°00'24"W 22.97 FEET
N53°24'06"W 97.00 FEET
N67°34'25"W 56.99 FEET TO THE INTERSECTION WITH LOT K, TOWN OF BASALT PUBLIC LAND PARCEL OF THE BASALT COMMERCIAL PARK DESCRIBED IN BOOK 280 AT PG 670:

THENCE SOUTHERLY ALONG THE WESTERLY LINE OF SAID LOT K:
S38°09'39"E 410.45 FEET
S28°12'23"E 326.10 FEET MORE OR LESS TO THE SOUTHERLY LINE OF TRACT NO. 48

THENCE S87°44'59"E 56.94 FEET TO THE POINT OF BEGINNING. CONTAINING 37.662 SQUARE FEET OR 0.865 ACRES MORE OR LESS.

NOTE:
APPROXIMATELY 11,000 SQUARE FEET IS LOCATED ABOVE THE HIGH LINE OF THE ROARING FORK RIVER AS LOCATED ON MAY 11, 2009. THE REMAINING PORTION IS LOCATED WITHIN THE RIVER.

PLAT LEGEND & NOTES

FOUND TRACT COR 1926 GLO BRASS CAP OR AS NOTED

FOUND SURVEY MONUMENT #5 REBAR W/ ALUM CAP 24320 OR AS NOTED

SET PROPERTY CORNER NO. 5 REBAR W/ CAP "LS 16129"

RECORD INFORMATION WAS FURNISHED BY THE CLIENT

SURVEYED PARCEL IS VACANT. NO POSTED ADDRESS OR TAX PARCEL ID NUMBER FOUND

PORTIONS OF THE ADJOINING PARCELS ARE DESCRIBED ALONG THE CENTERLINE OF THE ROARING FORK RIVER. IT APPEARS THAT THIS NATURAL BOUNDARY HAS CHANGED LOCATION SEVERAL TIMES SINCE THE ORIGINAL CONVEYANCES FROM THE ARBANEY RANCH. THIS MAY AFFECT THE OWNERSHIP OF THE SURVEYED PARCEL.

THE FOLLOWING RECORD INFORMATION, DEEDS & PLAT WERE USED IN THE ANALYSIS OF THIS SURVEY:

1. COLORADO STATE HIGHWAY NO. 82 BUSINESS LOOP
   ROW PLAT PROJECT #366-D DATED 1938
   ROW DEED BK 157 PG 550 E.D. ARBANET TO PITKIN COUNTY
2. COLORADO STATE HIGHWAY NO. 82 BYPASS
   ROW PLAT PROJECT FC 082-1(6) SEC 2
3. LOT K, TOWN OF BASALT PUBLIC LAND PARCEL
   AMENDED FINAL PLAT BASALT COMMERCIAL PARK: PLAT BK 64 PAGE 58
   CORRECTION DEED BK 699 PG 733 STOREY & TUCKER TO TOWN OF BASALT
   DEED BK 260 AT PAGE 670 ARBANEY TO ARHUR HYDE
   (CALLS WERE ROTATED 0°00'27" COUNTERCLOKWISE)
4. ROARING RIVER LODGES CONDOMINIUMS
   CORRECTION DEED ARBANEY et al TO ROARING RIVER ASSOCIATES
   (CALLS WERE ROTATED 0°00'27" COUNTERCLOCKWISE
5. PARCELS A & B, MEYER SUBDIVISION EXEMPTION
   SUBD. PLAT: PLAT BK 32 PAGE 95
   (CALLS WERE ROTATED 1°35'01" CLOCKWISE)

SURVEYOR'S CERTIFICATE

I, DAVID W. McBRIDE, A PROFFESSIONAL LAND SURVEYOR IN THE STATE OF COLORADO HEREBY CERTIFY THAT THIS FINAL PLAT & SITE PLAN WAS PREPARED BY ME FROM NOTES OF A FIELD SURVEY MADE UNDER MY DIRECT SUPERVISION ON THE GROUND OF THE PROPERTY SHOWN HEREIN DURING MAY 2009, AND THAT THE INFORMATION SHOWN HEREON IS CORRECT BASED ON THIS SURVEYOR'S KNOWLEDGE, INFORMATION AND BELIEF.

SIGNED THIS ____ DAY OF _____, 2009.

_____
DAVID W. McBRIDE PLS 16129

ACCORDING TO COLORADO LAW YOU MUST COMMENCE ANY LEGAL ACTION BASED UPON ANY DEFECT IN THIS PLAT WITHIN THREE YEARS AFTER YOU FIRST DISCOVERED SUCH DEFECT. IN NO EVENT, MAY ANY ACTION BASED UPON ANY DEFECT IN THIS PLAT BE COMMENCED MORE THAN TEN YEARS FROM THE DATE OF THE CERTIFICATION SHOWN HEREON.

SHEET 1 OF 1

PROPERTY INVESTIGATION
ARBANEY RANCH RIVER PARCEL
TRACT 48, SECTION 17 & 18, T8S R86W 6th PM

GRAND VALLEY SURVEYING LLC
3764 BLAIR ROAD
WHITEWATER CO 81527
(970) 210-2690 grandvalley@wildblue.net

MAY 26, 2009 | JOB NO. PIT-CO KAYAK
REVISED: JUNE 19, 2009