Land Use

Courthouse Annex • 2045 13th Street • Boulder, Colorado 80302 • Tel: 303.441.3930 • Fax: 303.441.4856
Mailing Address: P.O. Box 471 • Boulder, Colorado 80306 • **www.bouldercounty.org**

MEMO TO: Agencies and Adjacent Property Owners
FROM: Christian Martin, CFM, Planner II – Flood Recovery
DATE: October 18, 2016
RE: Docket LU-16-0028

Docket LU-16-0028: Boulder County Parks and Open Space (Left Hand Creek Restoration at Bielins Hock)

Request: Limited Impact Special Use review for a proposal to restore and stabilize an 800 linear feet length of Left Hand Creek on the Bielins-Hock property (9067 Ogallala Road) consisting of 9260 cubic yards of earthworks.

Location: Parcels 131520000044, 131520000054, 131520000025 & 131520000053, located at Left Hand Creek on the POS Bielins-Hock property near the intersection of the Diagonal Hwy and Ogallala Road, in Section 20 T2N, R69W.

Zoning: Agricultural (A) Zoning District

Applicant: Jesse Rounds, Boulder County Parks & Open Space

Limited Impact Special Review is required of proposed uses that may have greater impacts on services, neighborhoods, or the environment than those allowed by right under the Boulder County Land Use Code. This process will review conformance of the proposed use with the Boulder County Comprehensive Plan and the Land Use Code.

This process includes a public hearing before the Board of County Commissioners. Adjacent property owners and holders of liens, mortgages, easements or other rights in the subject property are notified of this hearing. The Land Use staff and County Commissioners value comments from individuals and referral agencies. Please check the appropriate response below or send a letter. Late responses will be reviewed as the process permits; all comments will be made part of the public record and given to the applicant. Only a portion of the submitted documents may have been enclosed; you are welcome to review the entire file at the Land Use Department. If you have any questions regarding this application, please contact me at (303) 441-3930 or cpmartin@bouldercounty.org.

Please return responses to the above address by **November 2, 2016.**

_____ We have reviewed the proposal and have no conflicts.
_____ Letter is enclosed.

Signed_____ PRINTED Name_____

Agency or Address _____

Bielins-Hock Limited Impact Special Use Permit Application Narrative

Boulder County Parks and Open Space is seeking to restore an 800 foot long section of Left Hand Creek on the Bielins-Hock property (9067 Ogallala Road) east of the Diagonal Highway (CO 119). The project design calls for the creek banks to be made more resilient through grading and subsurface armoring. The banks will be revegetated to stabilize sandy soils and provide better habitat for both native fish and creek-dependent species like the Preble's Meadow Jumping Mouse.

Location

The Left Hand Creek Watershed was severely impacted by the 2013 flood event. The subject property, is county open space known as the Bielins-Hock property, is located just east of State Highway 119 and the project area is north and east of the Longmont to Boulder Regional Trail (Attachment B: Location Map). The properties below will be impacted by the project:

- 9067 Ogallala Road Longmont, CO 80503 (131520000044)
- 849 N 95th Street Longmont, CO 80503 (131520000025)
- 8440 Diagonal Highway Longmont, CO 80503 (131520000053)
- 0 RR Longmont, CO 80503 (131520000054)

Purpose & Need

During the 2013 flood event, debris in Left Hand Creek created an in-stream plug on a piece of property upstream (south) of the Bielins-Hock property. The creek water began to flow over its north bank and as it flowed over the Bielins-Hock pasture the force of the water began to cut into the sandy soil below. In a short period of time the creek had cut a new channel north across the pasture (see before and after images, Figures 1 & 2) with this more direct route and wide channel, the creek completely abandoned the pre-flood channel and has since flowed in the channel cut during the flood event.

The channel through which the creek now flows is composed of a sandy bottom and mostly sandy banks. Sandy banks and bottoms are prone to sudden collapse in high flow events and tend to send sand very far down the creek during normal flows. This can impact homes and infrastructure hundreds of feet downstream of the specific reach.

The Left Hand Creek Watershed Master Plan, completed in 2014, identified the Bielins-Hock reach as an area requiring specific designs. The plan states:

For this project, perform bank and headcut stabilization, re-vegetate the area, maintain the pre-flood channel as an overflow channel... The railroad should be protected from further migration. Options include a sequence of engineered log jams or setback riprap (p. 66), with conceptual design on Sheet 10 of the Map book. (Project LHCP-03-05)

Therefore, Boulder County Parks and Open Space sought and received funding from the Natural Resource Conservation Service through the Emergency Watershed Protection program to stabilize and vegetate the creek banks. This process should result in less erosion and increased habitat. Stabilizing

banks along the creek will reduce the chances of trees in this area falling into the creek and creating new plugs in future flooding events. By reducing erosion and minimizing the danger from debris, this project should reduce impacts to private and public property both upstream and downstream of the property as well as provide increased protection to the railway west of the creek.

Work in this area has been limited since the flood. Directly after the flood, debris was removed from the creek to reduce flood potential. This effort was carried out under Parks and Open Space supervision by FEMA-approved and funded contractors. Once debris was removed, a contractor hired by Xcel Energy removed a gas pipeline that had been exposed by the flooding. This effort was overseen by Parks and Open Space staff. In 2016, after a request from the City of Longmont, Parks and Open Space worked with Lefthand Watershed Oversight Group to remove debris that had fallen into the creek during 2015. These projects were carried out either from the bank or from within the creek in an attempt to minimize the shaping of the creek bank.

Scope of Work

Since the flood the flows in Left Hand Creek have continued to erode the channel and impact the sandy slopes on either side of the creek. The project proposed in this application would stop the creek bed from cutting through its layers of sediment creating a deeper and deeper channel of the creek through the establishment of a low-flow channel. The erosion of the slopes on either side of the post-flood channel would be addressed through planting on the east bank and a combination of buried rip-rap and planting on the west bank. The project will extend 800 feet which is the entire length of the post-flood "new" channel.

There is setback riprap that is there to arrest erosion during major floods. The riprap setback is approximately 770 feet long, 11 feet tall, and will be placed at 3 feet thick. This totals 941 cubic yards of import material. At the base, the riprap is set back 20-25 feet, at the top, it is buried a minimum of 1 foot. At this placement, the rock will likely never become exposed except for very large flood events.

As currently designed, the confluence of the pre-flood and post-flood channels (Figure 2) is at the north end of the project area. The confluence will be armored with small rip-rap imported from off-site. This hardening is proposed to minimize erosion at this location because of the sandy nature of the bank.

The proposed project will result in the following cut and fill on the site:

Cut: 5,240 cf

Fill: 4,020 cf

Gross: 9,260 cf

Net: +1,223 cf of excess that will be balanced on site during construction. If the excess must be hauled off it will be used at other Boulder County Parks & Open Space Flood Recovery Projects on Parks & Open Space properties. Details of the on-site work can be found on Sheet 9, of Attachment 4.

Access to the work site will be from Diagonal Highway (State Route 119). Parks and Open Space maintains an access and maintenance easement across the rail line. The access will then require the use of the LOBO regional trail. The access route and staging area are indicated on Sheet 10 of Attachment 4.

The disposal site for the remaining material has not yet been selected; however, Parks & Open Space will work with contractors to reuse materials on Parks & Open Space properties as other creek restoration projects move forward.

Work Impacts

The Bielins-Hock project is intended to reduce the hazard of wash-out to the railroad and Longmont-Boulder Regional Trail (LOBO Trail) by stabilizing the west bank of Left Hand Creek. Construction will occur adjacent to the trail and the railroad and will impact approximately 3.8 acres of Parks and Open Space managed land. If construction activities require the closure of the trail, the closure will be properly signed and publicly announced in accordance with standard Parks & Open Space policies. However, closure is not expected except for short periods during project mobilization and demobilization.

This project is slated to be funded through a grant from the Emergency Watershed Protection program (EWP) administered at the federal level by the Natural Resource Conservation Service (NRCS) and at the state level by the Colorado Water Conservation Board (CWCB). CWCB is providing the initial design for the project and will serve as construction administrator; this will ensure that the project is built to their specifications and to the specifications of the EWP program. Another benefit of this process is that the design is being vetted by federal regulators at the U.S. Fish and Wildlife Service (USFWS) and the State Historic Preservation Office (SHPO) for compliance with federal regulations that protect Threatened and Endangered Species as well as historic features and structures. Additional oversight will be provided by the Army Corps of Engineers, the Boulder County Floodplain Administrator, and the Parks and Open Space Resource Management Division. All of this review and oversight is done to ensure that the project is done properly and with the minimum impact to plants, wildlife, our history, and our neighbors.

No threatened or endangered species have been identified in this stretch of Left Hand Creek in past surveys. However, this project is designed to create fish habitat throughout the project area. There will be no “drop structures” installed that make movement through the reach difficult or impossible for fish. Drop structures are used to control elevation change in creeks. The sandy bottom and relatively flat section of the creek will not require such structures. In order to minimize impacts to the creek erosion controls will be in place and planting will be designed to reduce future erosion as noted on Sheet 5, Attachment 4. Final erosion and sediment control plans will be developed by the construction contractor in cooperation with the project design team. This allows the controls to be assessed just prior to construction. The controls in this plan are Best Management Practices (BMPs).

Floodplain Development Permit

Based on the project design and calculations provided by our design consultant this project will not change the shape or extent of the floodplain and is therefore considered to cause no-rise. A detailed *no rise* certification report is attached for reference.

Additional Information to be obtained

At this phase of design; haul routes, traffic management plans, staging areas, disposal sites, and Stormwater management and erosion control plans have not been finalized. Since this will now proceed to a design-build process with oversight from the EWP program of the NRCS, we will develop details as we move toward final design. A draft sketch is included within the attached 30% Draft Drawings that includes a proposed access road and staging location on sheet 10, Attachment 4. For additional background information, please refer to Attachment 5.

Project Timing

With 30% designs complete, we expect permitting to continue through the fall into early 2017. In early 2017, we will put the project out for bid as a design-build project. In that form, we expect to begin construction in the late winter/early spring of 2017.

Figures

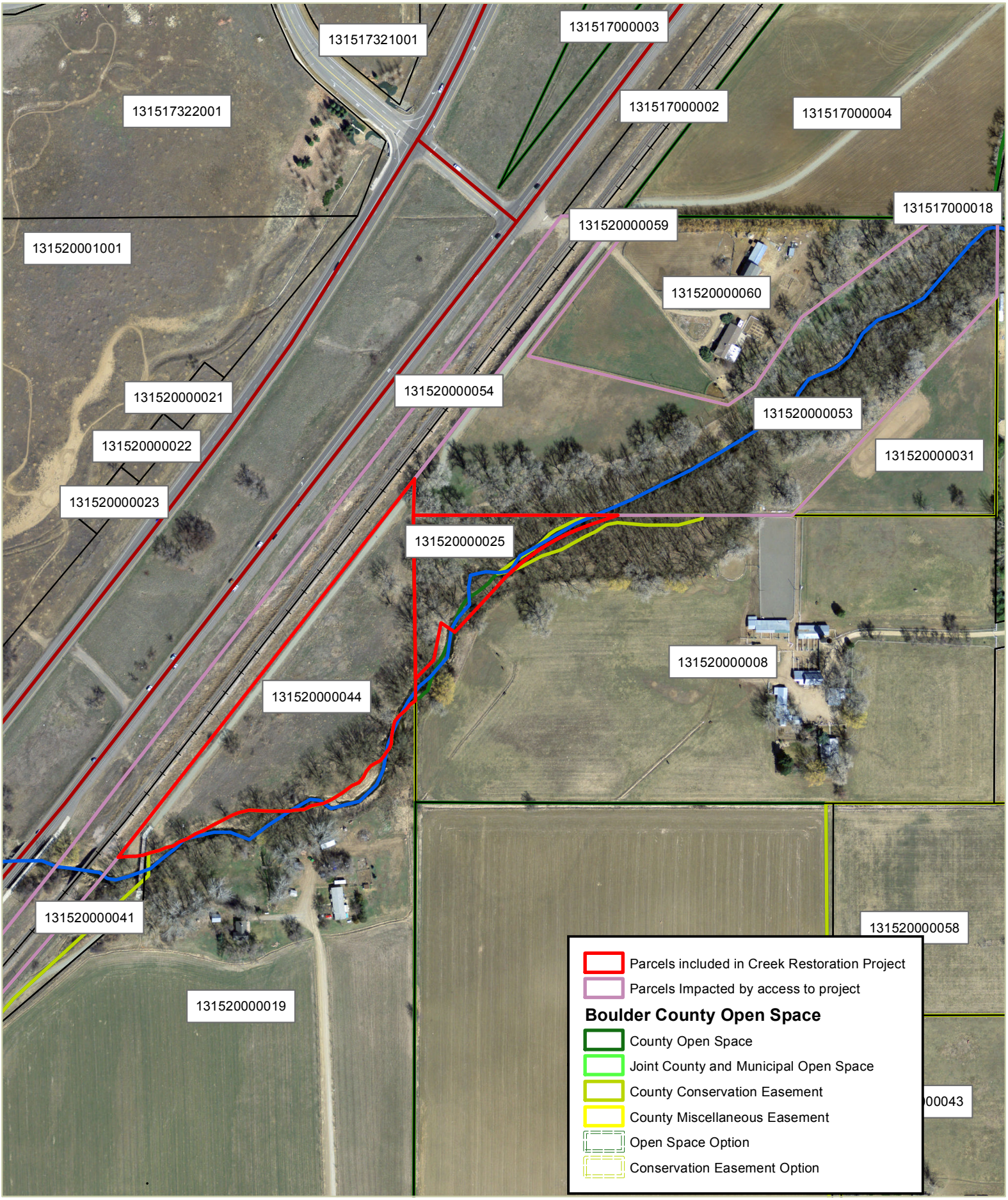
Figure 1: Bielins-Hock Open Space Pre-Flood
Figure 2: Bielins-Hock Open Space Post-Flood

Attachments

Attachment 1. Application Form and Fee Schedules
Attachment 2. Grading Fact Sheet
Attachment 3. Vicinity Map
Attachment 4. 30% Designs
Attachment 5. 30% Design Report

Figure 1: Bielins-Hock Open Space Pre-Flood

Parks & Open Space



2012

FILE: V:\gispa\res_planning\Special Projects\Left Hand Creek Flooding\Portrait Bielins-Hock Pre-Flood.mxd

0 100 200 Feet

N

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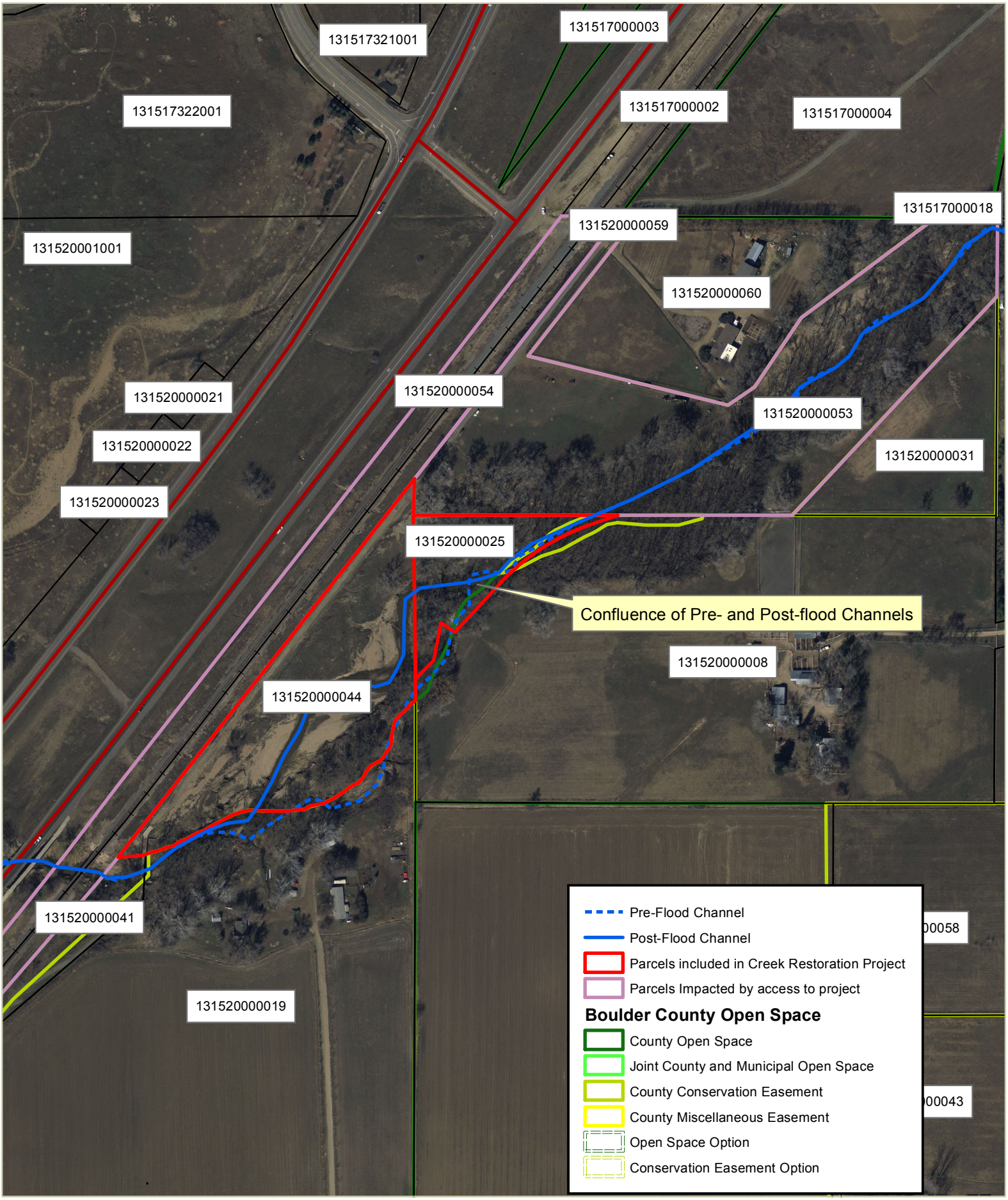
Figure 2: Bielins-Hock Open Space Post-Flood

Parks & Open Space



2014

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0 100 200 Feet

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Attachment 1

Boulder County Land Use Department
Courthouse Annex Building
2045 13th Street • PO Box 471 • Boulder, Colorado 80302
Phone: 303-441-3930 • Fax: 303-441-4856
Email: planner@bouldercounty.org
Web: www.bouldercounty.org/lu
Office Hours: Mon., Wed., Thurs., Fri. 8 a.m. to 4:30 p.m.
Tuesday 10 a.m. to 4:30 p.m.

Shaded Areas for Staff Only

Intake Stamp

Application Form

Project Number		Project Name	
☒ Limited Impact Special Use ☐ Limited Impact Special Use Waiver ☐ Modification of Special Use ☐ Site Plan Review ☐ Site Plan Review Waiver ☐ Subdivision Exemption ☐ Exemption Plat ☐ 1041 State Interest Review ☐ Other:	Application Deadline: First Wednesday of the Month ☐ Variance ☐ Appeal	Application Deadline: Second Wednesday of the Month ☐ Sketch Plan ☐ Preliminary Plan ☐ Final Plat ☐ Resubdivision (Replat) ☐ Special Use/SSDP	☐ Rezoning ☐ Road/Easement Vacation ☐ Location and Extent ☐ Road Name Change

Location(s)/Street Address(es): 9067 Ogallala Road Longmont, CO 80503 (131520000044 and 3 additional properties [see attached])

Subdivision Name

Lot(s)	Block(s)	Section(s) 20	Township(s) 2n	Range(s) 69W
Area in Acres	Existing Zoning Agricultural	Existing Use of Property		Number of Proposed Lots
Proposed Water Supply		Proposed Sewage Disposal Method		

Applicants:

Applicant/Property Owner: Boulder County Parks and Open Space			Email Address: jrounds@bouldercounty.org	
Mailing Address: 5201 St. Vrain Road				
City: Longmont	State: CO	Zip Code: 80503	Phone	Fax: 303-678-6180
Applicant/Property Owner/Agent/Consultant: Jesse Rounds			Email Address: jrounds@bouldercounty.org	
Mailing Address				
City: Longmont	State: CO	Zip Code: 80503	Phone: 303-678-6271	Fax: 303-678-6180
Agent/Consultant			Email Address	
Mailing Address				
City	State	Zip Code	Phone	Fax

Certification (Please refer to the Regulations and Application Submittal Package for complete application requirements.)

I certify that I am signing this Application Form as an owner of record of the property included in the Application. I certify that the information and exhibits I have submitted are true and correct to the best of my knowledge. I understand that all materials required by Boulder County must be submitted prior to having this matter processed. I understand that public hearings or meetings may be required. I understand that I must sign an Agreement of Payment for Application processing fees, and that additional fees or materials may be required as a result of considerations which may arise in the processing of this docket. I understand that the road, school, and park dedications may be required as a condition of approval.

I understand that I am consenting to allow the County Staff involved in this application or their designees to enter onto and inspect the subject property at any reasonable time, without obtaining any prior consent.

All landowners are required to sign application. If additional space is needed, attach additional sheet signed and dated.

X

Signature of Property Owner	Printed Name: Eric M. Lane	Date: 10/12/16
Signature of Property Owner	Printed Name	Date

The Land Use Director may waive the landowner signature requirement for good cause, under the applicable provisions of the Land Use Code.

3 Additional Project Parcels – Street Number (Parcel ID)

- 849 N 95th Street Longmont, CO 80503 (131520000025)
- 8440 Diagonal Highway Longmont, CO 80503 (131520000053)
- 0 RR Longmont, CO 80503 (131520000054)

Attachment 2

Grading Calculation

Cut and fill calculations are necessary to evaluate the disturbance of a project and to verify whether or not a Limited Impact Special Use Review (LISR) is required. A Limited Impact Special Use Review is required when grading for a project involves more than 500 cubic yards (minus normal cut/fill and backfill contained within the foundation footprint).

If grading totals are close to the 500 yard trigger, additional information may be required, such as a grading plan stamped by a Colorado Registered Professional Engineer.

Earth Work and Grading

This worksheet is to help you accurately determine the amount of grading for the property in accordance with the Boulder County Land Use Code. Please fill in all applicable boxes.

Note: Applicant(s) must fill in the shaded boxes even though foundation work does not contribute toward the 500 cubic yard trigger requiring Limited Impact Special Use Review. Also, all areas of earthwork must be represented on the site plan.

Earth Work and Grading Worksheet:

	Cut	Fill	Subtotal
Driveway and Parking Areas			
Berm(s)			
Other Grading	5240	4020	9260
Subtotal	5240	4020	9260 Box 1

* If the total in Box 1 is greater than 500 cubic yards, then a Limited Impact Special Review is required.

	Cut	Fill	Total
Foundation	0	0	0
Material cut from foundation excavation that will be removed from the property			

Excess Material will be Transported to the Following Location:

Excess Materials Transport Location:
Parks & Open Space Properties

Is Your Property Gated and Locked?

Note: If county personnel cannot access the property, it could cause delays in reviewing your application.

Certification

I certify that the information submitted is complete and correct. I agree to clearly identify the property (if not already addressed) and stake the location of the improvements on the site within four days of submitting this application. I understand that the intent of the Site Plan Review process is to address the impacts of location and type of structures, and that modifications may be required. Site work will not be done prior to issuance of a Grading or Building Permit.

Signature	Date
	10/12/22

Attachment 3

Boulder County Land Use Department

2045 13th Street, Boulder, CO 80302 303-441-3930 www.bouldercounty.org\lu

Land Use PreApplication Map: Vicinity

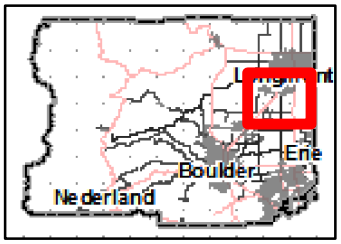
Parcel No: 131520000044, Parcel No: 131520000025
Parcel No: 131520000053 and Parcel No: 131520000054

Legend

- Subject Property
- Parcels
- Intermittent Stream
- Perennial Stream
- Municipalities
- Subdivisions

NORTH 0 1 Miles

Area of Detail Date: 7/15/2016



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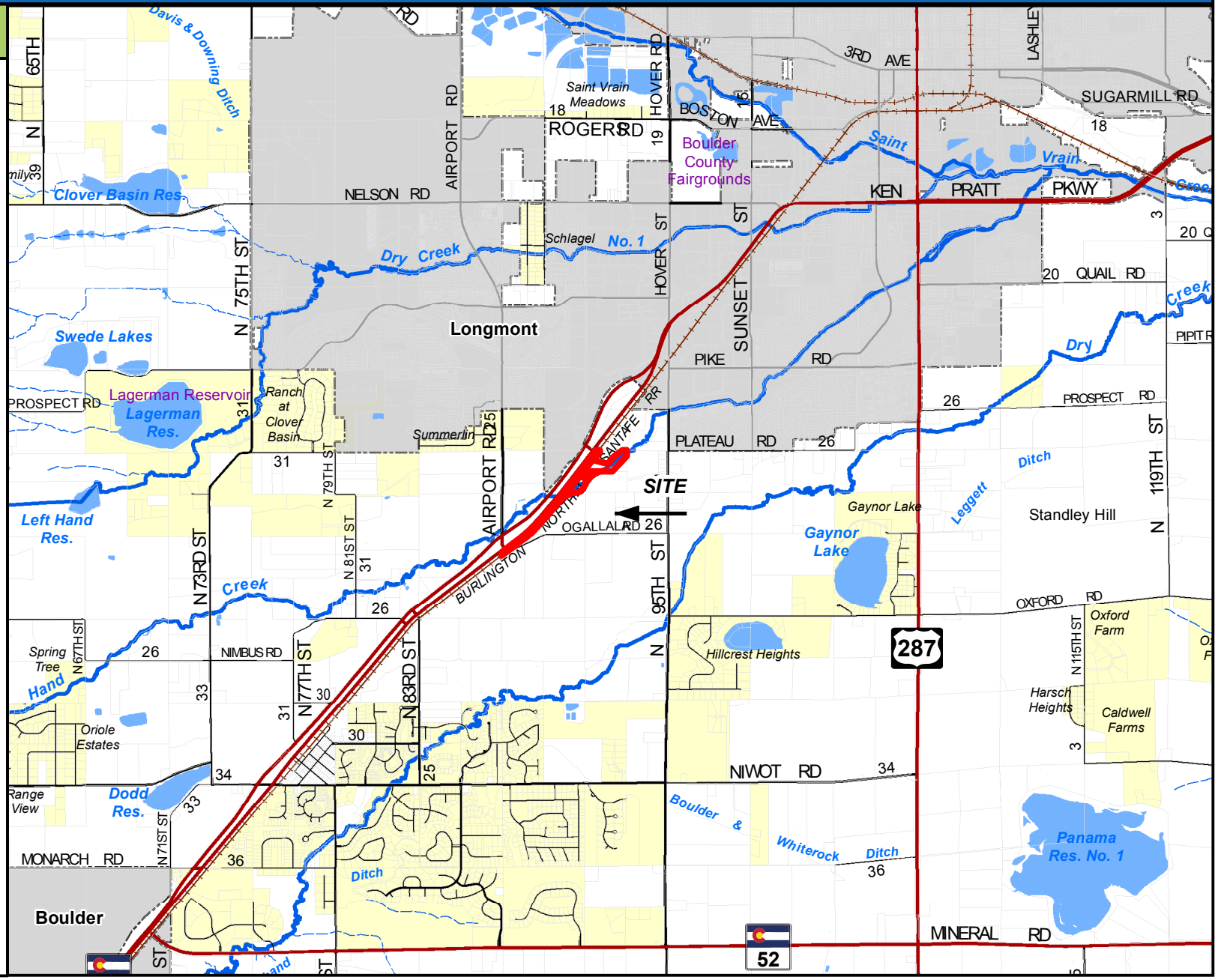


Attachment 4

EMERGENCY WATERSHED PROTECTION (EWP) PROGRAM

30% Draft Drawing Set for Internal Review

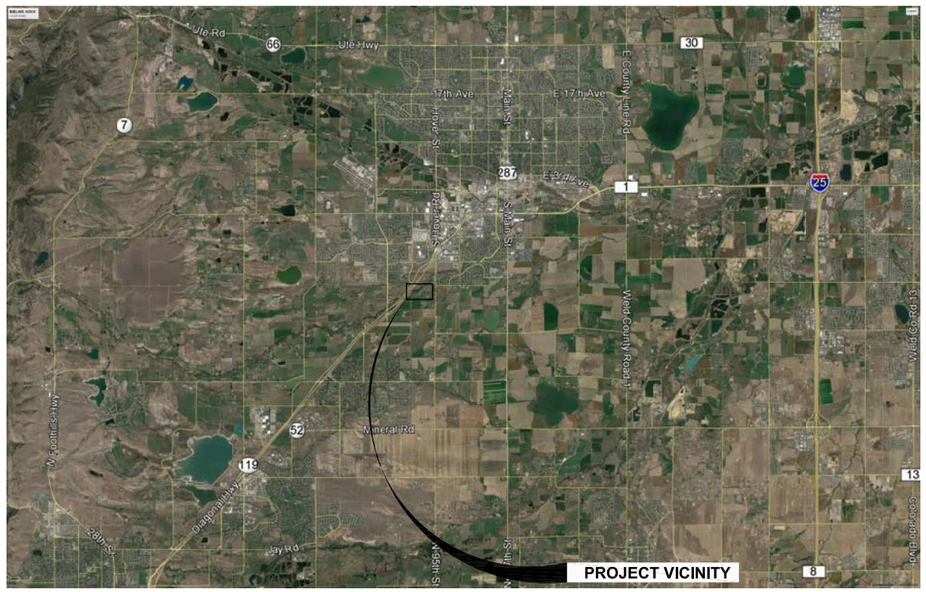
(NOT FOR CONSTRUCTION)

BIELINS HOCK BANK AND CHANNEL IMPROVEMENTS

BOULDER COUNTY, COLORADO

PREPARED BY:

RESILIENT WATERSHED PARTNERS
10106 WEST SAN JUAN WAY, SUITE 215
LITTLETON, COLORADO 80127



VICINITY MAP

NOT TO SCALE

SITE MAP

NOT TO SCALE

SHEET INDEX

Sheet List Table	
Sheet Number	Sheet Title
1	COVER SHEET
2	CONTROL
3	PLAN AND PROFILE
4, 4A, 4B, 4C	TYPICAL CROSS SECTIONS
5	VEGETATION PLAN VIEW
6	PLANTING SCHEDULE TABLES
7	DETAILS (SET BACK RIPRAP AND SOIL WRAP_
8	DETAILS (TYPICAL CHANNEL SECTION)
9	CUT AND FILL PLAN
10	PRELIMINARY ACCESS AND STAGING PLAN

PREPARED FOR:

BOULDER COUNTY OPEN SPACE
5201 ST VRAIN RD
LONGMONT, CO 80503

PREPARED BY:

RESILIANT WATERSHED PARTNERS.
10106 W SAN JUAN WAY
LITTLETON CO, 80127
PH : 303-872-9112
FX : 303-872-9104

DESIGNED:
DRAWN:
CHECKED:
DATE:

REVISION	DESCRIPTION	BY	DATE
R--			
R--			
R--			
R--			
R--			

BIELINS HOCK CHANNEL IMPROVEMENT

COVER SHEET

SHEET/REFERENCE NO.

PROJECT CONTROL INFORMATION:
1.) HORIZONTAL CONTROL IS BASED ON A MODIFIED NAD 83–COLORADO STATE PLANE NORTH DATUM. DRAWING COORDINATES ARE SCALED TO GROUND BY A SCALE FACTOR OF 1.0001396944 UTILIZING THE FOLLOWING LOCATION AS THE POINT OF ORIGIN (AKA #1):
LATITUDE=N40°07'38.42427"
LONGITUDE=W105°08'30.01125"
ELLIPSOID HEIGHT=4949.73'

2.) VERTICAL CONTROL IS BASED ON NAVD88 DATUM.

SITE CONTROL TO BE USED FOR CONSTRUCTION LAYOUT:
INFORMATION LISTED BELOW AS: POINT NUMBER, NORTHING, EASTING, ELEVATION AND DESCRIPTION.

1, 1835729.528, 3100213.550, 5004.39, SET NO. 5 REBAR WITH RED PLASTIC CAP "PSM CONTROL"
2, 1836030.8630, 3100444.1750, 5008.79, SET NO. 5 REBAR WITH RED PLASTIC CAP "PSM CONTROL"

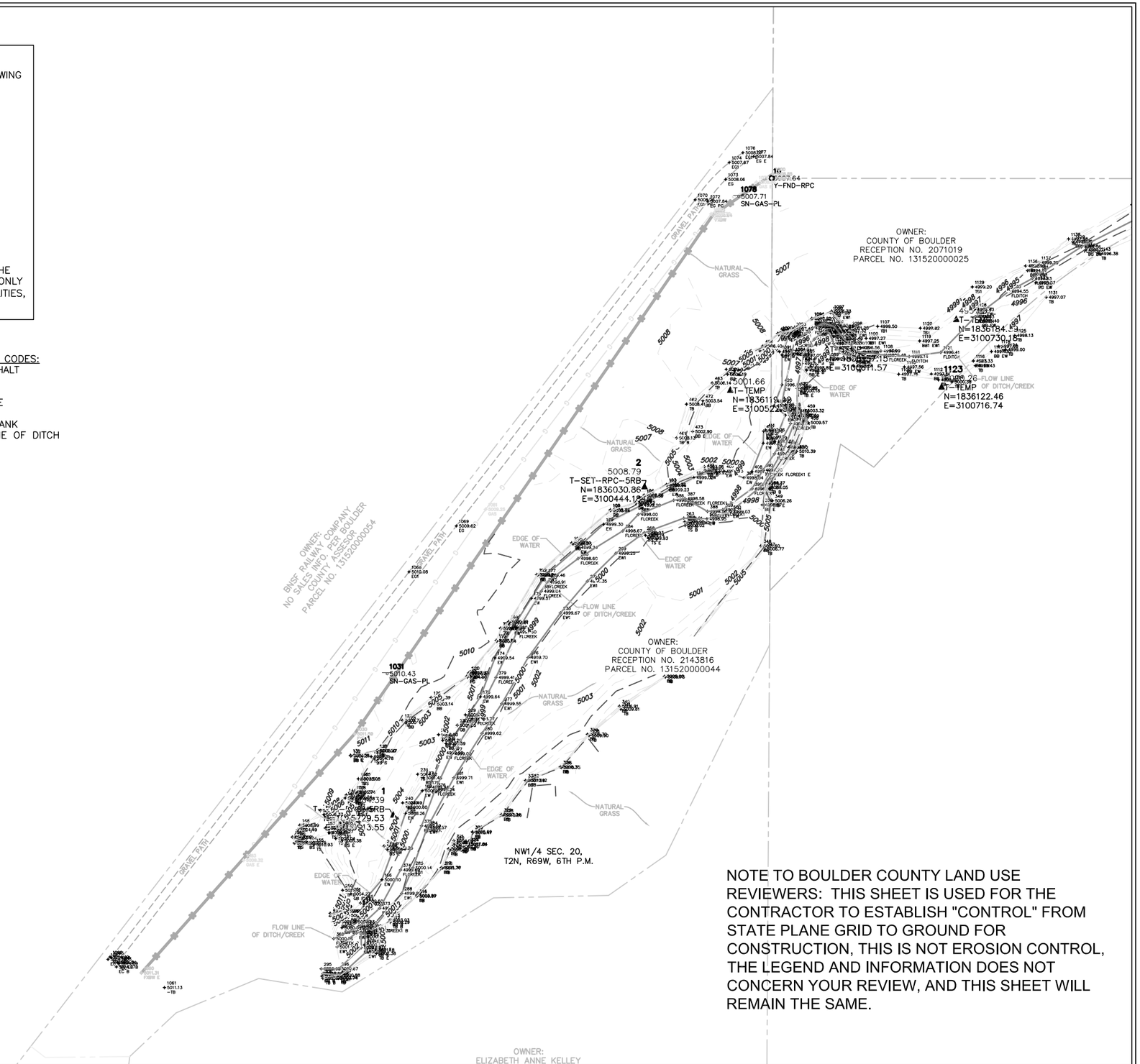
BURIED UTILITY NOTE:
UTILITY LOCATES AS SHOWN HEREON ARE TO ASSIST IN THE PLANNING/DESIGN PROCESS ONLY. DUE TO THE METHODOLOGY OF ELECTROMAGNETIC LOCATING PROCESSES, LOCATING IS NOT AN EXACT SCIENCE AND IS ONLY ACCURATE TO APPROXIMATELY 18". THEREFORE, TO OBTAIN THE EXACT LOCATION OF ANY/ALL BURIED UTILITIES, THEY WOULD NEED TO BE POTHOLED. SAID MARKS ARE NOT INTENDED FOR CONSTRUCTION USE.

LEGEND

EXISTING INDEX CONTOUR
EXISTING INTERMEDIATE CONTOUR
EXISTING BUILDING/STRUCTURE
EXISTING WATERLINE
EXISTING CABLE TV LINE
EXISTING OVERHEAD UTILS
EXISTING GAS LINE
EXISTING ELECTRIC LINE
EXISTING TELEPHONE LINE
EXISTING SANITARY SEWER
EXISTING STORM SEWER
EXISTING FIBER OPTIC
EXISTING CL DITCH
EXISTING WIRE FENCE
EXISTING SPLIT RAIL FENCE
EXISTING CHAIN LINK FENCE
EXISTING METAL/WOOD FENCE
EXISTING GUARDRAIL
EXISTING CULVERT
EXISTING EDGE OF ASPHALT
EXISTING EDGE OF GRAVEL/DIRT
EXISTING SECTION LINE
EXISTING RIGHT–OF–WAY LINE
SECTION CORNER
FOUND PROPERTY CORNER
LOCAL SITE BENCHMARK
SURVEY TRAVERSE POINT
TESTHOLE (GEOTECH–DRILLED)
TESTPIT (GEOTECH–DUG)
UTILITY POTHOLE
EXISTING WELL
EXISTING UTILITY MARKER
EXISTING SPRINKLER HEAD

EXISTING WATER VALVE
EXISTING WATER METER
EXISTING ELECTRIC HANDHOLE
EXISTING GAS VALVE
EXISTING TELEPHONE PEDESTAL
EXISTING UTILITY POLE
EXISTING GUY WIRE
EXISTING STREET LIGHTPOLE
EXISTING MAILBOX
EXISTING GAS METER
EXISTING SIGN
EXISTING SEWER MANHOLE
EXISTING VENT PIPE
EXISTING STORM MANHOLE
EXISTING WATER MANHOLE
EXISTING FIRE HYDRANT
EXISTING TELEPHONE MANHOLE
EXISTING ELECTRIC MANHOLE
EXISTING GREASE MANHOLE
EXISTING CLEAN OUT
EXISTING TRAFFIC HANDHOLE
EXISTING UTILITY HANDHOLE
EXISTING BOLLARD/POST
EXISTING CABLE TV PEDESTAL
EXISTING EVERGREEN TREE
EXISTING BUSH
EXISTING DECIDUOUS TREE
EXISTING ELECTRIC METER
EXISTING TRAFFIC SIGNAL
EXISTING TREE STUMP
EXISTING LANDSCAPE LIGHT
EXISTING IRRIGATION CONTROL VALVE
EXISTING ELECTRIC PEDESTAL
EXISTING TRAFFIC VALVE BOX

POINT DESCRIPTION CODES:
EA= EDGE OF ASPHALT
OP= ON PAVEMENT
OG= ON GROUND
TS= TOP OF SLOPE
TB= TOP OF BANK
BB= BOTTOM OF BANK
FLDITCH= FLOW LINE OF DITCH



NOTE TO BOULDER COUNTY LAND USE REVIEWERS: THIS SHEET IS USED FOR THE CONTRACTOR TO ESTABLISH "CONTROL" FROM STATE PLANE GRID TO GROUND FOR CONSTRUCTION, THIS IS NOT EROSION CONTROL, THE LEGEND AND INFORMATION DOES NOT CONCERN YOUR REVIEW, AND THIS SHEET WILL REMAIN THE SAME.

PREPARED FOR:
BOULDER COUNTY OPEN SPACE
5201 ST VRAIN RD
LONGMONT, CO 80503

PREPARED BY:
RESILIANT WATERSHED PARTNERS.
10106 W SAN JUAN WAY
LITTLETON CO, 80127
PH : 303–872–9112
FX : 303–872–9104

DESIGNED: GEB
DRAWN: GEB
CHECKED: JWS
DATE: OCT 2016

REVISION	DESCRIPTION	BY	DATE
R–..		...	...
R–..		...	...
R–..		...	...
R–..		...	...
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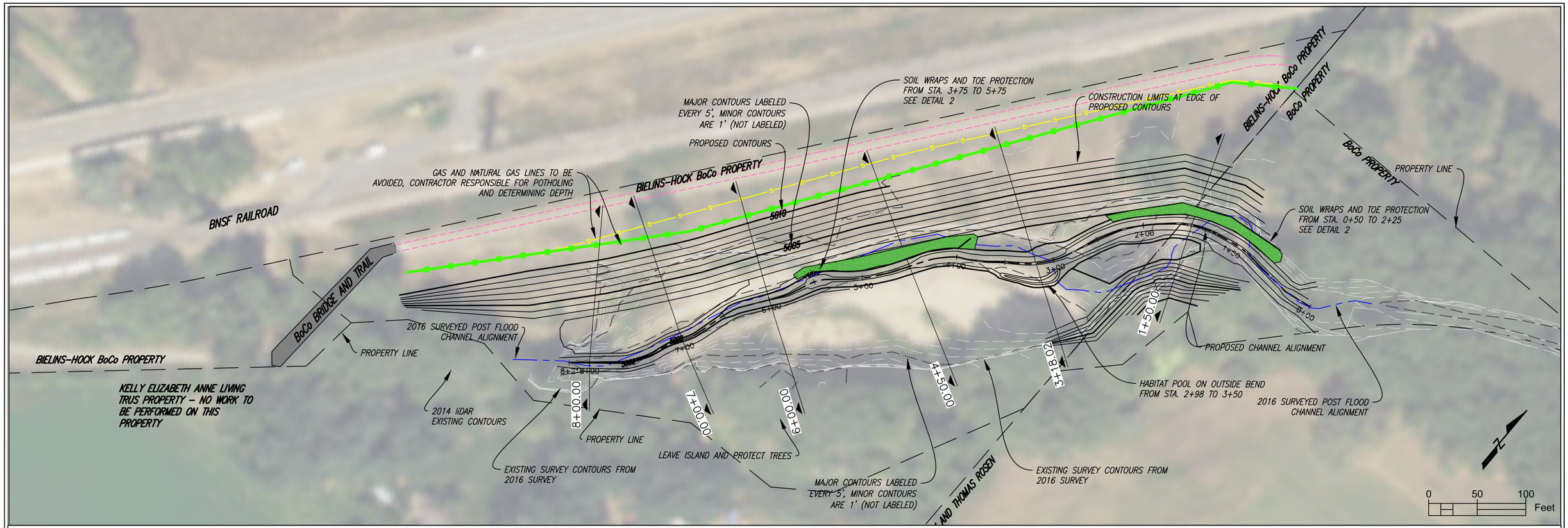
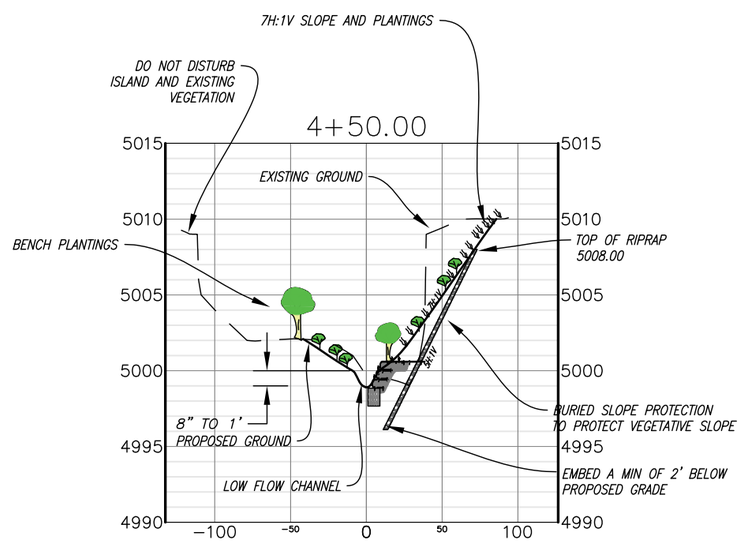
30% DESIGN FOR INTERNAL REVIEW

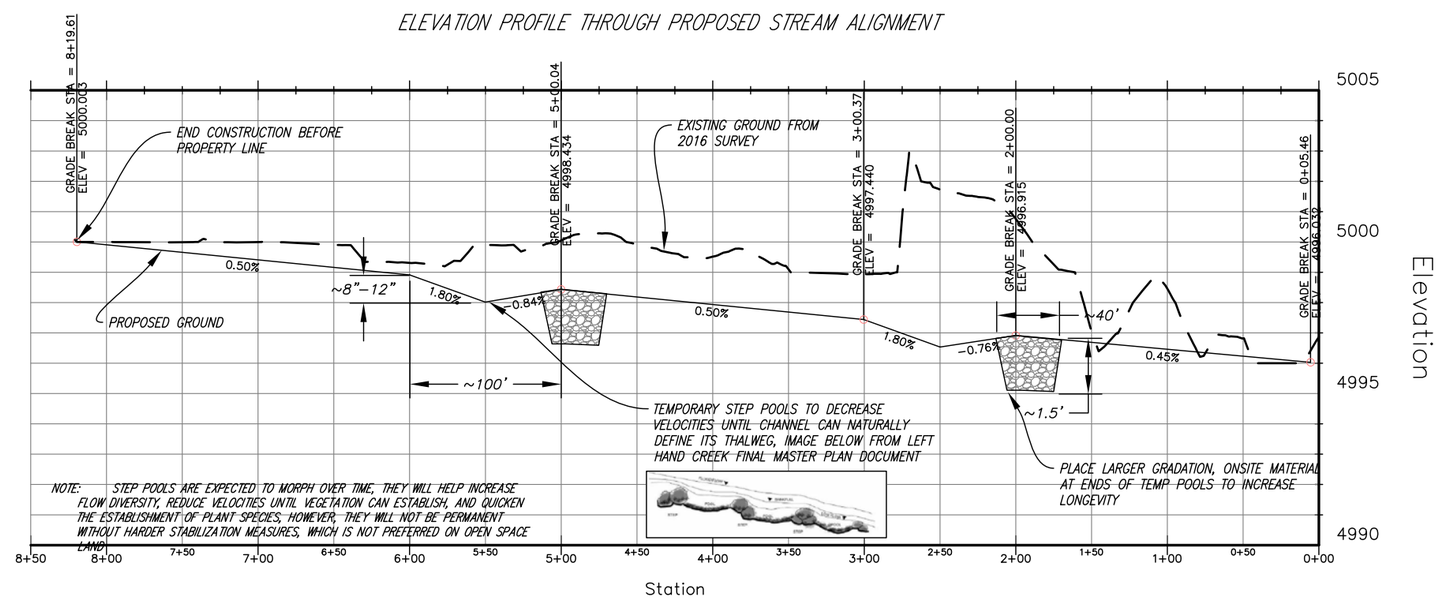
BIELINS HOCK CHANNEL IMPROVEMENT
CONTROL

SHEET/REFERENCE NO.
2
OF
10

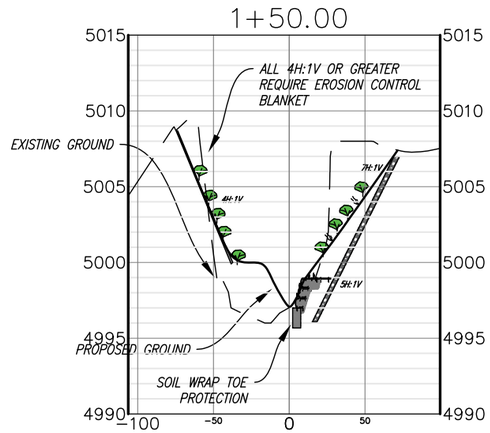


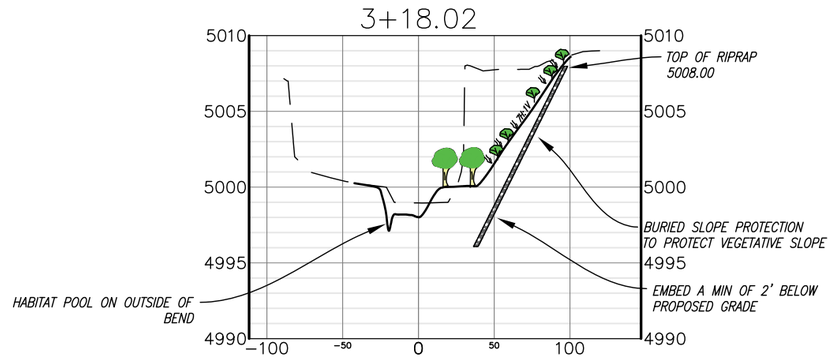


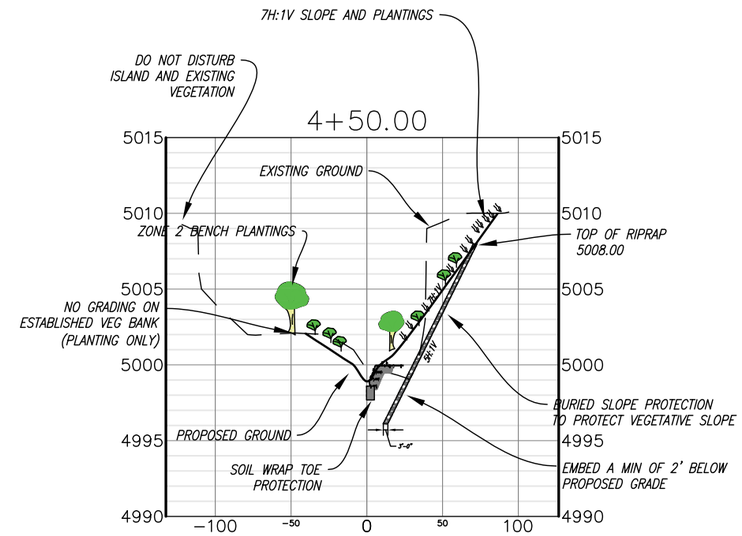
TYPICAL SECTION AT 4+50

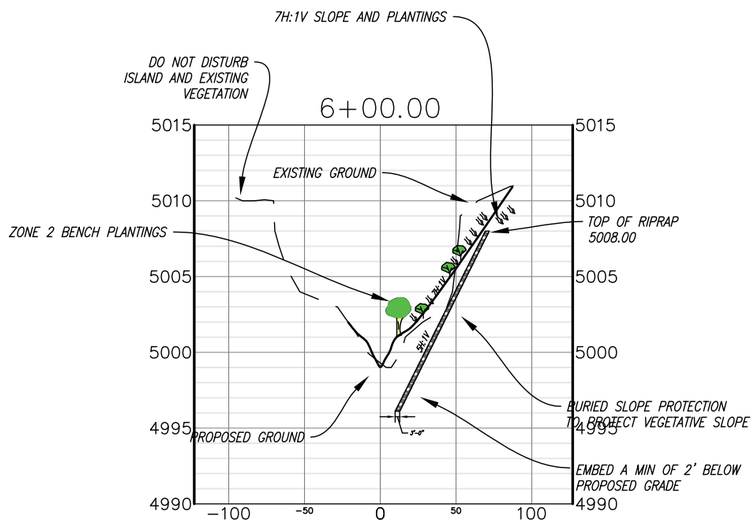


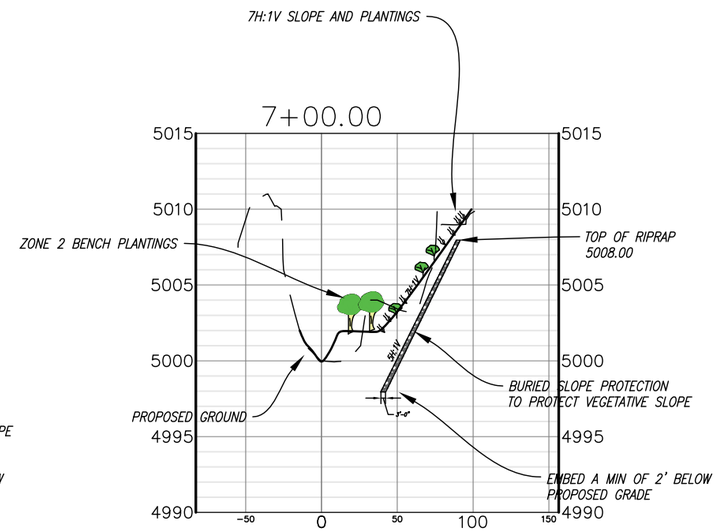
PREPARED FOR:	PREPARED BY:	DESIGNED: GEB DRAWN: GEB CHECKED: JWS DATE: OCT 2016	REVISION / DESCRIPTION / BY / DATE	30% DESIGN FOR INTERNAL REVIEW	BIELINS HOCK CHANNEL IMPROVEMENT CHANNEL PLAN AND PROFILE	SHEET/REFERENCE NO.
BOULDER COUNTY OPEN SPACE 5201 ST VRAIN RD LONGMONT, CO 80503	RESILIANT WATERSHED PARTNERS. 10106 W SAN JUAN WAY LITTLETON CO, 80127 PH : 303-872-9112 FX : 303-872-9104		R-.. ... ... R-.. ... ... R-.. ... ... R-.. ... ... R-..			3 OF 10

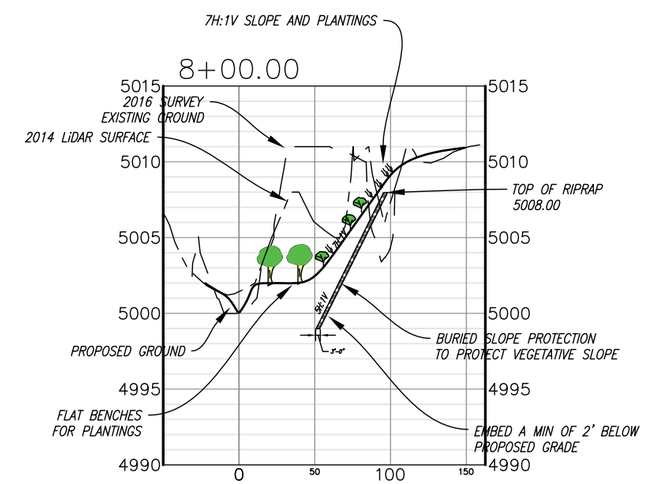












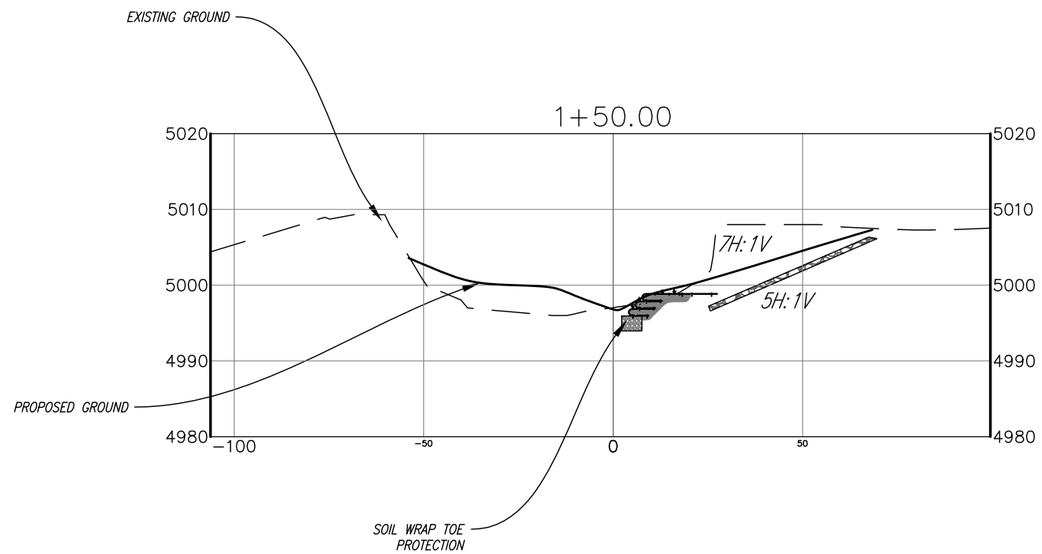
0 50 100 Feet

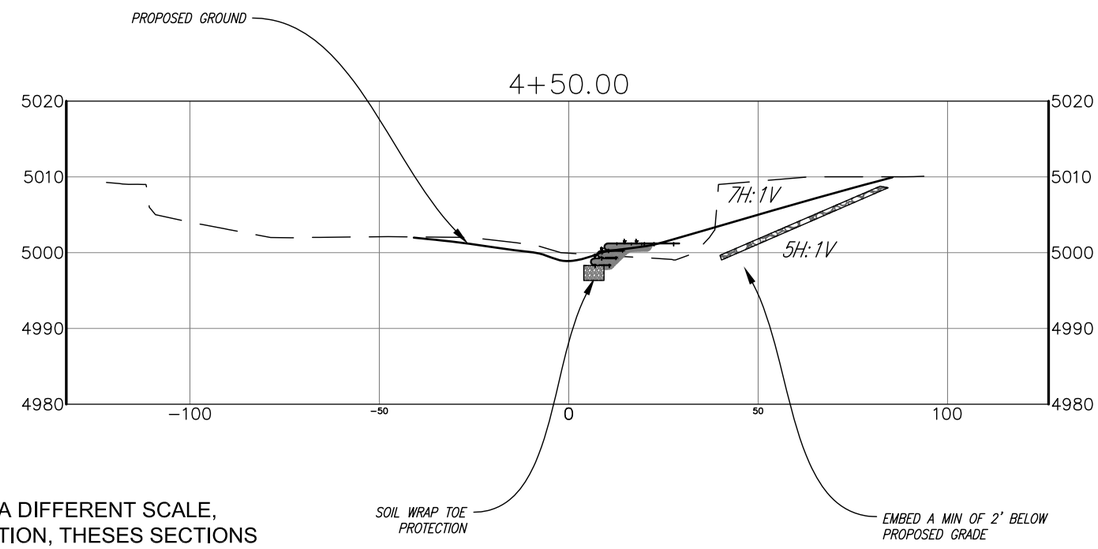
PREPARED FOR:	PREPARED BY:	DESIGNED: GEB	REVISION	DESCRIPTION	BY	DATE
BOULDER COUNTY OPEN SPACE 5201 ST VRAIN RD LONGMONT, CO 80503	RESILIANT WATERSHED PARTNERS. 10106 W SAN JUAN WAY LITTLETON CO, 80127 PH : 303-872-9112 FX : 303-872-9104	DRAWN: GEB CHECKED: JWS DATE: OCT 2016	R-.. R-.. R-.. R-.. R-..		... ...	... ...

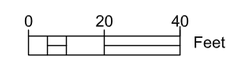
30% DESIGN FOR INTERNAL REVIEW

BIELINS HOCK CHANNEL IMPROVEMENT
CROSS SECTIONS

SHEET/REFERENCE NO.
4 OF 10







THESE SECTION SHEETS ARE INCLUDED TO SHOW THE SECTIONS AT A DIFFERENT SCALE, THIS SCALE IS 1"=20' FULL SCALE WITH A 2 TO 1 VERTICAL EXAGGERATION, THESES SECTIONS ARE THE SAME AS SHEET 4, EXCEPT THEY ARE EXAGGERATED AT A 2 VERTICAL TO 1 HORIZONTAL INSTEAD OF A 50 TO 1.

PREPARED FOR:

BOULDER COUNTY OPEN SPACE
5201 ST VRAIN RD
LONGMONT, CO 80503

PREPARED BY:

RESILIANT WATERSHED PARTNERS.
10106 W SAN JUAN WAY
LITTLETON CO, 80127
PH : 303-872-9112
FX : 303-872-9104

DESIGNED:	GEB
DRAWN:	GEB
CHECKED:	JWS
DATE:	OCT 2016

REVISION	DESCRIPTION	BY	DATE
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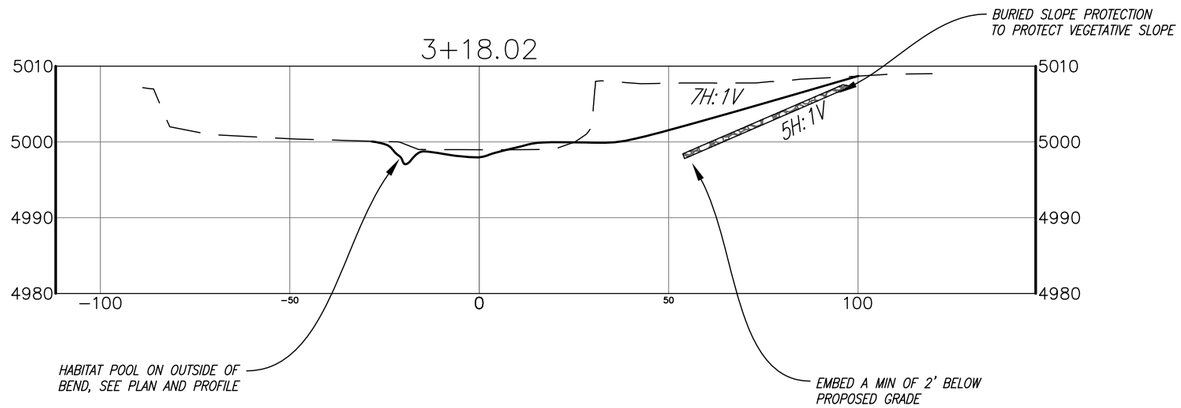
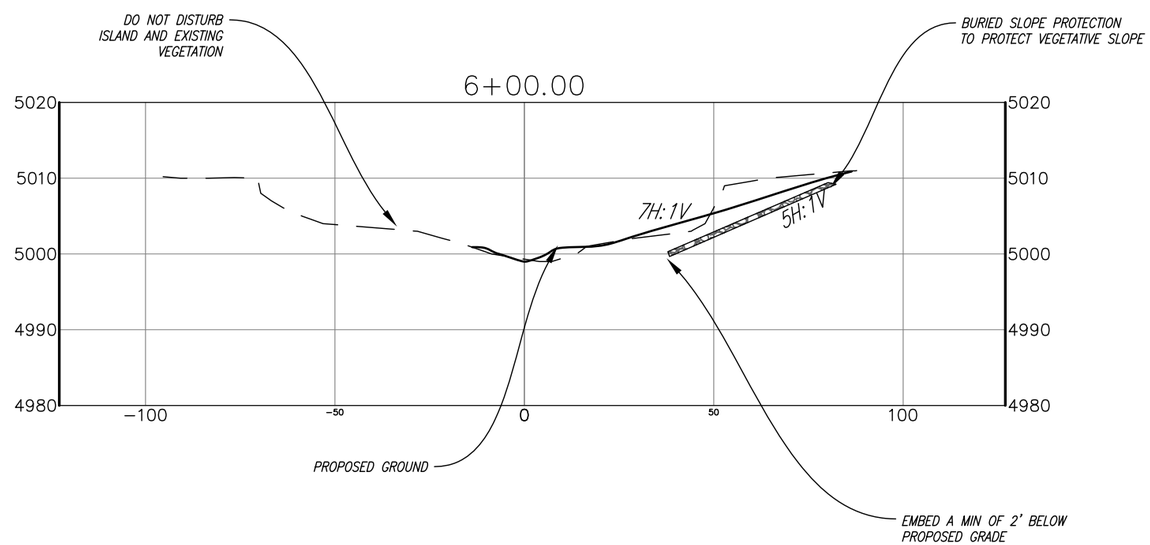
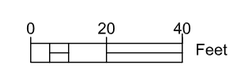
30% DESIGN FOR INTERNAL REVIEW

BIELINS HOCK CHANNEL IMPROVEMENT
CROSS SECTIONS (20 SCALE)

SHEET/REFERENCE NO.
4a
OF
10







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5201 ST VRAIN RD
LONGMONT, CO 80503

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PH : 303-872-9112
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DESIGNED:	GEB
DRAWN:	GEB
CHECKED:	JWS
DATE:	OCT 2016

REVISION	DESCRIPTION	BY	DATE
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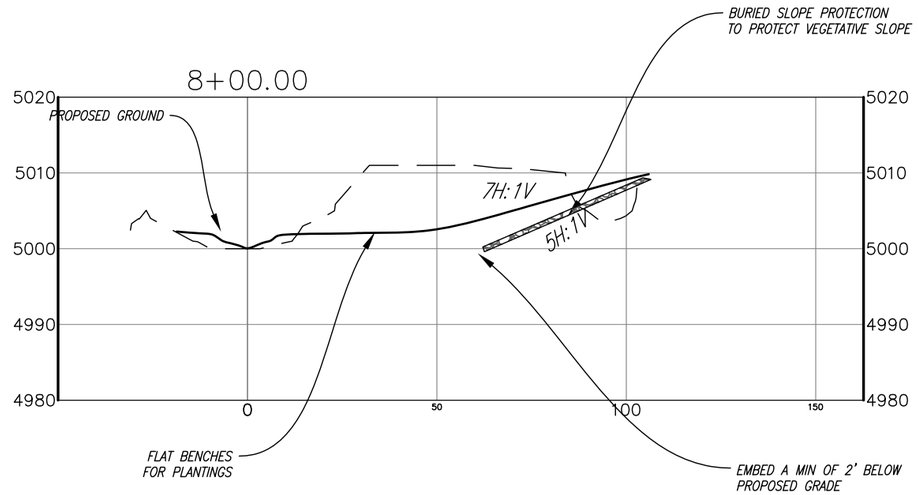
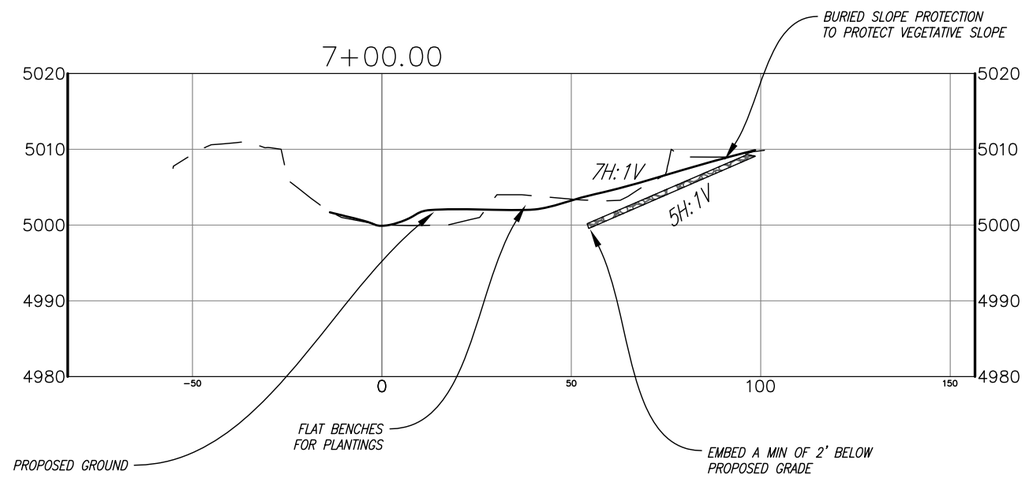
30% DESIGN FOR INTERNAL REVIEW

BIELINS HOCK CHANNEL IMPROVEMENT
CROSS SECTIONS (20 SCALE)

SHEET/REFERENCE NO.
4b OF 10





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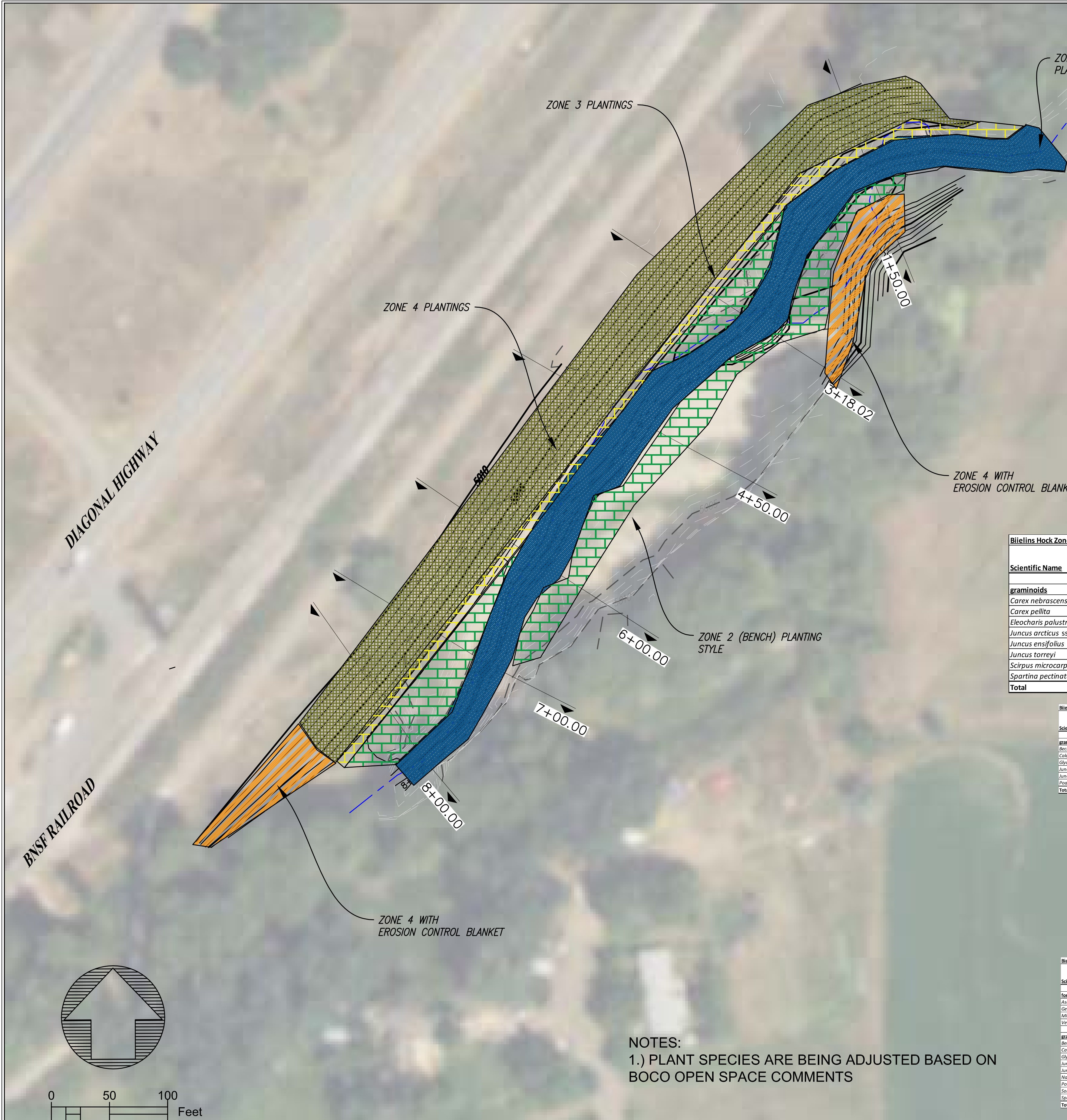
0 20 40 Feet

PREPARED FOR:	PREPARED BY:	DESIGNED: GEB	REVISION	DESCRIPTION	BY	DATE	30% DESIGN FOR INTERNAL REVIEW	BIELINS HOCK CHANNEL IMPROVEMENT CROSS SECTIONS (20 SCALE)	SHEET/REFERENCE NO.
BOULDER COUNTY OPEN SPACE 5201 ST VRAIN RD LONGMONT, CO 80503	RESILIANT WATERSHED PARTNERS. 10106 W SAN JUAN WAY LITTLETON CO, 80127 PH : 303-872-9112 FX : 303-872-9104	DRAWN: GEB CHECKED: JWS DATE: OCT 2016	R-.. R-.. R-.. R-.. R-..		... ...	... ...			4C OF 10



NOTES:
1.) PLANT SPECIES ARE BEING ADJUSTED BASED ON BOCO OPEN SPACE COMMENTS

Biielins Hock Zone 1: (Percent of Time Wet Annually 90 to 100) Containers/Rhizomes (0.42 ac)

Scientific Name	Common Name	Percent of mix	Material Type	Container Size	Plant Number
graminoids					
Carex nebrascensis	Nebraska sedge	20	container	10 cubic inch	1061
Carex pellita	wooly sedge	20	container	10 cubic inch	1061
Eleocharis palustris	creeping spikerush	10	container	10 cubic inch	530
Juncus arcticus ssp. *littoralis*	mountain rush	15	container	10 cubic inch	796
Juncus ensifolius	three-stamened rush	7.5	container	10 cubic inch	398
Juncus torreyi	Torrey's rush	10	container	10 cubic inch	531
Scirpus microcarpus	panicled bulrush	7.5	container	10 cubic inch	398
Spartina pectinata	prairie cordgrass	10	container	10 cubic inch	530
Total		**100**			**5305**

Biielins Hock Zone 1: (Percent of Time Wet Annually 90 to 100) Seed (0.42 ac)

Scientific Name	Common Name	Percent of mix	Seed number using 150 seeds/sq ft	Pure Live Seed (PLS) Weight	PLS lb Required per Ac	PLS lb Required for Project Area
graminoids						
Beckmannia syzigachne	American sloughgrass	15	22.5	1,025,000	0.96	0.40
Calamagrostis canadensis	bluejoint reedgrass	10	15	4,114,584	0.16	0.07
Glyceria striata	fowl mannagrass	20	30	170,000	7.69	3.23
Juncus arcticus ssp. *littoralis*	mountain rush	15	22.5	6,950,000	0.14	0.06
Juncus torreyi	Torrey rush	10	15	12,150,000	0.05	0.02
Poa palustris	fowl bluegrass	30	45	2,078,000	0.94	0.39
Total		**100**			**9.94**	**4.17**

Bielins Hock Zone 2: (Percent of Time Wet Annually 70 to 90) Containers/Rhizomes (0.58 ac)

Scientific Name	Common Name	Percent of mix	Material Type	Container Size	Plant Number
woody species					
Salix exigua	narrowleaf willow	25	cutting	4-ft cutting	458
Salix irrorata	bluestem willow	10	cutting	4-ft cutting	183
graminoids					
Carex nebrascensis	Nebraska sedge	15	container	10 cubic inch	275
Carex pellita	wooly sedge	15	container	10 cubic inch	275
Eleocharis palustris	creeping spikerush	2.5	container	10 cubic inch	46
Juncus arcticus ssp. *littoralis*	mountain rush	15	container	10 cubic inch	275
Juncus ensifolius	three-stamened rush	2.5	container	10 cubic inch	46
Juncus torreyi	Torrey's rush	2.5	container	10 cubic inch	46
Scirpus microcarpus	panicled bulrush	2.5	container	10 cubic inch	46
Spartina pectinata	prairie cordgrass	10	container	10 cubic inch	182
Total		**100**			**1832**

Bielins Hock Zone 2: (Percent of Time Wet Annually 70 to 90) Seed (0.58 ac)

Scientific Name	Common Name	Percent of mix	Seed number using 150 seeds/sq ft	Pure Live Seed (PLS) Weight	PLS lb Required per Ac	PLS lb Required for Project Area
forb species						
Asclepias incarnata	swamp milkweed	2.5	3.8	68,100	2.43	1.4094
Geum macrophyllum	largeleaf avens	2.5	3.8	793,353	0.21	0.1218
Mimulus guttatus	common monkeyflower	2.5	3.8	4,200,000	0.04	0.0232
Verbena hastata	blue verbene	2.5	3.8	1,792,800	0.09	0.0522
graminoids						
Beckmannia syzigachne	American sloughgrass	10	15	1,025,000	0.64	0.37
Calamagrostis canadensis	bluejoint reedgrass	5	7.5	4,114,584	0.08	0.05
Glyceria striata	fowl mannagrass	10	15	170,000	3.84	2.23
Juncus arcticus ssp. *littoralis*	mountain rush	15	22.5	6,950,000	0.14	0.08
Juncus torreyi	Torrey rush	10	15	12,150,000	0.05	0.03
Nasella viridula	green needlegrass	5	7.5	152,117	2.15	1.25
Poa palustris	fowl bluegrass	20	30	2,078,000	0.63	0.37
Sorghastrum nutans	yellow Indiangrass	5	7.5	153,500	2.13	1.24
Spartina pectinata	prairie cordgrass	10	15	153,500	4.26	2.47
Total		**100**			**16.69**	**9.68**

Bielins Hock Zone 3: (Percent of Time Wet Annually 40 to 70) Containers/Rhizomes (0.31/ac)

Scientific Name	Common Name	Percent of mix	Material Type	Container Size	Plant Number
woody species					
Alnus Incanna	Tenuifolia	10	container	1-quart	98
Cornus sericea	redosier dogwood	5	container	1-quart	49
Populus deltoides ssp. *monilifera*	plains cottonwood	25	cutting	5-ft cutting	245
Prunus virginiana ssp. *melanocarpa*	chokecherry	5	container	1-quart	49
Ribes aureum	golden currant	5	container	1-quart	49
Salix amygdaloides	peachleaf willow	5	container	1-quart	49
Salix exigua	narrowleaf willow	20	cutting	4-ft cutting	196
Salix irrorata	bluestem willow	5	container	1 quart	49
Salix lucida ssp. *caudata*	whiplash willow	5	container	1-quart	49
graminoids and others					
Carex nebrascensis	Nebraska sedge	5	container	10 cubic inch	49
Eleocharis palustris	creeping spikerush	5	container	1-quart	49
Equisetum arvense	scouring rush	5	rhizome	rhizome	49
Total		100			

Bielins Hock Zone 3: (Percent of Time Wet Annually 40 to 70) Seed

Scientific Name	Common Name	Percent of mix	Seed number using 150 seeds/sq ft	Pure Live Seed (PLS) Weight	PLS lb Required per Ac	PLS lb Required for Project Area
herbaceous dicot						
Gaillardia and Ratibida		3	4.5	7,250,000	0.02	0.01
Cleome serrulata	Rocky Mountain beeplant	3	4.5	87,250	1.6	0.50
Helianthus nuttallii	Nuttall's sunflower	3	4.5	217,000	0.62	0.19
Monarda fistulosa	wild bergamot	3	4.5	1,250,625	0.12	0.04
Solidago canadensis	Canada goldenrod	3	4.5	1,350,000	0.1	0.03
graminoids						
Elymus lanceolatus ssp. lanceolatus	thickspike wheatgrass	15	22.5	155,350	4.35	1.35
Glyceria striata	fowl mannagrass	5	7.5	170,000	1.33	0.41
Juncus arcticus ssp. *littoralis*	mountain rush	5	7.5	6,950,000	0.03	0.01
Juncus torreyi	Torrey rush	5	7.5	12,150,000	0.02	0.01
Nasella viridula	green needlegrass	10	15	152,117	2.96	0.92
Pascopyron smithii	western wheatgrass	15	22.5	133,000	5.08	1.57
Poa palustris	fowl bluegrass	15	22.5	2,078,000	0.33	0.10
Poa secunda	Sandberg bluegrass	15	22.5	902,500	0.75	0.23
Total		100	150 PLS Seeds/sq ft		17.31 PLS lb	5.37

Bielins Hock Zone 4: (Percent of Time Wet Annually 0 to 40) Containers/Rhizomes (1.43 ac)

Scientific Name	Common Name	Percent of mix	Material Type	Container Size	Plant Number
woody species					
Ericameria Nauseousus	Rubber Rabbit Brush	30	container	1-gallon	299
Populus deltoides ssp. *monilifera*	plains cottonwood	30	cutting	8-ft poles	398
Prunus virginiana ssp. *melanocarpa*	chokecherry	20	container	1-quart	299
Ribes aureum	golden currant	5	container	1-quart	100
Symphoricarpos rotundifolia	roundleaf snowberry	15	container	1 quart	298
Total		100			1992

Bielins Hock Zone 4: (Percent of Time Wet Annually 0 to 40) Seed (1.43 ac)

Scientific Name	Common Name	Percent of mix	Seed number using 150 seeds/sq ft	Pure Live Seed (PLS) Weight	PLS lb Required per Ac	PLS lb Required for Project Area
herbaceous dicot						
Campanula rotundifolia	harebell	2.5	3.75	7,250,000	0.02	0.03
Cleome serrulata	Rocky Mountain beeplant	2.5	3.75	87,250	1.87	2.67
Gallardia aristata	blanketflower	2.5	3.75	189,959	0.86	1.23
Helianthus nuttallii	Nuttall's sunflower	2.5	3.75	217,000	0.75	1.07
Monarda fistulosa	wild bergamot	2.5	3.75	1,250,625	0.13	0.19
Solidago canadensis	Canada goldenrod	2.5	3.75	1,350,000	0.12	0.17
Vicia americana	American vetch	2.5	3.75	354,495	0.46	0.66
graminoids						
Achnatherum hymenoides	Indian ricegrass	5	7.5	181,741	1.8	2.57
Bouteloua gracilis	blue grama	5	7.5	780,500	0.42	0.60
Elymus lanceolatus ssp. lanceolatus	thickspike wheatgrass	15	22.5	155,350	6.31	9.02
Koeleria macrantha	junegrass	5	7.5	2,057,500	0.16	0.23
Muhlenbergia montana	mountain muhly	5	7.5	1,500,000	0.22	0.31
Nasella viridula	green needlegrass	7.5	15	152,117	4.3	6.15
Pascopyron smithii	western wheatgrass	15	22.5	133,000	7.37	10.54
Poa secunda	Sandberg bluegrass	10	15	902,500	0.72	1.03
Psuedoroegenria spicata	bluebunch wheatgrass	5	7.5	140,000	2.33	3.33
Schizachyrium scoparium	little bluestem	10	15	195,000	3.35	4.79
Total		100	150 PLS Seeds/sq ft		31.19	44.6

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BOULDER COUNTY OPEN SPACE
5201 ST VRAIN RD
LONGMONT, CO 80503

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RESILIANT WATERSHED PARTNERS.
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LITTLETON CO, 80127
PH : 303-872-9112
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DESIGNED:
DRAWN:
CHECKED:
DATE:

REVISION	DESCRIPTION	BY	DATE
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30% DESIGN FOR INTERNAL REVIEW

BIELINS HOCK CHANNEL IMPROVEMENT
PLANTING ZONES

SHEET/REFERENCE NO.
5 OF 10

Biielins Hock Zone 1: (Percent of Time Wet Annually 90 to 100) Containers/Rhizomes (0.42 ac)					
Scientific Name	**Common Name**	**Percent of mix**	**Material Type**	**Container Size**	**Plant Number**
graminoids					
Carex nebrascensis	Nebraska sedge	20	container	10 cubic inch	1061
Carex pellita	wooly sedge	20	container	10 cubic inch	1061
Eleocharis palustris	creeping spikerush	10	container	10 cubic inch	530
Juncus arcticus ssp. *littoralis*	mountain rush	15	container	10 cubic inch	796
Juncus ensifolius	three-stamened rush	7.5	container	10 cubic inch	398
Juncus torreyi	Torrey's rush	10	container	10 cubic inch	531
Scirpus microcarpus	panicled bulrush	7.5	container	10 cubic inch	398
Spartina pectinata	prairie cordgrass	10	container	10 cubic inch	530
Total		**100**			**5305**

Biielins Hock Zone 1: (Percent of Time Wet Annually 90 to 100) Seed (0.42 ac)						
Scientific Name	**Common Name**	**Percent of mix**	**Seed number using 150 seeds/sq ft**	**Pure Live Seed (PLS) Weight**	**PLS lb Required per Ac**	**PLS lb Required for Project Area**
graminoids						
Beckmannia syzigachne	American sloughgrass	15	22.5	1,025,000	0.96	0.40
Calamagrostis canadensis	bluejoint reedgrass	10	15	4,114,584	0.16	0.07
Glyceria striata	fowl mannagrass	20	30	170,000	7.69	3.23
Juncus arcticus ssp. *littoralis*	mountain rush	15	22.5	6,950,000	0.14	0.06
Juncus torreyi	Torrey rush	10	15	12,150,000	0.05	0.02
Poa palustris	fowl bluegrass	30	45	2,078,000	0.94	0.39
Total		**100**			**9.94**	**4.17**

Bielins Hock Zone 2: (Percent of Time Wet Annually 70 to 90) Containers/Rhizomes (0.58 ac)					
Scientific Name	**Common Name**	**Percent of mix**	**Material Type**	**Container Size**	**Plant Number**
woody species					
Salix exigua	narrowleaf willow	25	cutting	4-ft cutting	458
Salix irrorata	bluestem willow	10	cutting	4-ft cutting	183
graminoids					
Carex nebrascensis	Nebraska sedge	15	container	10 cubic inch	275
Carex pellita	wooly sedge	15	container	10 cubic inch	275
Eleocharis palustris	creeping spikerush	2.5	container	10 cubic inch	46
Juncus arcticus ssp. *littoralis*	mountain rush	15	container	10 cubic inch	275
Juncus ensifolius	three-stamened rush	2.5	container	10 cubic inch	46
Juncus torreyi	Torrey's rush	2.5	container	10 cubic inch	46
Scirpus microcarpus	panicled bulrush	2.5	container	10 cubic inch	46
Spartina pectinata	prairie cordgrass	10	container	10 cubic inch	182
Total		**100**			**1832**

Bielins Hock Zone 2: (Percent of Time Wet Annually 70 to 90) Seed (0.58 ac)						
Scientific Name	**Common Name**	**Percent of mix**	**Seed number using 150 seeds/sq ft**	**Pure Live Seed (PLS) Weight**	**PLS lb Required per Ac**	**PLS lb Required for Project Area**
forb species						
Asclepias incarnata	swamp milkweed	2.5	3.8	68,100	2.43	1.4094
Geum macrophyllum	largeleaf avens	2.5	3.8	793,353	0.21	0.1218
Mimulus guttatus	common monkeyflower	2.5	3.8	4,200,000	0.04	0.0232
Verbena hastata	blue verbene	2.5	3.8	1,792,800	0.09	0.0522
graminoids						
Beckmannia syzigachne	American sloughgrass	10	15	1,025,000	0.64	0.37
Calamagrostis canadensis	bluejoint reedgrass	5	7.5	4,114,584	0.08	0.05
Glyceria striata	fowl mannagrass	10	15	170,000	3.84	2.23
Juncus arcticus ssp. *littoralis*	mountain rush	15	22.5	6,950,000	0.14	0.08
Juncus torreyi	Torrey rush	10	15	12,150,000	0.05	0.03
Nasella viridula	green needlegrass	5	7.5	152,117	2.15	1.25
Poa palustris	fowl bluegrass	20	30	2,078,000	0.63	0.37
Sorghastrum nutans	yellow Indiangrass	5	7.5	153,500	2.13	1.24
Spartina pectinata	prairie cordgrass	10	15	153,500	4.26	2.47
Total		**100**			**16.69**	**9.68**

Bielins Hock Zone 3: (Percent of Time Wet Annually 40 to 70) Containers/Rhizomes (0.31/ac)					
Scientific Name	**Common Name**	**Percent of mix**	**Material Type**	**Container Size**	**Plant Number**
woody species					
Alnus lncanna	Tenuifolia	10	container	1-quart	98
Cornus sericea	redosier dogwood	5	container	1-quart	49
Populus deltoides ssp. *monilifera*	plains cottonwood	25	cutting	5-ft cutting	245
Prunus virginiana ssp. *melanocarpa*	chokecherry	5	container	1-quart	49
Ribes aureum	golden currant	5	container	1-quart	49
Salix amygdaloides	peachleaf willow	5	container	1-quart	49
Salix exigua	narrowleaf willow	20	cutting	4-ft cutting	196
Salix irrorata	bluestem willow	5	container	1 quart	49
Salix lucida ssp. *caudata*	whiplash willow	5	container	1-quart	49
graminoids and others					
Carex nebrascensis	Nebraska sedge	5	container	10 cubic inch	49
Eleocharis palustris	creeping spikerush	5	container	1-quart	49
Equisetum arvense	scouring rush	5	rhizome	rhizome	49
Total		**100**			

Bielins Hock Zone 3: (Percent of Time Wet Annually 40 to 70) Seed						
Scientific Name	**Common Name**	**Percent of mix**	**Seed number using 150 seeds/sq ft**	**Pure Live Seed (PLS) Weight**	**PLS lb Required per Ac**	**PLS lb Required for Project Area**
herbaceous dicot						
Gaillardia and Ratibida		3	4.5	7,250,000	0.02	0.01
Cleome serrulata	Rocky Mountain beeplant	3	4.5	87,250	1.6	0.50
Helianthus nuttallii	Nuttall's sunflower	3	4.5	217,000	0.62	0.19
Monarda fistulosa	wild bergamot	3	4.5	1,250,625	0.12	0.04
Solidago canadensis	Canada goldenrod	3	4.5	1,350,000	0.1	0.03
graminoids						
Elymus lanceolatus ssp. lanceolatus	thickspike wheatgrass	15	22.5	155,350	4.35	1.35
Glyceria striata	fowl mannagrass	5	7.5	170,000	1.33	0.41
Juncus arcticus ssp. *littoralis*	mountain rush	5	7.5	6,950,000	0.03	0.01
Juncus torreyi	Torrey rush	5	7.5	12,150,000	0.02	0.01
Nasella viridula	green needlegrass	10	15	152,117	2.96	0.92
Pascopyron smithii	western wheatgrass	15	22.5	133,000	5.08	1.57
Poa palustris	fowl bluegrass	15	22.5	2,078,000	0.33	0.10
Poa secunda	Sandberg bluegrass	15	22.5	902,500	0.75	0.23
Total		**100**	**150 PLS Seeds/sq ft**		**17.31 PLS lb**	**5.37**

Bielins Hock Zone 4: (Percent of Time Wet Annually 0 to 40) Containers/Rhizomes (1.43 ac)					
Scientific Name	**Common Name**	**Percent of mix**	**Material Type**	**Container Size**	**Plant Number**
woody species					
Ericameria Nauseousus	Rubber Rabbit Brush	30	container	1-gallon	299
Populus deltoides ssp. *monilifera*	plains cottonwood	30	cutting	8-ft poles	398
Prunus virginiana ssp. *melanocarpa*	chokecherry	20	container	1-quart	299
Ribes aureum	golden currant	5	container	1-quart	100
Symphoricarpos rotundifolia	roundleaf snowberry	15	container	1 quart	298
Total		**100**			**1992**

Bielins Hock Zone 4: (Percent of Time Wet Annually 0 to 40) Seed (1.43 ac)						
Scientific Name	**Common Name**	**Percent of mix**	**Seed number using 150 seeds/sq ft**	**Pure Live Seed (PLS) Weight**	**PLS lb Required per Ac**	**PLS lb Required for Project Area**
herbaceous dicot						
Campanula rotundifolia	harebell	2.5	3.75	7,250,000	0.02	0.03
Cleome serrulata	Rocky Mountain beeplant	2.5	3.75	87,250	1.87	2.67
Gallardia aristata	blanketflower	2.5	3.75	189,959	0.86	1.23
Helianthus nuttallii	Nuttall's sunflower	2.5	3.75	217,000	0.75	1.07
Monarda fistulosa	wild bergamot	2.5	3.75	1,250,625	0.13	0.19
Solidago canadensis	Canada goldenrod	2.5	3.75	1,350,000	0.12	0.17
Vicia americana	American vetch	2.5	3.75	354,495	0.46	0.66
graminoids						
Achnatherum hymenoides	Indian ricegrass	5	7.5	181,741	1.8	2.57
Bouteloua gracilis	blue grama	5	7.5	780,500	0.42	0.60
Elymus lanceolatus ssp. lanceolatus	thickspike wheatgrass	15	22.5	155,350	6.31	9.02
Koeleria macrantha	junegrass	5	7.5	2,057,500	0.16	0.23
Muhlenbergia montana	mountain muhly	5	7.5	1,500,000	0.22	0.31
Nasella viridula	green needlegrass	7.5	15	152,117	4.3	6.15
Pascopyron smithii	western wheatgrass	15	22.5	133,000	7.37	10.54
Poa secunda	Sandberg bluegrass	10	15	902,500	0.72	1.03
Psuedoroegenria spicata	bluebunch wheatgrass	5	7.5	140,000	2.33	3.33
Schizachyrium scoparium	little bluestem	10	15	195,000	3.35	4.79
Total		**100**	**150 PLS Seeds/sq ft**		**31.19**	**44.6**

NOTES:
1.) PLANT SPECIES ARE BEING ADJUSTED BASED ON BOCO OPEN SPACE COMMENTS

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BOULDER COUNTY OPEN SPACE
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LONGMONT CO 80503

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PH : 303-872-9112
FX : 303-872-9104

DESIGNED: NRS
DRAWN: NRS
CHECKED: JWS
DATE: 1/18/13

REVISION	DESCRIPTION	BY	DATE
R-..		...	...
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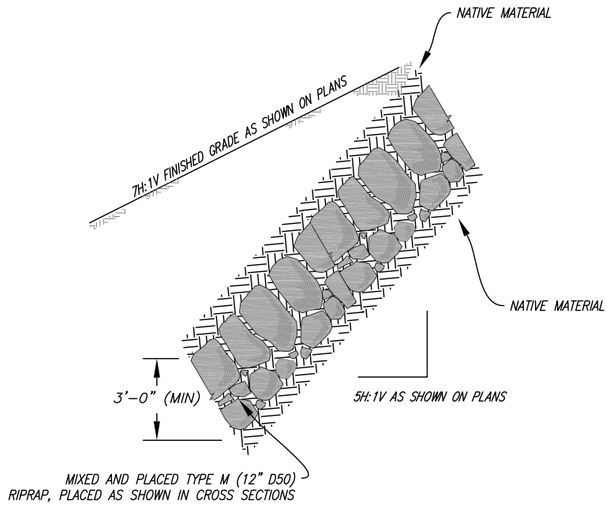
30% DESIGN FOR INTERNAL REVIEW

BIELINS HOCK CHANNEL IMPROVEMENT
PLANTING ZONE TABLES



1 SET BACK RIPRAP PROTECTION DETAILS

NTS

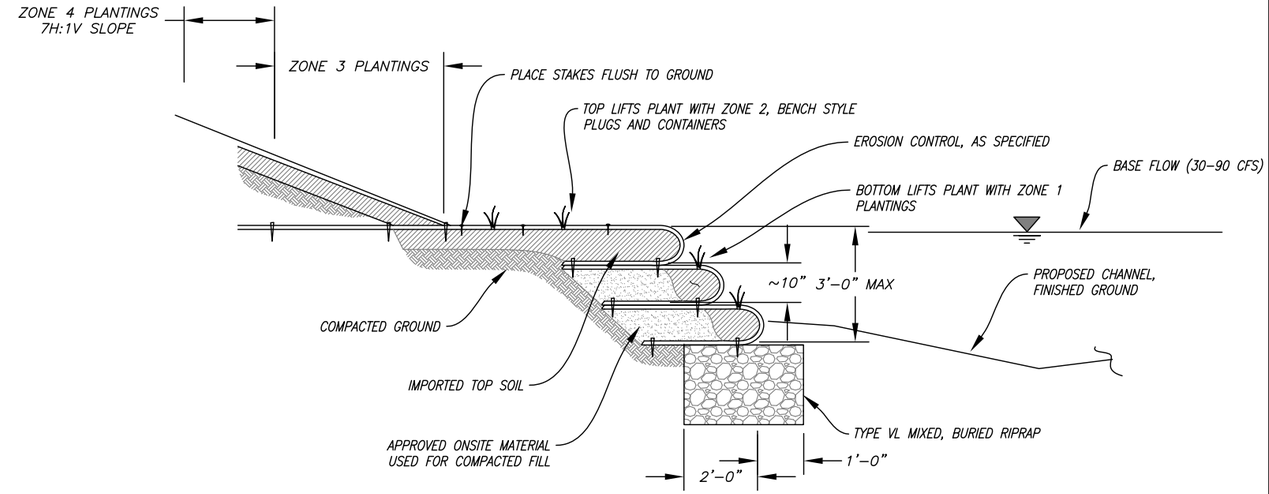
VOID–FILLED RIPRAP, ALSO REFERRED TO AS MIXED AND PLACED RIPRAP; PLACEMENT AND GRADATION NOTES:

1. WHERE "VOID–FILLED RIPRAP" IS DESIGNATED ON THE CONTRACT DRAWINGS, RIPRAP SHALL BE MIXED WITH THE MATERIALS AND ASSOCIATED PROPORTIONS LISTED IN TABLES ABOVE TO FILL THE VOIDS OF THE RIPRAP.
2. THE MIX PROPORTIONS PROVIDED IN TABLES ARE APPROXIMATE AND ARE SUBJECT TO ADJUSTMENT BY THE ENGINEER.
3. THE RIPRAP AND VOID–FILLED MATERIALS SHALL BE STOCKPILED SEPERATELY AND THOROUGHLY MIXED PRIOR TO PLACEMENT AND SHALL BE INSTALLED AND COMPACTED SO THAT A DENSE, INTERLOCKED LAYER OF RIPRAP AND VOID–FILL MATERIAL IS PROVIDED WITH RIPRAP VOIDS COMPLETELY FILLED. THE LOOSE MATERIAL SHALL BE PLACED IN A SINGLE LIFT OF SUFFICIENT HEIGHT SUCH THAT FINAL GRADE WILL BE ACHIEVED UPON COMPACTED. IF THE COMPACTED MATERIAL IS BELOW FINAL GRADE, PLACEMENT OF ONLY THE SMALLER VOID–FILL MATERIALS TO ACHIEVE FINAL GRADE IS NOT PERMITTED. IN SUCH CASES IT IS NECESSARY TO ADD MORE STANDARD SIZED VOID–FILLED RIPRAP AND REMIX THE ENTIRE THICKNESS OF ROCK TO ACHIEVE THE DESIGN SECTION. SEGREGATION OF MATERIALS SHALL BE AVOIDED AND IN NO CASE SHALL THE COMBINED MATERIAL CONSIST PRIMARILY OF THE VOID–FILL MATERIALS. THE DENSITY AND INTERLOCKING NATURE OF RIPRAP IN THE MIXED MATERIAL SHALL ESSENTIALLY BE THE SAME AS IF THE RIPRAP WAS PLACED WITHOUT FILLING THE VOIDS.
4. ALL VOID–FILLED RIPRAP THAT IS BURIED WITH TOPSOIL SHALL BE REVIEWED AND APPROVED BY THE ENGINEER PRIOR TO ANY TOPSOIL PLACEMENT.

VOID–FILLED RIPRAP PLACEMENT AND GRADATION			
RIPRAP DESIGNATION	% SMALLER THAN GIVEN SIZE BY WEIGHT	INTERMEDIATE ROCK DIMENSION (INCHES)	D_{50}* (INCHES)
TYPE VL	70 – 100 50 – 70 35 – 50 2 – 10	12 9 6 2	6
TYPE M	70 – 100 50 – 70 35 – 50 2 – 10	21 18 12 4	12
*D_{50} = MEAN ROCK SIZE			

NOTE: MIX ON SITE AND PRIOR TO PLACEMENT

MIX REQUIREMENTS FOR TYPE M AND H VOID–FILLED RIPRAP (D_{50} = 12 TO 18 INCH)		
APPROPRIATE PROPORTIONS (BY VOLUME)	MATERIAL TYPE	MATERIAL DESCRIPTION
6 PARTS	RIPRAP	D_{50} = 12–INCH (TYPE M) OR D_{50} = 18–INCH (TYPE H), SEE TABLE 3
2 PART	VOID–FILL MATERIAL	7–INCH MINUS CRUSHED ROCK SURGE (100% PASSING 7–INCH SIEVE, 80–100% PASSING 6–INCH SIEVE, 35–50% PASSING 3–INCH SIEVE, 10–20% PASSING 1½–INCH SIEVE)
1 PART	VOID–FILL MATERIAL	VTC (VEHICLE TRACKING CONTROL) ROCK (CRUSHED ROCK WITH 100% PASSING 4–INCH SIEVE, 50–70% PASSING 3–INCH SIEVE, 0–10% PASSING 2–INCH SIEVE)
1 PART	VOID–FILL MATERIAL	4–INCH MINUS PIT RUN SURGE (ROUND RIVER ROCK AND SAND, WELL GRADED, 90–100% PASSING 4–INCH SIEVE, 70–80% PASSING 1½–INCH SIEVE, 40–60% PASSING ⅜–INCH SIEVE, 10–30% PASSING #16 SIEVE)
1 PART	VOID–FILL MATERIAL	TYPE II BEDDING (CRUSHED ROCK WITH 100% PASSING 3–INCH SIEVE, 20–90% PASSING ¾–INCH SIEVE, 0–20% PASSING #4 SIEVE, 0–3% PASSING #200 SIEVE)
½ TO 1 PART	VOID–FILL MATERIAL	NATIVE TOPSOIL

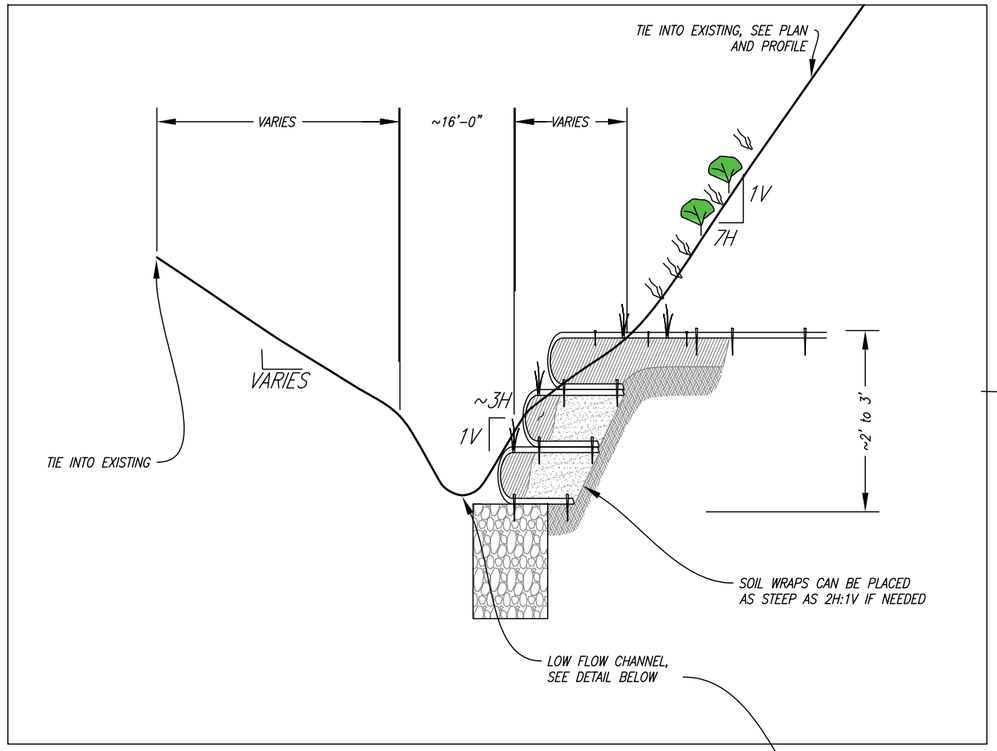


2 SOIL LIFT DETAILS

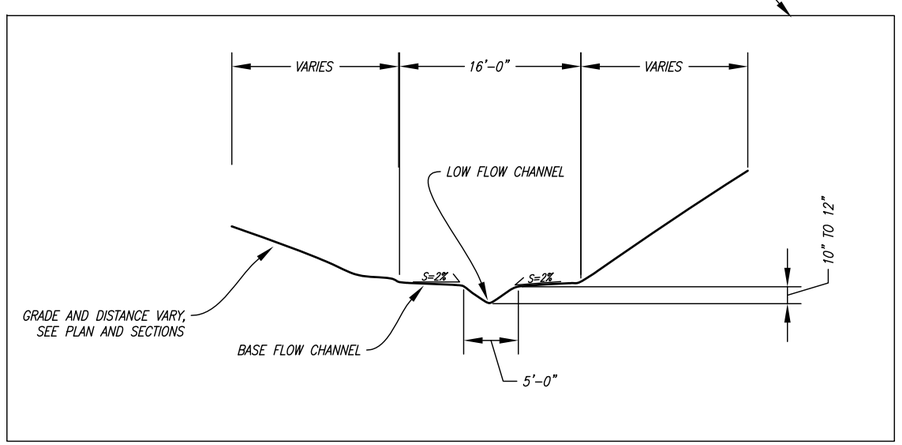
NTS

MIX REQUIREMENTS FOR TYPE VL AND L VOID–FILLED RIPRAP (D_{50} = 6 TO 9 INCH)*		
APPROPRIATE PROPORTIONS (BY VOLUME)	MATERIAL TYPE	MATERIAL DESCRIPTION
6 PARTS	RIPRAP	D_{50} = 6 INCH (TYPE VL) OR D_{50} = 9 INCH (TYPE L), SEE TABLE 3
1 PART	VOID–FILL MATERIAL	VTC (VEHICLE TRACKING CONTROL) ROCK (CRUSHED ROCK WITH 100% PASSING 4–INCH SIEVE, 50–70% PASSING 3–INCH SIEVE, 0–10% PASSING 2–INCH SIEVE)
1 PART	VOID–FILL MATERIAL	4–INCH MINUS PIT RUN SURGE (ROUND RIVER ROCK AND SAND, WELL GRADED, 90–100% PASSING 4–INCH SIEVE, 70–80% PASSING 1½–INCH SIEVE, 40–60% PASSING ⅜–INCH SIEVE, 10–30% PASSING #16 SIEVE)
1 PART	VOID–FILL MATERIAL	TYPE II BEDDING (CRUSHED ROCK WITH 100% PASSING 3–INCH SIEVE, 20–90% PASSING ¾–INCH SIEVE, 0–20% PASSING #4 SIEVE, 0–3% PASSING #200 SIEVE)
½ TO 1 PART	VOID–FILL MATERIAL	NATIVE TOPSOIL

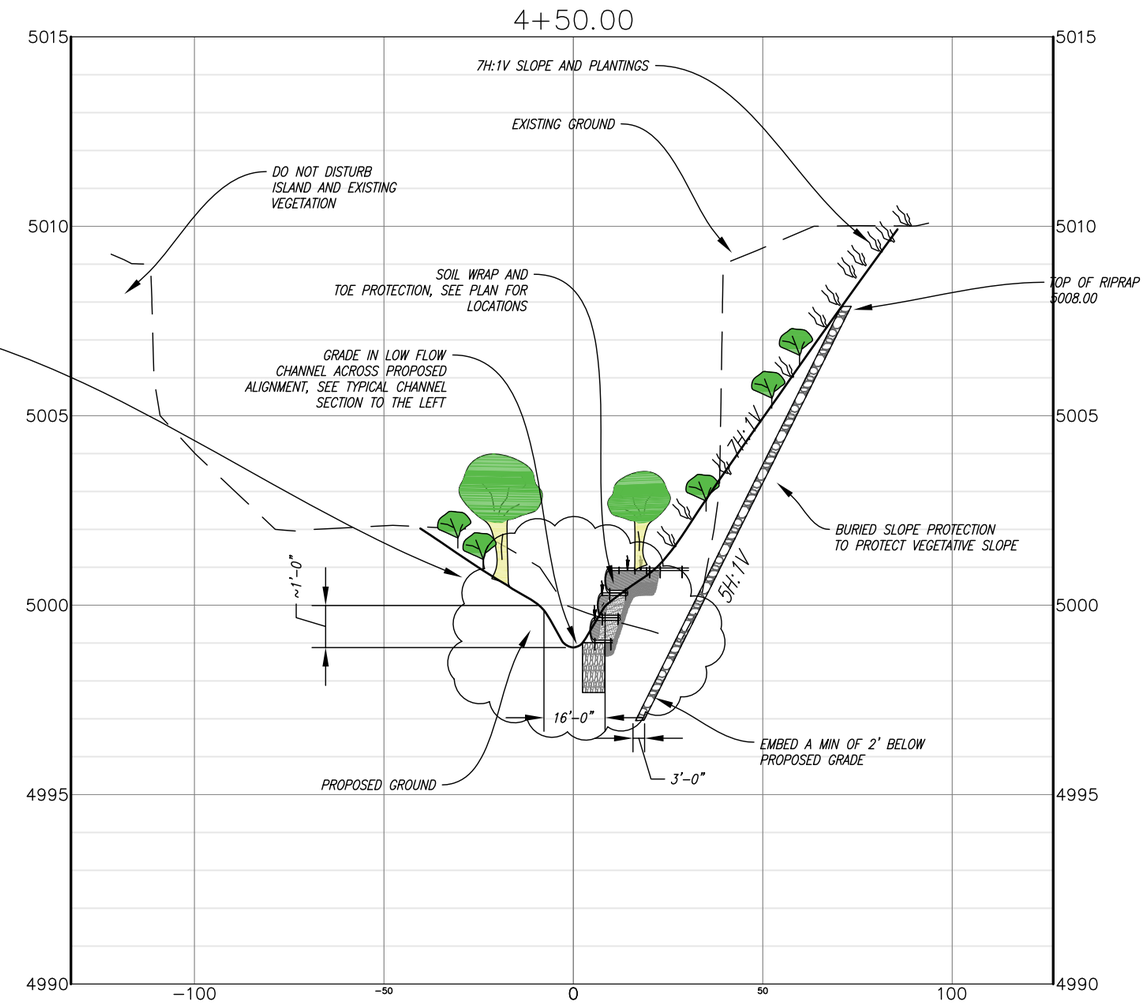
*SEE RIPRAP DETAILS FOR FURTHER NOTES AND INSTRUCTIONS



TYPICAL CHANNEL SECTION



LOW FLOW AND BASE FLOW CHANNEL SECTION (SCALE IS EXAGGERATED AT 2 VERTICAL TO 1 HORIZONTAL



TYPICAL SECTION AT 4+50

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BOULDER COUNTY OPEN SPACE 5201 ST VRAIN RD LONGMONT, CO 80503	RESILIANT WATERSHED PARTNERS. 10106 W SAN JUAN WAY LITTLETON CO, 80127 PH : 303-872-9112 FX : 303-872-9104					R-..		...	...
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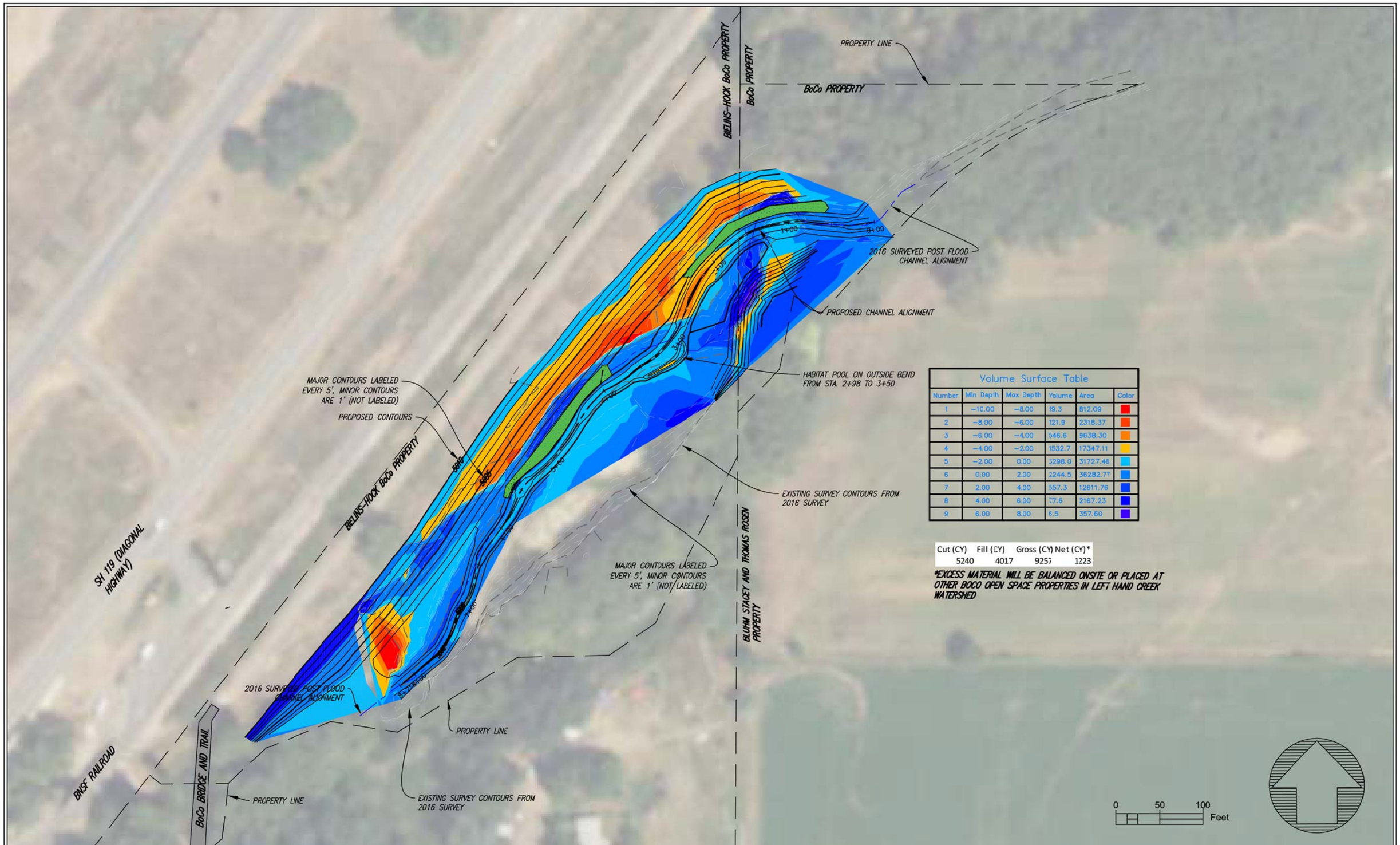
BIELENS HOCK CHANNEL IMPROVEMENT DETAILS (CHANNEL SECTION)

SHEET/REFERENCE NO.
8 OF 10



Volume Surface Table					
Number	Min Depth	Max Depth	Volume	Area	Color
1	−10.00	−8.00	19.3	812.09	
2	−8.00	−6.00	121.9	2318.37	
3	−6.00	−4.00	546.6	9638.30	
4	−4.00	−2.00	1532.7	17347.11	
5	−2.00	0.00	3298.0	31727.48	
6	0.00	2.00	2244.5	36282.77	
7	2.00	4.00	557.3	12611.76	
8	4.00	6.00	77.6	2167.23	
9	6.00	8.00	6.5	357.60	

Cut (CY)	Fill (CY)	Gross (CY)	Net (CY)*
5240	4017	9257	1223

*EXCESS MATERIAL WILL BE BALANCED ONSITE OR PLACED AT OTHER BOCO OPEN SPACE PROPERTIES IN LEFT HAND CREEK WATERSHED

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BOULDER COUNTY OPEN SPACE
5201 ST VRAIN RD
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DESIGNED: GEB
DRAWN: GEB
CHECKED: JWS
DATE: OCT 2016

REVISION	DESCRIPTION	BY	DATE
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30% DESIGN FOR INTERNAL REVIEW

BIELINS HOCK CHANNEL IMPROVEMENT
CUT FILL PLAN SHEET

SHEET/REFERENCE NO.
9 OF 10

NOTE: STAGING AND ACCESS WILL NEED TO BE FINALIZED BY CONTRACTOR, THIS IS ONLY A PRELIMINARY DRAFT OF THE MOST LIKELY ACCESS AND STAGING LOCATIONS.

PREPARED FOR:	PREPARED BY:	DESIGNED: GEB DRAWN: GEB CHECKED: JWS DATE: OCT 2016	REVISION / DESCRIPTION / BY / DATE	30% DESIGN FOR INTERNAL REVIEW	BIELINS HOCK CHANNEL IMPROVEMENT STAGING AND ACCESS (PRELIMINARY ONLY)	SHEET/REFERENCE NO. 10 OF 10
BOULDER COUNTY OPEN SPACE 5201 ST VRAIN RD LONGMONT, CO 80503	RESILIANT WATERSHED PARTNERS. 10106 W SAN JUAN WAY LITTLETON CO, 80127 PH : 303-872-9112 FX : 303-872-9104		R-.. ... ... R-.. ... ... R-.. ... ... R-.. ... ... R-..			

Attachment 5

DRAFT 30% Design Report
Bielins Hock Project – Left Hand Creek

30% Draft Submittal for EWP Team Review

Prepared by: Gerald Blackler, PE, PhD

as part of the Resilient Watershed Partners (RWP)Team

Prepared for: Emergency Watershed Protection Program (EWP) Review Team

October, 2016

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Attachment C - DRAFT 30% Design Drawing Set

Attachment D – Hydraulic Model Output

Attachment E – Biological Assessment

Introduction

Overview

Left Hand Creek experienced major flooding during one of Colorado's large flood events in September of 2013. Heavy rains lasting for 7 days over the foothills and eastern slope Rocky Mountain Range produced peak flows that made records for many front range streams. Hydrologic investigations of channel sections, high water marks, and critical depth estimates put the peak flow in Left Hand Creek around 3,500 cfs during that event.

Cause of the Problem

The flows alone were not the major cause of damage within the streams. Heavy sediment and debris loading clogged structures, developed avulsion zones, and in many locations the stream developed a new, permanent flood path where the stream did not return to its pre-flood channel after the floodwaters receded. These new channels (post flood channels) started a natural channel evolution process with new substrate, vegetation types, and channel geometry. This process occurred at Left Hand Creek downstream of Diagonal Highway (Highway 119), which is the subject location for this design and is herein referred to as the *project site*. Figure 1 below presents a before and after image showing how the new flood channel has carved a pathway into what was once a high overbank that held upland vegetation 10 to 15 feet above the previous channel bottom.

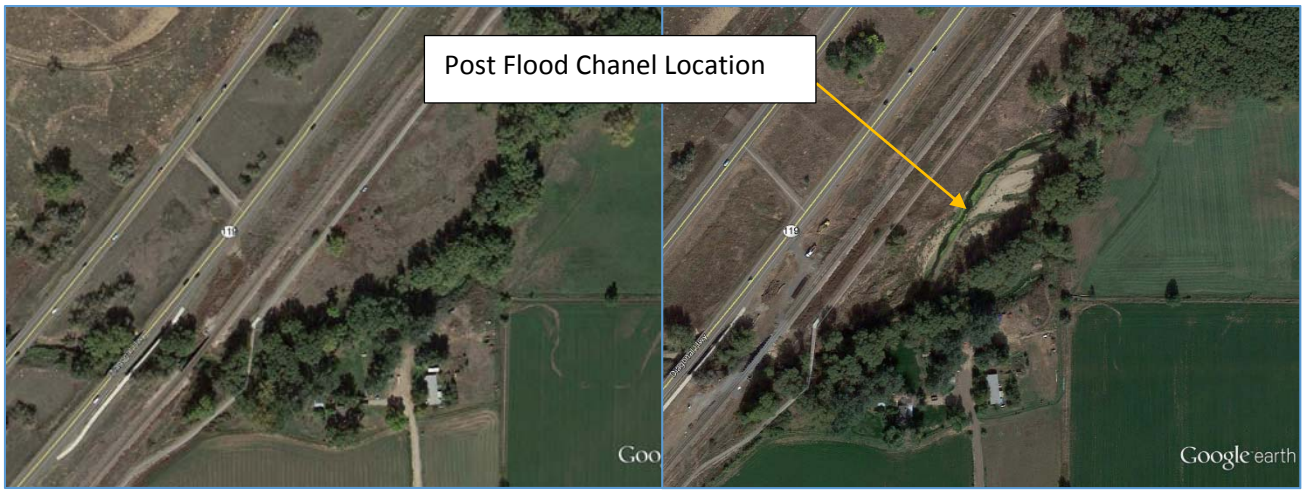

Figure 1 - Left - Image of Bielins Hock Project Site before 2013 Floods and Right - Image of Bielins Hock Project Site in 2015

Current Geomorphic Conditions

After Left Hand Creek jumped its pre flood bank, it began a new channel to the north west. Before the flood, this location consisted of wind-blown sands and silts, upland vegetation plants, and some gravelly substrates 2 to 3 feet below the sandy surface. As the channel carved through the banks, it removed 8-10 vertical feet of earth. At its new location, the channel evolution process has started again. Currently, the channel is down cutting and widening, picking up sediment from both the channel bottom and banks as the stream mechanics work to stabilize the slope, bed load, and to deposit a stable, hardened bottom. This could be classified as a Stage III and IV channel according to Schum's Channel Evolution Model (Schum and Parker 1973)(Simon and Rinaldi 2006), where the stream is down-cutting and widening. This design intends to put the channel into a quasi-equilibrium sooner than natural processes through shaping the channel, adding vegetation, stabilizing the floodplain, and managing the stream mechanics for stable velocities and stresses.

Figure 2 – Photos of the Project Site existing conditions showing the cut bank and post flood channel conditions.

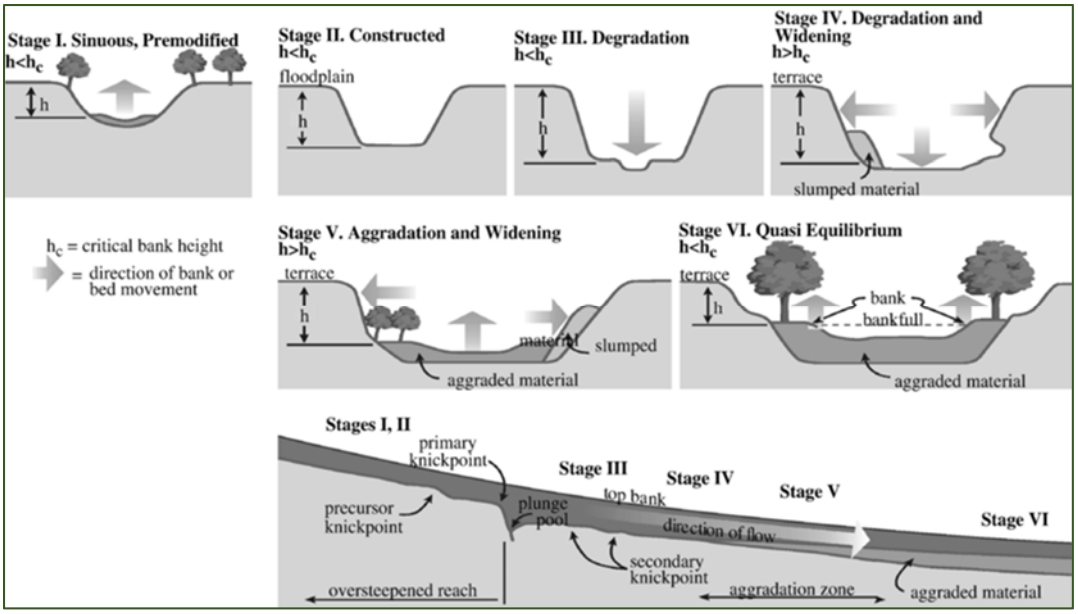

Figure 3 - Channel Evolution Model after Simon and Rinaldi (2006)

Purpose and Objective

The purpose and objective of this project is to:

- Stabilize the new channel path to eliminate major bank erosion and movement.
- Protect structures that are at risk from continued channel migration. These structures include:
    - Boulder County Open Space Trail and Bridge.
    - Railroad Embankments.
    - Downstream Private Properties.
- Develop a design that incorporates heavy vegetation practices, floodplain restoration, and re-creation of a stable channel section and profile that eliminates continued bank erosion.
- Support the overall reduction in sediment supply on Left Hand Creek that is being transported to downstream communities.

Previous Recommendations within Project Site

The design and analysis performed under this work follow the general recommendations within the Left Hand Creek Watershed Master Plan, which was prepared for Boulder County and finalized in 2014. These generally include:

- Set back riprap wall to protect infrastructure.

- Revegetation of banks and floodplain.
- Keeping post and pre flood channel for future flood conveyance.

The Figure below captures the recommendations from the Left Hand Creek Watershed Master plan document.

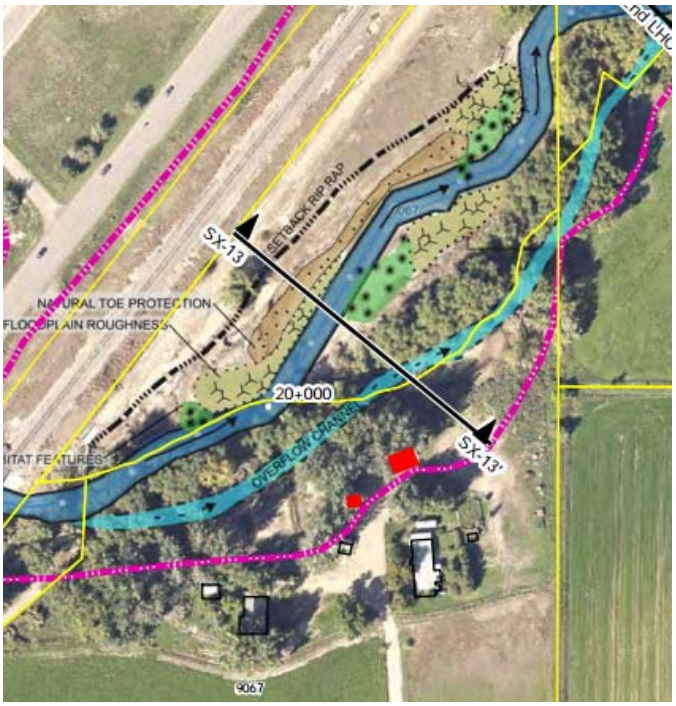

Figure 4 - Caption from the Left Hand Creek Watershed Master Plan

Alternatives Considered

Many alternatives were considered as part of this project. The main three include:

1. The first option encompassed grading and protection of properties to the south in addition to re-grading the north banks. This alternative quickly disintegrated as landowners to the south were not interested in participating with the required land owner agreements for the project. The Figure below is a caption of this alternative.

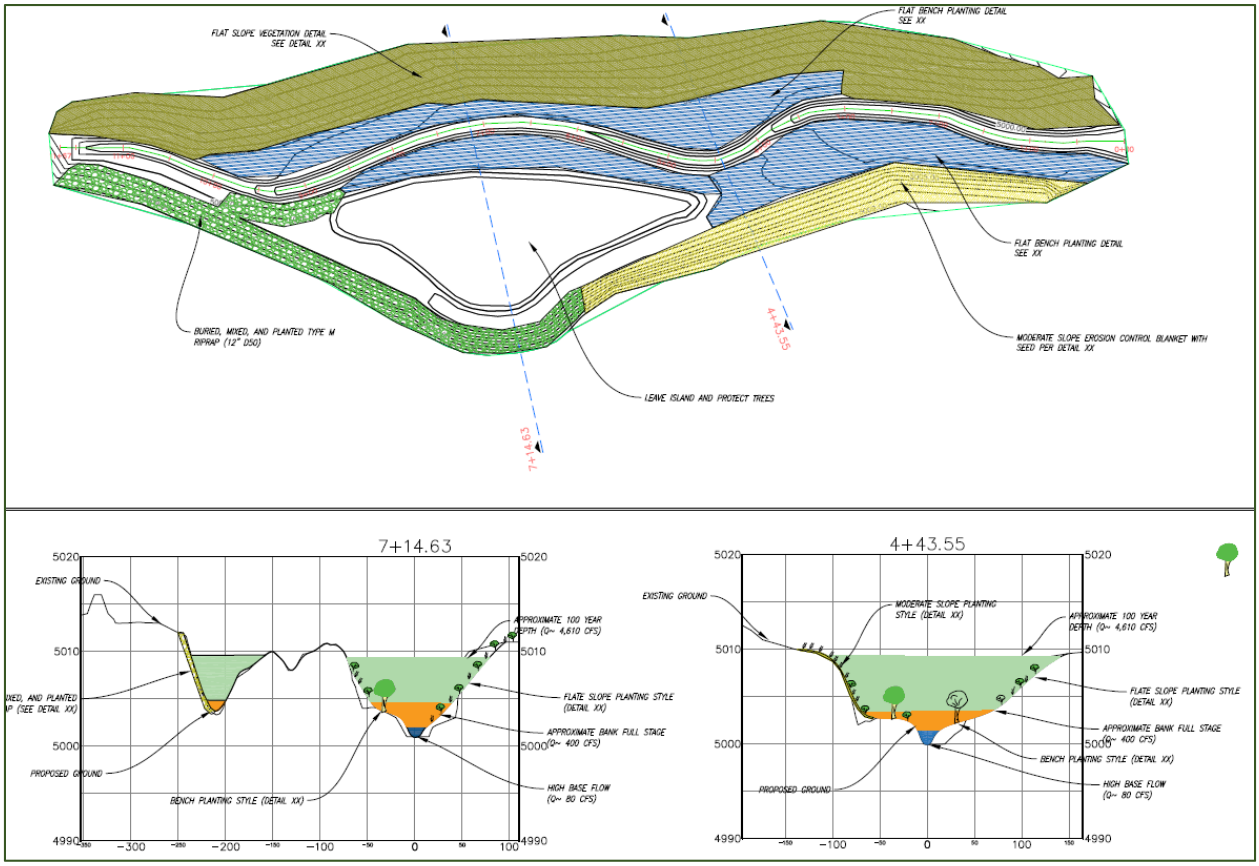

Figure 5 - Image of First Alternative Considered, where the entire project area would be re-established to protect houses to the South as well re-establishing the bank to the north.

2. The second alternative eliminated work on private land and only performed improvements on BoCo Open Space Property. This alternative laid back the bank, moved the post flood channel to the center of the newly carved flood path, and added some vertical stabilization of the creek bed. This alternative was modified based on the following comments from BoCo Open Space.
    a. BoCo requested to keep the low flow channel as close to its current location as possible.
    b. BoCo does not want any exposed imported rock in the project.
    c. BoCo does not want a “straight grade” profile.

The Figure below presents a caption of this alternative.

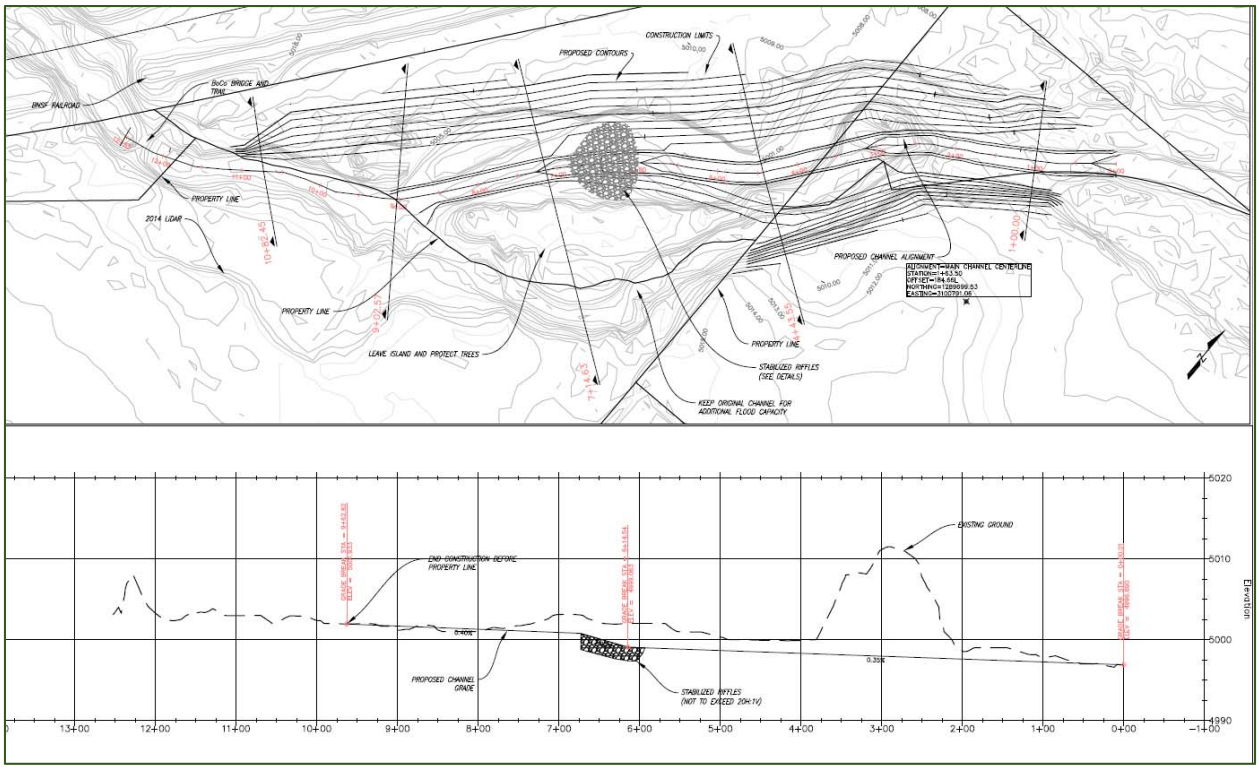

Figure 6 - Alternative 2 that graded a new channel towards the center of the new flood path to reduce the risk of eroding the toe of the newly graded and planted banks.

3. The third alternative presented in September of 2016 was a modification of Alternative 2 and included graded banks, bench style planting locations, and toe protection via soil lifts (sometimes referred to as soil wraps) to protect locations where the low flow channel approaches the toe of the newly graded and planted bank. Temporary drop pools were graded in to address the concerns of developing a "straight grade" channel profile, which was brought up by BoCo open space. These pools would have morphed and changed over time, but were included to help dissipate energy in the short time until vegetation could be established. A low flow channel was also shown in the grading and plans. The low flow channel was not re-enforced by any hardening, as such, the channel would have also taken a natural shape quickly after flows in the stream begin to move the fine sandy substrate and deposit material, which is a natural hardening process that occurs in streams, leading to the eventual shape and

establishment of a more defined low flow channel within the graded limits. The Figure below presents a caption of the third alternative.

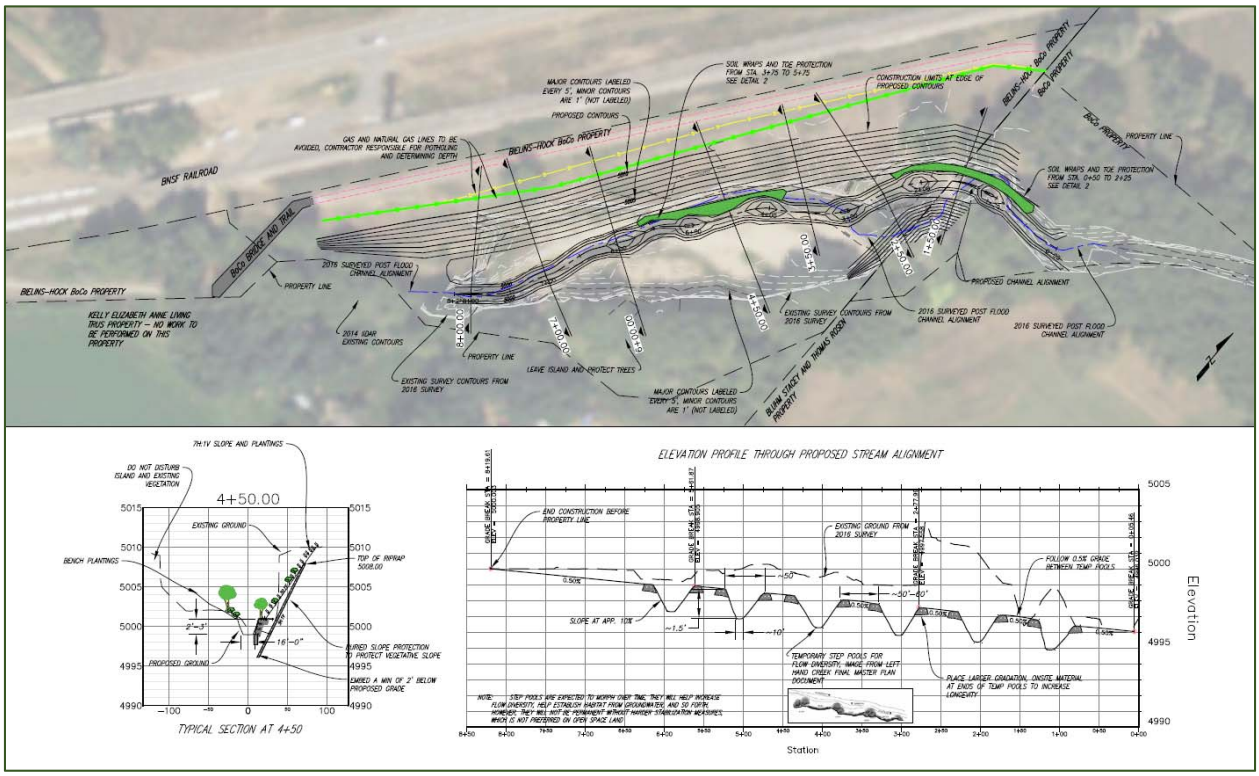

Figure 7 – Alternative 3 submitted September 2016

4. The final alternative being presented here is a modification of Alternative 3 and includes graded banks, bench style planting locations, and toe protection via soil lifts (sometimes referred to as soil wraps) to protect locations where the low flow channel approaches the toe of the newly graded and planted. Per comments from additional review, the drop pools were lessened in depth and slope, a habitat pool is added on the outside bend near station 3+18, a more refined low flow channel section was added. The Figure below is a caption if this final alternative being carried forward.

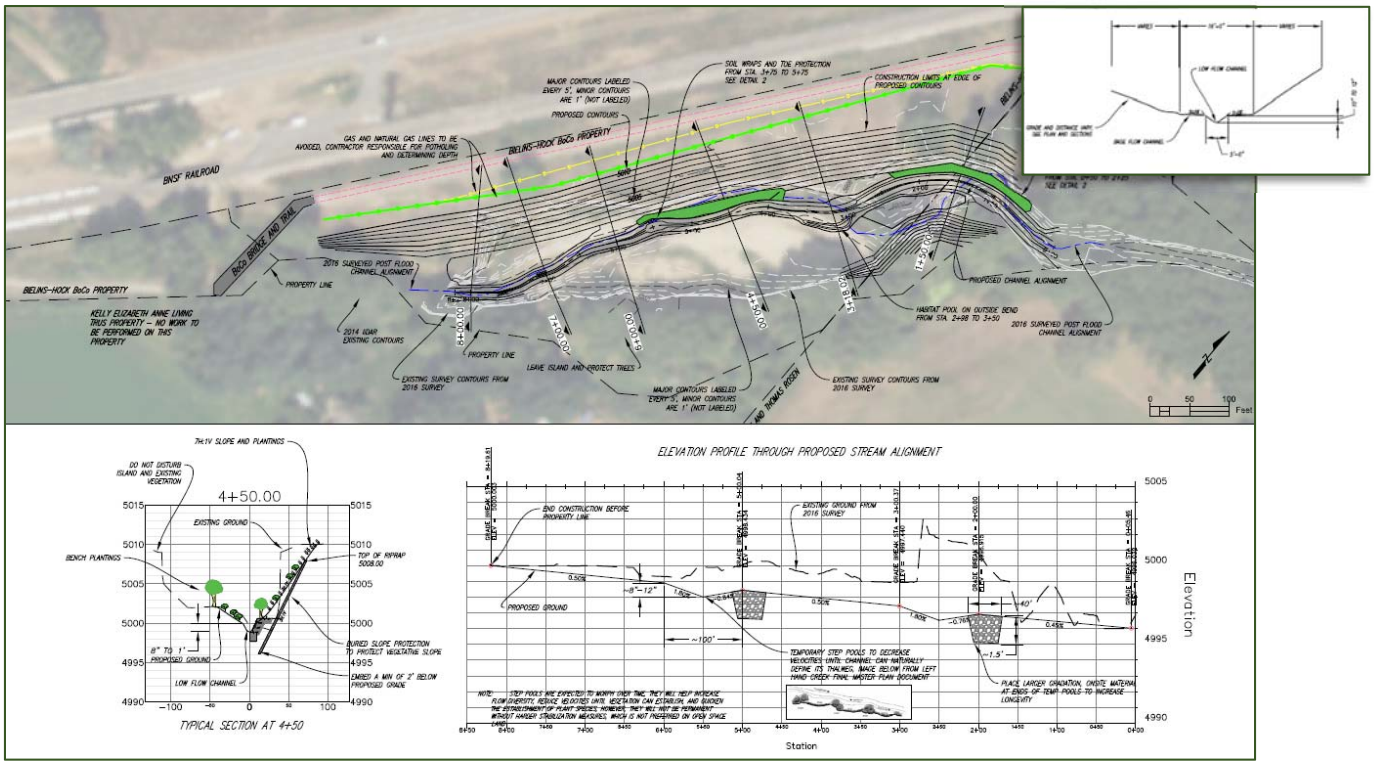

Figure 8 - Fourth Alternative, and final alternative being presented here

Project Benefits and Risks

This project will benefit downstream communities by reducing overall sediment loading in Left Hand Creek, re-establish a healthy floodplain bench and slope that will protect properties from future flooding, increase the capacity of the channel reach by leaving both the pre and post flood channels, and incorporate a heavy vegetation schedule that will enhance the aesthetic aspects of the location.

This project does not include heavy toe protection that would commonly be designed and engineered for streams as large as Left Hand Creek. This enhances the risk of eroding the newly graded bank and planted vegetation if a flood event occurs before much of the vegetation is fully established. This is being partially mitigated by soil wraps and very little riprap (VL Riprap) at locations where the stream is approaching the bank. The set-back riprap wall will eventually protect property if a flood erodes the bank back that far, however, the grading work and vegetation will be jeopardized at that point.

Hydrology

All hydrologic estimates were taken from previously conducted studies and regional regression equations. No new hydrology was performed as part of this study. Boulder County provided the 1982 Flood Insurance Study (FEMA 1982) for comparison of flood flows in the Plains Reaches. As shown in the figure below, the 1982 Hydrology peaks at the mouth of Left Hand Creek as it exits Left Hand and Geer Canyon. The flow attenuates as it progresses downstream, implying the controlling time to peak and flood wave originates from a storm resting over the mountain canyons and progressing slowly east to the plains.

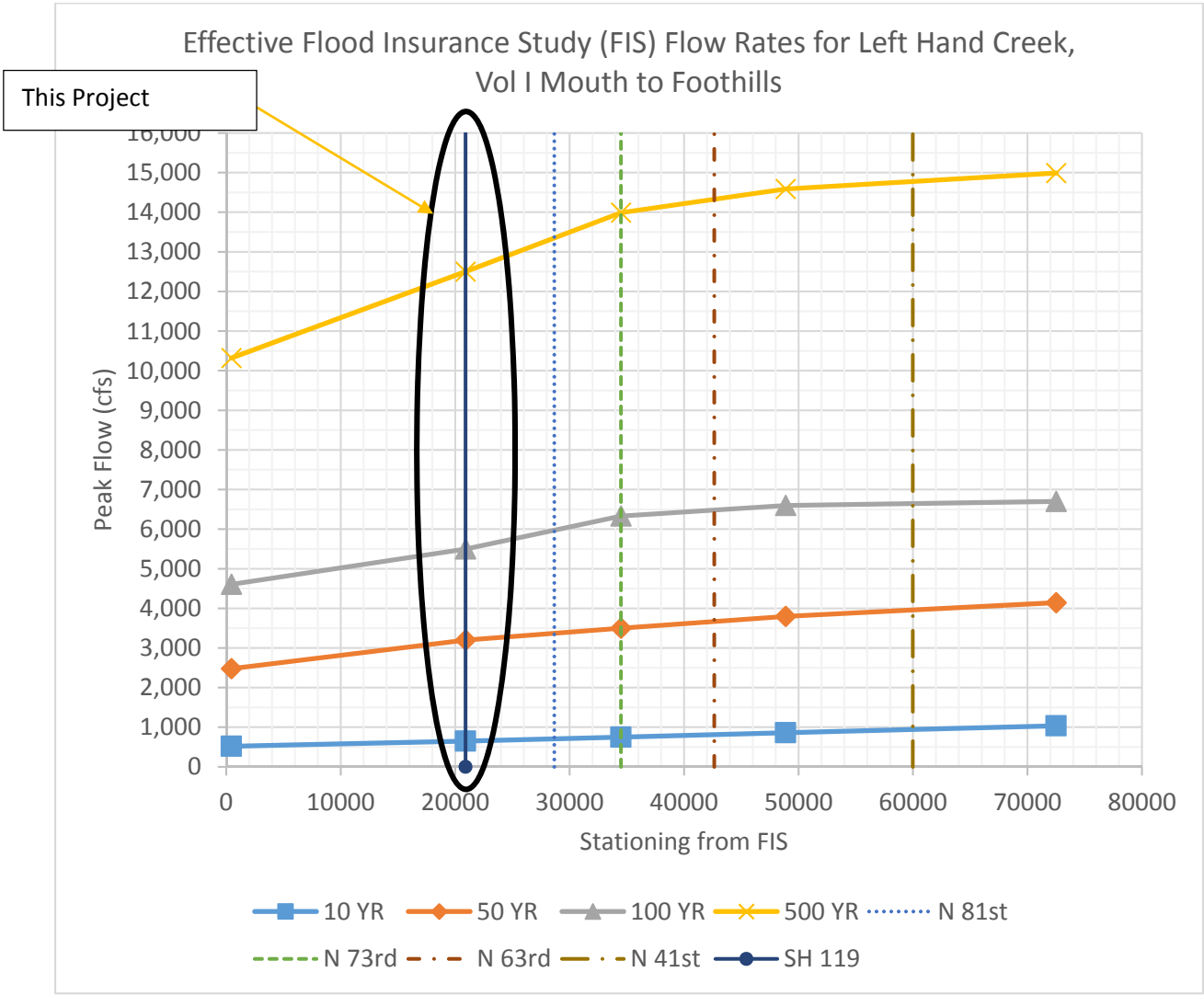

Figure 9 - FIS Flood Flows for Left Hand Creek Plains Regions

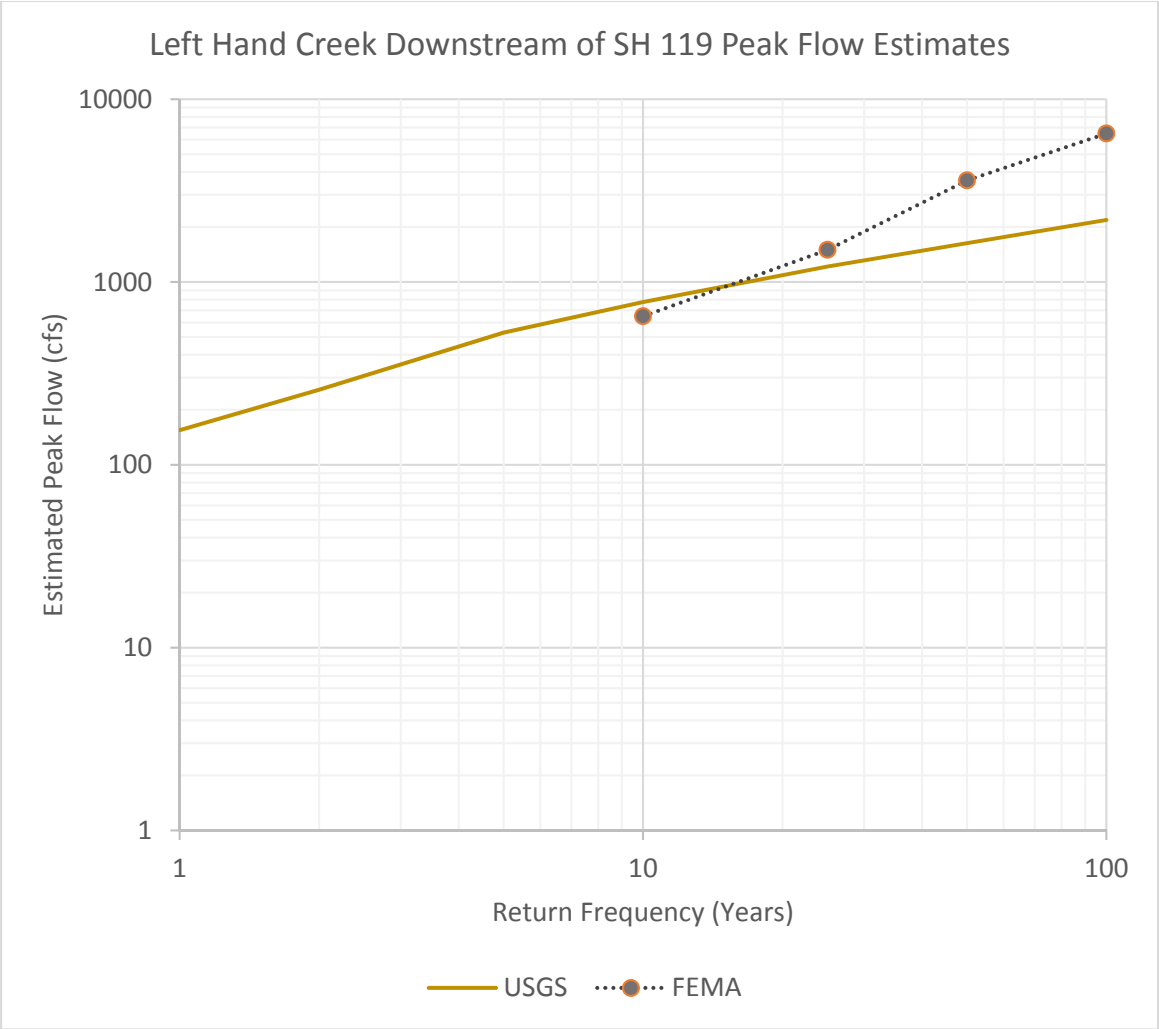

Figure 10 – Comparison of FEMA and USGS Flood Hydrology at Project Site.

The US Geological Survey (USGS) once had three stream gages located on Left Hand Creek and all of those gages are no longer in service. The length of record on those gages is not sufficient nor recent enough to warrant a detailed analysis. Based on the comparison of published flows by FEMA and regional regression equations, the following flows were selected for design of this project.

Table 1 - Selected Design Flows for Bielins Hock Project (All Values in CFS)

Base Flow (High)	Annual Flood	2-yr	5-Yr	10-Yr	50-Yr	100-Yr
90	150	260	530	650	3,200	5,500

Hydraulic Analysis and Design

Stream Design Hydraulic Summary

Hydraulic design was conducted to accomplish floodplain management, healthy stream design, and ecological goals. Floodplain analysis was performed to ensure that a "no rise" situation occurs from existing ground conditions to the proposed design conditions. Healthy stream design approach was taken to ensure that base flows, annual flood flows, and moderate flood flows (2-5 year) are distributed across the channel section to encourage healthy riparian growth and reasonable design velocities and shear stresses. The figure to the left is a caption of how these flows should be distributed across a natural channel section. While the figure below presents the design grade and water surface elevations for this design.

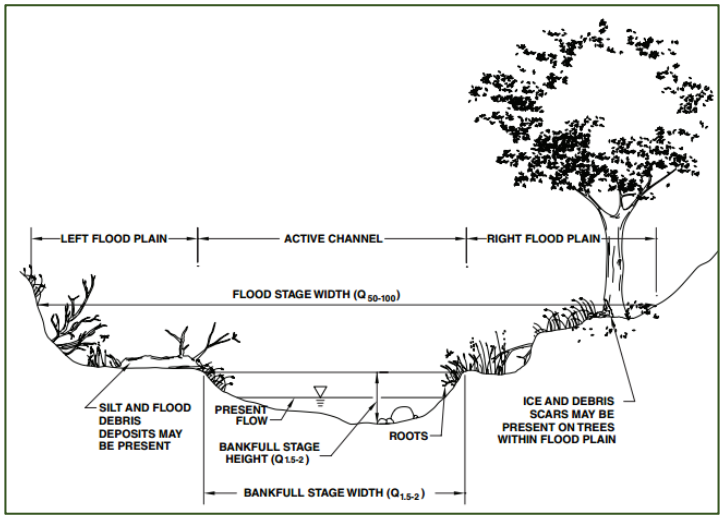

Figure 11 - Typical cross section of a healthy stream design, from the NRCS Stream Corridor Restoration Manual (Natl. Eng. Handbook 653, and 654)

There is a side split flow from the post to pre flood channel that required hydraulic analysis to appropriately model flood flows as they travel through the project site. A 2-Dimensional hydraulic model was developed to estimate the split flows under a range of flood events. Then the side spill weir coefficient within the 1D HEC RAS model (Floodplain Model) was adjusted to achieve a realistic split flow analysis. The 1D model then optimizes split flows to balance energy between the two channels.

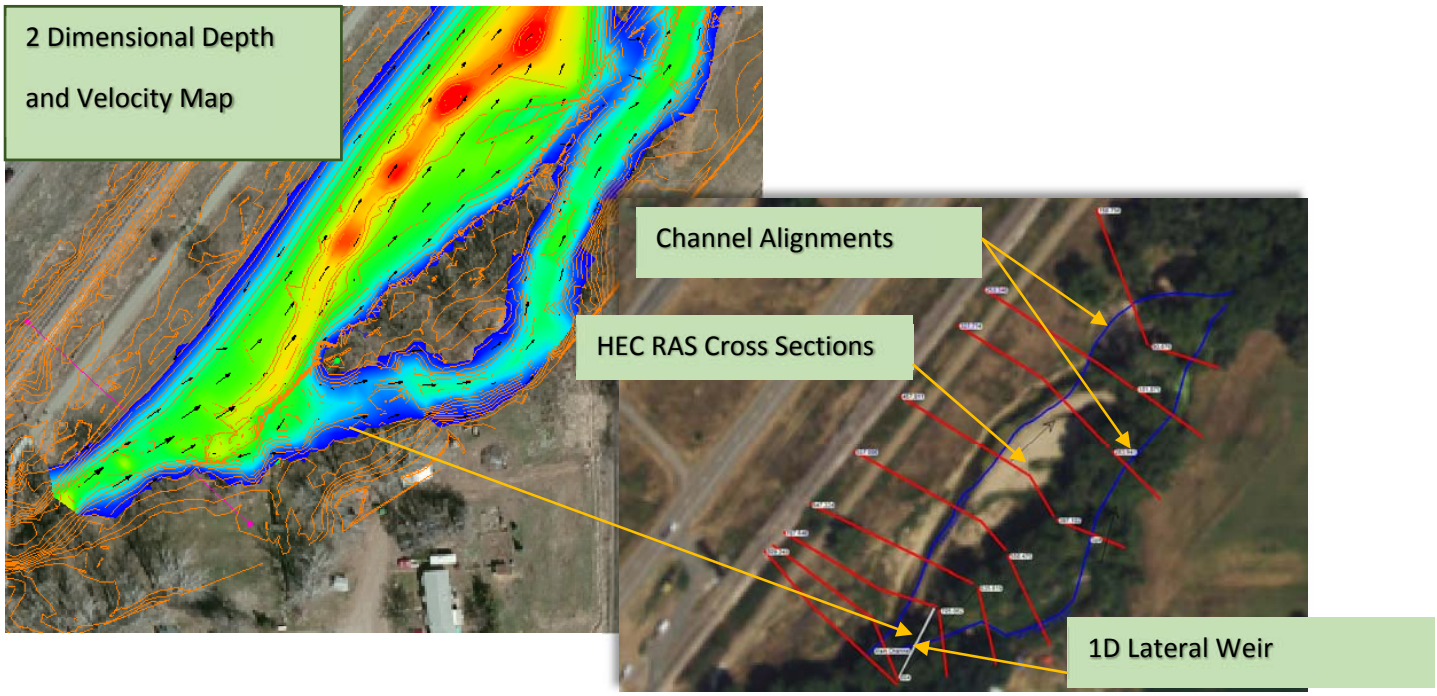

Figure 12 - Image of 2D and 1D Hydraulic Models developed for the Project Site's Existing and Proposed Conditions

Peak velocities during the 100 year flows are expected to reach upwards of 10 feet per second in the channel and 4-5 feet per second in the overbanks. Shear stresses in the channel may reach as high as 2 pounds per square foot and 1.5 pounds per square foot in the overbanks. However, through most of regraded channel, these shears are lower than 1.0 for even very high flows. With these levels of shears and velocities over a fine to medium sandy substrate, it is expected that the channel will continue to adjust and move, especially during flood events. For this reason, set back protections are incorporated into the design. This includes the setback riprap that is approximately 10 to 11 feet high, at a 5H:1V slope, and is set back into the bank per Boulder County Open Space's Requests that any imported rock be put as far back from the active channel as possible. The riprap is designed to function if a flood event scours away the vegetation and bank, then the void filled riprap will be a hardened stop point that will arrest the bank erosion. Until a large flood event, the rock will be buried deep in the bank and not noticeable.

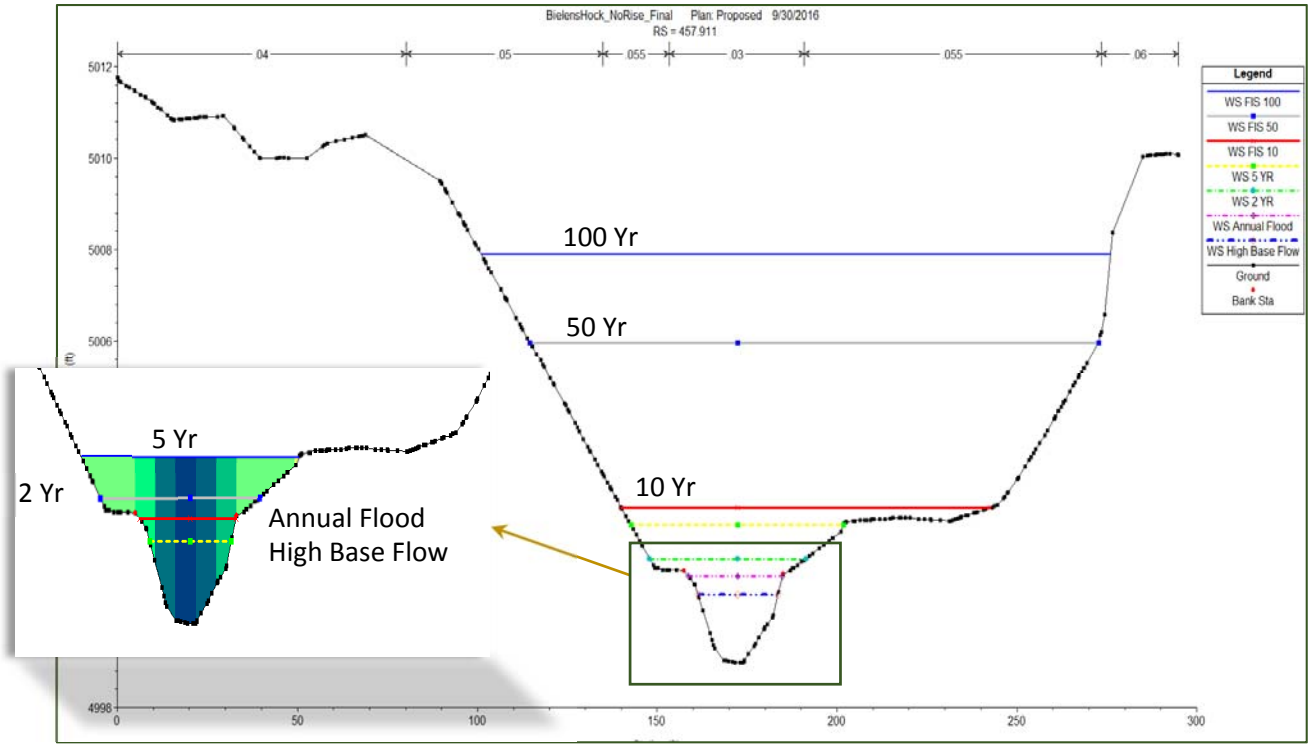

Figure 13 - Hydraulic Cross Section for the Proposed Conditions Typical Channel Section at Approximately Sta 4+57 in the Design Plans (NOTE: This section has a vertical exaggeration, which is very common from HEC RAS Output and in Engineering Design, for a less dramatic vertical exaggeration, please see the below figures.)

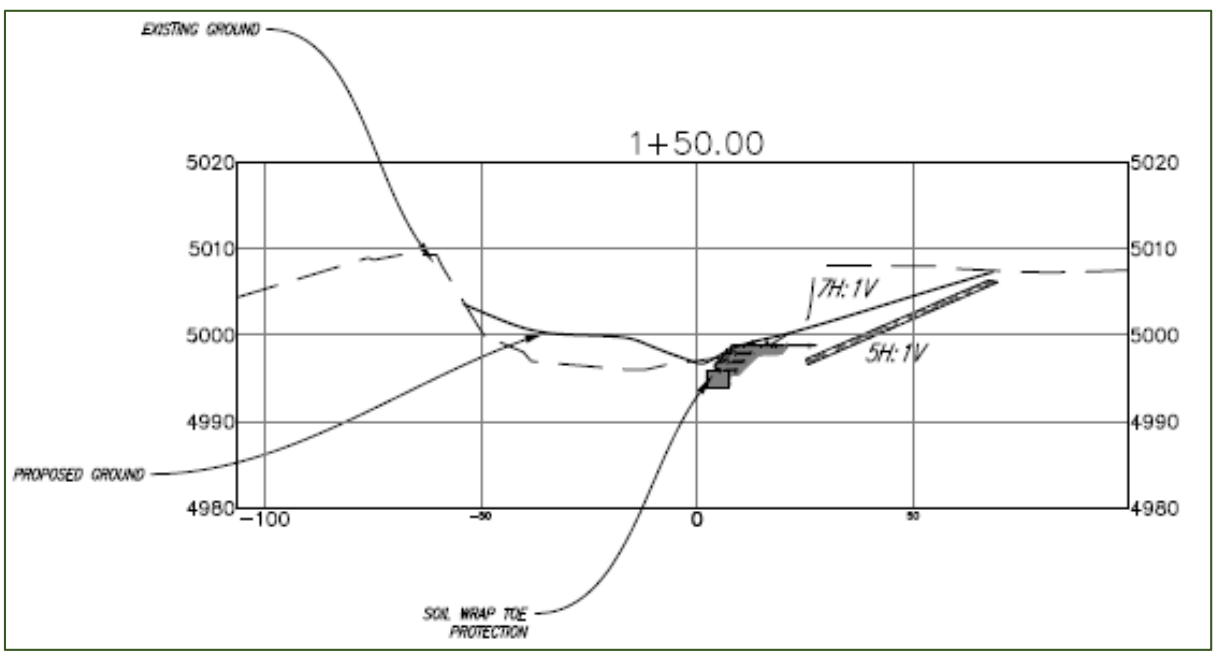

Figure 14 - Cross section with a 2 to 1 vertical exaggeration at station 1+50

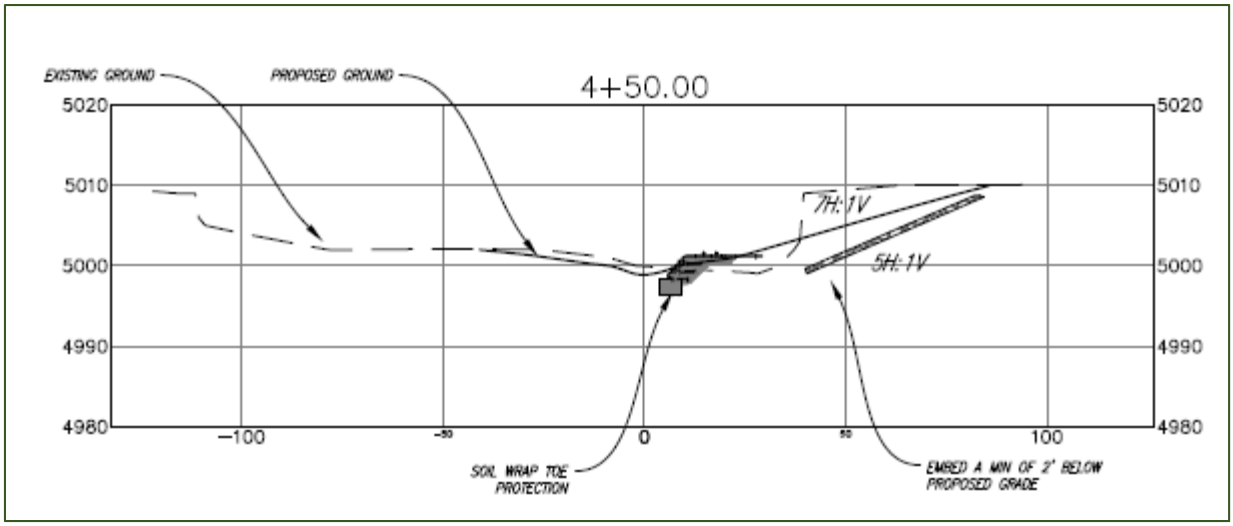

Figure 15- Cross section with a 2 to 1 vertical exaggeration at station 4+50, similar location to the HEC RAS Plot in Figure 13

Floodplain Analysis

A detailed floodplain analysis was conducted within regulations defined in the 44th Volume of the Code of Federal Regulations (CFR), Chapter 60.3 subpart (c) and (d), which define floodplain regulations for floodplains with designated special flood hazard zones and base flood elevations (BFEs). Subpart (c) outlines the requirements for these special flood hazard zones that do <u>not</u> have a regulatory floodway, while subpart (d) outlines the requirements for these special flood hazard zones the <u>do</u> have a regulatory floodway.

Adherence Floodplain Management Regulations

According to the formal FEMA FIS and FIRM, the floodplain designation at the project site is a Zone AE <u>without</u> a regulatory floodway. This would fall under the regulatory requirement of 44 60.3(c) and not subpart (d), which would allow the following language found in 44 CFR 60.3(c)(10):

(10) Require until a regulatory floodway is designated, that no new construction, substantial improvements, or other development (including fill) shall be permitted within Zones A1-30 and AE on the community's FIRM, unless it is demonstrated that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water ***<u>surface elevation of the base flood more than one foot</u>*** *at any point within the community.*

Within the 44 CFR, FEMA allows local communities to enforce stricter floodplain regulatory standards. As such, Boulder County's floodplain department may enforce stricter standards that would be more in line with a Zone AE Special Flood Hazard Zone that includes a regulatory floodway. Even in this event, our hydraulic analysis shows that the proposed grading will not increase base flood elevations for the 100-year flood event by any level within the project site, and therefore will be eligible for a *no rise* certificate from the local floodplain management group under either CFR regulation (44 CFR 60.3(c) or (d). Additionally, a *no rise* satisfies all requirements within Boulder County's land use development code Article 4-407.

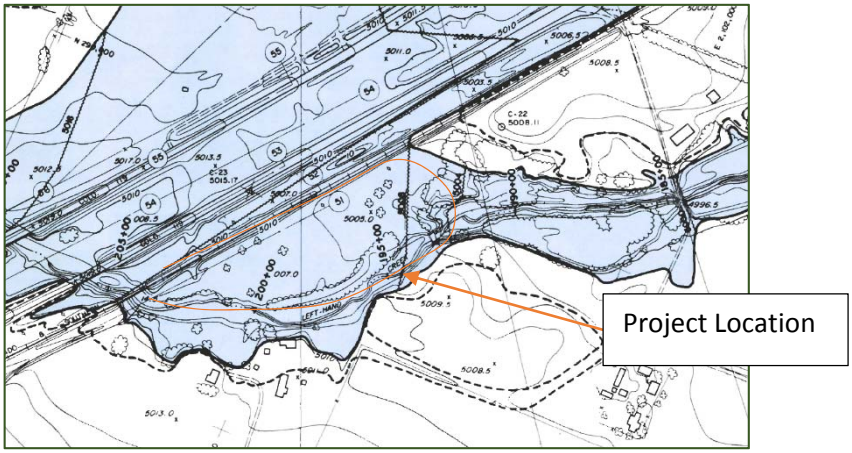

Figure 16 - Caption of the published floodplain from the 1982 FIS

The BFE recorded on the FEMA Flood Map is 5006 feet North American Vertical Datum 29 (NAVD29). A conversion to NAVD 88 for 40 deg 07' 38.79" N and 105 deg 08' 22.85" W is 0.984 meters or 3.2285 feet according to the USGS Vertcon Website. This makes the published BFE through the site 5009.23, which is equal to or greater than the highest computed water surface elevation within the proposed conditions hydraulic model.

Findings from this analysis are:

- The Project will cause a *no rise* condition from proposed to existing conditions, where the existing conditions are surveyed ground in 2016 and the proposed are constructed ground after the site.
- This project will not have impacts on the published BFEs.

This project is certifiable as a *no rise* condition under both Local and Federal Floodplain Regulations.

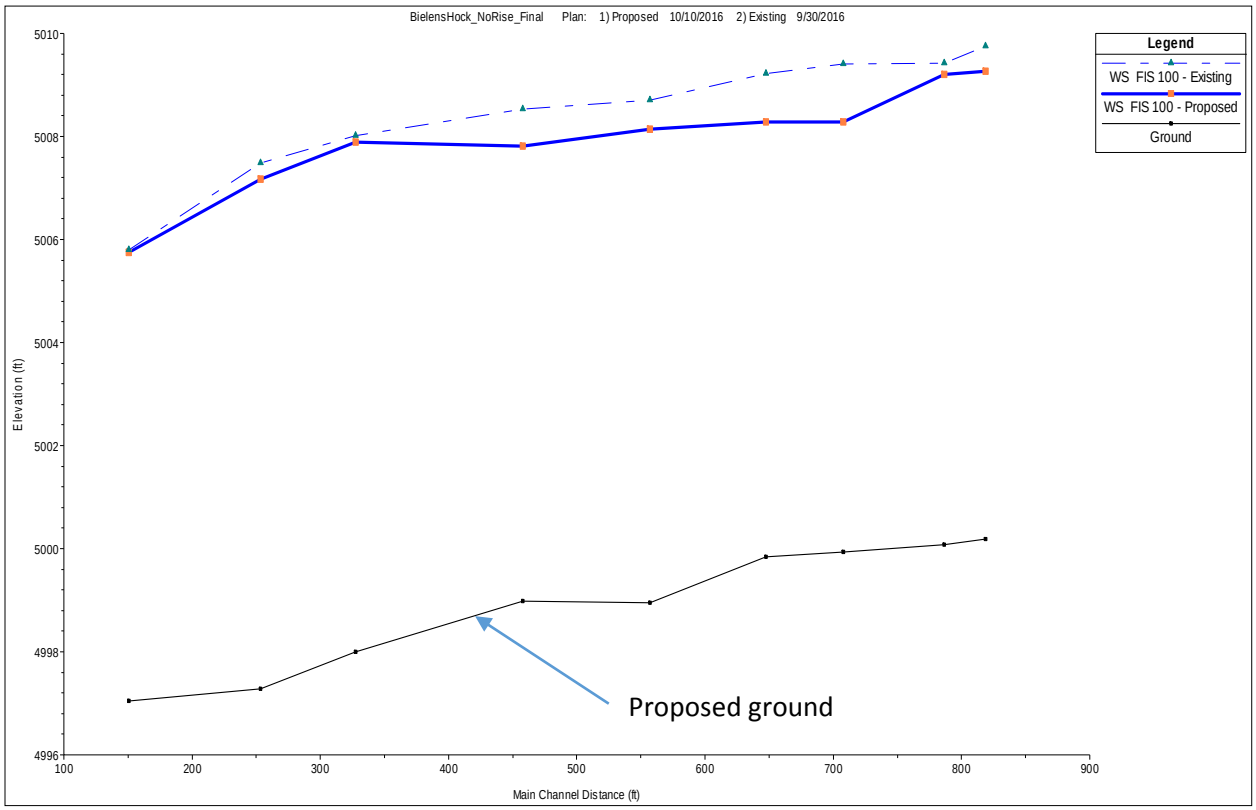

Figure 17 – Existing (Red Dash Line) and Proposed (Blue Line) 100 Year Water Surface Elevations from HEC-RAS No Rise Hydraulic Model

Table 2 - HEC RAS Output for Project Site

Station	Existing or Proposed	Ground El	Water Surface Elevation (WSE)	Velocity (ft/sec)	Difference in WSE (Proposed to Existing)
809.249	Proposed	5000.18	5009.26	9.74	-0.49
809.249	Existing	5000	5009.75	8.31	
805.766	Proposed	5000.08	5009.2	9.62	-0.22
805.766	Existing	4999.99	5009.42	9.89	
804	Lateral weir				
707.646	Proposed	4999.93	5008.28	12.17	-1.13
707.646	Existing	4999.92	5009.41	7.11	
647.334	Proposed	4999.84	5008.29	10.5	-0.94
647.334	Existing	4999.87	5009.23	6.36	
557.006	Proposed	4998.95	5008.15	7.8	-0.56
557.006	Existing	4999.74	5008.71	7.63	
457.911	Proposed	4998.98	5007.82	8.95	-0.71
457.911	Existing	4999.01	5008.53	6.37	
327.714	Proposed	4998	5007.89	5.9	-0.13
327.714	Existing	4999.03	5008.02	6.5	
253.346	Proposed	4997.28	5007.17	9.96	-0.31
253.346	Existing	4997.1	5007.48	6.61	
150.756	Proposed	4997.04	5005.76	13.66	-0.04
150.756	Existing	4997.35	5005.8	12.8	

Recommended Plantings

The recommended planting schedule varies by location and the proximity to base or high flows. Locations were separated into four (4) zones for channel and locations wet most of the year (Zone 1), benches (Zone 2), midland (Zone 3) and upland plantings (Zone 4). These are presented within the 30% Draft Drawings in the attachments.

References

FEMA (1981) "Floodplain Information Report, Lefthand Creek Mouth to Foothills Highway" Prepared for Boulder County, the City of Longmont, and the Colorado Water Conservation Board.

Joseph P. Capesius and Verlin C. Stephens (2009) *Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado,* Prepared in cooperation with the Colorado Water Conservation Board and the Colorado Department of Transportation

Schumm, A. and Parker, R. S., (1973), Implications of complex response of drainage systems for quaternary alluvial stratigraphy: Nature (Physical Science) v. 243, p. 99-100.

Simon, A., Rinaldi M., 2006. Disturbance, stream incision, and channel evolution: The roles of excess transport capacity and boundary materials in controlling channel response. Geomorphology 79 (2006) 361-383.

Attachments

Attachment A – Floodplain Development Permit Application

Attachment B – Location Map

Attachment C - DRAFT 30% Design Drawing Set

Attachment D – Hydraulic Model Output

Attachment E – Biological Assessment