Mancos River Habitat and Diversion Project – Phase 2

Final Report

Mancos Conservation District

March 2, 2013

CWCB GRANT INFORMATION

Colorado Water Conservation Board (CWCB) Contract C150511

INTRODUCTION AND BACKGROUND

In December 2012, the Southwest Basin Roundtable and the Colorado Water Conservation Board granted $119,340 for to the Mancos River Habitat and Diversion Project – Phase 2 (Contract C150511**)**.

The Project was a comprehensive effort to refresh the Mancos Valley Watershed Group's watershed stewardship goals, to continue collaborative river condition monitoring begun in 2006, and to implement the findings and plans developed in the Mancos River Diversion Project- Phase I to improve the ecological and agricultural function along more than a two mile reach of the Mancos River.

The objectives of the project were to:

1) To reassess the condition of the Mancos River after 5 years and several projects, and to provide a baseline for new river improvement efforts. This reassessment will also provide a baseline for stream improvement efforts in the South Town to Exon Diversion Reach.
2) To maintain and refresh the momentum of the Mancos Watershed Group by convening the group to review progress and identify the next set of priorities for action to steward the health and productivity of the Mancos River Watershed.
3) To further the efforts begun in the *Mancos River Diversion Project - Phase I* project to improve channel function and aquatic habitat condition on the Mancos River in the South Town to Exon Diversion reach of the Mancos River.
4) To decrease time and costs incurred in diverting irrigation water at 4 diversions within the South Town to Exon Diversion reach of the Mancos River (1 additional diversion was added in December 2015 downstream of the project reach).

With this report, the project is successfully completed. The projected long-term benefits to the Mancos River of the completion of this project are passage of high flows, increased channel bed and bank stability in the vicinity of each diversion, reduced bank erosion, increased fish trout and native fish movement past the 5 improved diversions. The projected long term benefits to irrigators from the completion of this project are the ability to clean diversion channels through use of newly installed sluice gates, the ability to divert the full water right associated with each ditch when available, improved ability to measure their diversions, and reduced maintenance.

PROJECT RESULTS

TASK 1 –Rapid Stream-Riparian Assessment training, watershed monitoring and project baseline.

Host a local training workshop in the Rapid Stream-Riparian Assessment (RSRA) methodology to equip local staff and volunteers to complete a reassessment of the functional condition of the Mancos River Watershed, and to establish a new baseline ahead of proposed river restoration activities. The result will be an assessment of change by reach over the past 5 years, at up to 17 reaches, as well as establishment of a new baseline for condition of reaches throughout the watershed. The South Town to Exon Diversion reach proposed to be restored in this project includes two of the reaches assessed in 2006. Reassessment of these two reaches will provide a baseline by which to gauge the ecological success of this South Town to Exon Diversion project.

Results:

The project completed a workshop to train participants in the RSRA protocol for assessing the functional condition and ecological health of small and medium sized rivers in the Southwest. The workshop was held June 8-10, 2012 with 12 participants. Over the three-day workshop, instructor Dr. Peter Stacey led the participants in the reassessment of three previously surveyed reaches of the Mancos River watershed: Reddert Ranch Reach on the East Mancos, mesa Verde NP/Ute Border Reach on the Mancos, and the Above Weber Diversion Reach on the West Mancos.

Building on the workshop, the Project Manager coordinated and lead 1 MCD staff person and 3 local TU volunteers in reassessing four additional reaches: Road J Bridge Reach and Excelsior/Sewage Plant Reach on the Mancos in 2013, and Below Jackson Gulch Reservoir Diversion Reach and Colyer Ranch Reach on the West Mancos in 2014. The two reaches reassessed in 2013 fall within the South Town to Exon reach where the project installed new diversion structures, so these resurveys also serve the purpose of providing baseline data for assessing changes to stream function/health that may be associated with this project.

Although the project had hoped to resurvey up to all 17 of the reaches first surveyed by Dr. Stacey with RSRA in 2006, time and funding did not allow for completion of the remaining ten reaches. The Mancos River Watershed Partners and MCD will reevaluate this objective and may choose to prioritize among the remaining 10 reaches to resurvey them based on the availability of volunteers. Table 1 shows the results of the resurveys conducted under the grant.

Table 1. *Results of RSRA resurveys conducted on seven reaches in the Mancos River watershed.*

	Reach (Date of Resurvey)						
Scores	**West Mancos - Below Jackson Gulch Reservoir Diversion 9/30/2014**	**West Mancos - Colyer Ranch Reach 10/3/2014**	**East Mancos- Reddert Ranch 6/9/2012**	**West Mancos- Above Weber Diversion 6/10/2012**	**Mancos - Excelsior/ Sewage Plant Reach 9/30/2013**	**Mancos - Road J Bridge 9/23/2013**	**Mancos - Mesa Verde NP/Ute Border 6/10/2012**
Overall Score	**3.58**	**3.27**	**3.5**	**3.1**	**3**	**3**	**3.5**
Algal Growth	4	2	1	1	2	1	5
Channel Shading	3	2	5	4	4	3	2
Water Quality Mean Score	3.5	2	3	2.5	3	2	3.5
Floodplain Connection	1	1	1	1	1	1	1
Vertical Bank Stability	4	4	5	5	5	4	5
Hydraulic Habitat Diversity	5	5	5	5	5	5	5
Riparian Area Soil integrity	4	4	5	2	1	3	5
Beaver Activity	1	2	2	3	2	1	3
Hydrogeomorphology Mean Score	3	3.2	3.6	3.2	2.8	2.8	3.8
Riffle-Pool Distribution	3	5	3	1	4	2	5
Underbank Cover	2	4	3	2	3	4	2
Cobble-Embeddedness	5	2	5	1	3	2	2
Aquatic macro-invertebrate diverstiy	3	5	4	5	5	5	5
Large Woody Debris	2	5	5	3	3	3	1
Overbank Cover and Terrestrial Invertebrate Habitat	5	5	5	5	3	4	5
Fish/Aquatic Habitat Mean Score	3.3	4.3	4.2	2.8	3.5	3.3	3.5
Riparian Zone Plant Community Structure and Cover	4	3	3	4	3	3	3
Shrub Demography and Recruitment	4	5	3	4	5	3	4
Tree Demography and Recruitment	5	5	5	5	5	4	5
Non-native Herbaceious Plant Species	5	1	1	2	1	1	1
Non-native Woody Plant Species	5	5	5	5	5	4	5
Mammalian Herbivory (Grazing) Impacts on Ground Cover	4	2	5	1	1	5	5
Mammalian Herbivory (Browsing) Impacts on Shrubs and Small Trees	5	1	3	1	2	3	5
Riparian Vegetation Mean Score	4.6	3.1	3.6	3.1	3.1	3.3	4.0
Shrub Patch Density	5	3	3	4	3	3	4
Mid-Canopy patch Density	3	3	4	4	2	3	2
Upper Canopy Patch Density	4	4	4	3	2	3	2
Fluvial Habitat Diversitsy	2	5	2	4	4	5	2
Terrestrial Wildlife Habitat Mean Score	3.5	3.75	3.3	3.8	2.8	3.5	2.5

TASK 2 – Convene Mancos River Watershed Group.
Convene the Mancos River Watershed Group though an open invitation to participate in a meeting to learn about progress to date and to review and renew priorities for action.

Results:
The Mancos Conservation District hosted a meeting of partners of the Mancos River Stakeholders Group on January 28, 2013 in conjunction with their Water 101 event. More than 20 people attended the meeting. The Agenda for the meeting and the Update to the Mancos Valley Watershed Group PowerPoint that served as the basis for discussion are attached below.

On August 23, 2013, the Project Coordinator organized and conducted a Mancos River Stakeholders Group field-trip to the headwaters of the East Mancos River. Fourteen people attended the field trip which focused on observation and discussion of the sources of water quality issues on the East Mancos. Photos 1 and 2 document this field trip.

In response to requests from stakeholders we have compiled key Mancos watershed documents (e.g. stocking records, geologic reports and water quality reports for the East Fork Mancos River) and posted them online at http://www.montezumaconservationdistricts.org/documents.cfm.

TASKS 3 - Complete baseline geomorphic survey of South Town to Exon Diversion reach.
Survey channel dimensions and profile through entire 2.4 mile reach from Mancos Town Sewage Treatment Plant downstream to the Exon Diversion.

TASK 4 – Develop reach restoration design, including 4 diversion structures in conjunction with channel and riparian restoration measures.
Design integrated channel and diversion functional restoration measures.

TASK 5 – Install diversion structures and channel habitat and riparian treatments.
Implement whole reach restoration plan through installation of 4 diversion structures and channel habitat and riparian treatments as designed in Task 4. In December 5, 2014, the design and installation of 1 additional irrigation structure at the Glasgow & Brewer headgate on the Mancos River was added to Task 5 and completed within the original budget.

Task 3-5 Results:
In 2013, NRCS/MCD technician Russell Klatt completed a GPS survey of the project and in September 2013, the design drawings for the habitat improvement portion of the project. The project obtained the required Army Corps permit (SPK-2013-00217-DC) for the designed habitat improvements. These improvements were installed in October and November 2013. They included installation of j-hooks, bank barbs, willow cuttings, weirs, rock cluster s and log complexes, along a total of approximately 6500 feet of the Mancos River across five different properties within the South Town to Exon project reach. The NRCS certified "Habitat Restoration Design" with photo points mapped is attached below. Photos 3 thru 22 document these habitat improvements.

In October 2013, the rock diversion to replace the cobble dam at the Bolen Diversion was installed along with the diversion box, culverts and measure box. See photos 23-26.

Plans for the Sheek Diversion were certified by NRCS on September 13, 2013. In October 2013, the flow measuring equipment and headgate were installed at the Sheek Diversion. See photos 27-30.

Plans for the Exon Diversion were certified by NRCS on September 3, 2013. In October 2014, the permanent rock structure at the Exon Diversion was completed according to those plans. See photos 31-34.

Plans for the Veitz diversion structure were completed in October 2014. In November 2014 the permanent rock structure was completed at the Veitz Ditch. See photos 35-38.

Plans for the Glasgow & Brewer Diversion structure were completed in October 2014. In November 2014, the permanent rock structure was completed at the Glasgow &Brewer Diversion, as outlined in the amendment to Task 5 Scope of Work submitted December 5, 2014. With the completion of the Glasgow & Brewer Diversion all deliverables under Task 5, as amended were completed. See photos 39-40.

TASK 6 – Coordinate, manage and report on all aspects of the project.
Coordinate completion of tasks 1-5 by various partners, funders and Mancos Conservation District, as well as writing and circulating progress reports and final project report.

Results:
This final report documents the successful completion of Tasks 1-5.

PHOTOS
TASK 2: East Mancos Field Trip, August 23, 2013
Photos 1 and 2

TASK 3-5: PRE & POST CONSTRUCTION PHOTOGRAPHS

Habitat Improvements

Photos 3 and 4

Diversion Project II Photo Point 1 Looking upstream towards

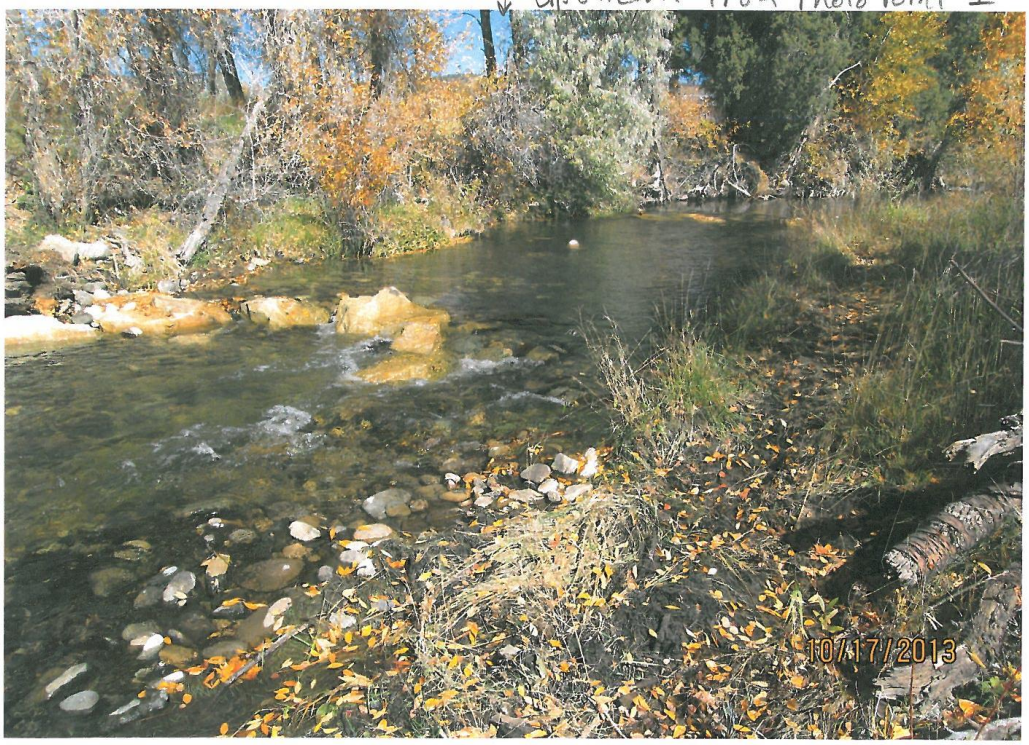
Ph. Pt. 1

Re-slope bank

Reach 1

Mancos River

↑ upstream from Photo Point 1



Habitat Improvements

Photos 5 and 6

Diversion Project II Photo Point 2 - Reach 2

Habitat Improvements

Photos 7 and 8

Habitat Improvements

Photos 9 and 10

Diversion Project II Photo Point 4 - Reach 3

downstream ↑ upstream ↓

Habitat Improvements

Photos 11 and 12

Diversion Project II Photo Point 5 - Reach 4

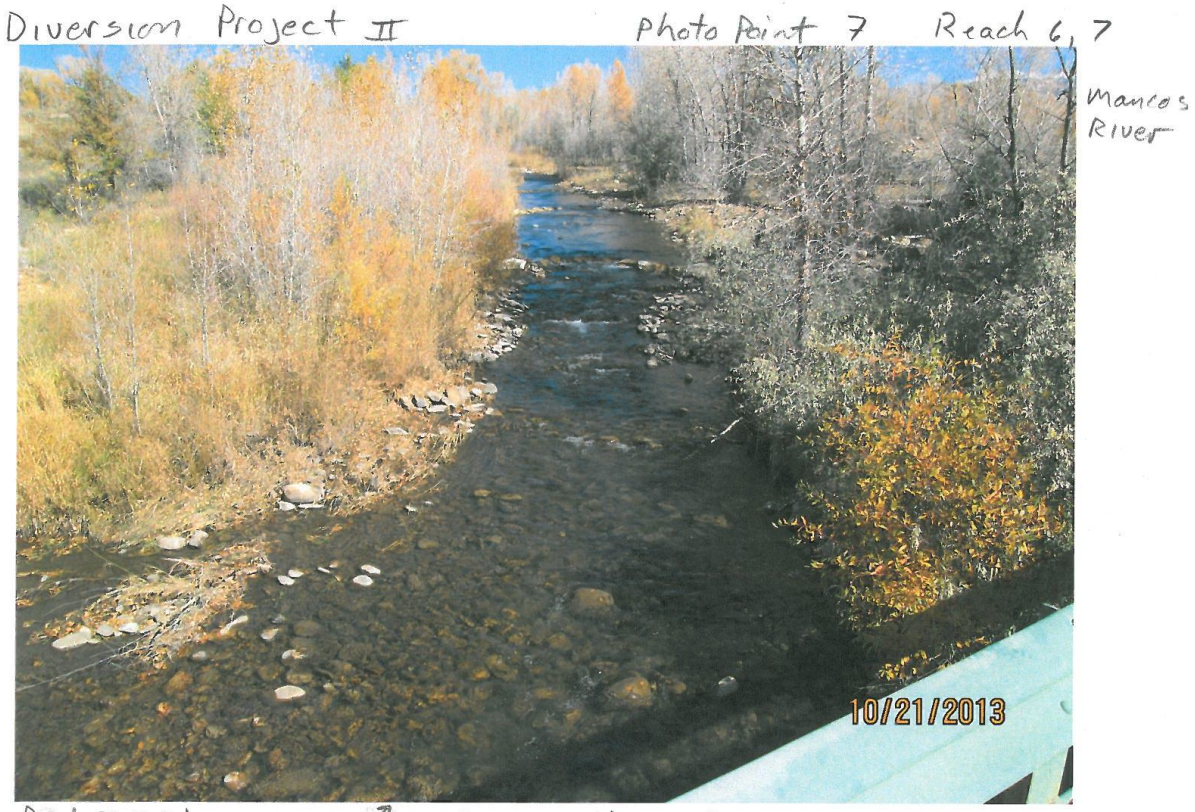
both - upstream

Habitat Improvements

Photos 13 and 14

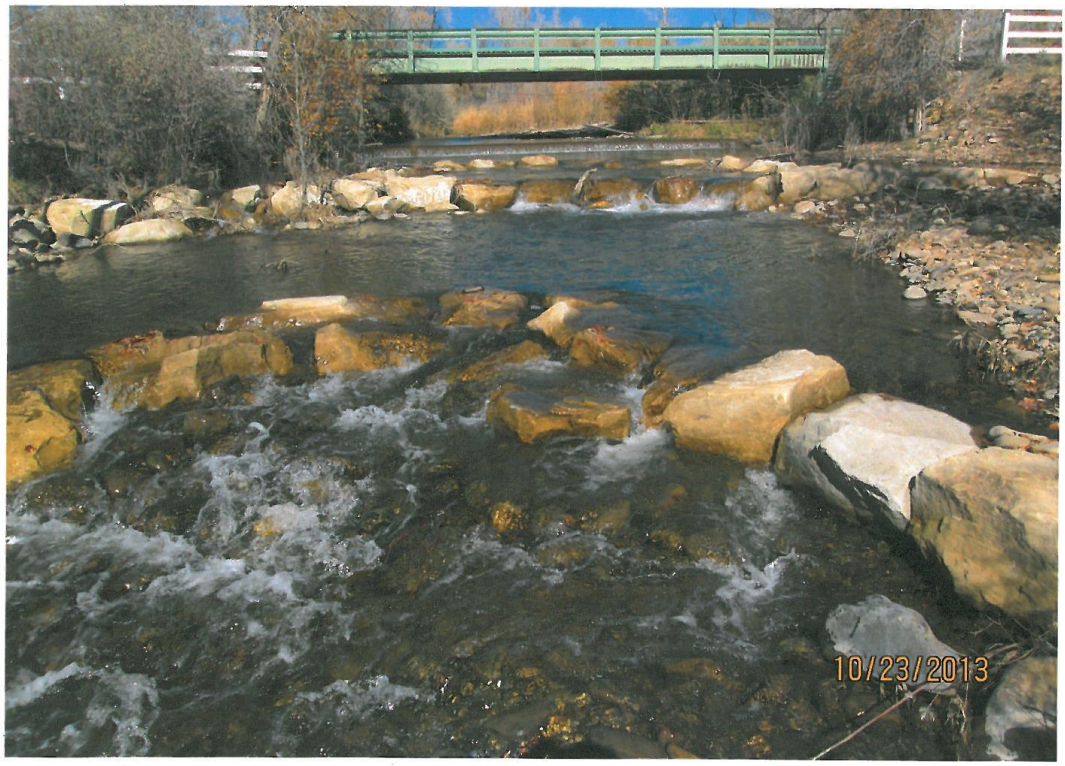
Habitat Improvements

Photos 15 and 16



Habitat Improvements

Photos 17 and 18



Habitat Improvements

Photos 19 and 20

Diversion Project II Mancos River weir

weir

Habitat Improvements

Photos 21 and 22

Diversion Project II Mancos River Weir

J-Hook

Bolen Diversion

Photos 23 and 24: Pre-project

Bolen Diversion

Phase II Diversions

Bolen Diversion

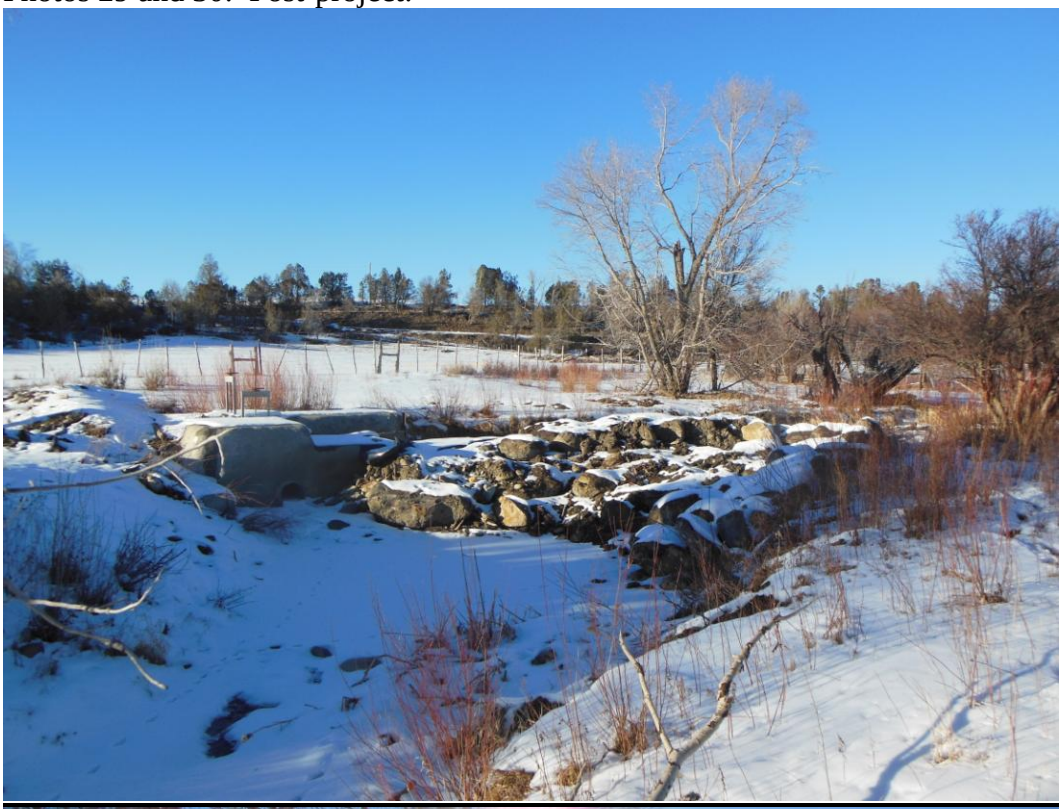
Photos 25 and 26: Post-project

Sheek Diversion

Photos 27 and 28: Pre-project:

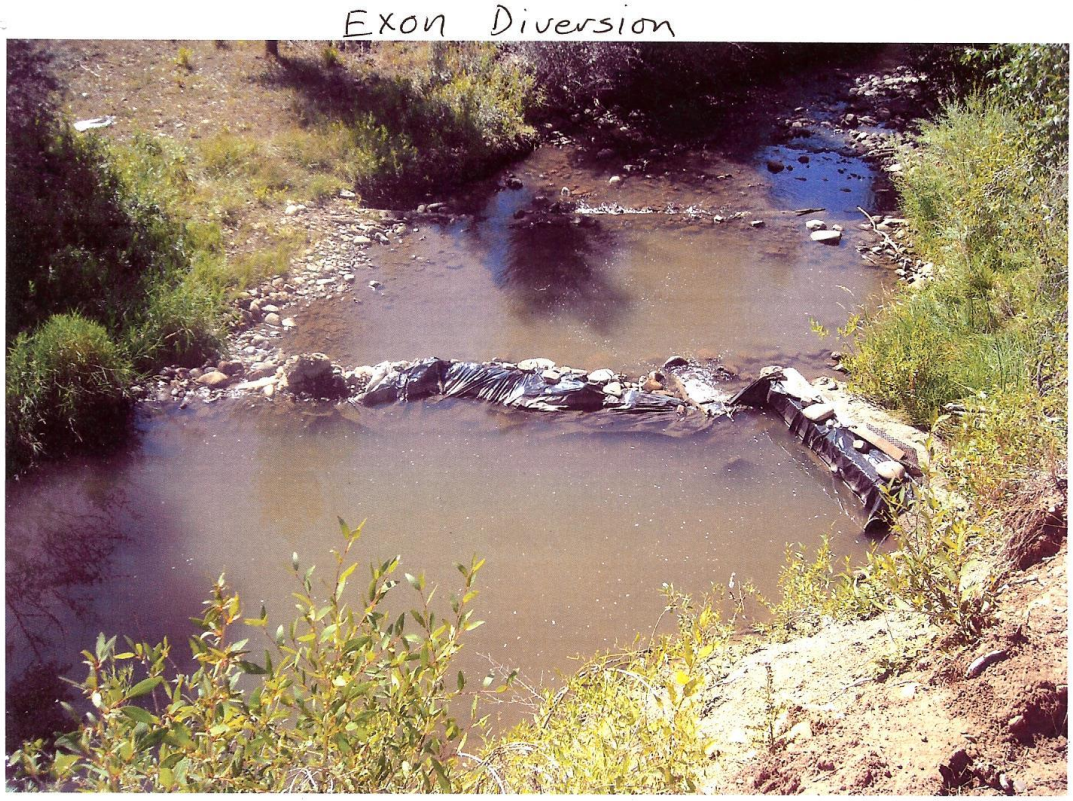
Sheek Diversion

Photos 29 and 30: Post-project:



Exon Diversion

Photos 31 and 32: Pre-project



Exon Diversion

Photos 33 and 34: Post-project

Veits Diversion

Photos 35 and 36: Pre- and Post-project

Veits Diversion

Photos 37 and 38: Pre- and Post-project

Glasgow &Brewer Diversion

Photo 39: Pre-project and 40: Post project

ATTACHMENTS:

- MCD Water 101 January 28, 2013 Agenda (1 page)
- MCD Water 101 "Update to the Mancos Valley Watershed Group" PowerPoint (17 pages)
- Mancos River Habitat and Diversion Project – Phase II NRCS certified "Habitat Restoration Design" (13 pages)

Water 101 in the Mancos Valley

SATURDAY, JANUARY 26, 2013

COMMUNITY CENTER, Mancos, CO
10 am – 5 pm

Lunch will be served!

AGENDA:

10 am – 11:30	Gary Kennedy will speak about the Jackson Reservoir and how it works. There will be time for questions and answers.
11:30 – 12:30	Lunch will be served.
12:30 – 2:00	Marty Robbins of the Department of Water Resources will speak about the Priority Water System and how works, wells, ponds, etc. There will be a question and answer session.
2:00 – 2:30	A representative from the Town of Mancos and Brandon Bell of Mancos Rural Water will be on hand to answer any questions about how the town water and rural water systems work.
2:30 – 5:00	Mancos River Stakeholders Meeting will be held. Stakeholders will be updated on what has taken place in the last year regarding the Mancos River Watershed Plan. There will be a question and answer session.

THIS WORKSHOP IS BEING BROUGHT TO ALL LANDOWNERS FREE OF CHARGE BY *THE MANCOS CONSERVATION DISTRICT.*

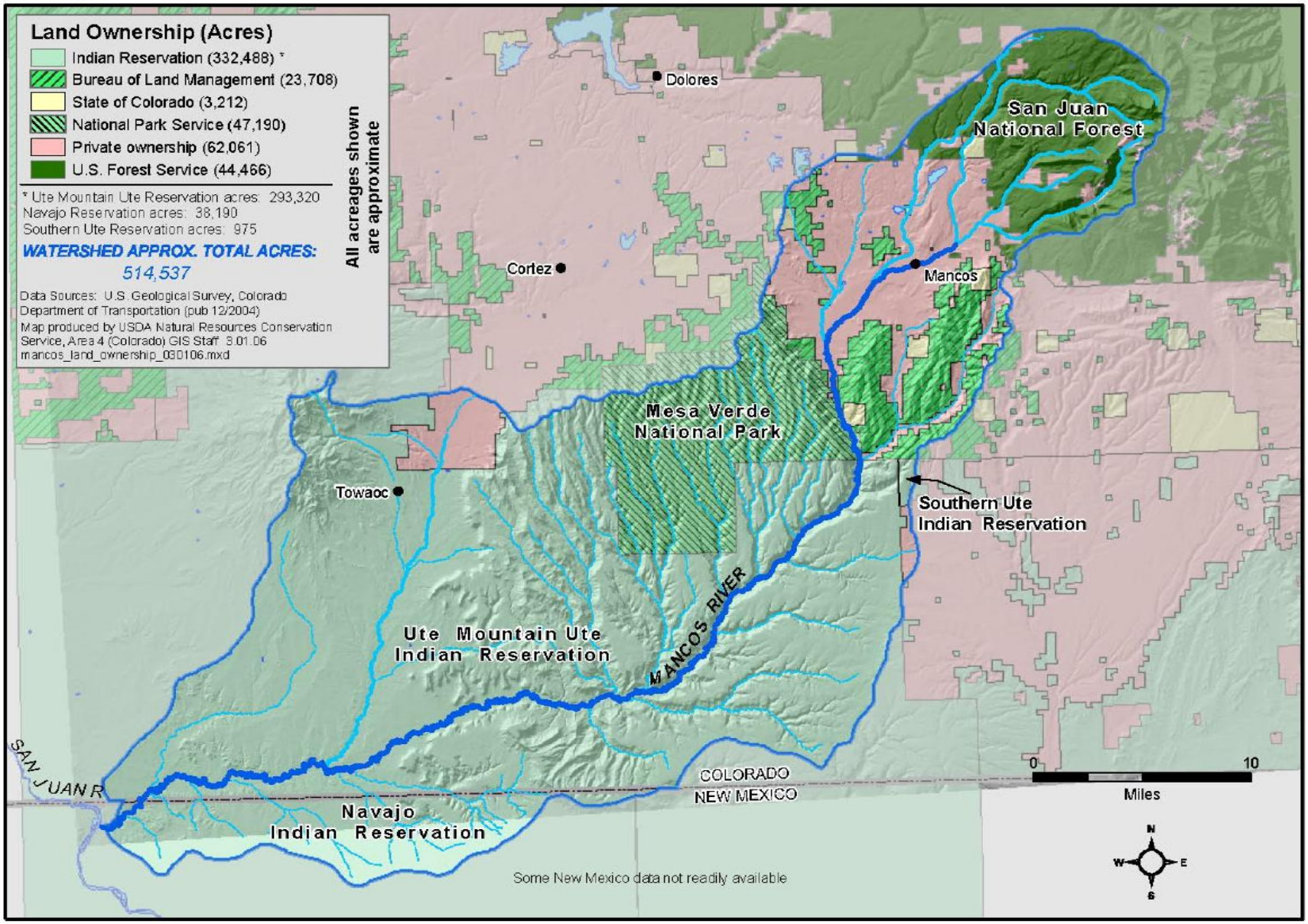
IF YOU EVER HAD ANY QUESTIONS ABOUT HOW WATER WORKS IN THE MANCOS VALLEY, THIS IS YOUR CHANCE TO FIND OUT! Please RSVP: (970) 533-7317 by 1/18/13.

Update
to

Mancos Valley Watershed Group

January 2013

Mancos River Watershed Land Ownership/Jurisdiction



Forest Service Projects

- Burnt Ridge Aspen sale
- North Mancos Grazing Analysis
- Box Canyon Trail ReRoute

- Doc Lowell Trailhead- improvement of parking area
- Sudden Aspen Decline research by FLC
- ongoing weed treatments.

USFS (cont'd)

- Doyle Irrigation Ditch (T36N, R12W, Sec. 7) has undergone construction installing pipe underground and new intake system. Seeding efforts in November and to be monitored in 2013.
- 1,660-foot six-inch underground irrigation water transmission line owned by Victoria Townsend (T36N, R12W, Sec. 35) in the Starvation Creek drainage will be renewed for additional 30 years. No change is proposed
- water well and 320-foot one-inch underground pipeline for domestic water use by Forrest and Julie Ott (T36N, R12W, Sec. 32) adjacent to their private property on Mancos Hill will be renewed for additional 30 years. No change is proposed
- All USFS land parcels within Mancos have been conveyed into private ownership

Mancos River Basin Instream Flow Report

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Preliminary Evaluation of
Flow Restoration Options

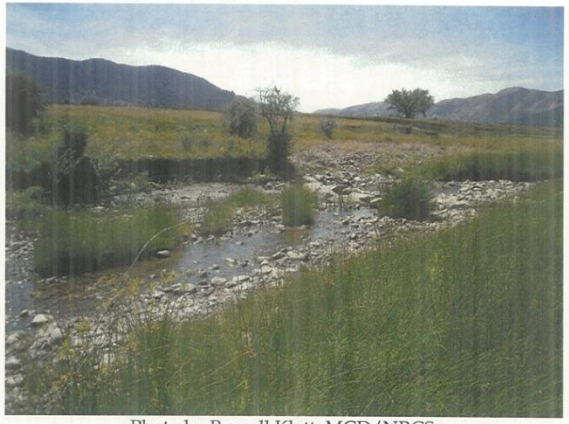


Photo by Russell Klatt, MCD/NRCS

Prepared for The Mancos Conservation District
May 17, 2011

Amy W. Beatie, Esq.
Executive Director

Zach Smith
Staff Attorney

COLORADO WATER TRUST

1430 Larimer Street, Suite 300 | Denver, CO 80202 | Phone: 720-570-2897 | Fax: 303-99

Recommendations

1. Examine potential for new Instream Flow appropriations
   - Flow protection tool
   - Natural environment to be protected?
   - Water available?
   - No injury!
2. Examine potential for instream flow acquisitions
   - Flow restoration tool
   - Voluntary!
3. Continue efficiencies projects
4. Consider other projects as appropriate
   - Tamarisk/russian olive control
   - Stream channel function/health

Mancos Watershed Plan

5/24/2011

Mancos Valley Watershed Group

Headwaters of the Mancos River

Management Measure
Restoring reaches in valley impacted by historical levees (Stacey 2007)
Diversions 1-12 with riparian restoration and improving hydrogeomorphology
Purchasing water for in-stream flows
Reduce salinity loads
Reduce Selenium, especially in the Navajo Wash tributary
Close, improve and maintain roads in National Forest lands
Reduce sediment loads from burn areas
Habitat rehabilitation in Mancos Canyon
TOTAL C

Hoch Restoration Project

- 1 mile Mancos River
- grazing management plan
- Design/installation of in-stream structures to maintain pool habitat, cover, bank stability, channel-bed stability, and fish passage.
- creation of 32 pools ,removal of 1 fish barrier, and replacement of annual in-channel berming at 1 headgate with a permanent structure
- Partners: Landowner, Town of Mancos, MCD, CSCB, NRCS

Beaver, Willis & Bolen Irrigation Diversion Improvement Project

Purpose

- Improve irrigation diversion efficiency
- Reduce in-channel disturbances & maintenance
- Allow fish migration (*& provide low water holding pools*)

Timelines

- Field surveys 2010
- Construction Plans, NRCS Design Reports & Approvals
  - > Beaver Diversion (December 2010)
  - > Willis Diversion (June 2011)
  - > Bolen Diversion (no Design Report, June 2011)
- Construction of Beaver & Willis Diversions (November 2011)

Partners

- Mancos Conservation District, NRCS, CWCB
- Beaver, Willis and Bolen ditch companies

Survey/Design/Construction Contractor

- Mark Oliver (Basin Hydrology, Durango)

Basin Hydrology, Inc.

www.basinhydrology.com

Beaver Diversion - preconstruction

Basin Hydrology, Inc.

www.basinhydrology.com

Beaver Diversion – post construction

Basin Hydrology, Inc.

www.basinhydrology.com

Beaver Diversion – post construction

Basin Hydrology, Inc.

www.basinhydrology.com

Beaver Diversion – post construction

Basin Hydrology, Inc.

www.basinhydrology.com

Willis Diversion – preconstruction

Basin Hydrology, Inc.

www.basinhydrology.com

Willis Diversion – post construction

Willis Diversion – post construction

Basin Hydrology, Inc.

www.basinhydrology.com

Mancos River Habitat and Diversion Project – Phase II

- $119K from SW Basins Roundtable and CWCB
- To restore aquatic habitat AND efficiency of 4 irrigation diversions along a 2.4 mile reach downstream of town (Veits, Bolen, Sheek and Exon).
- allowing for fish and sediment passage
- promoting channel stability.
- Partners: Landowners, ditch companies MCD, Trout Unlimited, CWCB, Peter Stacey

Rapid Stream Riparian Re-Assessment

- 2006: 17 reaches
- 2012: 3 reaches re-assessed
- 2013: plan to reassess 14 remaining reaches in June

MANCOS RIVER HABITAT AND DIVERSION PROJECT- PHASE II

CERTIFICATION NOTES:

1) CULTURAL RESOURCES

IF ARCHAEOLOGICAL RESOURCES ARE ENCOUNTERED DURING CONSTRUCTION/EXCAVATION, CEASE ALL ACTIVITIES AND CONTACT NRCS AT ONCE.

2) UTILITIES

"I REALIZE THAT AS A LANDOWNER, I AND/OR THE CONTRACTOR I HIRE, MAY BE LIABLE FOR ANY DAMAGE TO UTILITIES DURING CONSTRUCTION. NRCS MAKES NO REPRESENTATION THAT UTILITIES SHOWN ON PLANS ARE EXACTLY LOCATED OR THAT ALL UTILITIES PRESENT ARE SHOWN".

"I WILL PROVIDE NRCS WITH THE UTILITY NOTIFICATION CENTER OF COLORADO (UNCC) TICKET NUMBER MY CONTRACTOR HAS ACQUIRED PRIOR TO START OF CONSTRUCTION".

MANDATORY COLORADO LAW REQUIREMENTS
CALL UTILITY NOTIFICATION
CENTER OF COLORADO
1-800-922-1987 OR 811

CALL 2 BUSINESS DAYS IN ADVANCE
BEFORE YOU DIG, GRADE, OR EXCAVATE
FOR MARKING OF UNDERGROUND MEMBER UTILITIES

3) OPERATOR CERTIFICATION

I am aware of the existence of buried lines (gas, power, sewer etc) along the proposed pipeline route:
YES NO (circle one)

OPERATOR Mancos Conservation District

DATE 9/3/13

UNCC TICKET NUMBER B324600239

OPERATOR OBLIGATIONS:

THE MANCOS CONSERVATION DISTRICT (OPERATOR) WILL TAKE RESPONSIBLITY FOR THE OPERATION AND MAINTENANCE OF THE INSTALLED WORK AS DESCRIBED ON THESE DESIGN DRAWING PAGES FOR A PERIOD OF 5 YEARS. AN OPERATION AND MAINTENANCE PLAN IS IN THE NRCS ENGINEERING FOLDER.

THIS DESIGN HAS BEEN DISCUSSED WITH ME AND I ACCEPT THE DESIGN AS PRESENTED BASED UPON THE CALCULATIONS & SPECIFICATIONS USED BY NRCS. I ACCEPT RESPONSIBILITY TO INSURE THIS PROJECT IS INSTALLED AS DESIGNED UNLESS CHANGES ARE APPROVED BY NRCS.

OPERATOR _____ DATE _____

LANDOWNER

I APPROVE THAT THE MANCOS CONSERVATION DISTRICT ACT AS THE PRINCIPAL OPERATOR OF THE PROJECT. I HAVE REVIEWED THESE DESIGN DRAWINGS AND AGREE WITH THE NRCS APPROVAL OF THE DESIGNS.

LANDOWNER _____ DATE _____

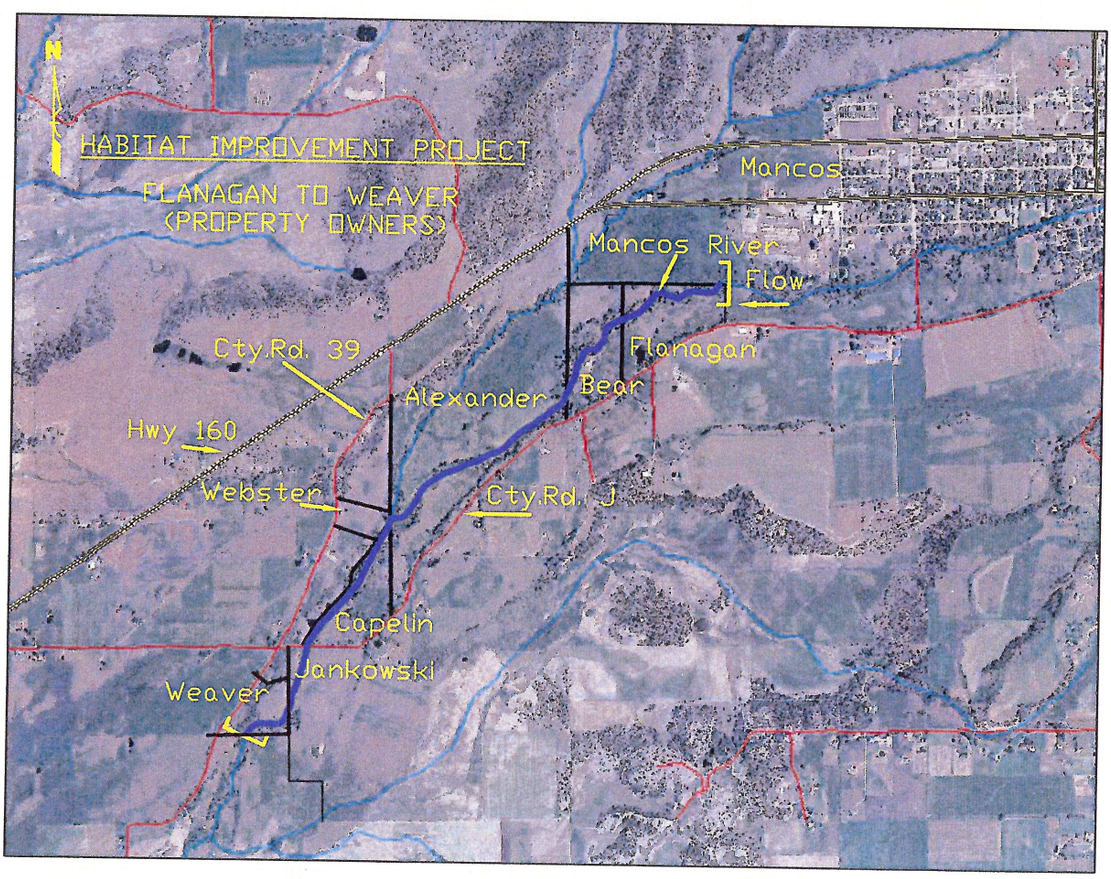
TOTAL MATERIAL QUANTITIES:

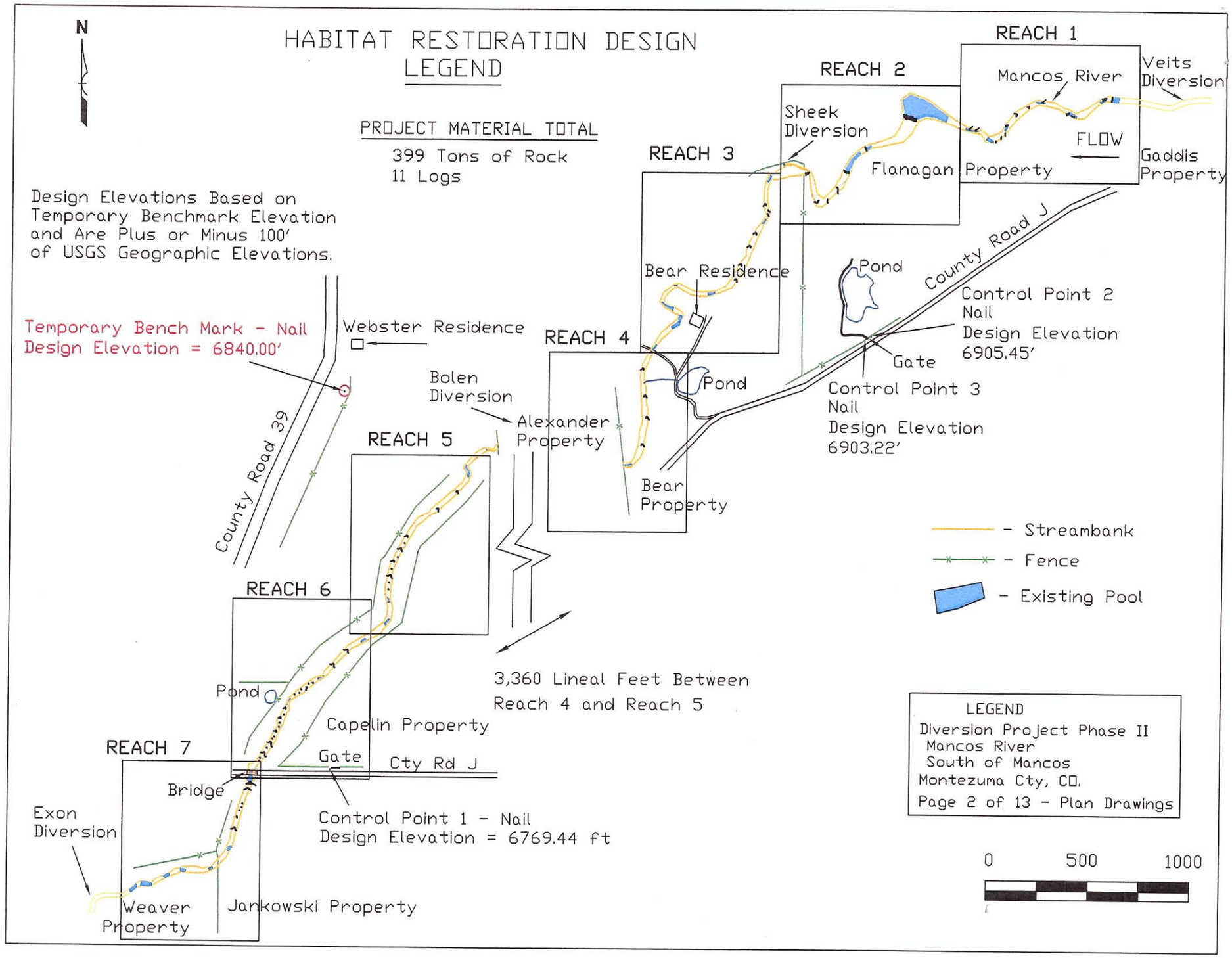
399 Tons of Angular Quarry Rock

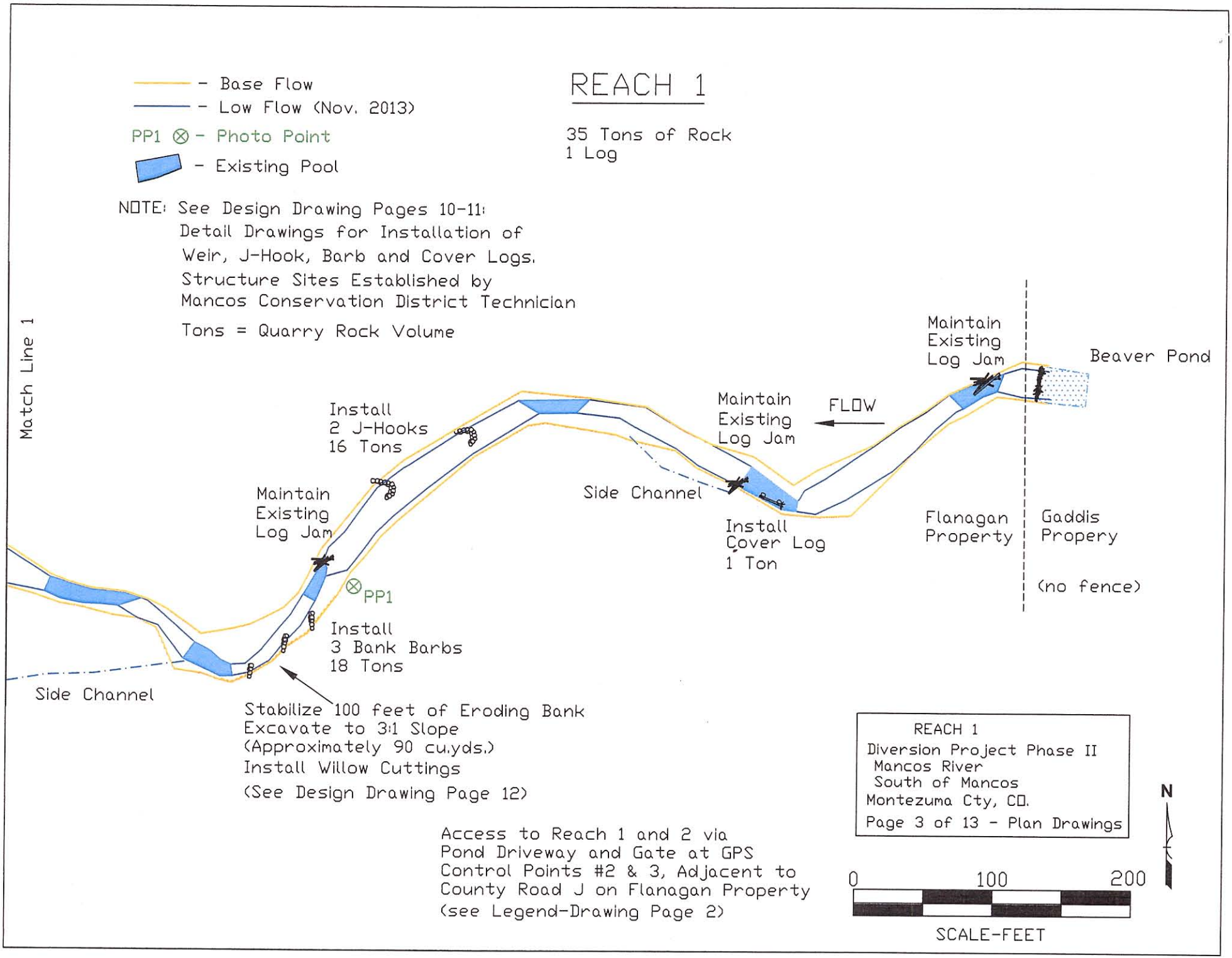
% OF MATERIAL SMALLER THAN TYPICAL STONE	TYPICAL STONE DIMENSIONS, inches
100	48
50-70	38
35-50	26
0	18

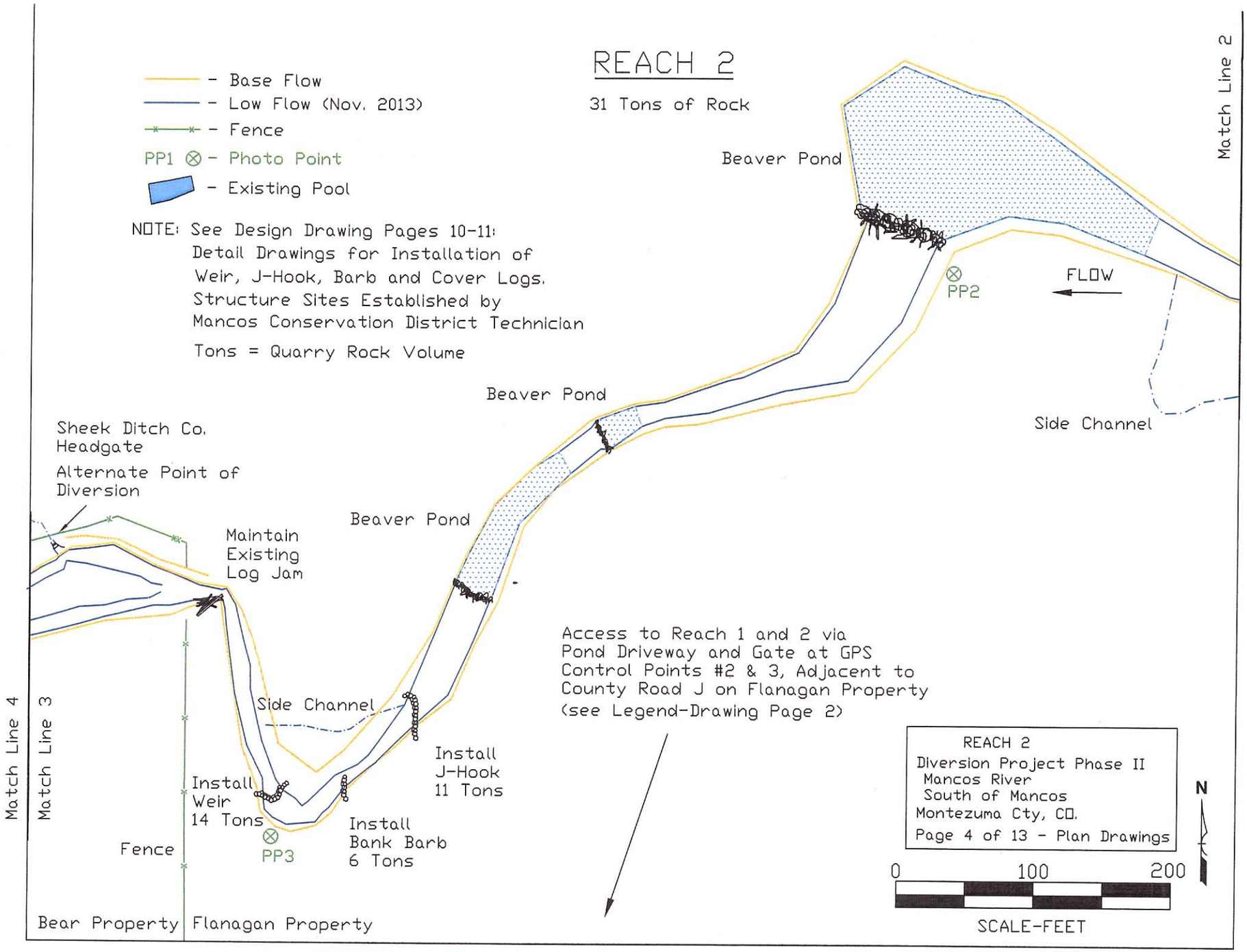
11 Large Logs

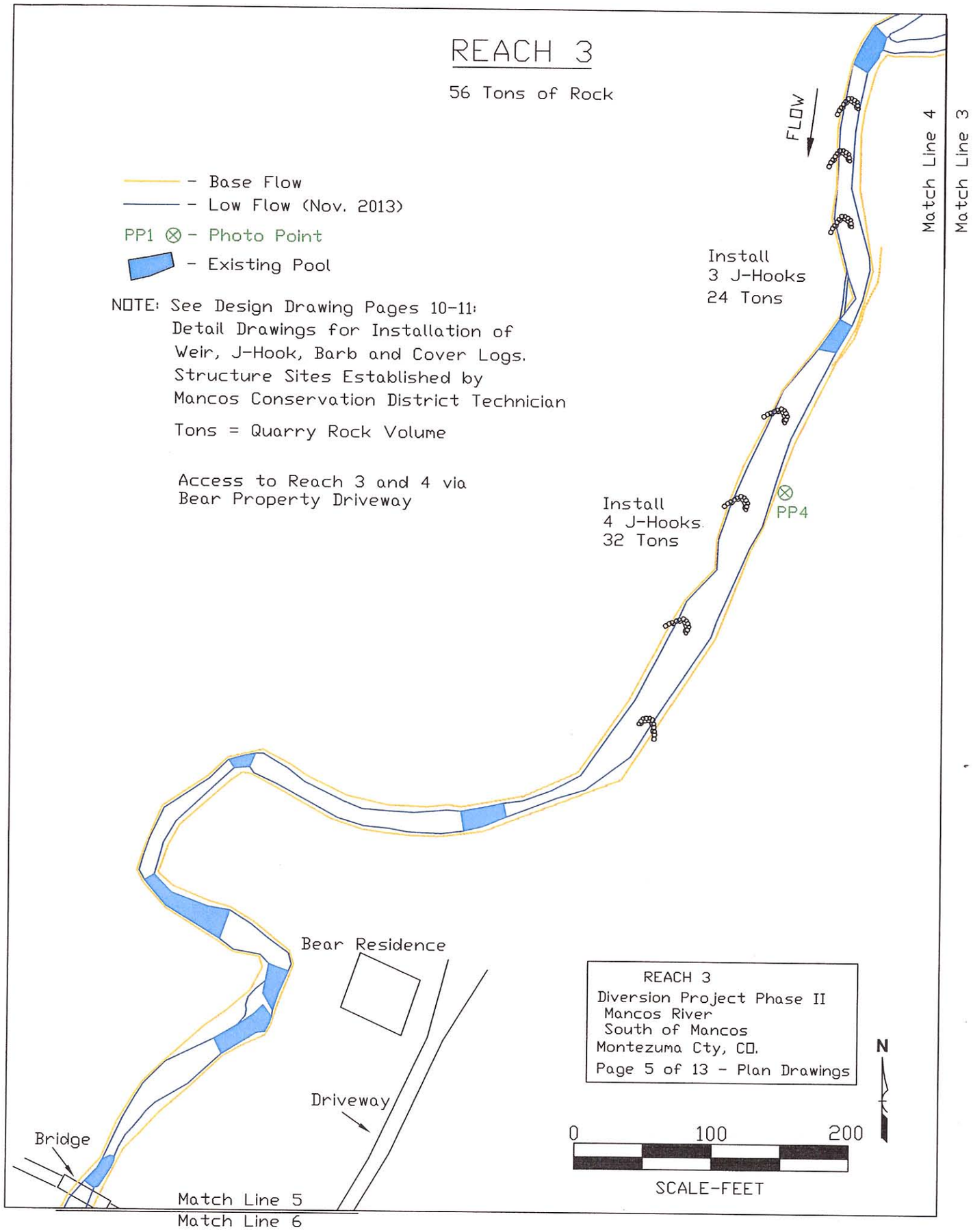
Dimension	Minimum Size
Rootwad Diameter	Bankfull Discharge Depth
Trunk Diameter	0.5 x Bankfull Discharge Depth
Tree Length	0.25 x Bankfull Discharge Width

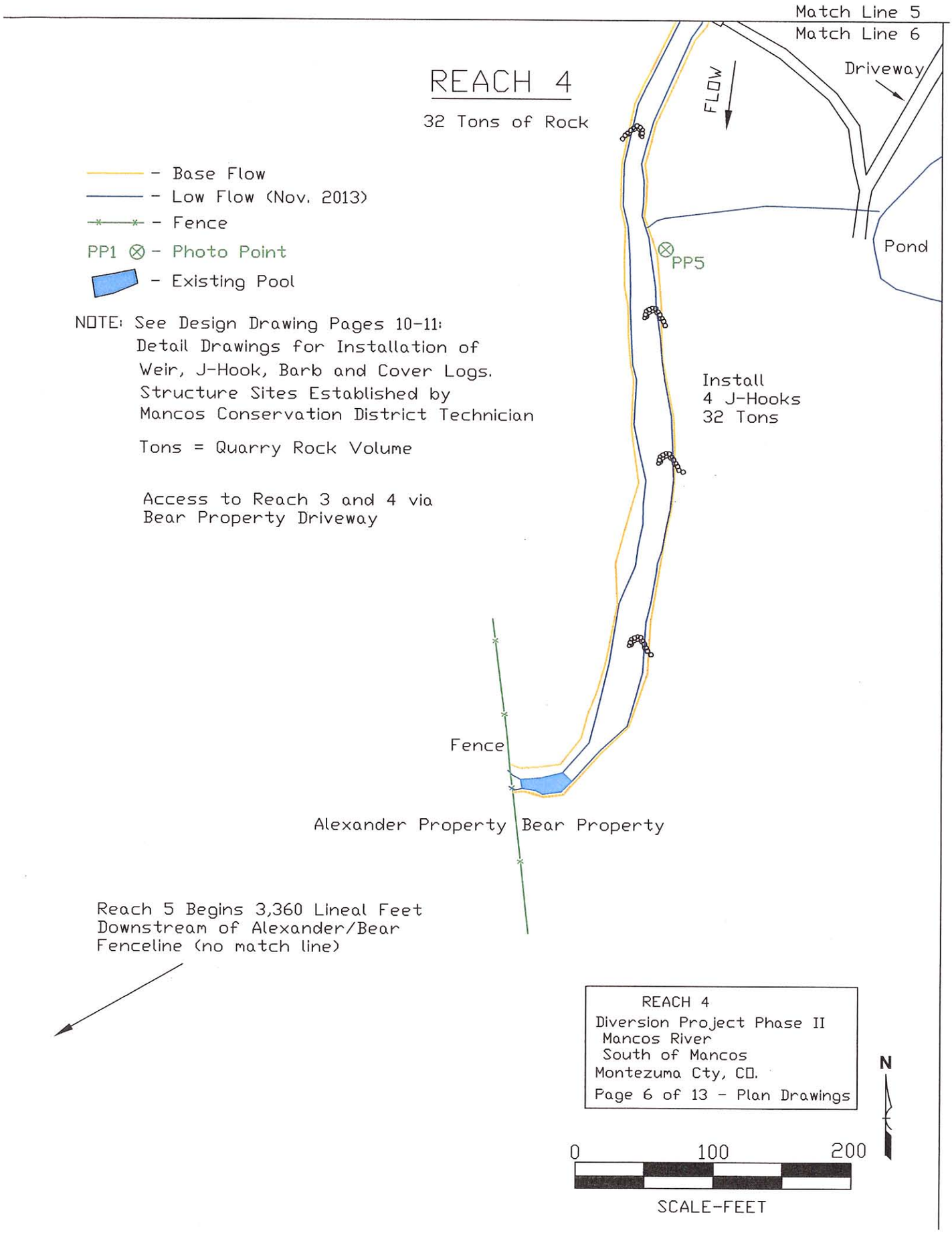


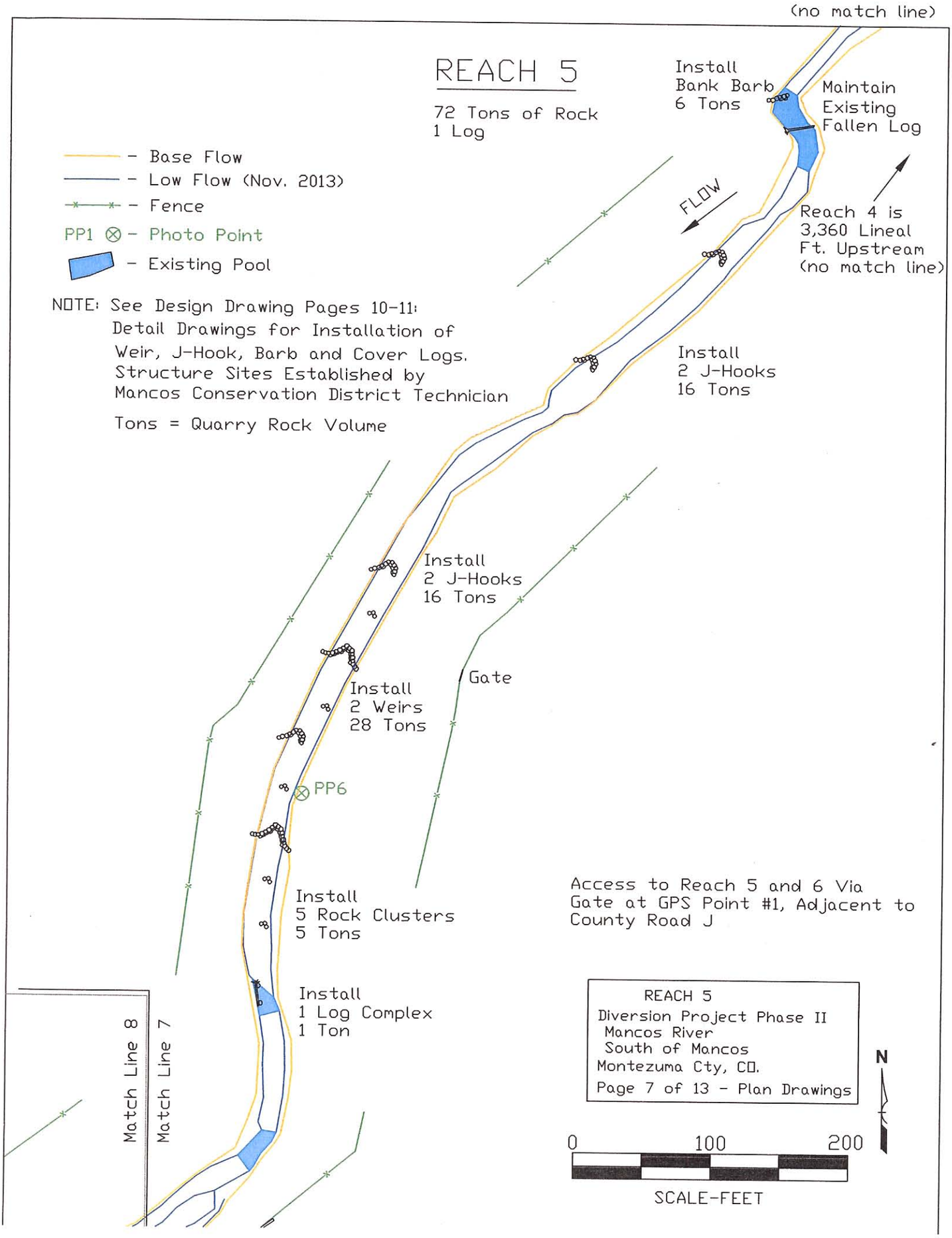

N
HABITAT RESTORATION DESIGN
LEGEND
PROJECT MATERIAL TOTAL
399 Tons of Rock
11 Logs
Design Elevations Based on Temporary Benchmark Elevation and Are Plus or Minus 100' of USGS Geographic Elevations.
Temporary Bench Mark - Nail
Design Elevation = 6840.00'
Webster Residence
County Road 39
REACH 1
REACH 2
REACH 3
REACH 4
REACH 5
REACH 6
REACH 7
Mancos River
Veits Diversion
Sheek Diversion
FLOW
Flanagan Property
Gaddis Property
Bear Residence
Pond
County Road J
Control Point 2
Nail
Design Elevation
6905.45'
Gate
Control Point 3
Nail
Design Elevation
6903.22'
Bolen Diversion
Alexander Property
Bear Property
- Streambank
- Fence
- Existing Pool
3,360 Lineal Feet Between
Reach 4 and Reach 5
Pond
Capelin Property
Gate
Cty Rd J
Bridge
Exon Diversion
Control Point 1 - Nail
Design Elevation = 6769.44 ft
Weaver Property
Jankowski Property
LEGEND
Diversion Project Phase II
Mancos River
South of Mancos
Montezuma Cty, CO.
Page 2 of 13 - Plan Drawings
0
500
1000


Base Flow
Low Flow (Nov. 2013)
PP1 ⊗ - Photo Point
Existing Pool
REACH 1
35 Tons of Rock
1 Log
NOTE: See Design Drawing Pages 10-11:
Detail Drawings for Installation of
Weir, J-Hook, Barb and Cover Logs.
Structure Sites Established by
Mancos Conservation District Technician
Tons = Quarry Rock Volume
Match Line 2
Match Line 1
Maintain
Existing
Log Jam
Beaver Pond
Maintain
Existing
Log Jam
FLOW
Install
2 J-Hooks
16 Tons
Side Channel
Maintain
Existing
Log Jam
Install
Cover Log
1 Ton
Flanagan
Property
Gaddis
Propery
(no fence)
PP1
Install
3 Bank Barbs
18 Tons
Side Channel
Stabilize 100 feet of Eroding Bank
Excavate to 3:1 Slope
(Approximately 90 cu.yds.)
Install Willow Cuttings
(See Design Drawing Page 12)
Access to Reach 1 and 2 via
Pond Driveway and Gate at GPS
Control Points #2 & 3, Adjacent to
County Road J on Flanagan Property
(see Legend-Drawing Page 2)
REACH 1
Diversion Project Phase II
Mancos River
South of Mancos
Montezuma Cty, CO.
Page 3 of 13 - Plan Drawings
N
0
100
200
SCALE-FEET


REACH 2
31 Tons of Rock
- Base Flow
- Low Flow (Nov. 2013)
- Fence
PP1 - Photo Point
- Existing Pool
NOTE: See Design Drawing Pages 10-11: Detail Drawings for Installation of Weir, J-Hook, Barb and Cover Logs. Structure Sites Established by Mancos Conservation District Technician
Tons = Quarry Rock Volume
Beaver Pond
PP2
FLOW
Match Line 2
Match Line 1
Beaver Pond
Side Channel
Sheek Ditch Co. Headgate
Alternate Point of Diversion
Beaver Pond
Maintain Existing Log Jam
Side Channel
Install J-Hook 11 Tons
Install Weir 14 Tons
PP3
Install Bank Barb 6 Tons
Fence
Match Line 4
Match Line 3
Bear Property
Flanagan Property
Access to Reach 1 and 2 via Pond Driveway and Gate at GPS Control Points #2 & 3, Adjacent to County Road J on Flanagan Property (see Legend-Drawing Page 2)
REACH 2
Diversion Project Phase II
Mancos River
South of Mancos
Montezuma Cty, CO.
Page 4 of 13 - Plan Drawings
N
0
100
200
SCALE-FEET

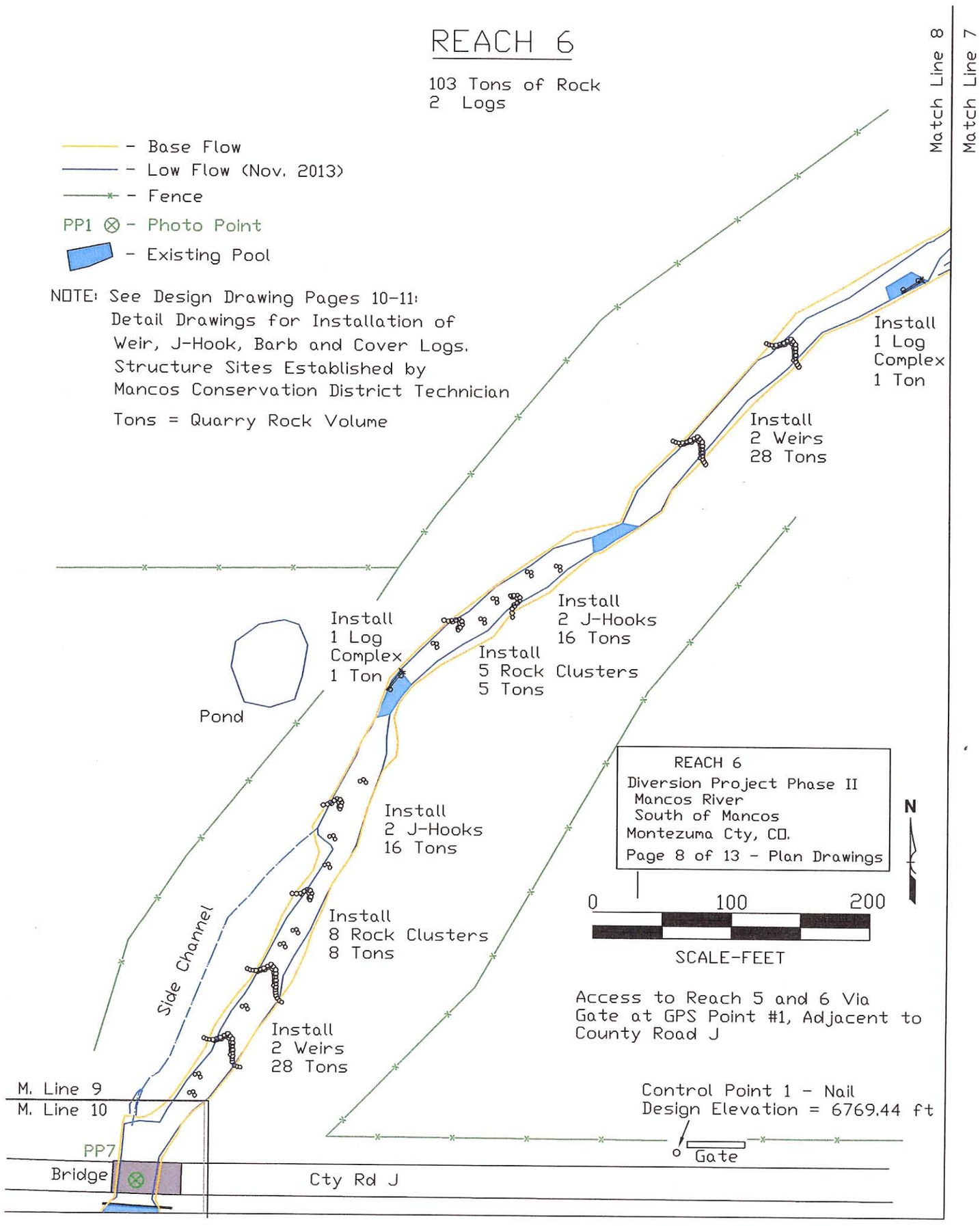

REACH 3
56 Tons of Rock
FLOW
Match Line 4
Match Line 3
– Base Flow
– Low Flow (Nov. 2013)
PP1 ⊗ – Photo Point
– Existing Pool
NOTE: See Design Drawing Pages 10-11:
Detail Drawings for Installation of
Weir, J-Hook, Barb and Cover Logs.
Structure Sites Established by
Mancos Conservation District Technician
Tons = Quarry Rock Volume
Access to Reach 3 and 4 via
Bear Property Driveway
Install
3 J-Hooks
24 Tons
Install
4 J-Hooks
32 Tons
PP4
Bear Residence
Driveway
Bridge
Match Line 5
Match Line 6
REACH 3
Diversion Project Phase II
Mancos River
South of Mancos
Montezuma Cty, CO.
Page 5 of 13 - Plan Drawings
N
0
100
200
SCALE-FEET


Match Line 5
Match Line 6
REACH 4
32 Tons of Rock
FLOW
Driveway
Pond
PP5
- Base Flow
- Low Flow (Nov. 2013)
- Fence
PP1 - Photo Point
- Existing Pool
NOTE: See Design Drawing Pages 10-11:
Detail Drawings for Installation of
Weir, J-Hook, Barb and Cover Logs.
Structure Sites Established by
Mancos Conservation District Technician
Tons = Quarry Rock Volume
Access to Reach 3 and 4 via
Bear Property Driveway
Install
4 J-Hooks
32 Tons
Fence
Alexander Property
Bear Property
Reach 5 Begins 3,360 Lineal Feet
Downstream of Alexander/Bear
Fenceline (no match line)
REACH 4
Diversion Project Phase II
Mancos River
South of Mancos
Montezuma Cty, CO.
Page 6 of 13 - Plan Drawings
N
0
100
200
SCALE-FEET


(no match line)
REACH 5
72 Tons of Rock
1 Log
Install
Bank Barb
6 Tons
Maintain
Existing
Fallen Log
- Base Flow
- Low Flow (Nov. 2013)
- Fence
PP1 - Photo Point
- Existing Pool
FLOW
Reach 4 is
3,360 Lineal
Ft. Upstream
(no match line)
NOTE: See Design Drawing Pages 10-11:
Detail Drawings for Installation of
Weir, J-Hook, Barb and Cover Logs.
Structure Sites Established by
Mancos Conservation District Technician
Tons = Quarry Rock Volume
Install
2 J-Hooks
16 Tons
Install
2 J-Hooks
16 Tons
Gate
Install
2 Weirs
28 Tons
PP6
Install
5 Rock Clusters
5 Tons
Install
1 Log Complex
1 Ton
Match Line 8
Match Line 7
Access to Reach 5 and 6 Via
Gate at GPS Point #1, Adjacent to
County Road J
REACH 5
Diversion Project Phase II
Mancos River
South of Mancos
Montezuma Cty, CO.
Page 7 of 13 - Plan Drawings
N
0
100
200
SCALE-FEET

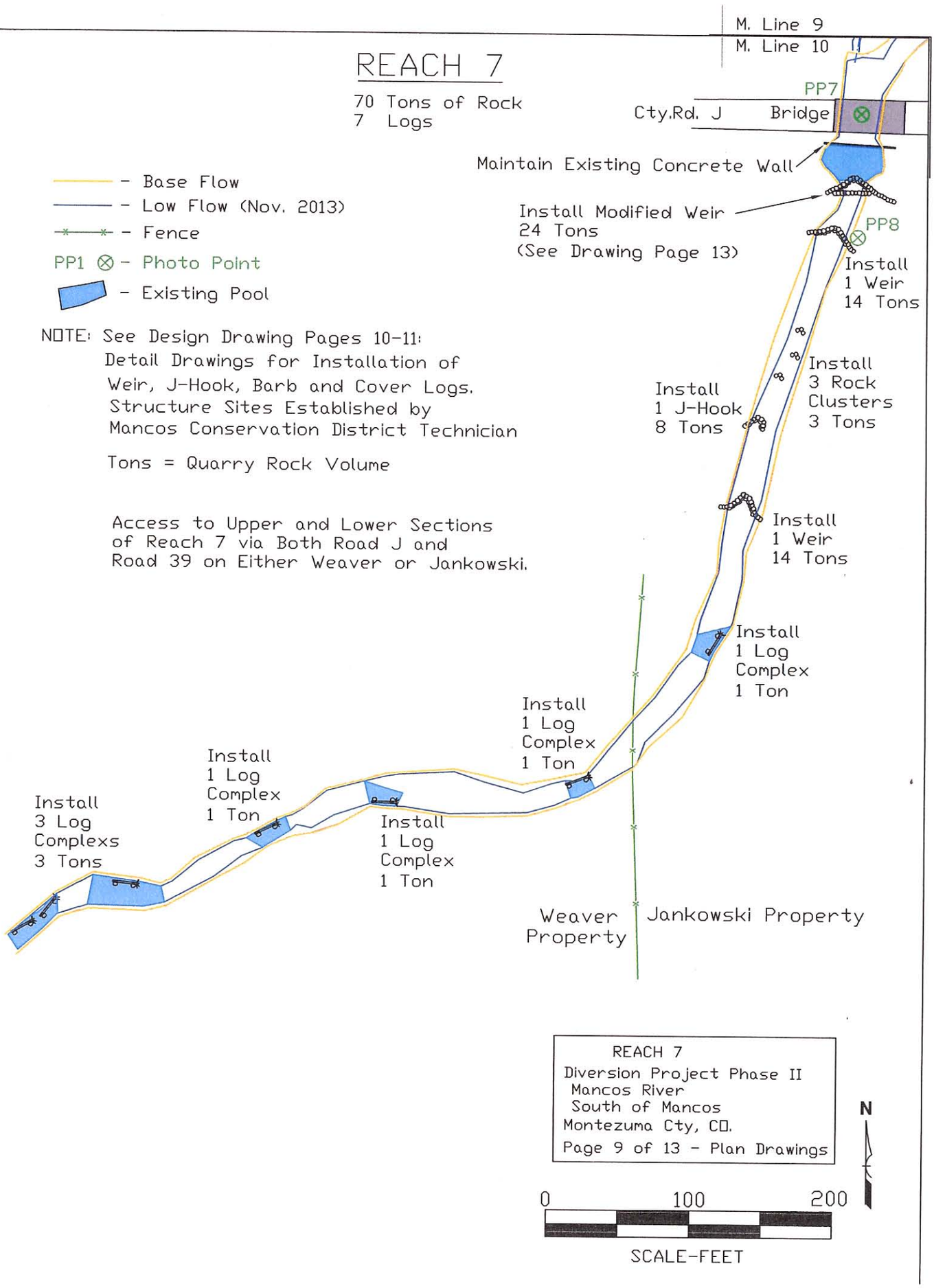
REACH 6

103 Tons of Rock
2 Logs



REACH 7

70 Tons of Rock
7 Logs



- Base Flow
- Low Flow (Nov. 2013)
- Fence
- PP1 ⊗ - Photo Point
- Existing Pool

NOTE: See Design Drawing Pages 10-11:
Detail Drawings for Installation of
Weir, J-Hook, Barb and Cover Logs.
Structure Sites Established by
Mancos Conservation District Technician

Tons = Quarry Rock Volume

Access to Upper and Lower Sections
of Reach 7 via Both Road J and
Road 39 on Either Weaver or Jankowski.

REACH 7
Diversion Project Phase II
Mancos River
South of Mancos
Montezuma Cty, CO.
Page 9 of 13 - Plan Drawings

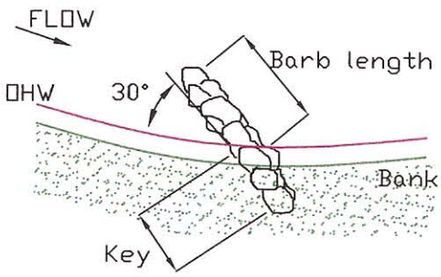
N

0 100 200

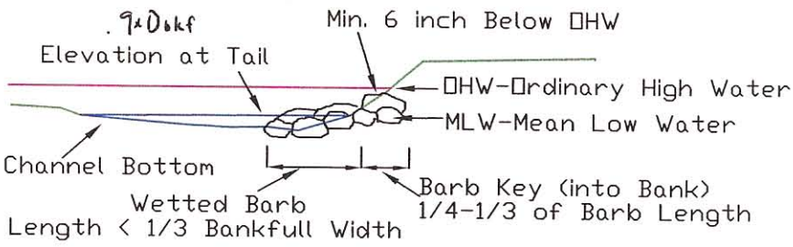
SCALE-FEET

DESIGN DETAILS
Instream Structures

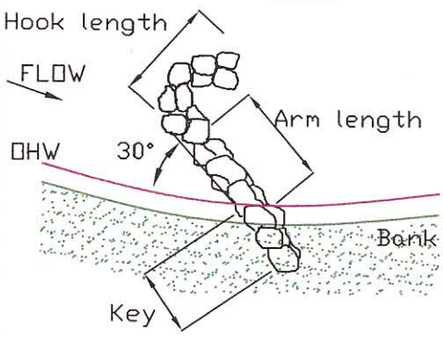
BANK BARB
Plan View



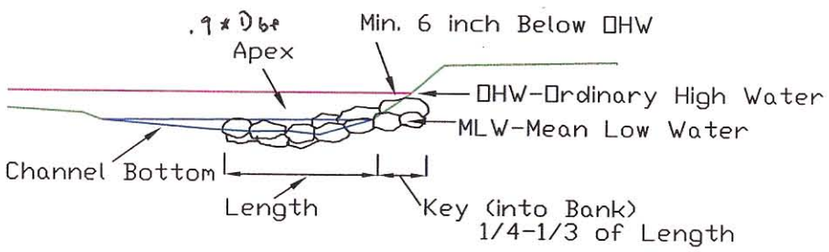
BANK BARB
Profile View



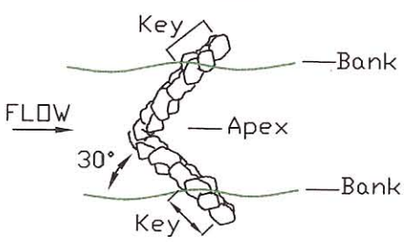
J-Hook
Plan View



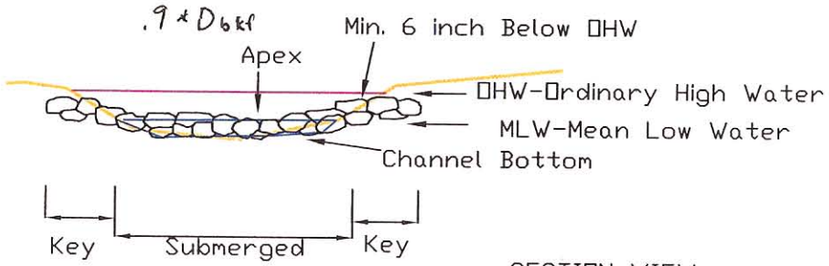
J-Hook
Profile View



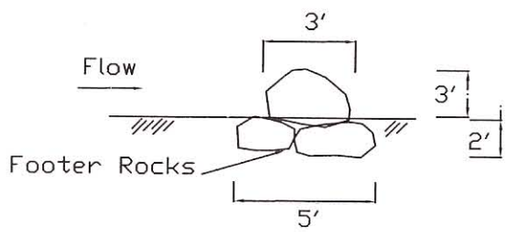
WEIR
Plan View



WEIR
Profile View



SECTION VIEW



ROCK VOLUME

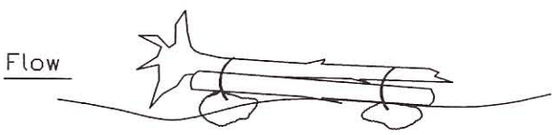
Average 3 ft Diameter Rock = 0.5 Tons/Rock
Average 10 ft Barb with 3 ft Key = 6 Tons
Average 15 ft J-Hook with 3 ft Key = 8 Tons
Average 20 ft Weir with 3 ft Keys = 14 Tons

% OF MATERIAL SMALLER THAN TYPICAL STONE	TYPICAL STONE DIMENSIONS, inches
100	48
50-70	38
35-50	26
0	18

DESIGN DETAILS - ROCK
Diversion Project Phase II
Mancos River
Montezuma Cty, CO.
Page 10 of 13 - Plan Drawings

DESIGN DETAILS
Anchoring Log Complexes

Cabled to Boulders

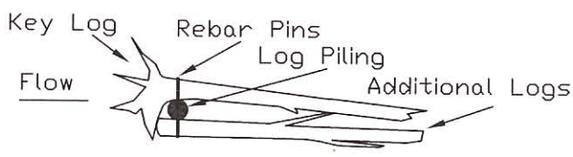


PROFILE

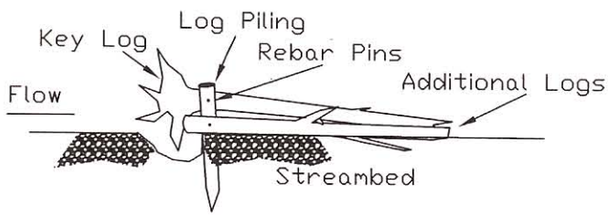
Cables epoxyed into holes drilled into rock

END VIEW

Piling Anchored

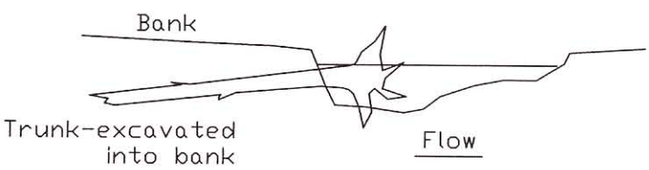


PLAN VIEW

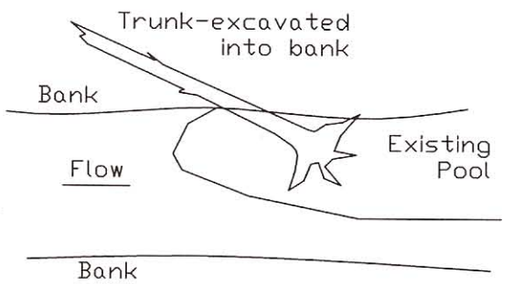


PROFILE VIEW

Stem Buried in Streambank
Single Root Wad or Complex Logs



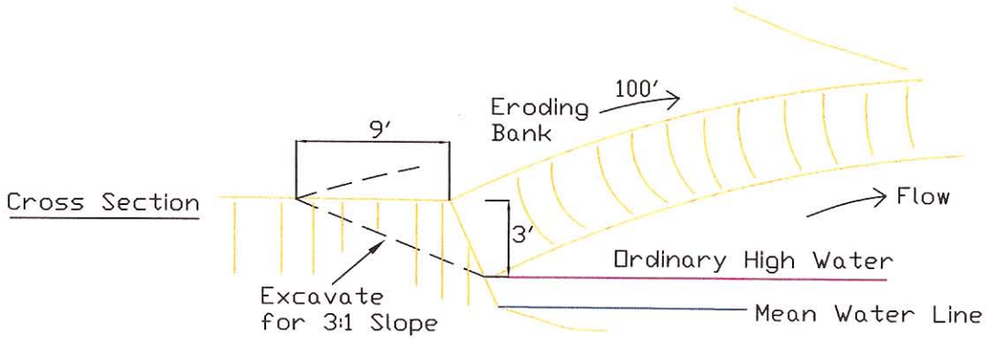
Profile Along ℄ of Stream

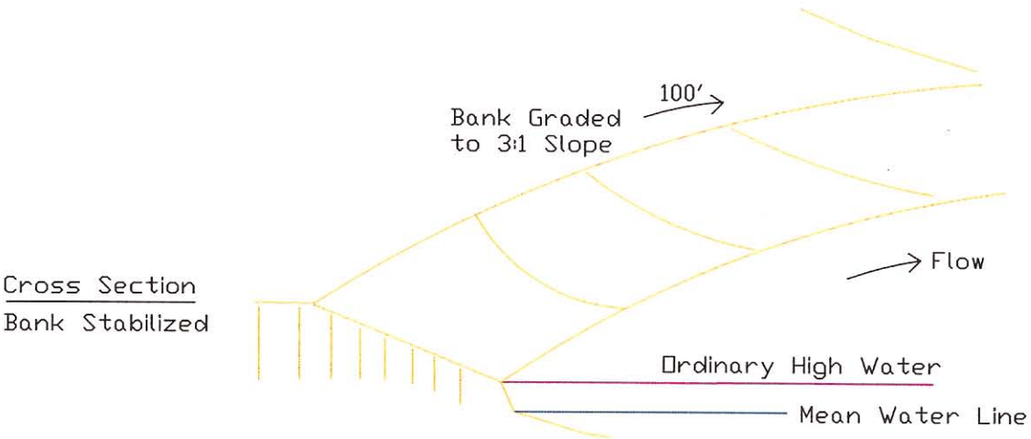


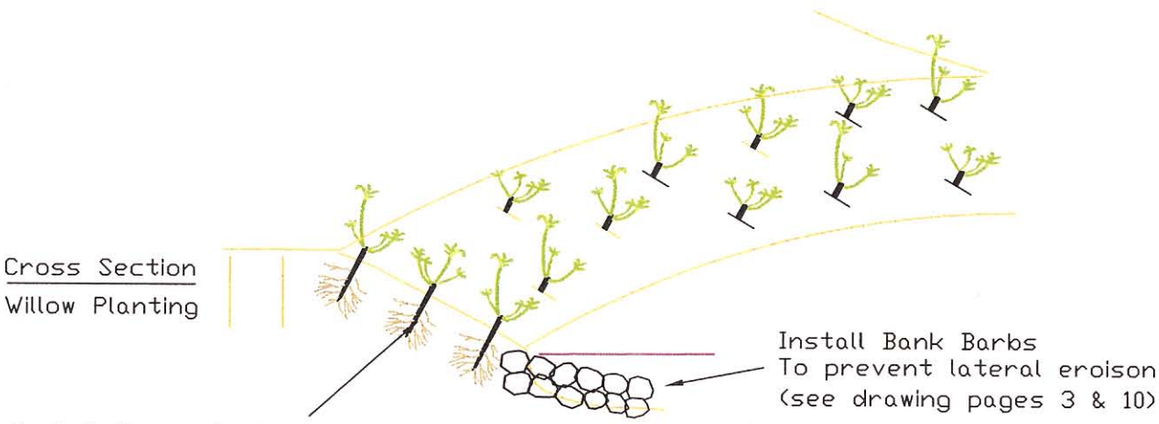
PLAN VIEW

DESIGN DETAILS - WOOD
Diversion Project Phase II
Mancos River
South of Mancos
Montezuma Cty, CO.
Page 11 of 13 - Plan Drawings

STREAMBANK EROSION REPAIR
REACH 1
Not to Scale







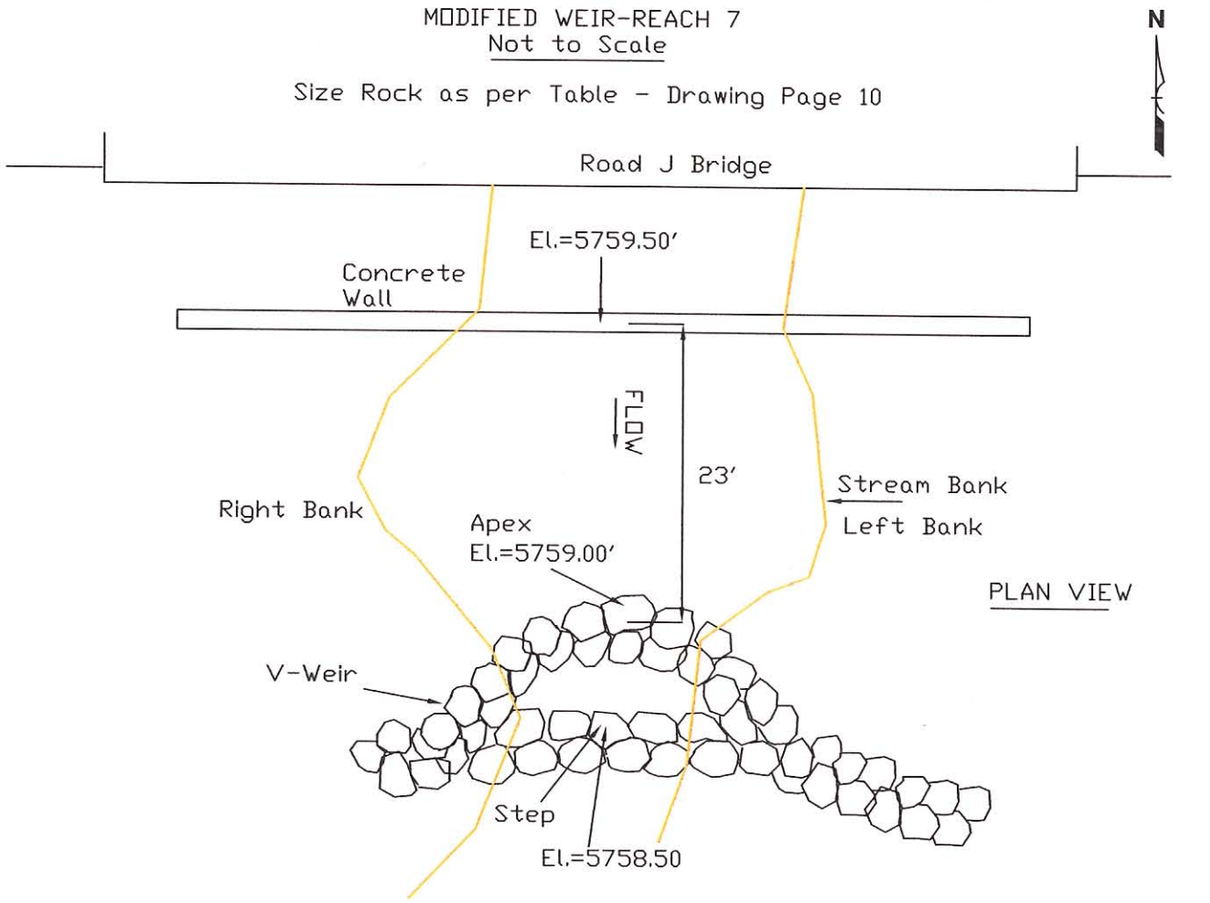
Install Dormant Live Willow Stakes in Spring.
Live Stakes are Generally 1/2 to 1 1/2 Inches in Diameter and 2-3 Feet Long.
Refer to NRCS Engineering Field Handbook, Chapter 16-Streambank and Shoreline Protection, Pages 16-13 and 16-14, Live Stakes.

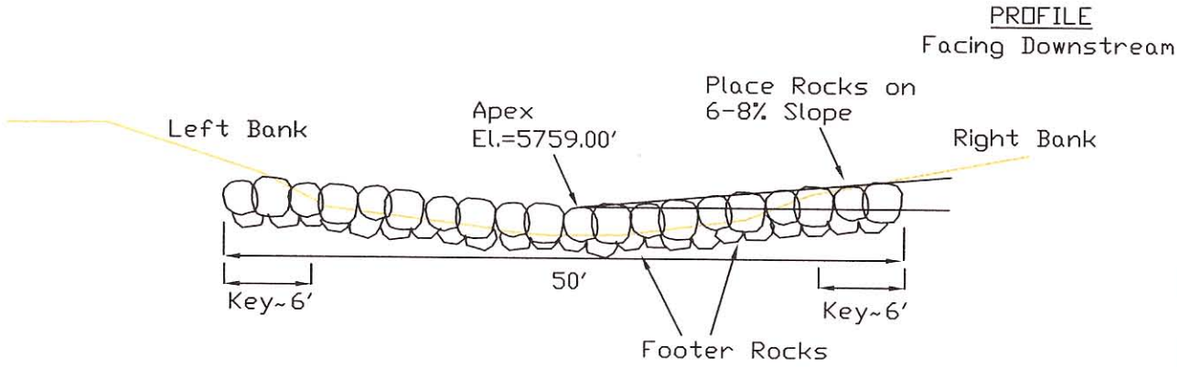
Note: Drawing of rooted/leafed condition is not representative of the stakes at the time of installation.

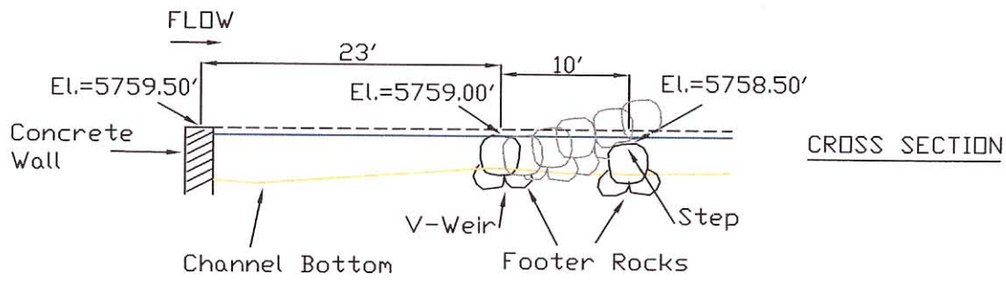
STREAMBANK
Diversion Project Phase II
Mancos River
South of Mancos
Montezuma Cty, CO.
Page 12 of 13 - Plan Drawings

MODIFIED WEIR-REACH 7
Not to Scale

Size Rock as per Table - Drawing Page 10







Design Elevations Based on Temporary Benchmark Elevation and are Plus or Minus 100' of USGS Elevations.

MODIFIED WEIR
Diversion Project Phase II
Mancos River
South of Mancos
Montezuma Cty, CO.