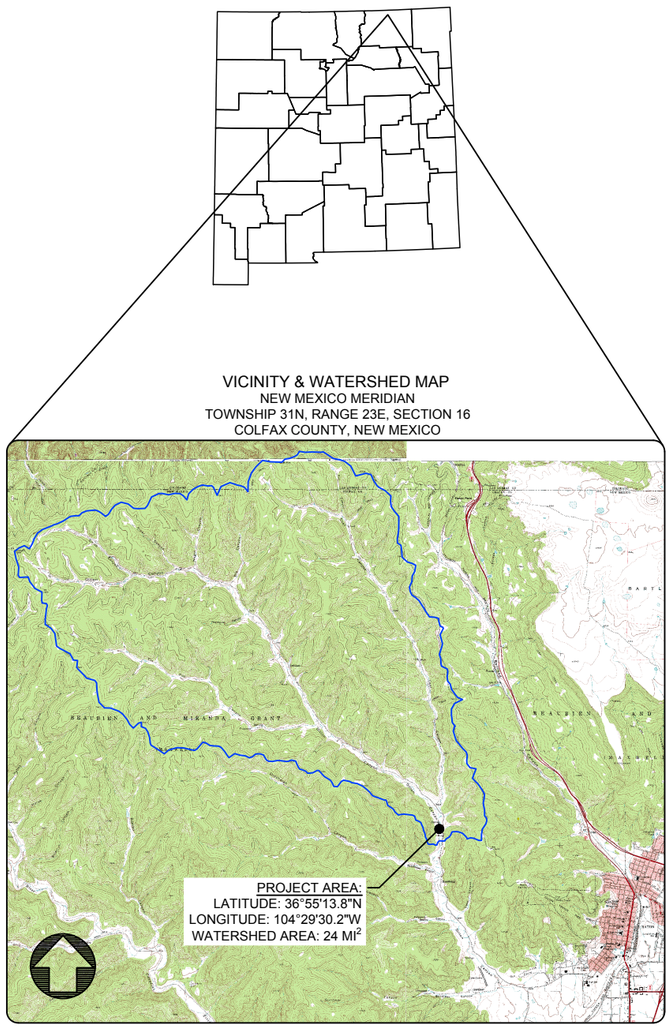
Swastika Mine and Dutchman Canyon Maintenance and Stream Restoration Project

Construction Drawings - 100% Submittal

Vermejo Park Ranch, Colfax County, NM

EMNRD-MMD-2020-03



VICINITY & WATERSHED MAP
NEW MEXICO MERIDIAN
TOWNSHIP 31N, RANGE 23E, SECTION 16
COLFAX COUNTY, NEW MEXICO

Recovered Riffle Section - Dillon Canyon

SUBMITTED TO

CLIENT:
New Mexico Energy, Minerals and Natural Resources Department
Mining and Minerals Division
Abandoned Mine Land Program
1220 S. Saint Francis Drive
Santa Fe, NM 87505
(505) 476-3423

PROJECT MANAGER:
Joe Vinson & Laurence D'Alessandro

PROJECT ENGINEER:
Mike Tompson & Yeny Maestas

PROJECT PARTNER:
Vermejo Park Ranch (VPR)
PO Box Drawer E
Raton, NM
(505) 445-3097

SUBMITTED BY

ENGINEERING DESIGN & PLAN PREPARATION:
Oxbow Ecological Engineering, LLC
3491 S. Gillenwater Drive
Flagstaff, AZ 86005
(928) 266-6192

REVEGETATION DESIGN & STREAM RESTORATION TECHNICAL ADVISOR:
NCD Engineering, Inc.
2900 N. West St. Ste 5
Flagstaff, AZ 86004
(928) 774 2336

STREAM RESTORATION TECHNICAL ADVISOR:
Watershed Artisans, Inc.
1000 Cordova Place #832
Santa Fe, NM, 87505
(505) 577-9625

SHEET INDEX

CAUTION

THIS PROJECT REQUIRES CONSTRUCTION WORK IN, AROUND, AND OVER HAZARDOUS AND UNPROTECTED MINE SHAFTS, STOPES, ADITS, AND OTHER OPENINGS WHICH MAY BE OPEN TO THE SURFACE OR HIDDEN FROM VIEW BY TRASH, DEBRIS, OR THIN AND UNSTABLE LAYERS OF SURFACE MATERIALS OR ROCK. THE CONSTRUCTOR SHALL BE RESPONSIBLE FOR THOROUGHLY INVESTIGATING THE SITE CONDITIONS AND SCHEDULING EQUIPMENT, EQUIPMENT OPERATIONS, PERSONNEL AND SAFETY PROCEDURES TO PREVENT ACCIDENTS AND INJURIES.

oxbow ecological engineering, llc
river + riparian + wetland + wildland
3491 S Gillenwater Dr ● Flagstaff, AZ 86005
(928) 266-6192 ● www.oxbow-eco-eng.com

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New Mexico Abandoned Mine Land Program
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PROJECT ENGINEER:
Mike Tompson & Yeny Maestas

PARTNER:
Vermejo Park Ranch
PO Box Drawer 'E'
Raton, NM
(505) 445-3097

DRAWN BY: GFC

DESIGNED BY: NA

REVIEWED BY: NA

ENGINEER OF RECORD:

GEORGE F. CATHEY
NEW MEXICO
21540
1-31-20
PROFESSIONAL ENGINEER

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DATE:	OEE PROJECT #:
01.31.20	NM-007-03

DRAWING:
Cover Sheet

DRAWING #:	SHEET #:	REVISION #:
CVR01	1 OF 24	1

Abbreviations

@	AT
AB	AGGREGATE BASE
AC	ACRE
ACP	ASPHALT CONCRETE PAVEMENT
APPROX	APPROXIMATELY
CC	CENTER TO CENTER
CFS	CUBIC FEET PER SECOND
℄	CENTER LINE
CLSM	CONTROLLED LOW STRENGTH MATERIAL
CMP	CORRUGATED METAL PIPE
CONC	CONCRETE
CP	CONTROL POINT
CY	CUBIC YARD
Ø	DIAMETER
DIPS	DUCTILE IRON PIPE SIZE
DR	DIMENSION RATIO
DTL	DETAIL
DWG	DRAWING
EA	EACH
ELEV	ELEVATION
EX	EXISTING
FG	FINISHED GRADE ELEVATION
FL	FLOWLINE ELEVATION
FPT	FEMALE PIPE THREAD
FT	FEET
FTG	FITTING
GA	GAUGE
GALV	GALVANIZED
GB	GRADE BREAK
GPM	GALLONS PER MINUTE
H	HEIGHT
HDPE	HIGH DENSITY POLYETHYLENE
IE	INVERT ELEVATION
IN.	INCH
L	LENGTH
LB	POUNDS
LF	LINEAR FEET
LS	LUMP SUM
MAX	MAXIMUM
M.E.	MATCH EXISTING
MIN	MINIMUM
MISC	MISCELLANEOUS
MPT	MALE PIPE THREAD
NO.	NUMBER
NTS	NOT TO SCALE
OC	ON CENTER
OEE	OXBOW ECOLOGICAL ENGINEERING, LLC
OHWM	ORDINARY HIGH WATER MARK
PE	LOW DENSITY POLYETHYLENE
PROP.	PROPOSED
PSI	POUNDS PER SQUARE INCH
R	RADIUS
REQD	REQUIRED
SCH	SCHEDULE
SF	SQUARE FEET
SHT	SHEET
STA	STATION
STD	STANDARD
SY	SQUARE YARD
SYMM	SYMMETRICAL
TN	TONS
TYP	TYPICAL
VLV	VALVE
W	WIDTH
W/	WITH
WCS	WATER CONTROL STRUCTURE
WSE	WATER SURFACE ELEVATION

Construction Notes & Estimated Quantities

SITE PREPARATION

103 (1 LS) CLEARING, GRUBBING, STRIPPING, SALVAGE & DISPOSAL

EARTHWORK ELEMENTS

201 (1,260 CY) EXCAVATE & SHAPE STREAM CHANNEL & POINT BARS

202 (960 CY) FILL & SHAPE FLOODPLAIN BENCHES

203 (1 LS) REMOVE AND DISPOSE OF OVERBURDEN

204 (1,500 LF) SHAPE UPLAND CHANNEL

STREAM STABILIZATION ELEMENTS

301 (17 EA) SUPPLY & CONSTRUCT BOULDER CROSS VANES

302 (26 EA) SUPPLY & CONSTRUCT BOULDER CLUSTERS

303 (1 EA) SUPPLY & CONSTRUCT BOULDER BASIN

304 (1 EA) SUPPLY & CONSTRUCT GRADED ROCK BASIN

305 (20 EA) SUPPLY & CONSTRUCT GRADED ROCK RIFFLES

306 (380 LF) SUPPLY & CONSTRUCT GRADED ROCK SILLS

307 (8 EA) SUPPLY & CONSTRUCT GRADED ROCK STREAM BARBS

308 (170 LF) SUPPLY & INSTALL BIODEGRADABLE COIR LOGS

UPLAND STABILIZATION ELEMENTS

401 (16 EA) SUPPLY & CONSTRUCT ROCK MULCH RUNDOWN

402 (16 EA) SUPPLY & CONSTRUCT MEDIA LUNA

403 (75 EA) SUPPLY & CONSTRUCT ONE ROCK DAM

404 (13 EA) SUPPLY & CONSTRUCT ZUNI BOWL

NATIVE PLANTINGS

501 (1,800 PLUGS) PLACE WETLAND PLUGS: COMMON SPIKERUSH

502 (1,800 PLUGS) PLACE WETLAND PLUGS: BALTIC & TORREY'S RUSH

503 (1,950 CLUSTERS) PLACE RIPARIAN POLE PLANTINGS: 3-POLE WILLOW CLUSTER

504 (170 LF) PLACE RIPARIAN POLE CUTTINGS: SHINGLED WILLOW FASCINE

505 (90 CLUSTERS) PLACE RIPARIAN POLE CUTTINGS: 3-POLE COTTONWOOD CLUSTER

506 (1 AC) SPREAD & MULCH NATIVE SEED MIX: RIPARIAN

507 (1 AC) SPREAD & MULCH NATIVE SEED MIX: UPLAND

TABLE 1: Data Sources

NUMBER	TYPE	DATE	SOURCE	DESCRIPTION
1	AERIAL IMAGERY	2014	WILSON & COMPANY	UNMANNED AERIAL SYSTEM (UAS) POST-FLOOD PHOTO PROVIDED BY WILSON & COMPANY, INC.
2	TOPOGRAPHY (AS-BUILT)	2012	AML	AS-BUILT INFORMATION PROVIDED BY AML.
3	TOPOGRAPHY (RTK GPS SUPPLEMENTAL SURVEY)	10/2014 & 7/2019	OEE	SUPPLEMENTAL POST FLOOD SURVEY INFORMATION WAS COLLECTED BY OEE IN OCTOBER 2014 & JULY 2019 TO AUGMENT AND ENHANCE EXISTING 2012 AS-BUILT SITE INFORMATION FROM AML. THIS SUPPLEMENTAL SURVEY WAS TIED TO VERMEJO PARK RANCH CONTROL NETWORK. SEE TABLE 2 & 3 FOR MORE INFO.
4	AVOIDANCE AREAS: ARCHEOLOGICAL SITES	NA	AML	CULTURAL FEATURES IDENTIFIED BEFORE AND DURING THE 2012 CONSTRUCTION PROJECT. THIS DATA SET INCLUDED FEATURES IDENTIFIED AS *DOCUMENTED & PRESERVED*, *DOCUMENTED & REBURIED*, AND *UNKNOWN*.
5	AVOIDANCE AREAS: MILKWEED PLANTING SITES	NA	AML	MILKWEED PLANTING AREAS TO BE PRESERVED, IF POSSIBLE

TABLE 2: Datum & Coordinate Projection Information

HORIZONTAL DATUM	NAD83
PROJECTED COORDINATE SYSTEM	NEW MEXICO STATE PLANE EAST ZONE (3001)
VERTICAL DATUM	NAVD88
GEOID MODEL	GEOID12A (CONUS)
UNITS	SURVEY FEET

NOTES

THE SURVEY WAS TIED TO THE VERMEJO PARK RANCH CONTROL NETWORK WITHIN DILLON AND DUTCHMAN CANYON. THE POINTS IN THE TABLE WERE RECOVERED AS PART OF A BENCHMARK SEARCH CONDUCTED BY OEE.

TABLE 3: Control Points

NUMBER	NORTHING	EASTING	ELEVATION	DESIGNATION	DESCRIPTION
1	2,155,420.19	494,902.98	6,839.94	HV-303	RED PLASTIC CAP STAMPED WITH "CONTROL POINT, NMPS 11599"
2	2,151,226.29	494,570.54	6,767.62	HV-305	RED PLASTIC CAP STAMPED WITH "CONTROL POINT, NMPS 11599"
3	2,152,071.52	494,934.87	6,803.60	CP-310	RED PLASTIC CAP STAMPED WITH "CONTROL POINT, NMPS 11599"
4	2,151,454.14	492,978.56	6,809.14	CP-711	RED PLASTIC CAP STAMPED WITH "CONTROL POINT, NMPS 11599"

Assessment Data Summary

			Dimension/Cross Section Data								Pattern Data	Profile Data
	Watershed Area	Stream Classification	Bankfull Area (A_{BKF})	Bankfull Width (W_{BKF})	Bankfull Mean Depth (D_{BKF})	Bankfull Maximum Depth (D_{MBKF})	Width to Depth Ratio (W_{BKF}/D_{BKF})	Width of Floodprone Area (W_{FPA})	Entrenchment Ratio (W_{FPA}/W_{BKF})	Inner Berm Area (A_{IB})	Sinuosity (K)	Average Water Surface Slope (S)
	mi^2	-	ft^2	ft	ft	ft	ft/ft	ft	ft/ft	ft^2		ft/ft
Coal Canyon B4c Reference Reach [Rosgen Design Table Conversion]	23.8	B4c	21.6	23.8	0.91	1.62	26.2	37.3	1.6	6.1	1.26	0.01460
Dillon Canyon C4 Reference Reach [Rosgen Design Table Conversion]	23.8	C4	21.6	17.9	1.21	2.23	14.8	61.8	3.5	6.3	1.21	0.01482
Regional Relationships Eastern Arizona & New Mexico Sites [Moody (2003)]	23.8	-	24.2	24.1	1.00	1.67	24.1	NA	NA	NA	NA	NA
Dillon Canyon F4 Impaired Reach [Rosgen Design Table Conversion]	23.8	F4	21.6	26.1	0.83	1.47	31.5	32.2	1.2	5.9	1.22	0.01316

Design References

1.1. Analysis of the Magnitude and Frequency of Peak Discharge and Maximum Observed Peak Discharge in New Mexico and Surrounding Areas, 2008, US Geological Survey.
1.2. Applied River Morphology, 1996, David Rosgen.
1.3. Design of Stream Barbs (Engineering Technical Note No. 23), 2005, Natural Resources Conservation Service.
1.4. Erosion Control Field Guide, 2013, Craig Sponholtz & Avery Anderson
1.5. Let the Water Do the Work, 2012, Bill Zeedyk & Van Clothier
1.6. Regional Relationships for Bankfull Stage in Natural Channels of the Arid Southwest, 2003, Tom Moody et al
1.7. Stream Corridor Restoration: Principles, Processes, and Practices (Part 653 National Engineering Handbook), 2001, Natural Resources Conservation Service.
1.8. Streambank Soil Bioengineering (Part 654 National Engineering Handbook, Technical Supplement 14I), 2007, Natural Resources Conservation Service.
1.9. Streambank Soil Bioengineering Field Guide for Low Precipitation Areas, 2002, Natural Resources Conservation Service.
1.10. StreamStats v4.1.6, US Geological Survey.

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PARTNER:
Vermejo Park Ranch
PO Box Drawer 'E'
Raton, NM
(505) 445-3097

DRAWN BY: GFC
DESIGNED BY: GFC
REVIEWED BY: NA

ENGINEER OF RECORD:

GEORGE F. CATHEY NEW MEXICO 21540 1-31-20 PROFESSIONAL ENGINEER

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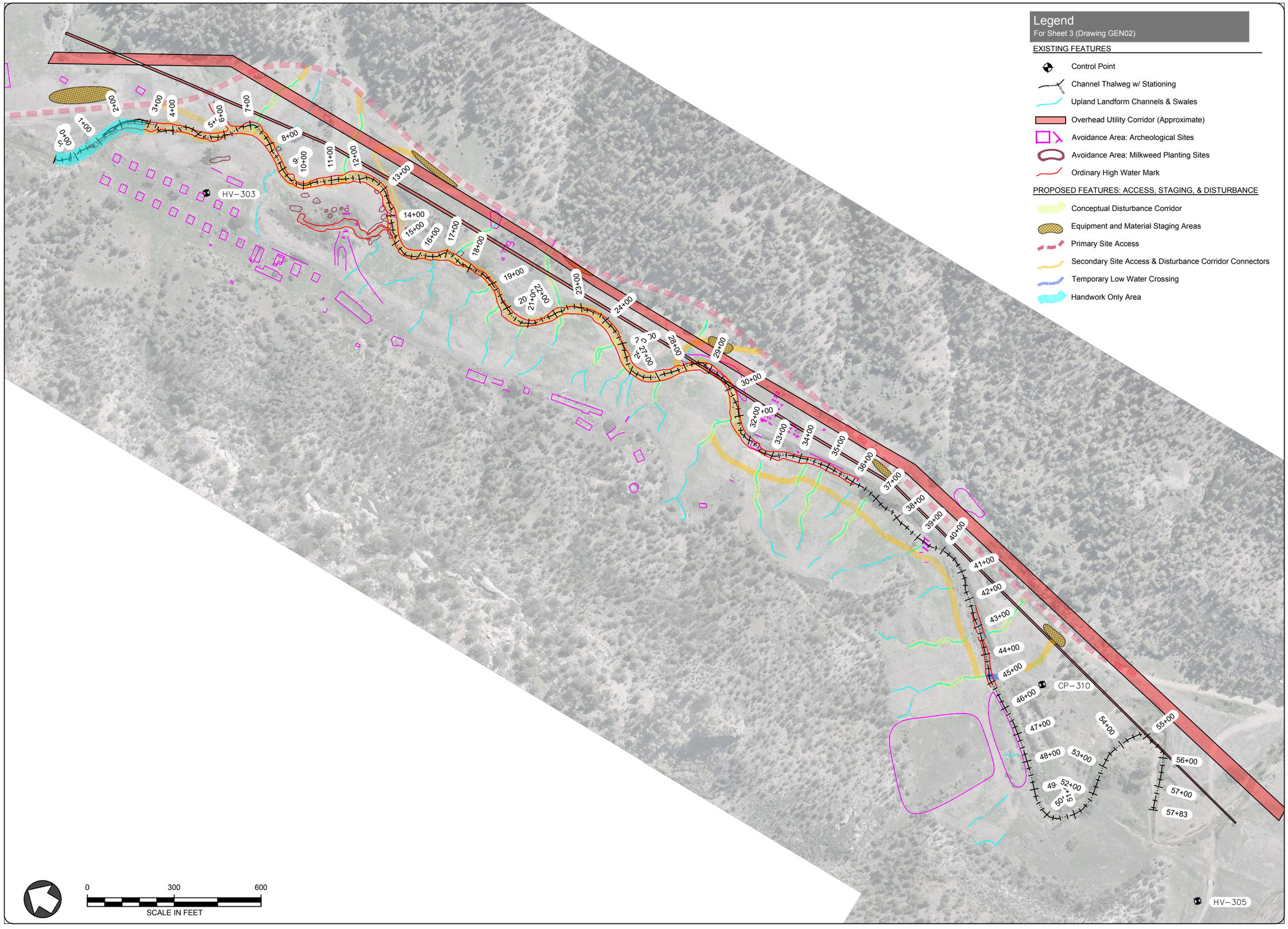
DATE: 01.31.20
OEE PROJECT #: NM-007-03

DRAWING:
General Notes: Abbreviations, Quantity Summary, Data Sources, & Control Points

DRAWING #: GEN01
SHEET #: 2 OF 24
REVISION #: 0



Legend
For Sheet 3 (Drawing GEN02)

EXISTING FEATURES

- Control Point
- Channel Thalweg w/ Stationing
- Upland Landform Channels & Swales
- Overhead Utility Corridor (Approximate)
- Avoidance Area: Archeological Sites
- Avoidance Area: Milkweed Planting Sites
- Ordinary High Water Mark

PROPOSED FEATURES: ACCESS, STAGING, & DISTURBANCE

- Conceptual Disturbance Corridor
- Equipment and Material Staging Areas
- Primary Site Access
- Secondary Site Access & Disturbance Corridor Connectors
- Temporary Low Water Crossing
- Handwork Only Area

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PO Box Drawer 'E'
Raton, NM
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DRAWING:
Site Overview:
Access, Staging, Jurisdictional & Avoidance Areas

DRAWING #:	SHEET #:	REVISION #:
GEN02	3 OF 24	0

Legend

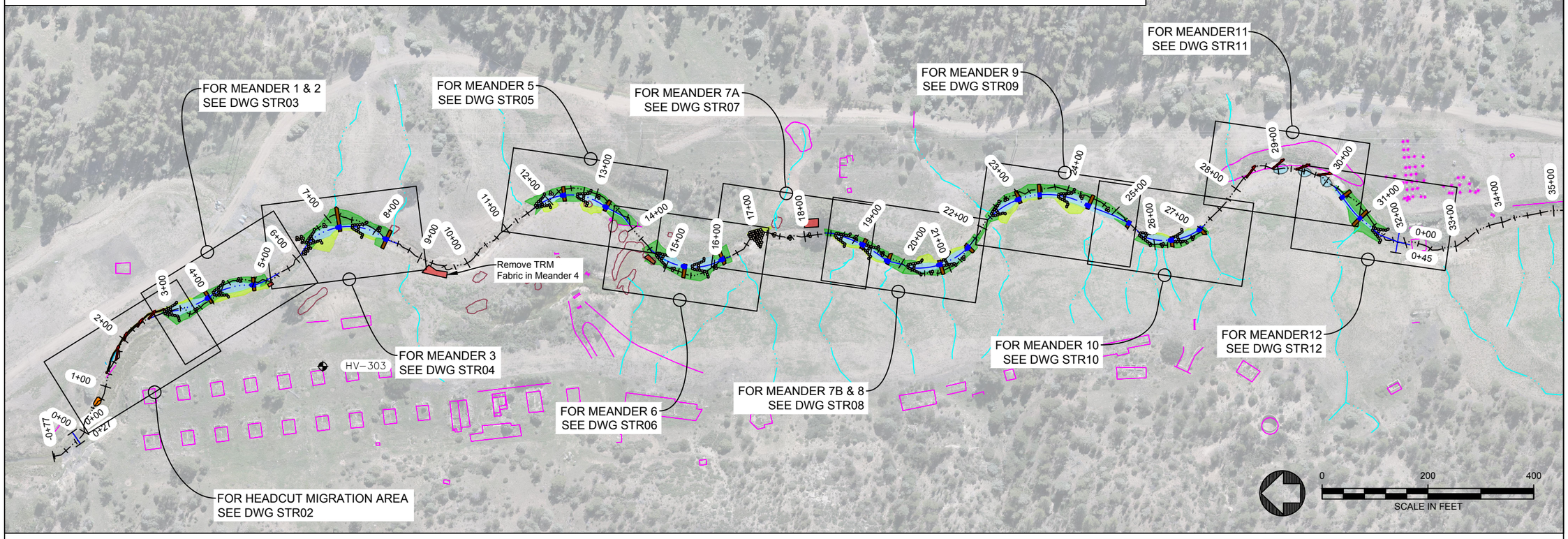
For Sheet 4-15 (Drawing STR01-STR12)

EXISTING FEATURES

- Control Point
- Channel Thalweg w/ Stationing
- Major Contour @ 5 Foot Interval
- Minor Contour @ 1 Foot Interval
- Upland Landform Channels & Swales
- Avoidance Area: Archeological Sites
- Avoidance Area: Milkweed Planting Sites

PROPOSED FEATURES: STREAM STABILIZATION

- 201 — Construction Note
- A/2 — Construction Item View, Section, or Detail Indicator: Letter Designation (Top) and Sheet Reference (Bottom)
- Finished Grade Major Contour @ 5 Foot Interval
- Finished Grade Minor Contour @ 1 Foot Interval
- Boulder Cross Vane (S05 16) (S06 16)
- Boulder Cluster (S14 17)
- Boulder Basin (S13 17)
- Graded Rock Basin (S09 17)
- Graded Rock Riffle (S01 16) (S03 16)
- Graded Rock Sill (S03 16) (S04 16)
- Graded Rock Stream Barb (S07 17) (S08 17)
- Shingled Willow Fascine (S10 17) (S12 17)
- Biodegradable Coir Logs (S10 17) (S11 17)
- New Stream Channel Thalweg
- Stream Channel Excavation & Shaping (S01 16) (S02 16) (S15 18) (S16 18)
- Point Bar Excavation & Shaping (S01 16) (S02 16) (S15 18) (S16 18)
- Floodplain Bench Fill & Shaping (S01 16) (S02 16) (S15 18) (S16 18)
- Remove Exposed Erosion Control Fabric



Project Description

The New Mexico Abandoned Mine Land (AML) Program, in partnership with Vermejo Park Ranch, is working to mitigate the effects of legacy coal mining on land and water resources at the Swastika Mine Reclamation site. As part of this effort, AML completed work in 2012 to:

- Stabilize and reclaim an extensive series of steep and actively eroding coal gob piles within Dillon Canyon using geomorphic approaches to create a restored landform
- Restore a straightened and deeply incised section of stream channel adjacent to the gob piles

Recent flooding in the canyon has caused project wide erosion to restored elements including gullying of swales and channels constructed as part of the upland landform restoration and down-cutting, scour, and lateral migration of the constructed stream channel.

Project Goals & Objectives

Based on the inventory and post-flood analysis completed for the project, the restoration team developed a set of site specific practices that could be used to mitigate flood damage in the canyon. This conceptual "restoration toolbox" includes measures that, if implemented holistically, could help to enhance water quality, improve stream stability and function, and expand wetland and riparian habitat.

- Water Quality Enhancement Goals: Reduce sediment pollution from eroding banks (BEHI/NBS/BANCS model), decrease width-to-depth to reduce temperature and increase dissolved oxygen, improve sediment transport/channel competency
- Short-term/Long-term River Stability Goals: Increase entrenchment ratio (flood relief) with floodplain benches on riffles and meanders, construct deep pools to dissipate energy on meanders, integrate large boulders to protect floodplain benches as vegetation is established, integrate grade control to prevent further downcutting
- Habitat Improvement Goals: Increase wetland/riparian acreage with floodplain bench and other plantings.

Primary Design Elements

The following sheets include examples of each restoration practice along with its potential impacts to the project goals. The remainder of the sheets in this drawing set show the placement of these elements within the stream corridor.

Pool Construction/Bank Stabilization at Meanders

- Construct deep pools on meander bends based on reference data to help dissipate energy.
- Construct floodplain benches on the outside bank of the meander, integrating large boulders clusters to protect the bank and bench
- It should be noted that bedrock may be encountered throughout the site and equipment shall be utilized to excavate through the rock to meet the lines and grades shown on the plans.

Channel Conversion/Enhancement

- Reshape F4 and damaged B4c riffles sections to stable B4c configurations by constructing inner berms and benches.

Grade Control

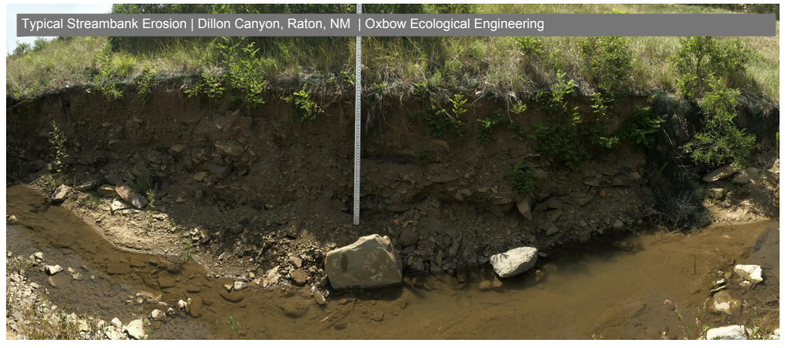
- Place cross vanes at the head of pools and constructed riffles & sills at the tailout to provide grade control.

Native Plantings

- Densely plant benches and other designated areas with willow poles, wetland plugs, and seed.

Erosion Control Fabric Removal

- Carefully remove all unvegetated, damaged sections of erosion control fabric along the channel banks, as shown on plans.



Typical Streambank Erosion | Dillon Canyon, Raton, NM | Oxbow Ecological Engineering

Streambank Erosion

Most outside meander banks within the constructed channel have eroded significantly, leaving raw vertical/overhanging banks and partially formed lateral scour pools. The height of these banks relative to bankfull depth combined with steep bank angles, little or no root density or bank protection, and stratified bank soils creates a high potential for further bank erosion. Without intervention/stabilization efforts to address these impairments, these banks could become a significant source of non-point source sediment pollution and could threaten upland landform restoration measures and sensitive historical sites.

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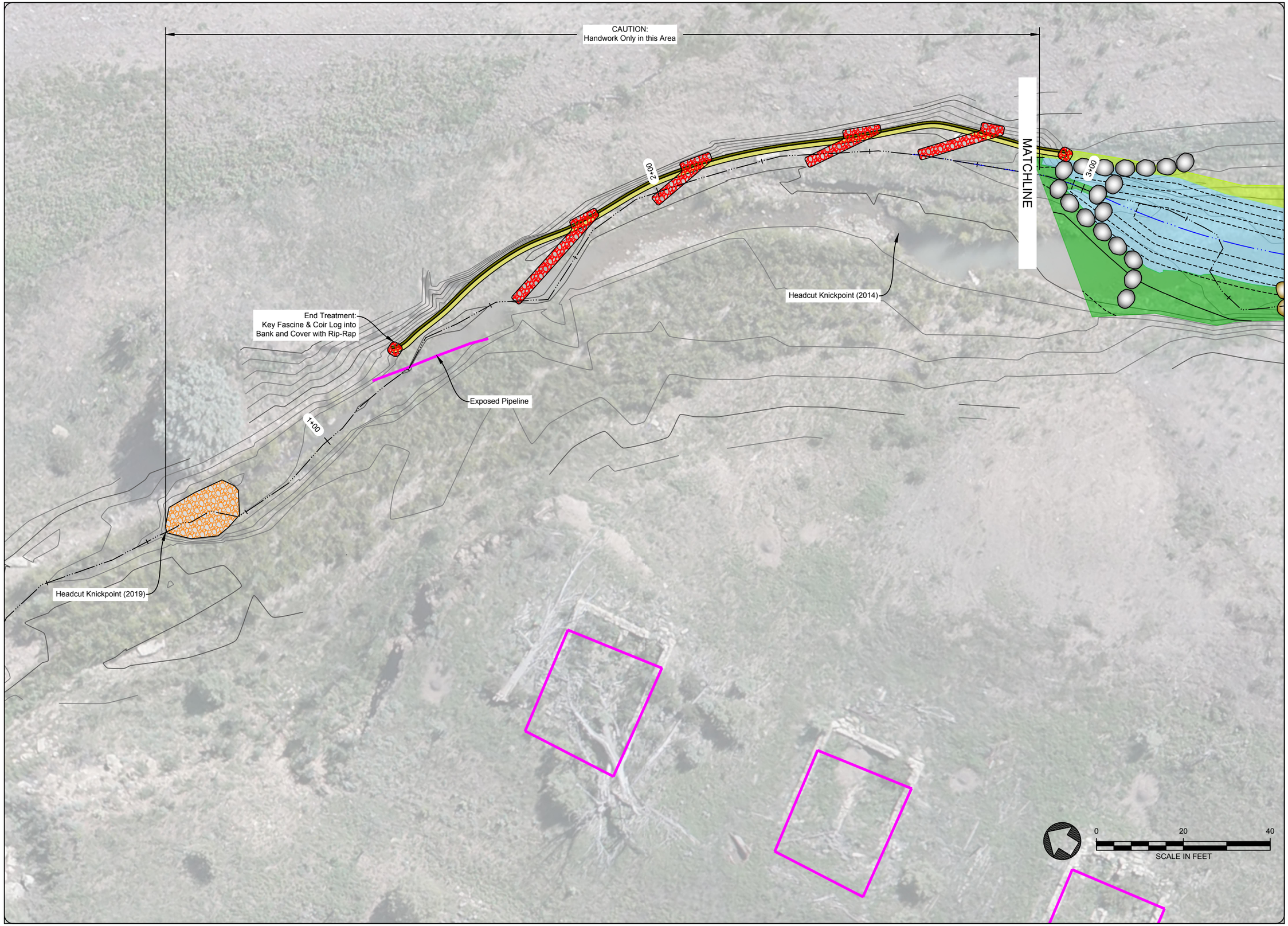
01.31.20	NM-007-03

DRAWING:
Stream Stabilization:
Improvement Plan Overview

DRAWING #:	SHEET #:	REVISION #:
STR01	4 OF 24	0



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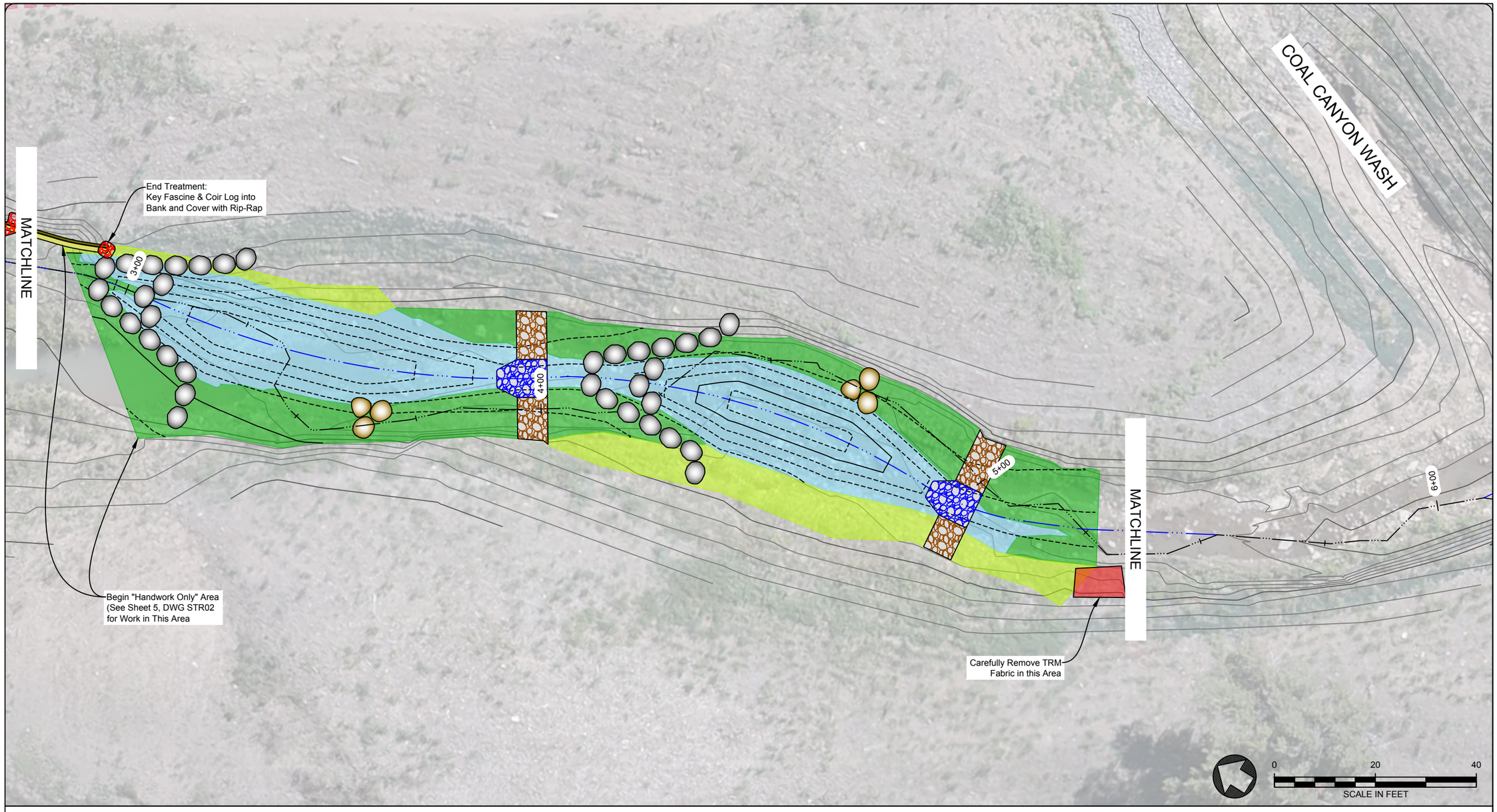
DRAWING:
Stream Stabilization:
Headcut Migration Area
Plan

DRAWING #:	SHEET #:	REVISION #:
STR02	5 OF 24	1



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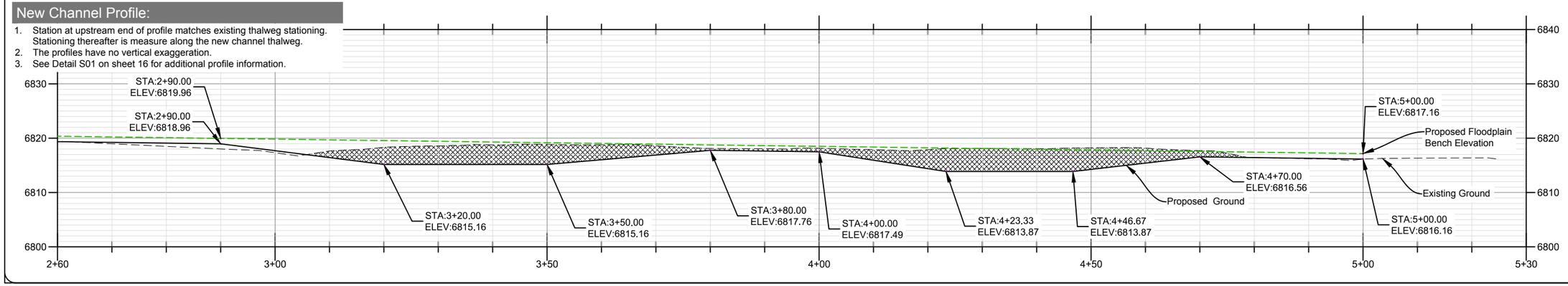

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PROJECT NAME:
Swastika Mine and Dutchman Canyon Maintenance and Stream Restoration Project

LOCATION:
Vermejo Park Ranch
Colfax County, NM

PROJECT NUMBER:
EMNRD-MMD-2020-03

PROJECT PHASE:
Construction Drawings
100% Submittal

CLIENT:
New Mexico Abandoned Mine Land Program
1220 South St. Francis Dr
Santa Fe, NM 87505
(505) 476-3476

PROJECT MANAGER:
Joe Vinson & Laurence D'Alessandro

PROJECT ENGINEER:
Mike Tompson & Yeny Maestas

PARTNER:
Vermejo Park Ranch
PO Box Drawer 'E'
Raton, NM
(505) 445-3097

DRAWN BY: GFC

DESIGNED BY: GFC

REVIEWED BY: NA

ENGINEER OF RECORD:
GEORGE F. CATHEY
NEW MEXICO
21540
1-31-20
PROFESSIONAL ENGINEER

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01.31.20	NM-007-03

DRAWING:
Stream Stabilization:
Meander 1 & 2
Plan & Profile

DRAWING #:	SHEET #:	REVISION #:
STR03	6 OF 24	0

COAL CANYON WASH

Protect existing banks and new benches with ~6 boulder clusters near the confluence with Coal Canyon

6+00

7+00

8+00

9+00

MATCHLINE

0 20 40

SCALE IN FEET

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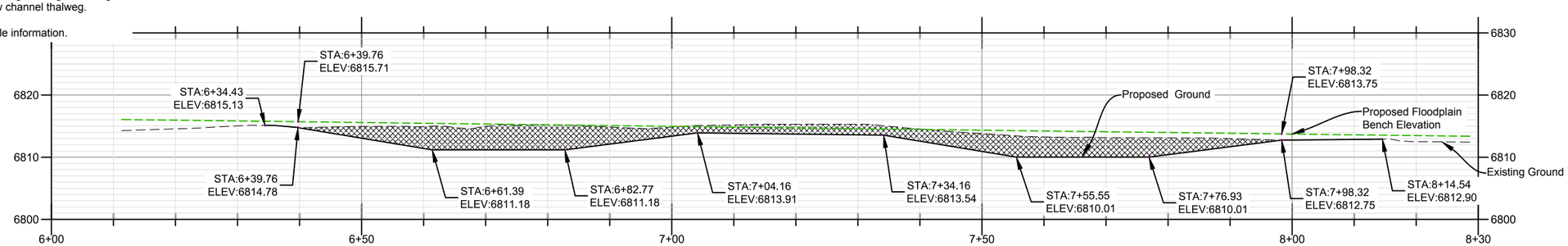

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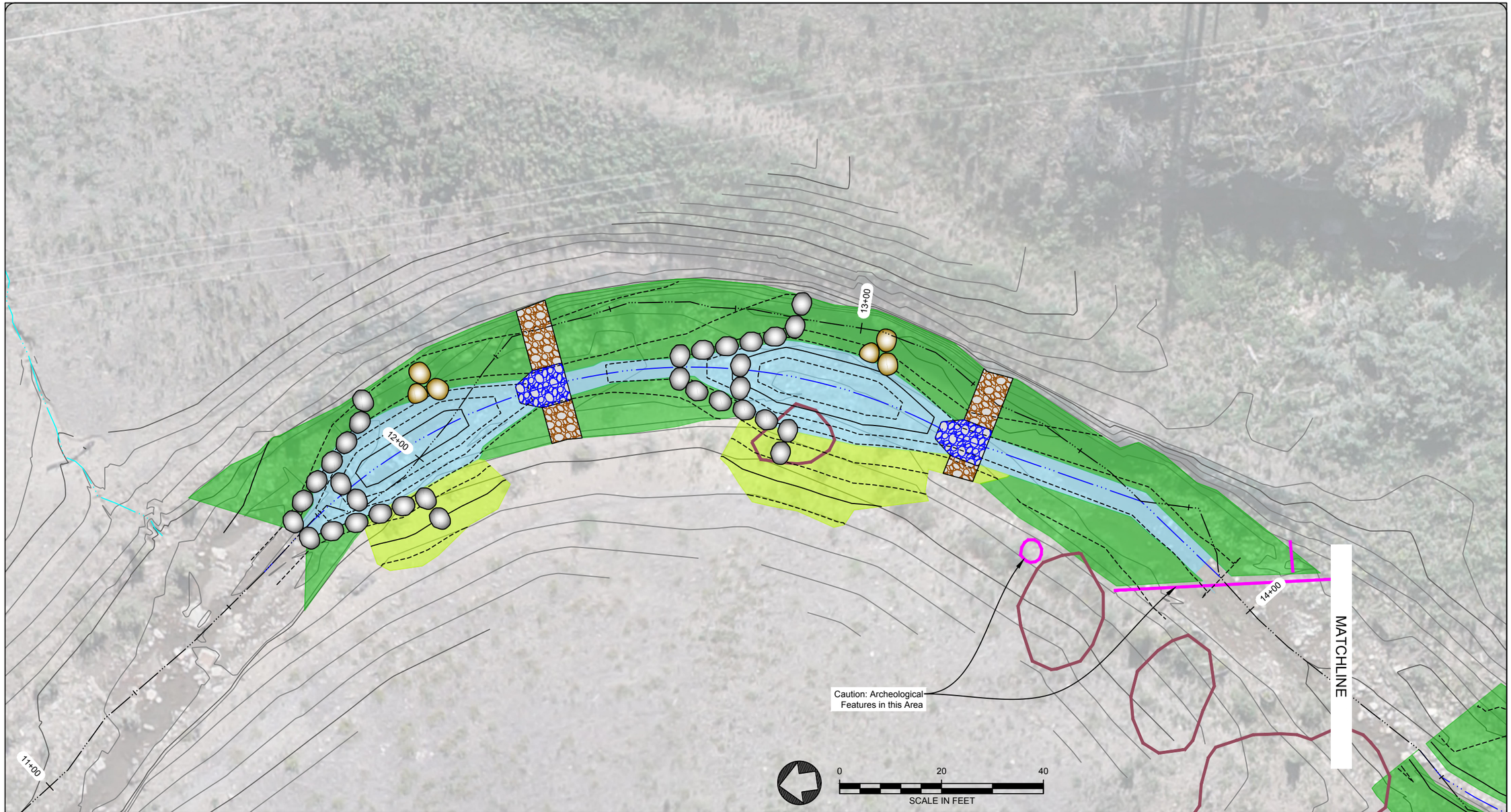
DRAWING:
Stream Stabilization:
Meander 3
Plan & Profile

DRAWING #:	SHEET #:	REVISION #:
STR04	7 OF 24	0



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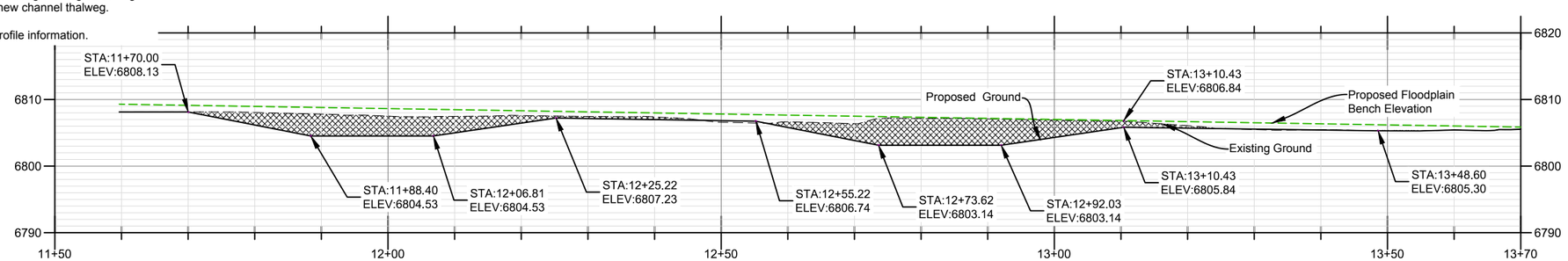

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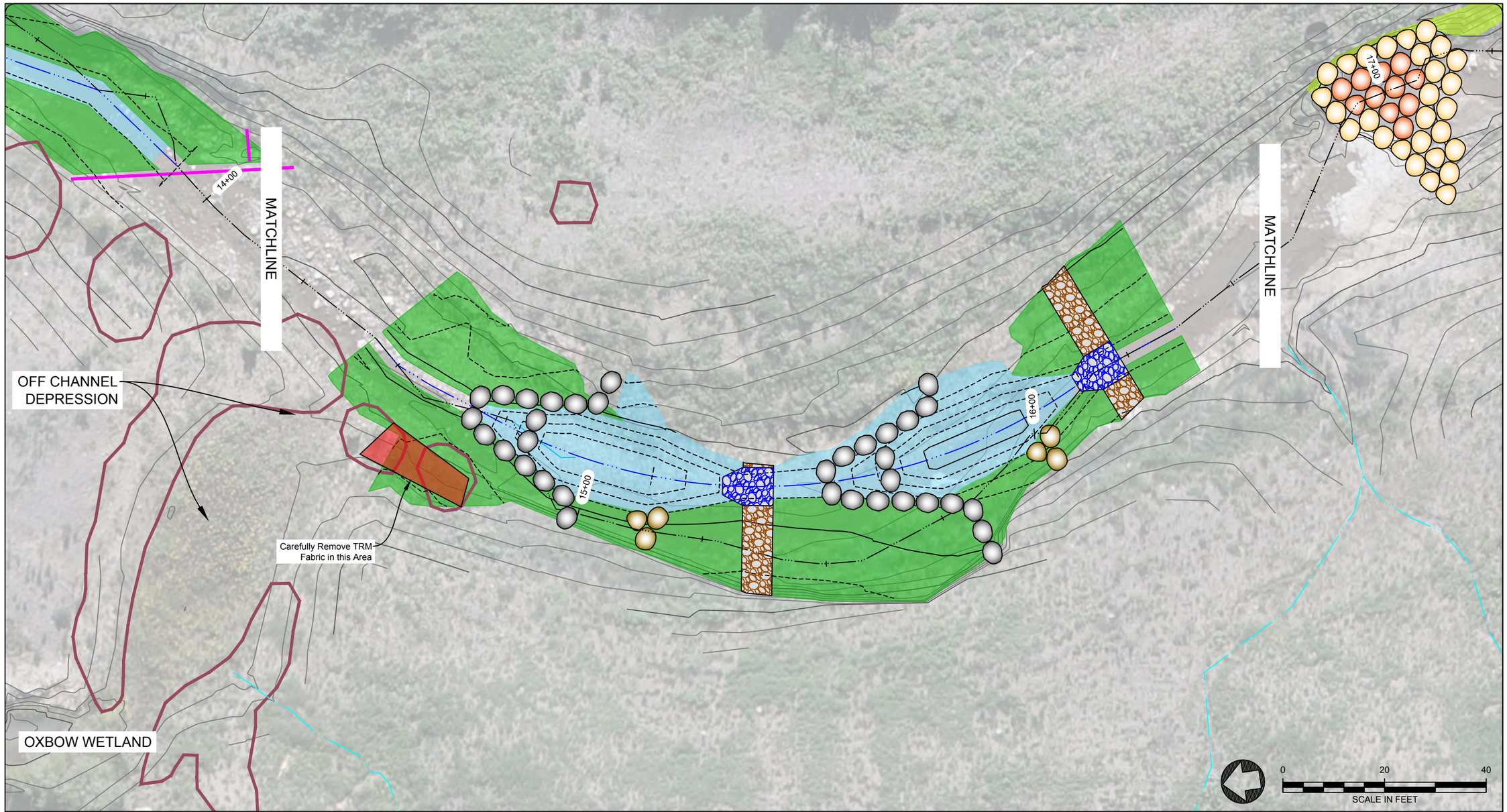
DRAWING:
Stream Stabilization:
Meander 5
Plan & Profile

DRAWING #:	SHEET #:	REVISION #:
STR05	8 OF 24	1



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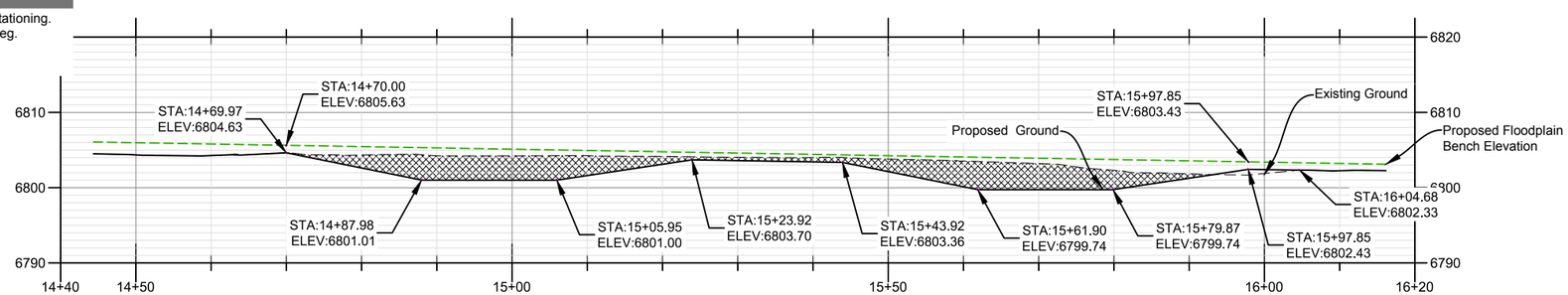

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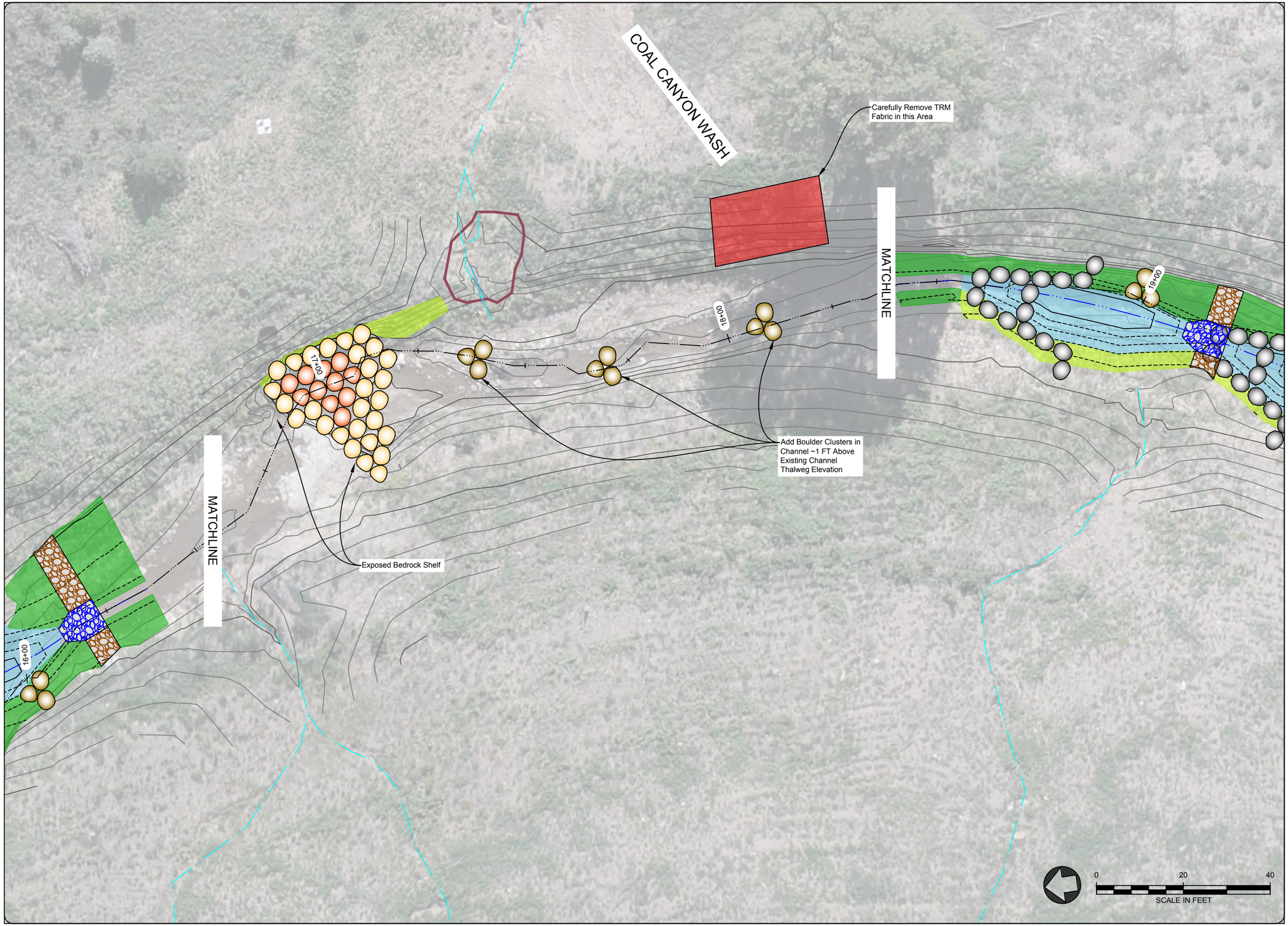
DRAWING:
Stream Stabilization:
Meander 6
Plan & Profile

DRAWING #:	SHEET #:	REVISION #:
STR06	9 OF 24	0



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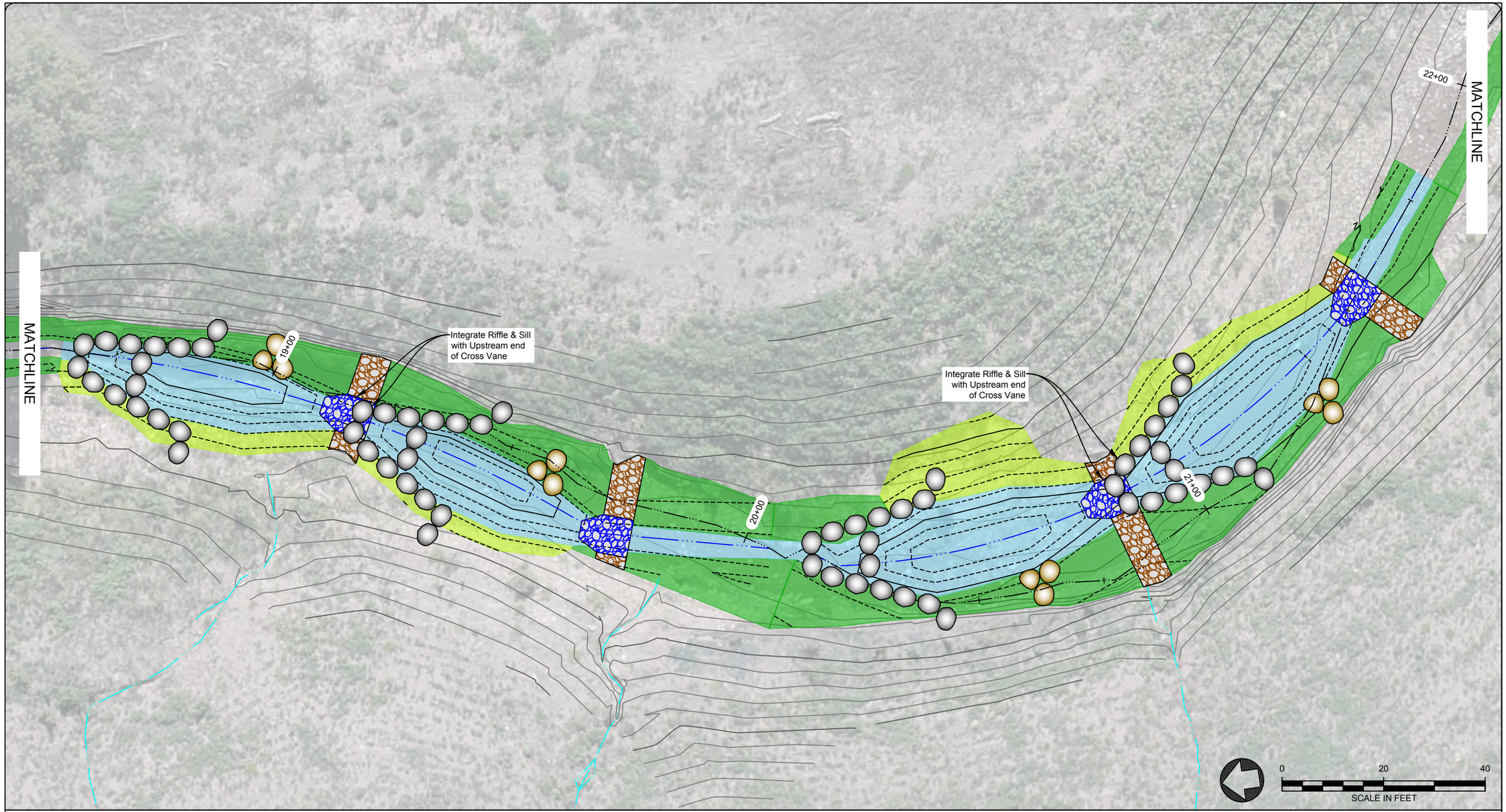
DRAWING:
Stream Stabilization:
Meander 7A
Plan

DRAWING #:	SHEET #:	REVISION #:
STR07	10 OF 24	0



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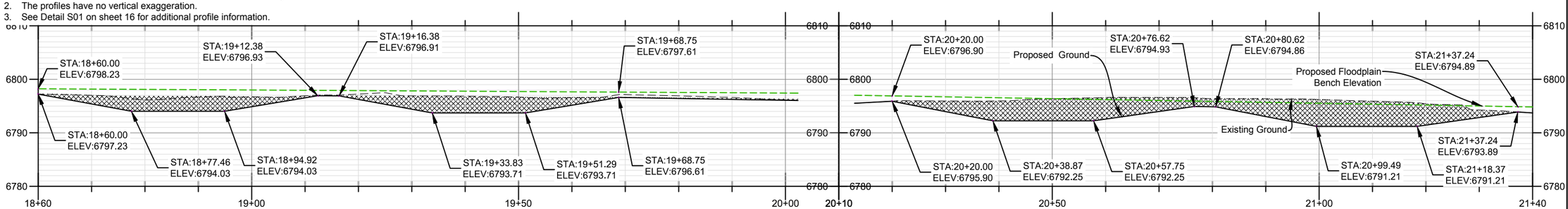

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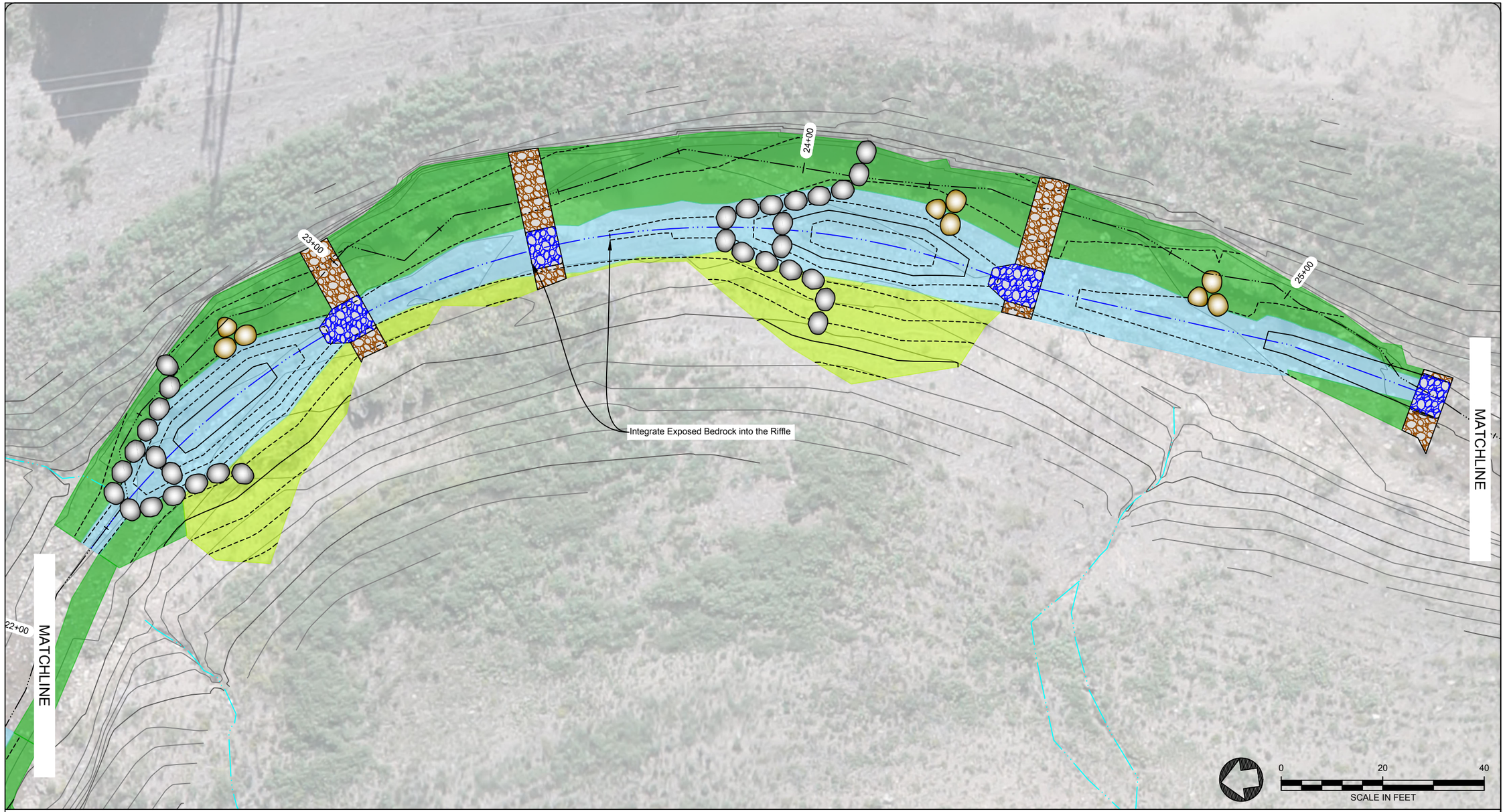
DRAWING:
Stream Stabilization:
Meander 7B & 8
Plan & Profile

DRAWING #:	SHEET #:	REVISION #:
STR08	11 OF 24	0



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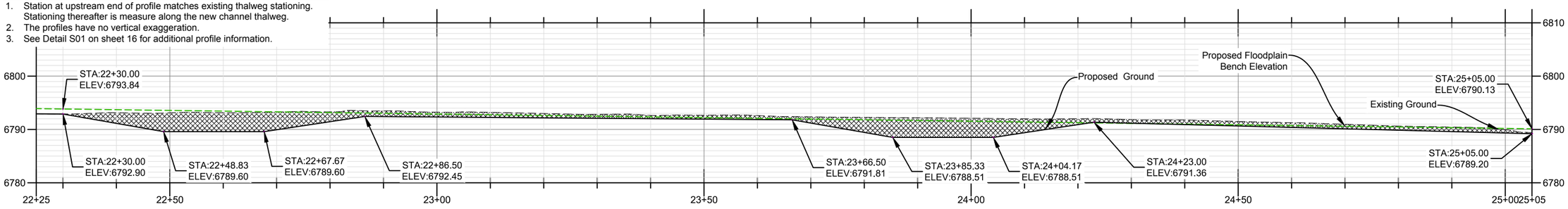

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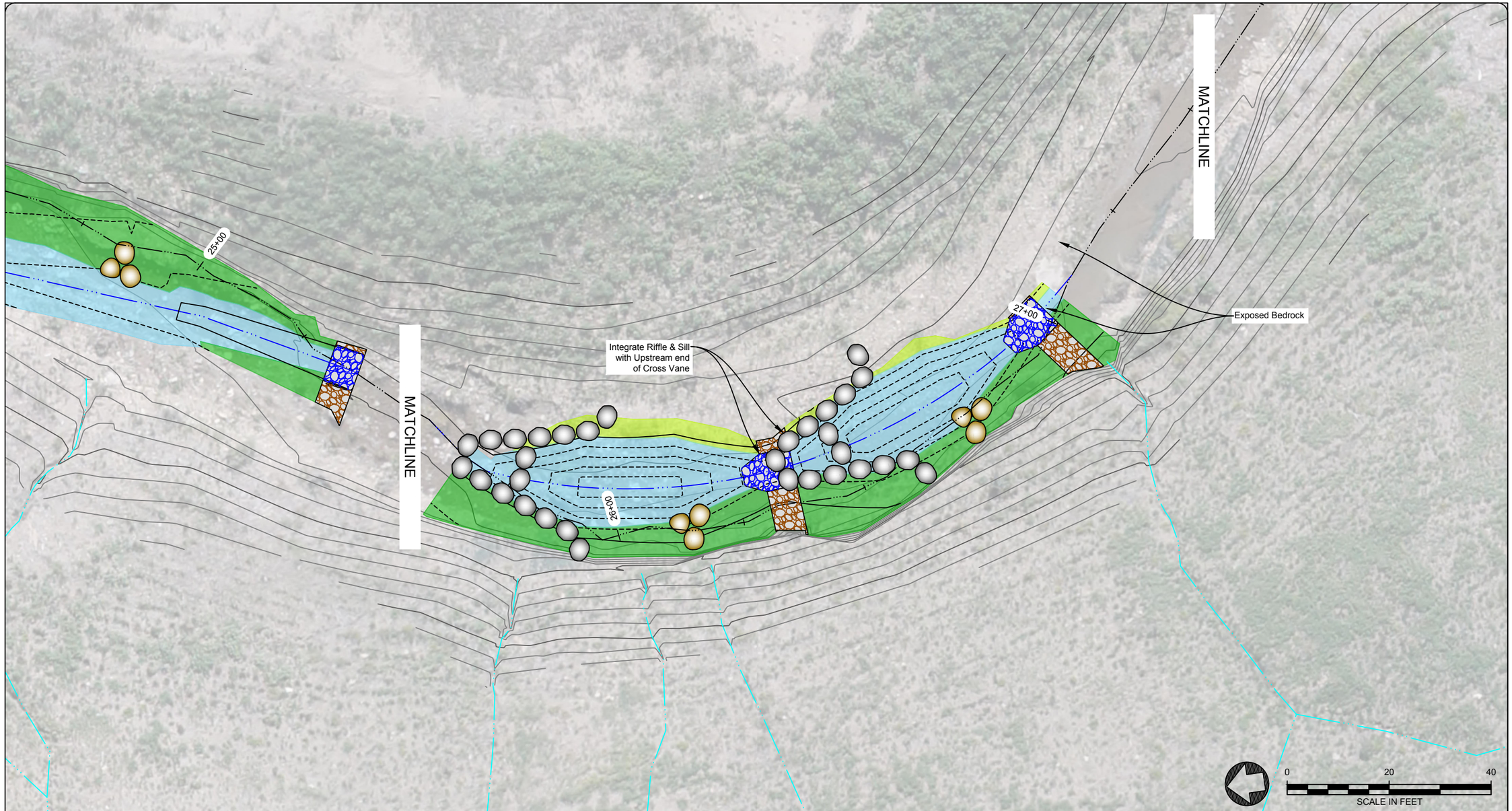
DRAWING:
Stream Stabilization:
Meander 9
Plan & Profile

DRAWING #:	SHEET #:	REVISION #:
STR09	12 OF 24	0



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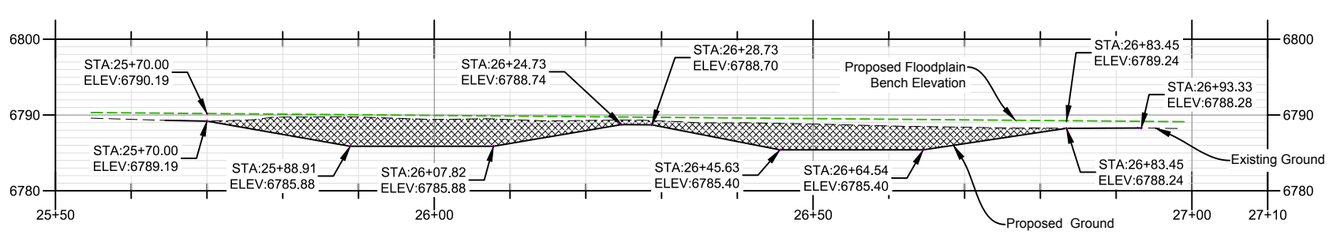

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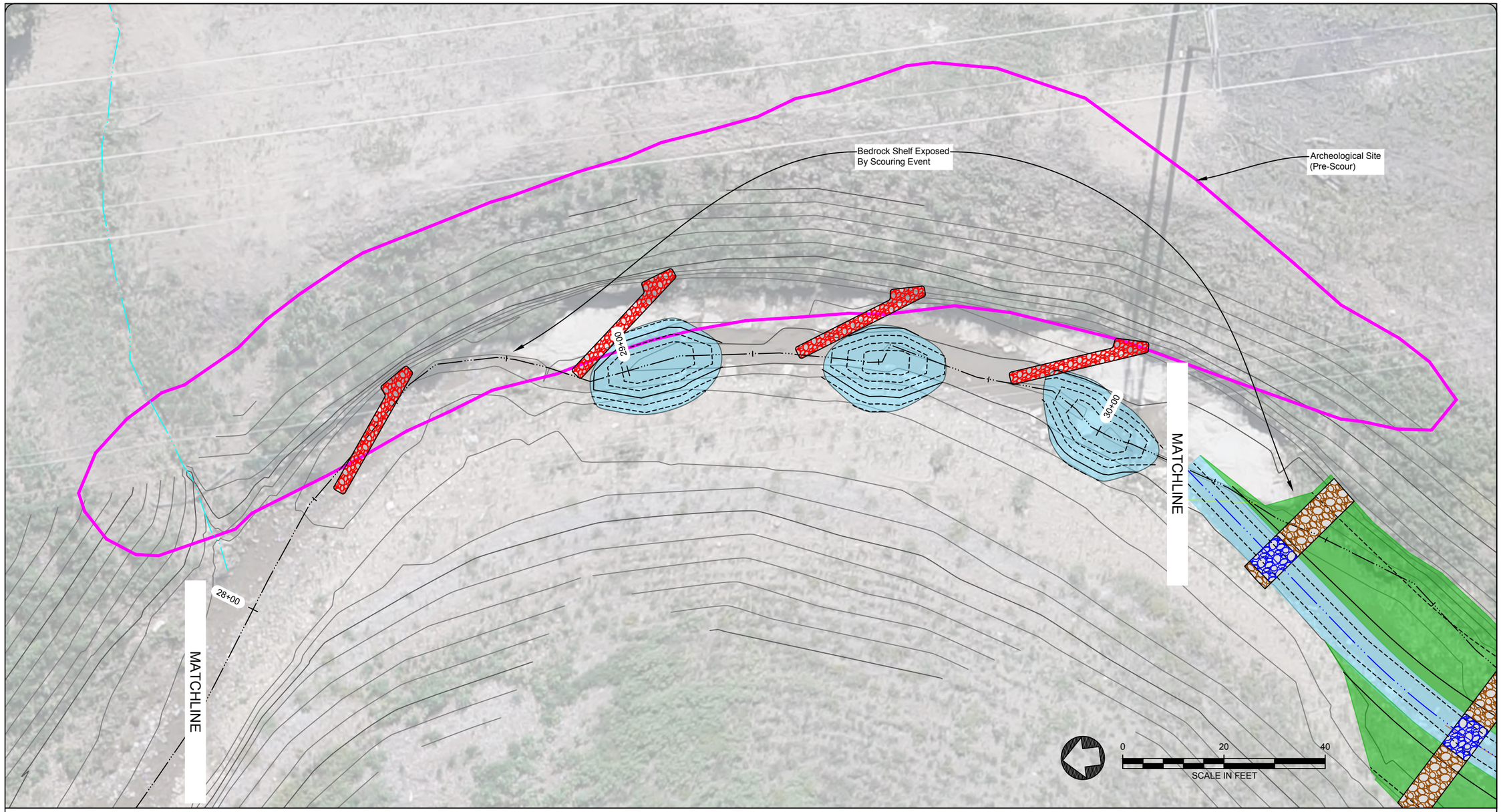
DRAWING:
Stream Stabilization:
Meander 10
Plan & Profile

DRAWING #:	SHEET #:	REVISION #:
STR10	13 OF 24	0



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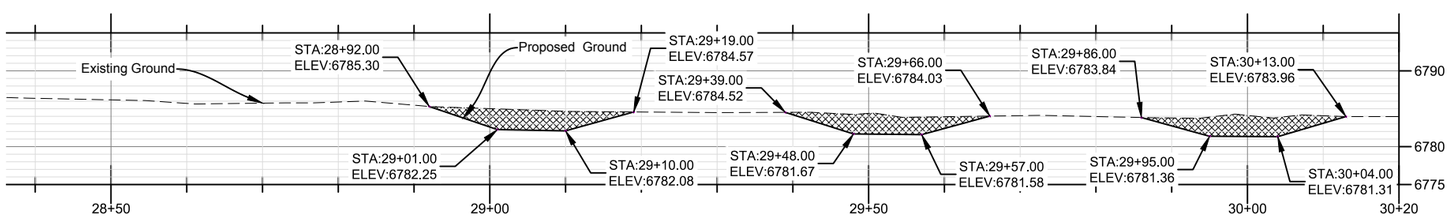

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DRAWING:
Stream Stabilization:
Meander 11
Plan & Profile

DRAWING #:	SHEET #:	REVISION #:
STR11	14 OF 24	0

MATCHLINE

30+00

Edge of Bedrock Shelf

31+00

32+00

Downstream extent of 2012 channel project

Stable reference pool site with deep lateral scour pool & floodplain bench stabilized with dense willows above ground and subsurface boulders integrated with willow root mat.

0 20 40

SCALE IN FEET

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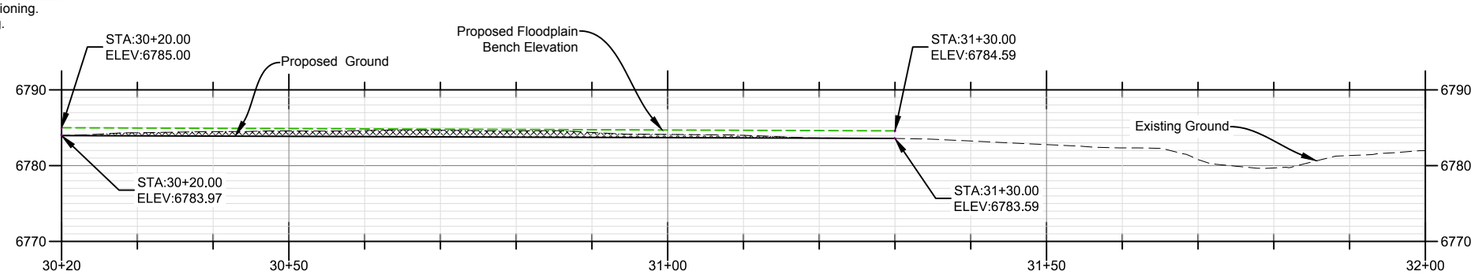

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Raton, NM
(505) 445-3097

DRAWN BY: GFC

DESIGNED BY: GFC

REVIEWED BY: NA

ENGINEER OF RECORD:

GEORGE F. CATHEY
NEW MEXICO
21540
1-31-20
PROFESSIONAL ENGINEER

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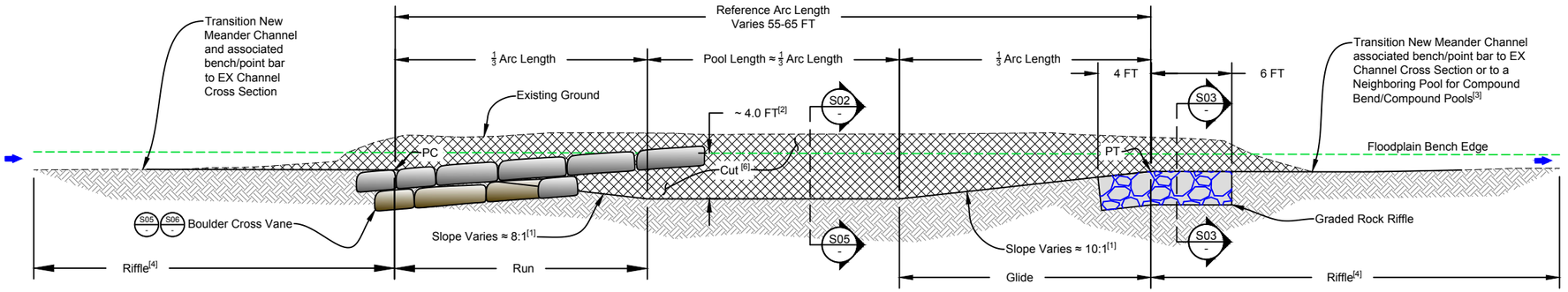
811 Know what's below. Call before you dig.

DATE:	OEE PROJECT #:
01.31.20	NM-007-03

DRAWING:
Stream Stabilization:
Meander 12
Plan & Profile

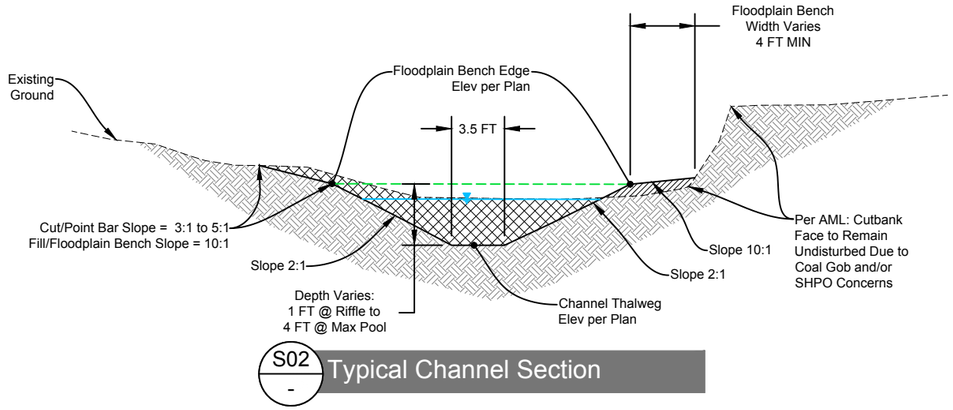
DRAWING #:	SHEET #:	REVISION #:
STR12	15 OF 24	1



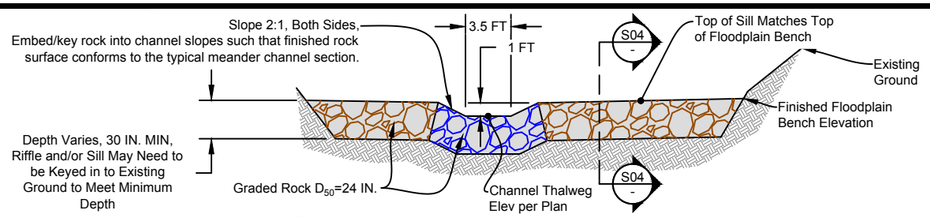
S01 - Typical Meander Profile

MEANDER PROFILE NOTES:

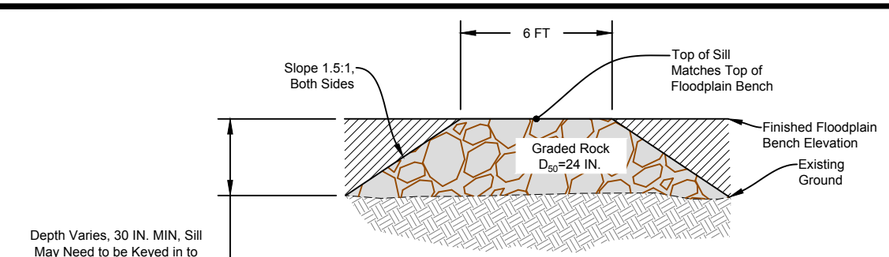
1. Slope of run and glide facets based on stable reference values collected at pools located directly upstream and downstream of the project area.
2. Target max pool depth for a lateral scour pool, measured from bankfull, was calculated by multiplying the mean bankfull depth (≈ 0.9 FT) by a factor of 4 [Rosgen(2011)]. This max pool depth correlates with the stable pools described in Note 1 above.
3. Arc length ratios for each meander indicated that multiple pools were required for each bend. This fit with field observations of shallow compound pools/compound bends forming along the bends.
4. Riffle/Inner Berm dimensions based on stable B4c reference riffle located in Coal Canyon.
5. Grade stabilization structures (i.e. cross vanes and constructed riffles not shown for clarity).
6. Bedrock is likely to be encountered throughout the site based on field observations. Equipment shall be utilized that is capable of excavating through the rock to meet the lines and grades shown on the plans.



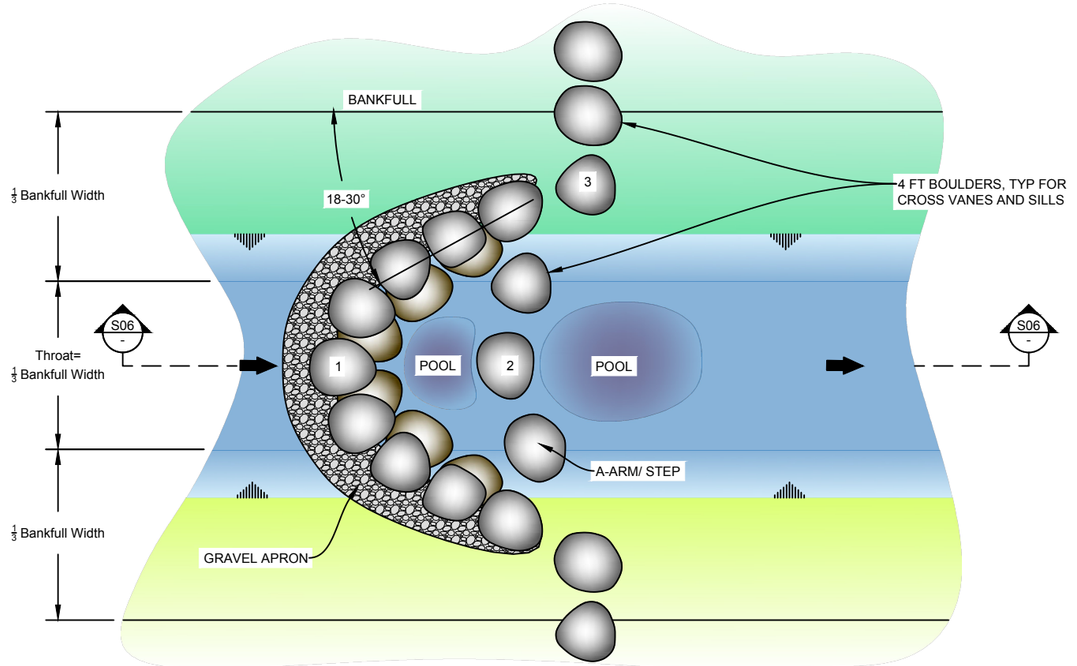
S02 - Typical Channel Section



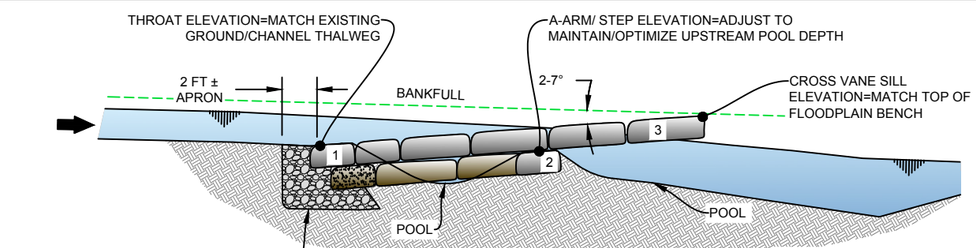
S03 - Typical Graded Rock Riffle & Sill Section



S04 - Typical Graded Rock Sill Section



S05 - Typical Cross Vane Plan



S06 - Typical Cross Vane Profile

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PROJECT NAME:
Swastika Mine and Dutchman Canyon Maintenance and Stream Restoration Project

LOCATION:
Vermejo Park Ranch
Colfax County, NM

PROJECT NUMBER:
EMNRD-MMD-2020-03

PROJECT PHASE:
Construction Drawings
100% Submittal

CLIENT:
New Mexico Abandoned Mine Land Program
1220 South St. Francis Dr
Santa Fe, NM 87505
(505) 476-3476

PROJECT MANAGER:
Joe Vinson & Laurence D'Alessandro

PROJECT ENGINEER:
Mike Tompson & Yeny Maestas

PARTNER:
Vermejo Park Ranch
PO Box Drawer 'E'
Raton, NM
(505) 445-3097

DRAWN BY: GFC
DESIGNED BY: GFC
REVIEWED BY: NA

ENGINEER OF RECORD:
GEORGE F. CATHEY NEW MEXICO 21540 1-31-20 PROFESSIONAL ENGINEER

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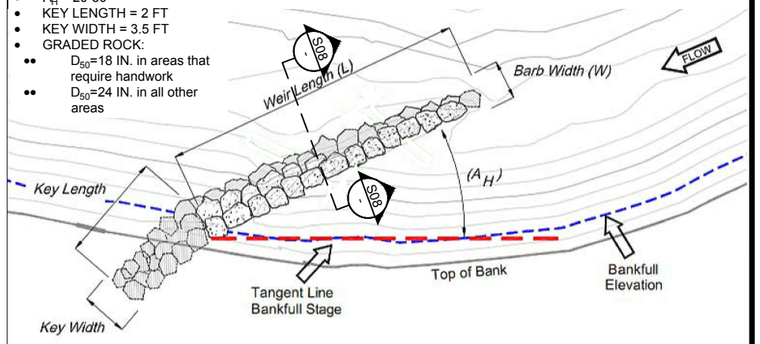
DATE:	OEE PROJECT #:
01.31.20	NM-007-03

DRAWING:
Stream Stabilization: Meander & Structure Sections & Details

DRAWING #:	SHEET #:	REVISION #:
STR13	16 OF 24	0

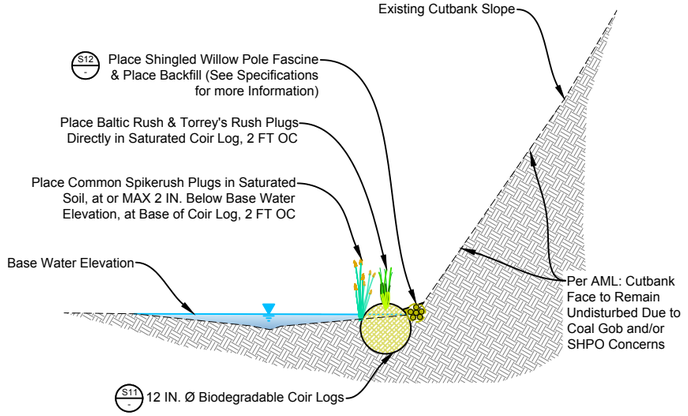
DIMENSIONS:

- L = Varies (8-20 FT)
- W = 3.5 FT
- A_H = 20-30°
- KEY LENGTH = 2 FT
- KEY WIDTH = 3.5 FT
- GRADED ROCK:
  - D_{50}=18 IN. in areas that require handwork
  - D_{50}=24 IN. in all other areas

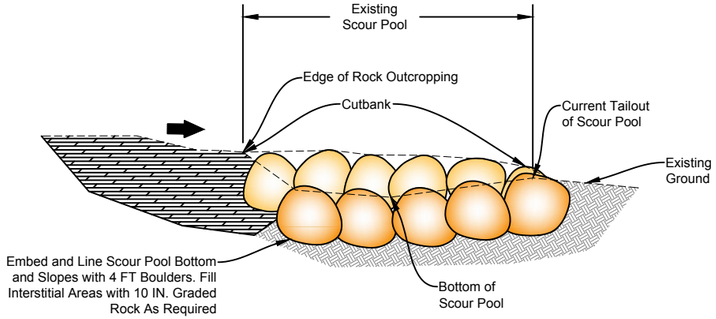


S07 - Graded Rock Stream Barb Plan

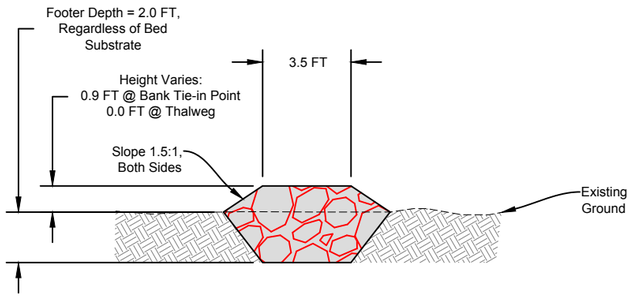
Image from NRCS "Design of Stream Barbs" (2005)



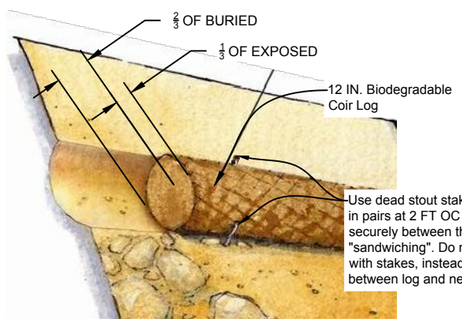
S10 - Cutbank Toe Treatment



S13 - Boulder Basin Profile

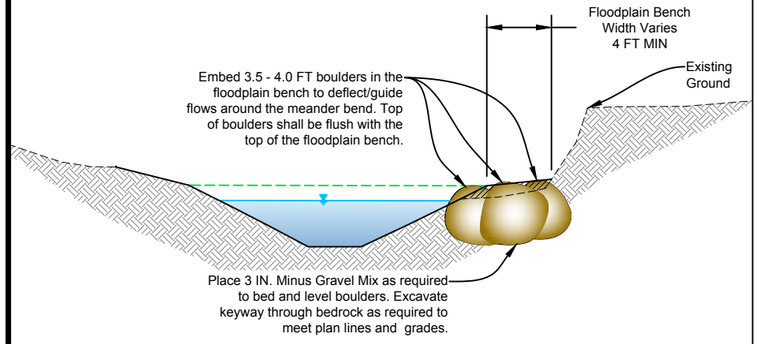


S08 - Graded Rock Stream Barb Section

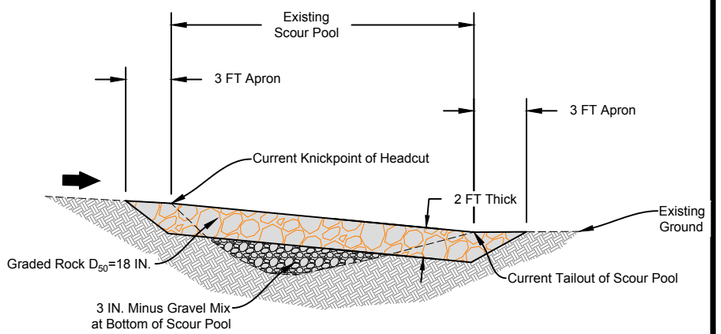


S11 - Coir Log Schematic

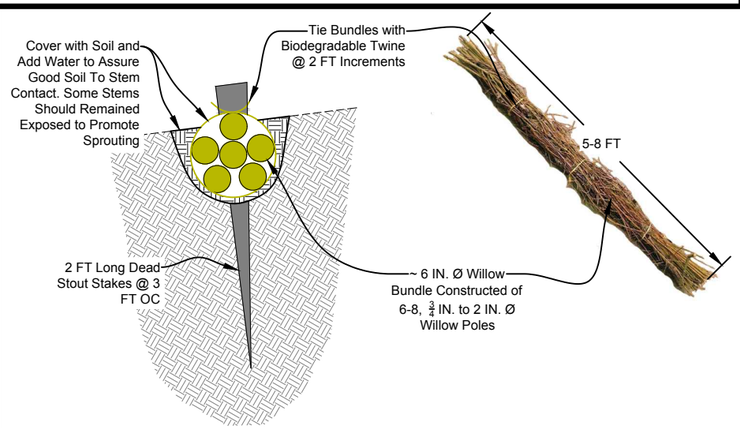
Image from Apex Coir Products



S14 - Boulder Cluster Section



S09 - Graded Rock Basin Profile



S12 - Shingled Willow Fascine Schematic

NOTES:

- Start installation along the toe of the slope at the bottom of the reach.
- Align the fascine bundle along the toe contour behind the coir log.
- Excavate a hole into permanently wetted soil to place the upstream butt end of the bundle.
- Place bundle in hole and stake (use wedge shaped dead stout stakes) through the bundle at approximately 2 foot centers. Allow stake to protrude 3 inches above top of bundle. Downstream end of the bundle should rise above the bankfull elevation at a shallow angle.
- Repeat the process with the next bundle upstream. Overlap the downstream end of the bundle over the butt end of the downstream bundle by 1.5 to 2 feet. Continue to upstream end of reach.
- Cover the brush with soil, then wash in to assure good soil to stem contact. Some of the stems should remain exposed to sunlight to promote sprouting. Use material from next, upslope trench.
- Since this is a surface treatment, it is important to avoid sites that will be too wet or too dry. Butt ends of the bundle should be in permanently wet soil and downstream end should extend above bankfull elevation.

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(505) 476-3476

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PROJECT ENGINEER:
Mike Tompson & Yeny Maestas

PARTNER:
Vermejo Park Ranch
PO Box Drawer 'E'
Raton, NM
(505) 445-3097

DRAWN BY: CS(NCD)

DESIGNED BY: CS(NCD), AH

REVIEWED BY: GFC

ENGINEER OF RECORD:

GEORGE F. CATHEY NEW MEXICO 21540 1-31-20 PROFESSIONAL ENGINEER

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DATE: 01.31.20

OEE PROJECT #: NM-007-03

DRAWING: Stream Stabilization: Structure Sections & Details

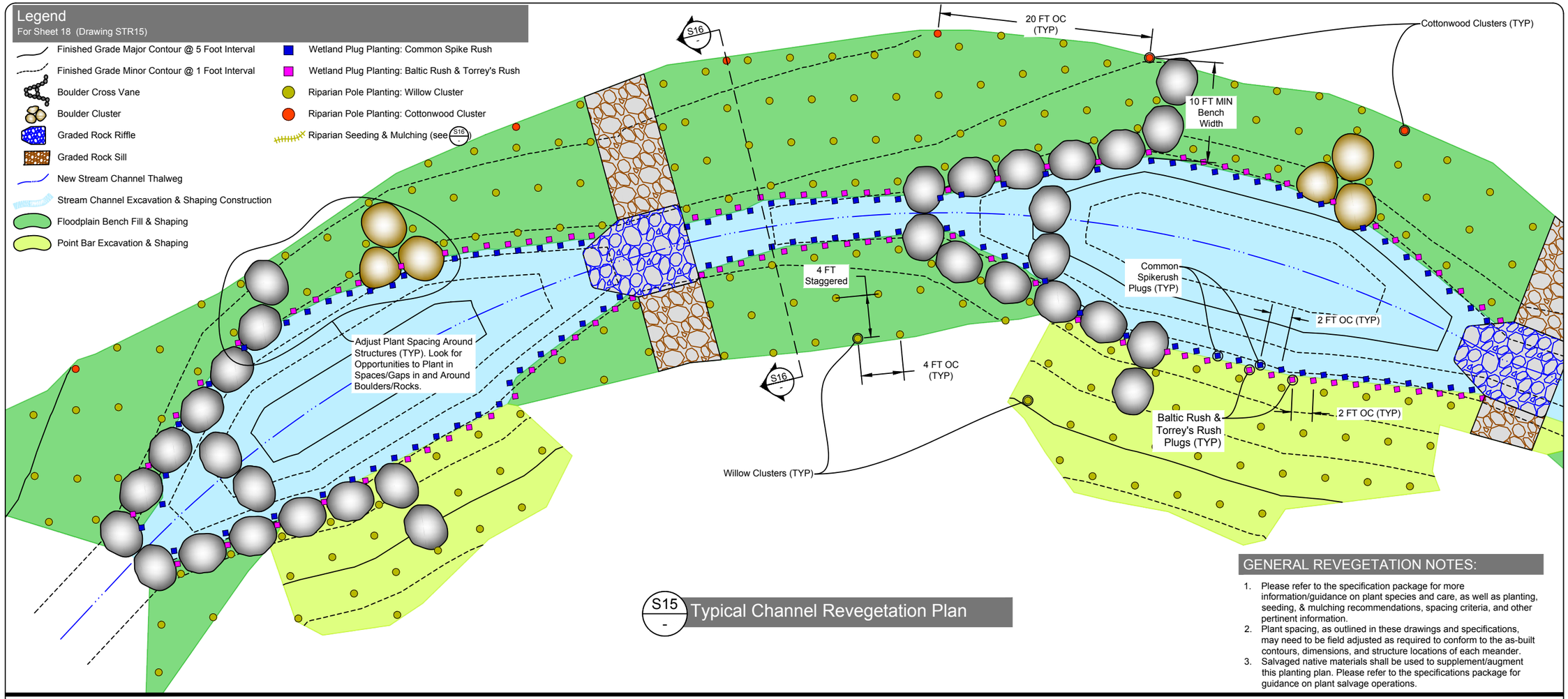
DRAWING #: STR14

SHEET #: 17 OF 24

REVISION #: 0

Legend
For Sheet 18 (Drawing STR15)

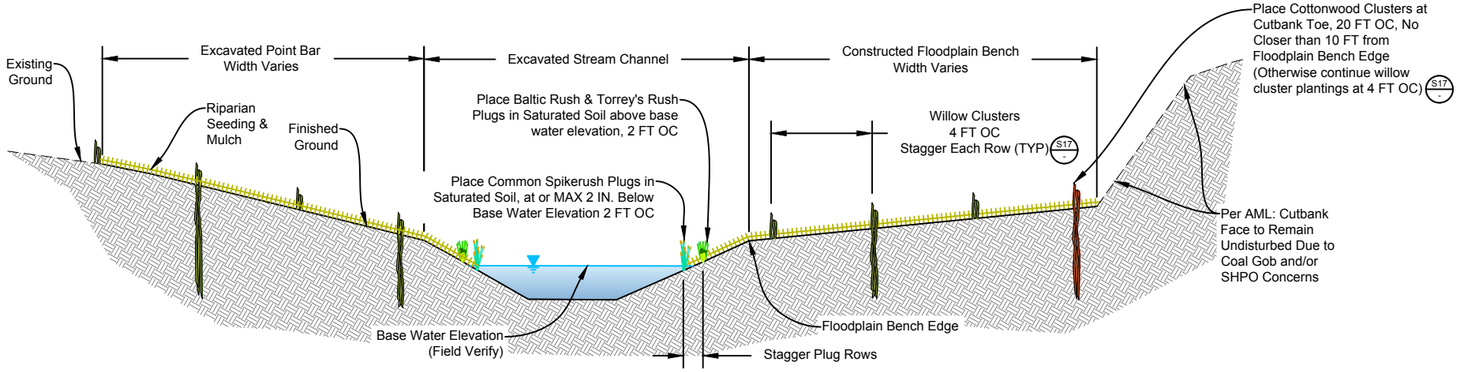
- Finished Grade Major Contour @ 5 Foot Interval
- Finished Grade Minor Contour @ 1 Foot Interval
- Boulder Cross Vane
- Boulder Cluster
- Graded Rock Riffle
- Graded Rock Sill
- New Stream Channel Thalweg
- Stream Channel Excavation & Shaping Construction
- Floodplain Bench Fill & Shaping
- Point Bar Excavation & Shaping
- Wetland Plug Planting: Common Spike Rush
- Wetland Plug Planting: Baltic Rush & Torrey's Rush
- Riparian Pole Planting: Willow Cluster
- Riparian Pole Planting: Cottonwood Cluster
- Riparian Seeding & Mulching (see S16 -)



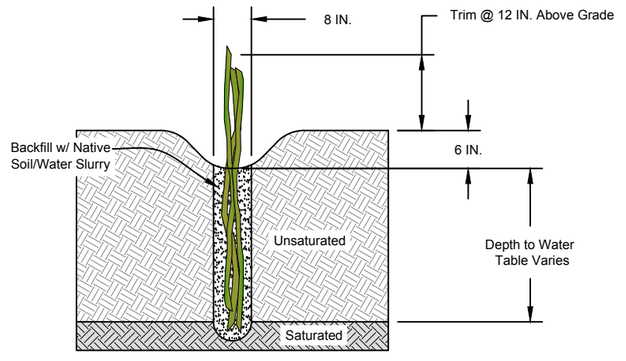
S15 - Typical Channel Revegetation Plan

GENERAL REVEGETATION NOTES:

1. Please refer to the specification package for more information/guidance on plant species and care, as well as planting, seeding, & mulching recommendations, spacing criteria, and other pertinent information.
2. Plant spacing, as outlined in these drawings and specifications, may need to be field adjusted as required to conform to the as-built contours, dimensions, and structure locations of each meander.
3. Salvaged native materials shall be used to supplement/augment this planting plan. Please refer to the specifications package for guidance on plant salvage operations.



S16 - Typical Channel Revegetation Section



S17 - Willow & Cottonwood Pole/Post Plantings

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PROJECT NUMBER:
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Construction Drawings
100% Submittal

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(505) 476-3476

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PARTNER:
Vermejo Park Ranch
PO Box Drawer 'E'
Raton, NM
(505) 445-3097

DRAWN BY: GFC
DESIGNED BY: CS(NCD), AH
REVIEWED BY: GFC

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DATE:	OEE PROJECT #:
01.31.20	NM-007-03

DRAWING:
Stream Stabilization: Native Revegetation Sections & Details

DRAWING #:	SHEET #:	REVISION #:
STR15	18 OF 24	0

Legend

For Sheet 19-23 (Drawing UPL01-UPL05)

EXISTING FEATURES

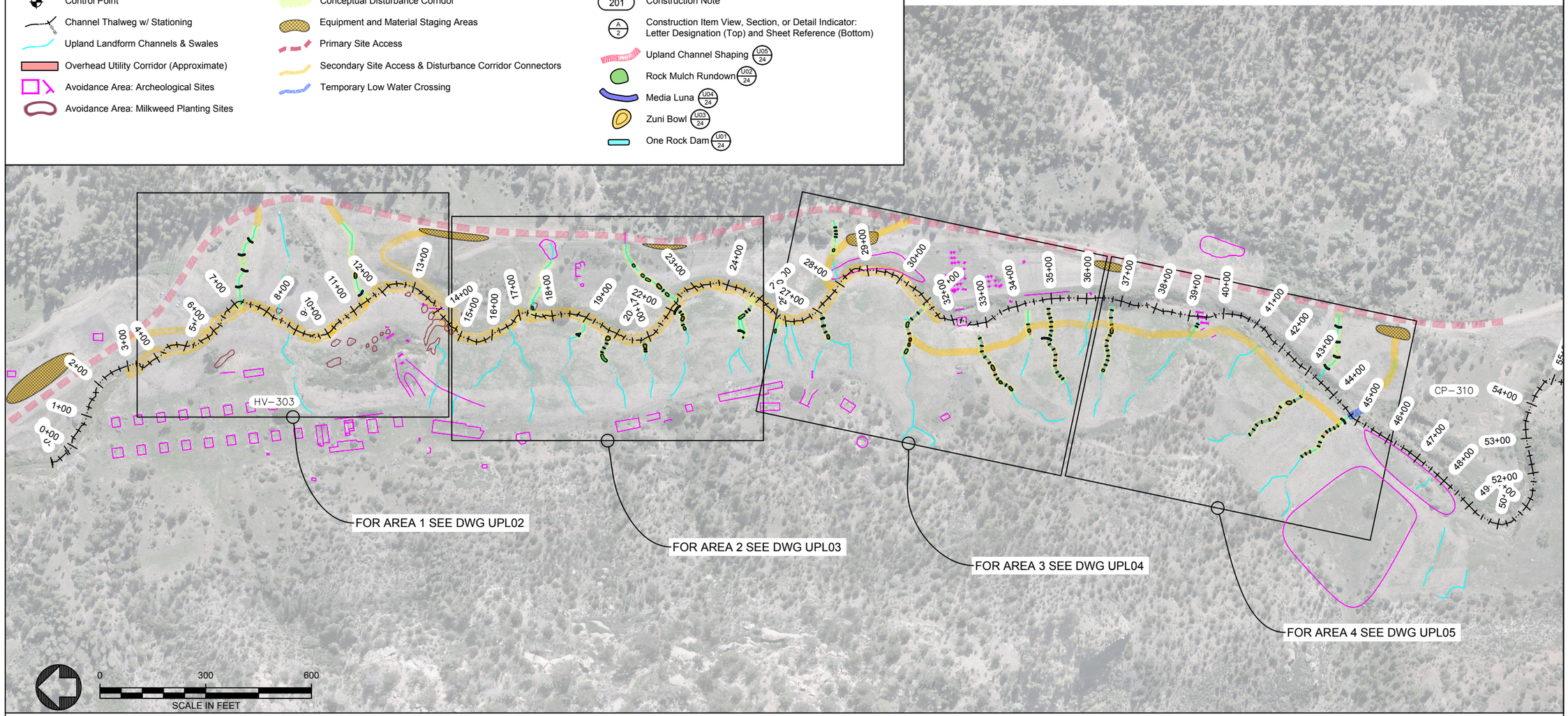
- Control Point
- Channel Thalweg w/ Stationing
- Upland Landform Channels & Swales
- Overhead Utility Corridor (Approximate)
- Avoidance Area: Archeological Sites
- Avoidance Area: Milkweed Planting Sites

PROPOSED FEATURES: ACCESS, STAGING, & DISTURBANCE

- Conceptual Disturbance Corridor
- Equipment and Material Staging Areas
- Primary Site Access
- Secondary Site Access & Disturbance Corridor Connectors
- Temporary Low Water Crossing

PROPOSED FEATURES: UPLAND STABILIZATION

- 201 — Construction Note
- A/2 — Construction Item View, Section, or Detail Indicator: Letter Designation (Top) and Sheet Reference (Bottom)
- Upland Channel Shaping (U05/24)
- Rock Mulch Rundown (U02/24)
- Media Luna (U04/24)
- Zuni Bowl (U03/24)
- One Rock Dam (U01/24)



Project Description

The New Mexico Abandoned Mine Land (AML) Program, in partnership with Vermejo Park Ranch, is working to mitigate the effects of legacy coal mining on land and water resources at the Swastika Mine Reclamation site. As part of this effort, AML completed work in 2012 to:

- Stabilize and reclaim an extensive series of steep and actively eroding coal gob piles within Dillon Canyon using geomorphic approaches to create a restored landform
- Restore a straightened and deeply incised section of stream channel adjacent to the gob piles

Recent flooding in the canyon has caused project wide erosion to restored elements including gullying of swales and channels constructed as part of the upland landform restoration and down-cutting, scour, and lateral migration of the constructed stream channel.

Project Goals & Objectives

Based on the inventory and post-flood analysis completed for the project, the restoration team developed a set of site specific practices that could be used to help heal upland flood damage. This conceptual "restoration toolbox" includes measures that, if implemented holistically, could help to mitigate flood damage in the canyon and minimize impacts to existing vegetation and habitat.

- Reduce sediment pollution and protect capped gob piles from eroding swales and channels by stabilizing gullies, headcuts, and rills using low impact rock and boulder structures.
- Limit disturbance to the absolute minimal necessary by utilizing hand labor where possible and low ground pressure, small footprint equipment where required. Where equipment is required, construction shall be staged and choreographed such that equipment can operate within a narrow area of disturbance that shall be delineated prior to construction. Seed disturbed areas with native seed.

Primary Design Elements

The following sheets include examples of each restoration practice along with its potential impacts to the project goals. The remainder of the sheets in this drawing set show potential areas where these practices could be implemented.

Gully & Headcut Treatment

- Gullies will need to be reshaped in cross section, and in the case of headcuts, in profile as well.
- Once reshaping efforts are complete, place native seed, and then carefully place rock rip-rap to construct media lunas, zuni bowls, rock mulch rundowns, and one rock dams to stabilize the gullies and headcuts


Dillon Canyon, Raton, NM | Oxbow Ecological Engineering

Typical Gully Erosion


Dillon Canyon, Raton, NM | Oxbow Ecological Engineering

Typical Headcut

As part of the original landform restoration efforts over 30 earthen swales and channels were constructed to convey local runoff (swales) and runoff from surrounding undisturbed watersheds (channels). Design slopes range from 5% to 32%, with an approximate average of 15%. Based on the post-flood field inventory from 2014, almost all the swales and channels had signs of rilling at the top of the drainage and progressively deepening gullies as they near the Dillon channel (~85% of overall swale/channel length impacted by erosion). Intermittent headcuts of various sizes were found throughout the swale/channel alignments. Some of these headcuts were localized around damaged erosion control BMPs. Down-cutting and scrolling of the main Dillon Canyon Channel have exacerbated headcutting at the confluence with the landform swales and channels.

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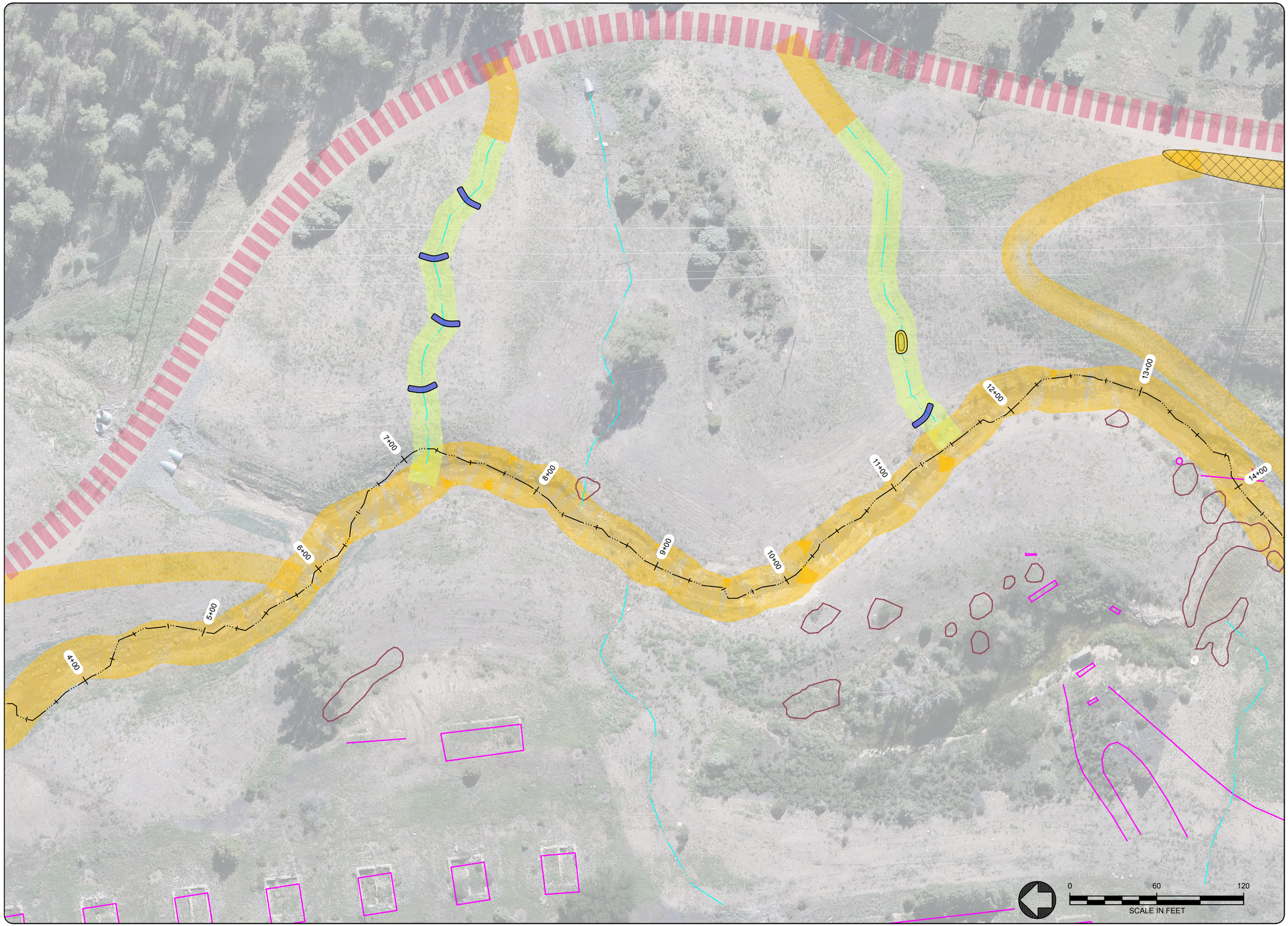
01.31.20	NM-007-03

DRAWING:
Upland Stabilization:
Improvement Plan Overview

DRAWING #:	SHEET #:	REVISION #:
UPL01	19 OF 24	0



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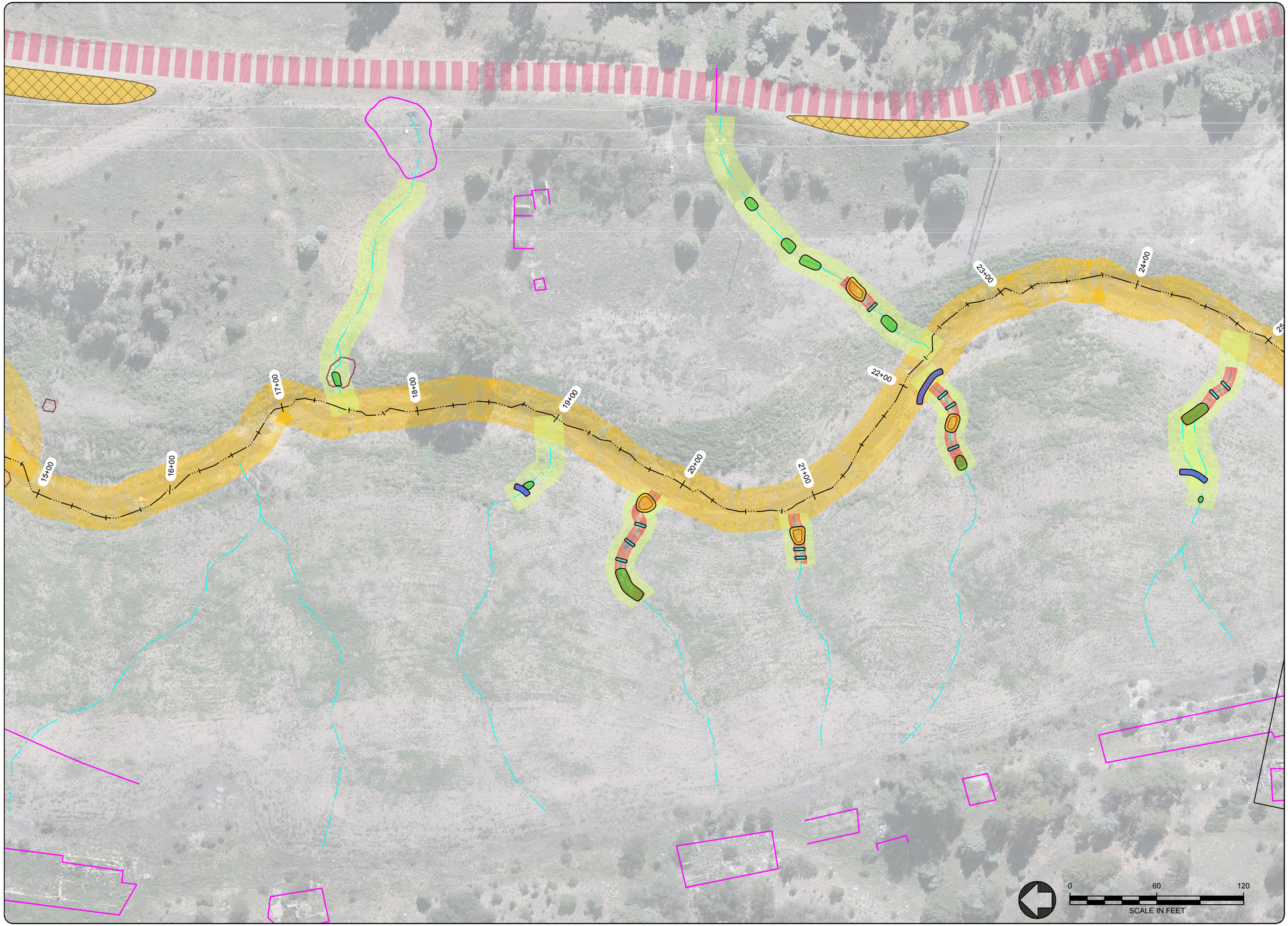
DRAWING:
Upland Stabilization:
Area 1 Improvement Plan

DRAWING #:	SHEET #:	REVISION #:
UPL02	20 OF 24	0



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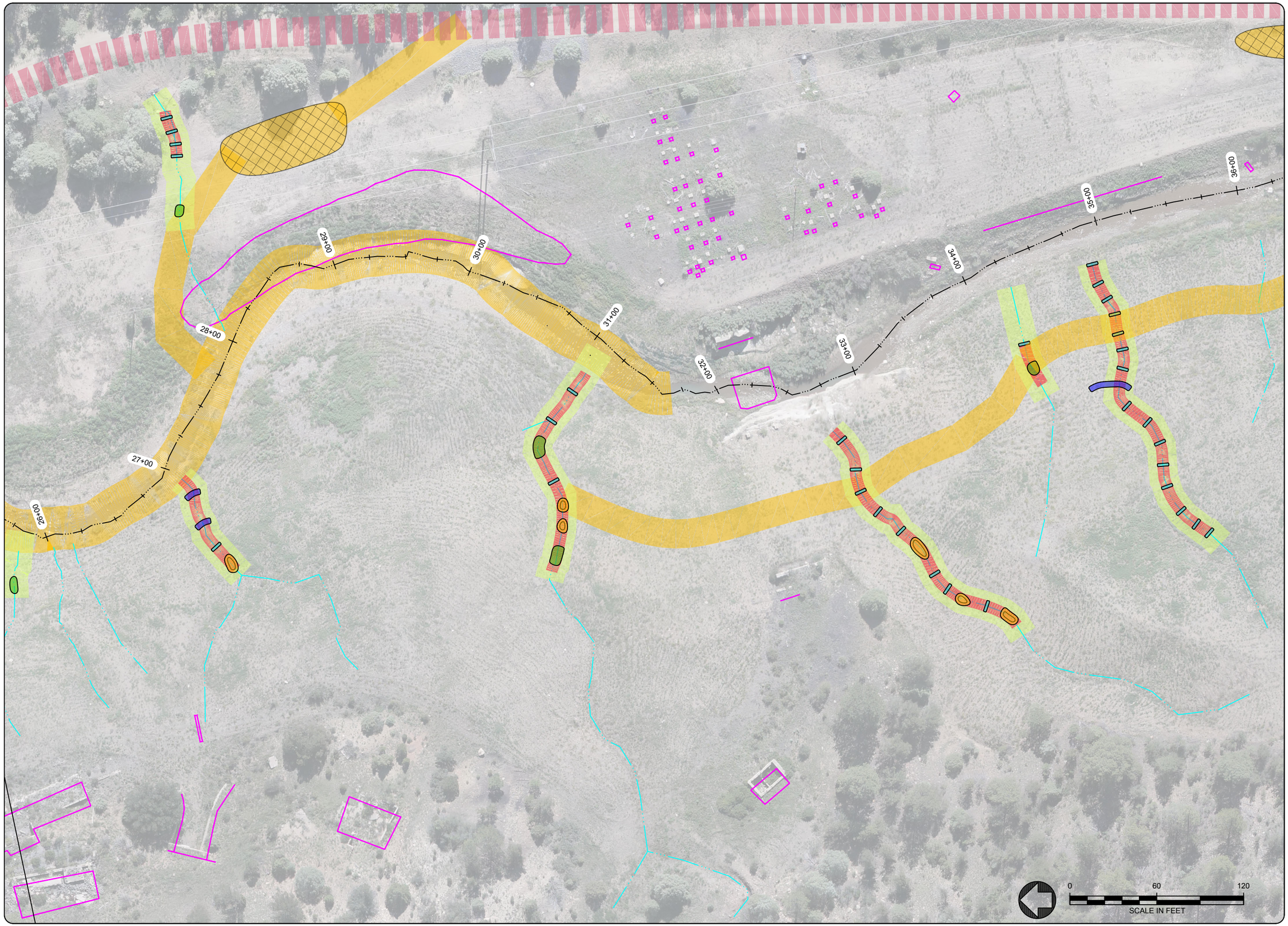
811 Know what's below. Call before you dig.

DATE:	OEE PROJECT #:
01.31.20	NM-007-03

DRAWING:
Upland Stabilization:
Area 2 Improvement Plan

DRAWING #:	SHEET #:	REVISION #:
UPL03	21 OF 24	1



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PROJECT NAME:
Swastika Mine and Dutchman Canyon Maintenance and Stream Restoration Project

LOCATION:
Vermejo Park Ranch
Colfax County, NM

PROJECT NUMBER:
EMNRD-MMD-2020-03

PROJECT PHASE:
Construction Drawings
100% Submittal

CLIENT:
New Mexico Abandoned Mine Land Program
1220 South St. Francis Dr
Santa Fe, NM 87505
(505) 476-3476

PROJECT MANAGER:
Joe Vinson & Laurence D'Alessandro

PROJECT ENGINEER:
Mike Tompson & Yeny Maestas

PARTNER:
Vermejo Park Ranch
PO Box Drawer 'E'
Raton, NM
(505) 445-3097

DRAWN BY: GFC

DESIGNED BY: GFC

REVIEWED BY: NA

ENGINEER OF RECORD:

GEORGE F. CATHEY
NEW MEXICO
21540
1-31-20
PROFESSIONAL ENGINEER

UNAUTHORIZED CHANGES & USES:
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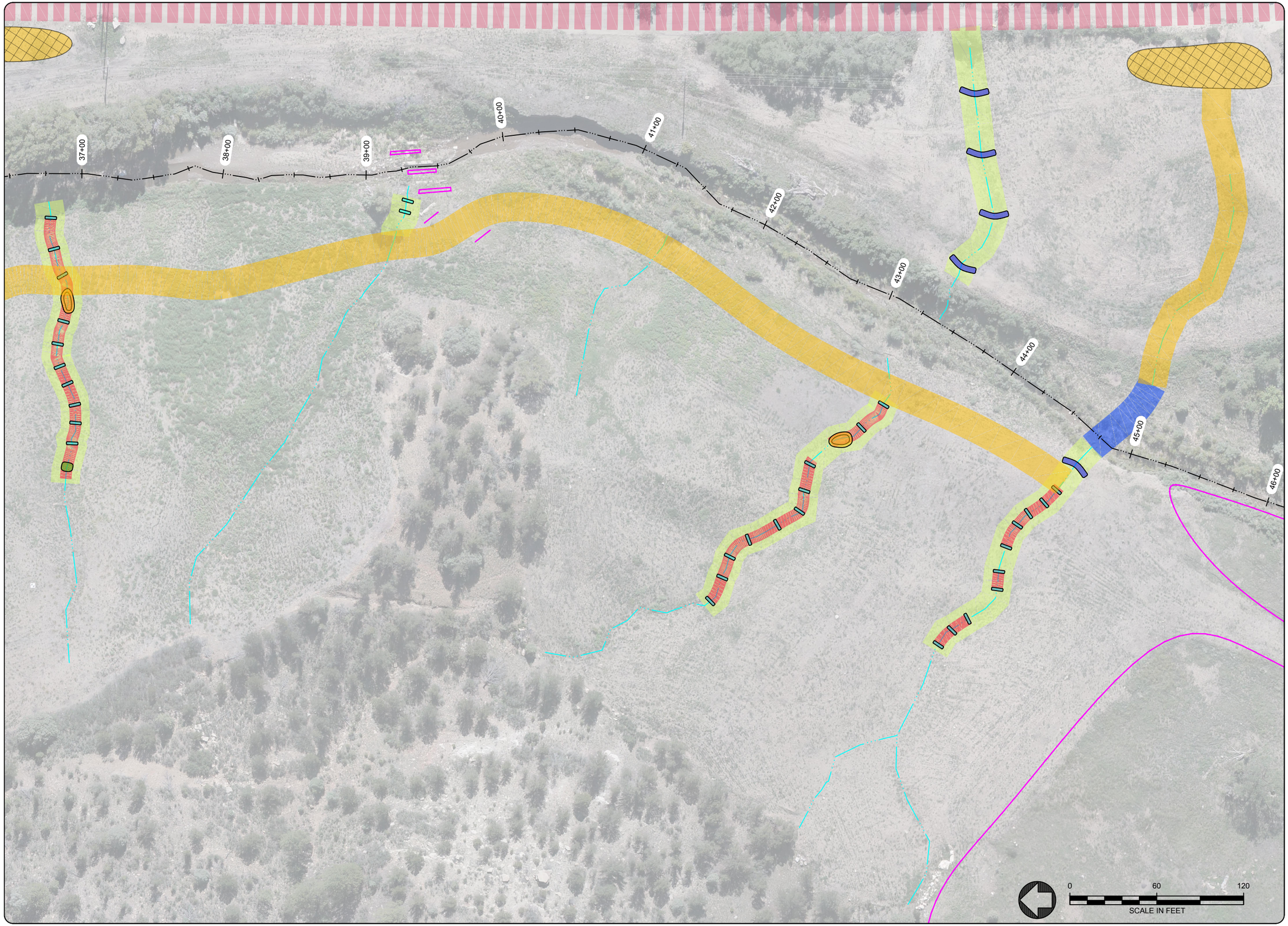
01.31.20	NM-007-03

DRAWING:
Upland Stabilization:
Area 3 Improvement Plan

DRAWING #:	SHEET #:	REVISION #:
UPL04	22 OF 24	1



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PROJECT NAME:
Swastika Mine and Dutchman Canyon Maintenance and Stream Restoration Project

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PROJECT NUMBER:
EMNRD-MMD-2020-03

PROJECT PHASE:
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Mike Tompson & Yeny Maestas

PARTNER:
Vermejo Park Ranch
PO Box Drawer 'E'
Raton, NM
(505) 445-3097

DRAWN BY: GFC

DESIGNED BY: GFC

REVIEWED BY: NA

ENGINEER OF RECORD:

GEORGE F. CATHEY
NEW MEXICO
21540
1-31-20
PROFESSIONAL ENGINEER

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01.31.20	NM-007-03

DRAWING:
Upland Stabilization:
Area 4 Improvement Plan

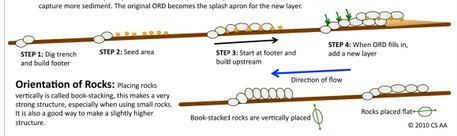
DRAWING #:	SHEET #:	REVISION #:
UPL05	23 OF 24	1

U01 - One Rock Dam

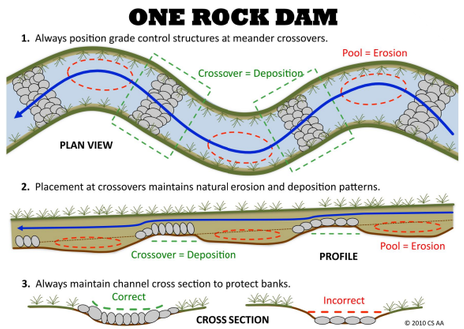
*A low grade control structure built with a single layer of rock on the bed of the channel. ORDs stabilize the bed of the channel by slowing the flow of water, increasing roughness, recruiting vegetation, capturing sediment, and **gradually** raising the bed level over time. ORDs are also passive water harvesting structures. The single layer of rock is an effective rock mulch that increases soil micisture, infiltration, and plant growth. Original concept developed by Bill Zeedyk.*

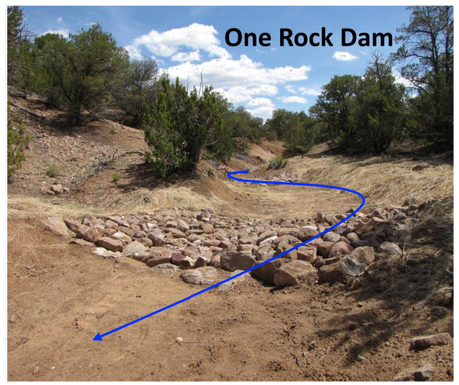
Design & Construction

1. Select area to build the ORD; dig a shallow footer trench and fill with one or two rows of rock, so that no rock protrudes more than 2 in/5cm above the bed of the channel. This will serve as the ***splash apron*** for the ORD.
2. Scatter native grass and wildflower seeds in the area where the ORD is to be built.
3. Start building at the footer and continue upstream, laying down one layer of rock horizontally, as if you were building a rock wall.
4. Once the ORD is completely filled with sediment, another layer can be added to further raise the bed of the channel and capture more sediment. The original ORD becomes the splash apron for the new layer.



Orientation of Rocks: Placing rocks vertically is called book-stacking, this makes a very strong structure, especially when using small rocks. It is also a good way to make a slightly higher structure.



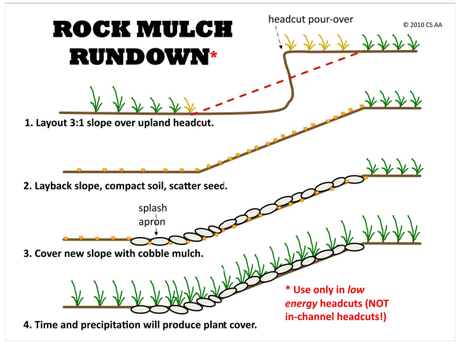


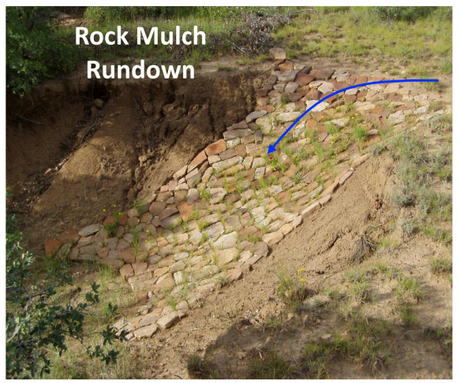
U02 - Rock Mulch Rundown

A headcut control structure where the face of the headcut has been laid back to a stable angle of repose (minimum of a 3:1 slope), and then covered with a single layer of rock mulch. The mulch serves to slow runoff, increase soil moisture, recruit vegetation, and ultimately prevent the headcut from migrating further up slope. Rock Mulch Rundowns are ONLY to be used on low energy headcuts, like those found in upland rills and gullies with small catchment areas, and where sheetflow collects and enters a channel. Original concept by Craig Sponholtz.

Design & Construction

1. Select a low energy headcut for treatment.
2. Determine the extent of the 3:1 slope. Take care to balance the cutting required to achieve a 3:1 slope vs. the potential disturbance to existing vegetation.
3. Layback the headcut by cutting away soil from the top of the face, and then use the cut material to fill the base of the headcut. Where possible, the Rundown should be the entire width of the channel below the headcut, or when no channel exists, the width of the headcut itself. Narrow headcuts may need to be widened to accommodate the rock work. Adjacent headcuts, separated by unreoded fingers of earth, but leading to the same channel, can be combined into a single Rundown structure. Knock down the unreoded earth between the headcuts, and use it as fill.
4. Compact the fill.
5. Scatter native grass and wildflower seed and rake the surface of the Rundown.
6. Dig a shallow trench on the down slope side of the Rundown and fill with one to two rows of rock, so that no rock protrudes more than 2 in/5cm above the bed of the channel. This will serve as the ***splash apron*** for the Rundown.
7. Cover the entire surface of the Rundown with a single layer of rock mulch. The center of the Rundown should be the lowest point in the structure so that water will not run around the edges.
8. Continue to lay rock on the surface of the Rundown until you reach the height of the ***headcut pour-over***. No rocks should protrude above this level to allow water to flow freely over the structure. It is very important to avoid gaps in the rock work because gaps cause weak points in the structure. Fill gaps with small gravel if needed. To improve durability, you can use a biodegradable geotextile mesh to line the surface of the Rundown prior to laying rocks.



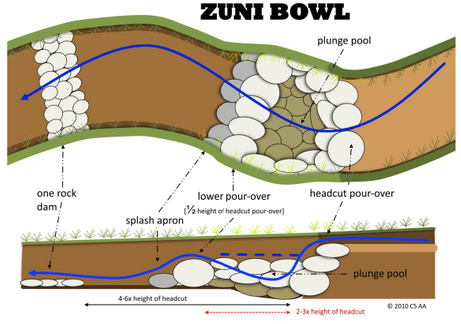


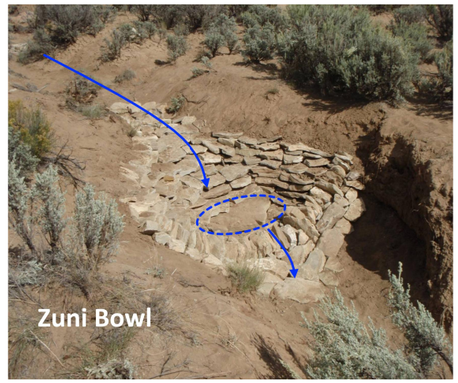
U03 - Zuni Bowl

A headcut control structure composed of rock lined step falls and plunge pools that prevents headcuts from continuing to migrate upstream. Zuni Bowls stabilize actively eroding headcuts by dissipating the energy of falling water at the headcut pour-over and the bed of the channel. The structure converts the single cascade of an eroding headcut into a series of smaller step falls. Zuni Bowls also serve to maintain soil moisture on the face of the headcut, encouraging the establishment of protective vegetation. Original concept developed by Bill Zeedyk and the people of Zuni Pueblo.

Design & Construction

1. Select a headcut for treatment; shape and layback the face of tho headcut to create a uniform surface on which to build.
2. Determine the height of the headcut. Next measure and mark the location downstream from the face of the headcut that is two to three times (2-3x) the height of the headcut. At this location dig a shallow trench and fill with one to two rows of rock, so that no rock protrudes more than 2 in/5cm above the bed of the channel. This will serve as the ***splash apron*** for the Zuni Bowl.
3. Scatter native grass and wildflower seeds in the area where the Zuni Bowl is to be built.
4. Gather the largest rocks available, and place them in a row just upstream from, and in contact with the splash apron. These rocks should sit at an elevation approximately ½ the total height of the headcut. This will serve as the ***lower pour-over*** of the Zuni Bowl.
5. Armor the bottom of the ***plunge pool*** with a single layer of rocks. Place these rocks at a uniform height to create a stable foundation for the rest of the Zuni Bowl.
6. Starting just upstream from the lower pour-over, lay courses of rock around the face of the headcut. This will form the walls of the bowl. Maintain contact with the shaped surface. The structure will have more integrity if built with layers of off-set rocks that form a sloping wall around the headcut, as opposed to merely lining the face with rocks. Improve the durability of the structure by avoiding gaps in the rock work. As an extra precaution, you can use biodegradable geotextile fabric to line the face of the headcut prior to laying rocks.
7. Continue to lay courses of rock around the face of the headcut until you reach the height of the ***headcut pour-over***. No rocks should protrude above this level to allow water to flow freely over the structure.
8. Construct a ***ORD*** downstream from the Zuni Bowl. Place the upstream edge of the ORD approximately four to six times (4-6x) the height of the headcut away from the headcut pour-over.



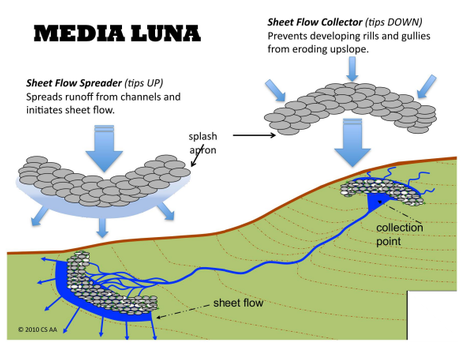


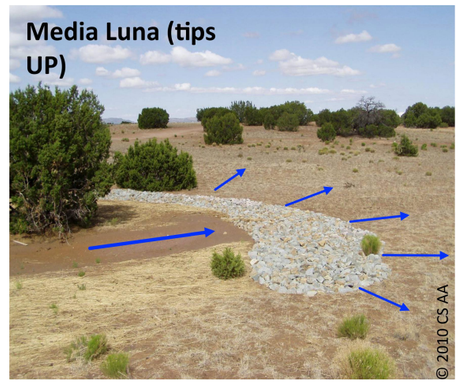
U04 - Media Luna

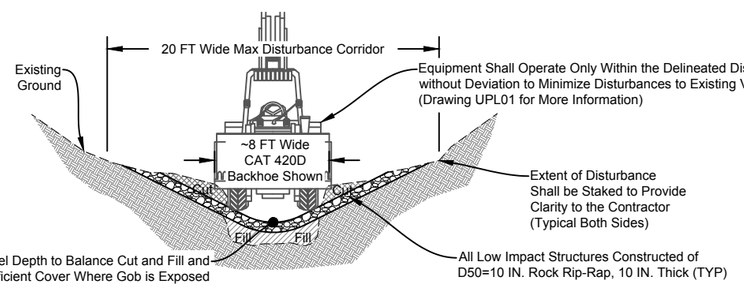
There are two types of Media Luna structures – both used to manage sheet flow and prevent erosion. "Sheet flow collectors" (tips DOWN) prevent erosion (i.e. headcuts) at the head of rills and gullies by creating a stable transition from sheet flow to channel flow at the collection point. "Sheet flow spreaders" (tips UP) are used on relatively flat ground to disperse erosive channelized flow and reestablish sheet flow where it once occurred. Original concept developed by Van Clothier, and expanded upon by Craig Sponholtz.

Design & Construction

1. Identify which type of Media Luna (i.e. "tips UP" or "tips DOWN") is appropriate for the treatment site.
2. If the treatment site is at the collection point of a network of rills (< 6 in/15cm deep) or small channels (< 1 ft/30cm deep) then use a ***sheet flow collector*** (tips DOWN). First lay out the down-slope edge of the structure by selecting two points on the banks of the main channel immediately down slope from where the rills entor. Using a leveling tool, lay out a level arc from bank to bank so that the tips point down slope, and the arc spans all of the rills that you aim to treat.
3. If the treatment site is located where runoff from rills or a shallow channel can easily be spread across relatively flat ground, then use a ***sheet flow spreader*** (tips UP). First lay out the down-slope edge of the structure by creating a level arc across the flat area with the tips on a slightly higher contour. The tips should be far enough up-slope that they prevent water from running around the ends of the structure.
4. For both ***sheet flow collectors*** and ***sheet flow spreaders*** - lay out the up-slope edge of the structure by tracing a level arc parallel to the down-slope edge to create a band that is at least 3 ft/1m wide. Media Lunas composed of wider bands of cobble mulch offer more protection from erosion, improved infiltration and increased plant recruitment.
5. Start by digging a shallow trench from tip to tip along the dowr-slope edge. Fill the trench with one to two rows of rock, so that no rock protrudes more than 2 in/5cm above ground level. This will serve as the ***splash apron*** for the Media Luna.
6. Scatter native grass and wildflower seeds in the area where the Media Luna is to be built.
7. For both types of Media Lunas, start on the down-slope edge and work up slope covering the ground with a single layer of cobble mulch to form a band at least 3 ft/1m wide. The tops of the rocks on the up-slope edge need to be level to ensure proper function of the structure.







U05 - Typical Channel Shaping

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PROJECT NAME:
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LOCATION:
Vermejo Park Ranch
Colfax County, NM

PROJECT NUMBER:
EMNRD-MMD-2020-03

PROJECT PHASE:
Construction Drawings
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CLIENT:
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PROJECT ENGINEER:
Mike Tompson & Yeny Maestas

PARTNER:
Vermejo Park Ranch
PO Box Drawer 'E'
Raton, NM
(505) 445-3097

DRAWN BY: CS(WA), GFC

DESIGNED BY: GFC

REVIEWED BY: NA

ENGINEER OF RECORD:
GEORGE F. CATHEY NEW MEXICO 21540 1-31-20 PROFESSIONAL ENGINEER

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01.31.20	NM-007-03

DRAWING:
Upland Stabilization: Sections & Details

DRAWING #:	SHEET #:	REVISION #:
UPL06	24 OF 24	0