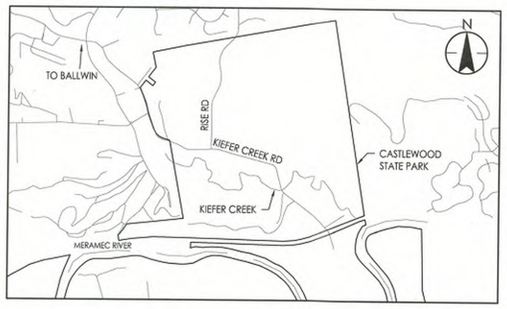
CASTLEWOOD STATE PARK
STREAMBANK RESTORATION PHASE I
(Ballwin, Missouri)

LOCATION MAP:



Stantec

OWNER: STATE OF MISSOURI
MICHAEL L. PARSON,
GOVERNOR

DEPARTMENT OF
NATURAL RESOURCES

PROJECT MANAGEMENT: OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT,
DESIGN AND CONSTRUCTION

DESIGNER: STANTEC CONSULTING SERVICES, INC.

PROJECT NUMBER: X2002-01

SITE NUMBER: 5205
ASSET NUMBER: 7815205028

STATE OF MISSOURI
JAMES KERRY GRIFFITH
NUMBER
PE 2017026130
PROFESSIONAL ENGINEER

3/24/2020

SHEET NUMBER:

G-001

1 OF 16 SHEETS
MARCH 24, 2020

GENERAL NOTES

1. DEFINITIONS - WHENEVER THE FOLLOWING TERMS ARE USED IN THESE PLANS FOR CONSTRUCTION, IT IS UNDERSTOOD THAT THEY REPRESENT THE FOLLOWING:
   - **1.1. CONSTRUCTION DOCUMENTS:** PLANS FOR CONSTRUCTION, CONSTRUCTION SPECIFICATIONS, COST ESTIMATE, AND ANY OTHER REFERENCED SPECIFICATIONS OR STANDARDS CONSTITUTE THE COMPLETE CONSTRUCTION DOCUMENTS FOR THIS PROJECT.
   - **1.2. CONTRACTOR:** ENTITY RESPONSIBLE FOR CONSTRUCTION.
   - **1.3. ENGINEER:** STANTEC CONSULTING SERVICES INC. (STANTEC)
   - **1.4. OWNER:** CASTLEWOOD STATE PARK
   - **1.5. RESPONSIBLE PARTY:** THE NATURE CONSERVANCY, MISSOURI CHAPTER
   - **1.6. STORM WATER POLLUTION PREVENTION PLAN (SWPPP):** A PLAN REQUIRED BY THE LAND DISTURBANCE GENERAL PERMIT NO. MO-R100038 THAT INCLUDES SITE MAP(S), AN IDENTIFICATION OF CONSTRUCTION/CONTRACTOR ACTIVITIES THAT COULD CAUSE POLLUTANTS IN THE STORM WATER, AND A DESCRIPTION OF MEASURES OR PRACTICES TO CONTROL THESE POLLUTANTS.
   - **1.7. BEST MANAGEMENT PRACTICES (BMP):** ANY PROGRAM, TECHNOLOGY, PROCESS, SITING CRITERIA, OPERATING METHOD, MEASURE, OR DEVICE THAT CONTROLS, PREVENTS, REMOVES, OR REDUCES POLLUTION.
   - **1.8. DISTURBANCE LIMITS:** THE BOUNDARY WITHIN WHICH ALL CONSTRUCTION, MATERIALS STORAGE, AND ALL OTHER CONSTRUCTION ACTIVITIES SHALL OCCUR.
   - **1.9. BANKFULL ELEVATION:** THE POINT OF INCIPIENT FLOODING IN AN ALLUVIAL CHANNEL.
   - **1.10. THALWEG:** THE LOWEST POINT OF THE BANKFULL CHANNEL. THIS ELEVATION IS THE REFERENCE FOR ALL ELEVATIONS ON OR ALONG THE CHANNEL AND HYDRAULIC STRUCTURES DESCRIBED IN THIS SECTION AND THROUGHOUT THE CONSTRUCTION DOCUMENTS.
   - **1.11. ROOT WADS:** THE ROOT MASS OF A TREE AND ATTACHED TRUNK. ROOT WADS AND LOGS MAY BE HARVESTED FROM THE SITE AS APPROVED BY THE LAND OWNER. ROOT WADS OR LOGS MAY BE BROUGHT IN FROM OFF-SITE. HARVESTING SHALL BE EXECUTED IN A MANNER AS NOT TO LEAVE SIGNIFICANT VOIDS IN THE EXISTING RIPARIAN CORRIDOR.
2. THESE DRAWINGS WERE PREPARED BY STANTEC USING PUBLICLY AVAILABLE LIDAR DATED 2011 AND AERIAL IMAGERY DATED 2016. THE MAJOR DISCREPANCIES BETWEEN THE TWO FORMS OF DATA IS DUE TO LATERAL BANK EROSION. STANTEC PERFORMED A GEOMORPHIC ASSESSMENT OF THE PROJECT AREA IN APRIL 2016. THE GEOMORPHIC ASSESSMENT INCLUDED A GROUND SURVEY OF THE TOP OF BANK AND THALWEG OF PORTIONS OF KIEFER CREEK IN AND/OR NEAR THE PROJECT AREA.
3. FOR DESIGN PURPOSES, THE LIDAR WAS ADJUSTED TO AGREE WITH THE MORE RECENT AERIAL IMAGERY WITHIN THE PROPOSED WORK AREAS.
4. SURVEY COORDINATES REFERENCES TO MISSOURI STATE PLAN EAST COORDINATE SYSTEM NAD83. ELEVATIONS ARE BASED ON NAVD88.
5. ALL EXISTING TOPOGRAPHIC, DRAINAGE, ROADWAY, AND ANY OTHER EXISTING PLANIMETRIC DATA SHOWN ON THE PLANS ARE ONLY APPROXIMATE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR FINAL VERIFICATION AND LOCATION.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR HEALTH AND SAFETY OF ITS PERSONNEL. THE CONTRACTOR SHALL ADHERE TO REQUIREMENTS FOR SAFETY AND CONSTRUCTION FROM OSHA UNLESS OTHER REGULATORY REQUIREMENTS ARE MORE STRINGENT AND/OR SUPERSEDE OSHA REQUIREMENTS.
7. THE CONTRACTOR SHALL CONDUCT ALL OPERATIONS IN ACCORDANCE WITH APPLICABLE ENVIRONMENTAL PERMITS, RULES, LAWS, AND REGULATIONS.
8. THE CONTRACTOR SHALL PERFORM REQUIRED UTILITY LOCATION SERVICES, SURVEY AND DOCUMENT THOSE LOCATIONS. AT THE TIME THESE PLANS FOR CONSTRUCTION WERE PREPARED THERE WERE NO KNOWN EXISTING UNDERGROUND OR ABOVE GROUND UTILITIES WITHIN THE PROJECT'S DISTURBANCE LIMITS. HOWEVER, THE CONTRACTOR IS RESPONSIBLE FOR DETERMINING THE LOCATION OF ALL UTILITIES, IF ANY, NOT SHOWN AND SHALL PROVIDE NECESSARY MEASURES TO PROTECT UTILITIES FROM DAMAGE DUE TO CONSTRUCTION ACTIVITIES. SHOULD CONDUITS OR OTHER UTILITIES THAT ARE NOT SHOWN ON THE DRAWINGS BE ENCOUNTERED, THE CONTRACTOR SHALL CONTACT THE OWNER IMMEDIATELY.
9. THE CONTRACTOR SHALL CONSULT WITH THE ENGINEER TO IDENTIFY DISTURBANCE LIMITS, HAUL ROUTES, AND STAGING AREAS AS SHOWN IN THESE PLANS FOR CONSTRUCTION. THE CONTRACTOR SHALL COOPERATE AT ALL TIMES WITH THE OWNER, ANY OTHER CONTRACTORS, AND ENGINEER TO HELP RESOLVE ANY SCHEDULING OR OTHER CONFLICTS THAT MIGHT ARISE.
10. ALL EQUIPMENT, GAS TANKS, DUMPSTERS, AND PORTABLE RESTROOMS SHALL BE STORED WITHIN THE STAGING AREAS.
11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTENANCE OF ALL HAUL ROUTES AND STAGING AREAS USED DURING CONSTRUCTION. THE CONTRACTOR SHALL RESTORE THESE AREAS TO THEIR ORIGINAL CONDITION OR BETTER, UNLESS THE OWNER GIVES WRITTEN PERMISSION TO THE CONTRACTOR TO RETAIN THE AREA "AS-IS".
12. THE CONTRACTOR SHALL UTILIZE NATIVE MATERIAL FROM THE SITE WHERE AVAILABLE WITHIN THE DISTURBANCE LIMITS AND ALLOWED BY THE OWNER. NATIVE MATERIAL THAT CAN BE FOUND ON SITE INCLUDES TREES THAT CAN PROVIDE LIVE STAKES, TREES THAT CAN BE USED FOR ROOT WADS, AND EXISTING BED MATERIAL FOR ROCK SILT SCREENS AND THE NATIVE ROCK RIFFLE.
13. THE CONTRACTOR SHALL PRESERVE LARGE TREES ALONG THE STREAM AND ON THE SITE EVERYWHERE POSSIBLE. THE CONTRACTOR SHALL ONLY REMOVE TREES AND SHRUBS THAT ARE ABSOLUTELY NECESSARY FOR THE EXECUTION OF THE WORK AND SHALL MAKE ALL EFFORTS TO MINIMIZE TREE REMOVAL. IN ADDITION, TREES SHALL BE REMOVED IN A MANNER TO ALLOW THEM TO BE REUSED ON THE SITE AS ROOT WADS. ALL VEGETATION INCLUDING TREES, SNAGS, LOGS, STUMPS, SHRUBS, TOPSOIL, AND OTHER ORGANIC MATERIAL SHALL BE REMOVED TO A DEPTH OF AT LEAST 6 INCHES FROM THE FOLLOWING AREAS SPECIFIED BELOW:
    - ALL AREAS TO RECEIVE FILL
    - ALL AREAS WHICH WILL BE EXCAVATED

    ALL MATERIAL STRIPPED SHALL BE REMOVED FROM WITHIN THE LIMITS OF EXCAVATION OR AREAS TO BE FILLED AND SHALL BE TEMPORARILY STOCKPILED FOR USE AS FINAL DRESSING OF THE SITE OR PLACED IN THE TOPSOIL STOCKPILE. STOCKPILING AND PLACEMENT OF STRIPPED MATERIAL SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.
11. TO MINIMIZE IMPACTS TO INDIANA AND NORTHERN LONG-EARED BATS DURING THE SUMMER AND FALL, ALL CLEARING OF TREES GREATER THAN 3 INCHES DIAMETER AT BREAST HEIGHT IS PROHIBITED BETWEEN APRIL 1ST AND OCT. 14TH, UNLESS APPROVED BY U.S. FISH AND WILDLIFE SERVICES (USFWS).
12. THE CONTRACTOR SHALL STAKE THE PROPOSED BANK STABILIZATION FOR REVIEW BY THE ENGINEER BEFORE INITIATING EXCAVATION. DEPENDING ON ENCOUNTERED CONDITIONS SOME SHIFTING OF THE PROPOSED BANK LOCATIONS MAY BE NECESSARY. ANY COST ASSOCIATED WITH CHANGING STRUCTURE LOCATIONS OR ALIGNMENT SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.
13. THE CONTRACTOR SHALL NOTIFY ENGINEER 72 HOURS PRIOR TO INSTALLING ANY STRUCTURES. PLACEMENT AND ELEVATION OF STRUCTURES SHALL BE DIRECTED BY THE ENGINEER
14. THE CONTRACTOR SHALL NOT CONSTRUCT MORE THAN 500 FEET OF BANK AND CHANNEL WITHOUT EROSION CONTROL BLANKET IN PLACE.
15. THE PROPOSED BANK STABILIZATION SHALL BE CONSTRUCTED BY FIRST EXCAVATING TO THE PROPER DEPTHS INDICATED IN THE DETAIL AND CROSS SECTIONS TO PLACE BOULDER TOE. THIS SHALL BE DONE AS CHANNEL EXCAVATION AND IS TYPICALLY ACCOMPLISHED WITH A TRACKED EXCAVATOR. THE DETAILS AND CROSS SECTIONS SHOWN PROVIDE WIDTHS AND SLOPES FOR AID IN CONSTRUCTING THE CHANNEL TO THE APPROPRIATE DIMENSIONS. THE SLOPING OF THE CROSS SECTIONS SHALL THEN BE PERFORMED AS SHOWN ON THE CROSS SECTIONS. ANY STOCKPILING OF MATERIALS OR "DOUBLE HANDLING" NECESSARY TO BUILD THE CHANNEL SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.
16. THE PROPOSED GRADE SHALL BE FINISHED TO A SMOOTH AND COMPACT SURFACE IN ACCORDANCE WITH THE LINES, GRADES AND CROSS SECTIONS OR ELEVATIONS SHOWN ON THE DRAWINGS. THE DEGREE OF FINISH FOR ELEVATIONS SHALL BE WITHIN 0.1 FEET OF THE GRADES AND ELEVATIONS INDICATED.
17. CONTRACTOR SHALL USE AN EXCAVATOR WITH A HYDRAULIC THUMB TO CONSTRUCT BOULDER TOE WITH ROOT WADS AND LIVE BRUSH LAYERING.
18. THE BID ITEMS, BOULDER TOE WITH ROOT WADS, LIVE BRUSH LAYERING, OR ANY OTHER WORK NOTED HEREIN SHALL INCLUDE ALL LABOR AND MATERIALS NECESSARY TO CONSTRUCT. BID ITEMS INCLUDE SEEDING, PLANTING AND MULCH, AND EROSION CONTROL BLANKETS NECESSARY TO RESTORE AREAS DISTURBED DURING CONSTRUCTION OF STRUCTURES.
19. CONSTRUCTION SPECIFICATIONS FOR CROSS SECTIONS WILL BE HELD TO THE TOLERANCES SHOWN ON SHEET C-104.
20. BANK STABILIZATION AREAS SHALL BE RE-VEGETATED AS SOON AS POSSIBLE BY SEEDING IN ACCORDANCE WITH THE PLANTING TABLE AND BY INSTALLING EROSION CONTROL BLANKET. ALL SEEDING AND INSTALLATION OF EROSION CONTROL BLANKET SHALL BE PERFORMED IN ACCORDANCE WITH THE CONSTRUCTION SPECIFICATIONS.
21. PERMANENT SEED MIX IS TYPICALLY INSTALLED IN THE FALL, AND IF THE TIMING OF PROJECT IS SUCH THAT THE PERMANENT SEED MIX CANNOT BE PLACED IN THE FALL, THEN THE CONTRACTOR SHALL SEED WITH THE TEMPORARY SEED MIX TO PROVIDE TEMPORARY COVER UNTIL PERMANENT MIX CAN BE SEEDED. HOWEVER, FOR THIS PROJECT ALL PERMANENT SEEDING SHALL OCCUR DURING CONSTRUCTION WITH THE ANTICIPATION OF A LOW SUCCESS RATE. THE CLIENT ANTICIPATES HAVING TO RE-SEED WITH PERMANENT SEED MIX IN THE FALL.
22. TYPICALLY ANY HARVESTING AND INSTALLATION OF LIVE STAKES AND LIVE BRUSH IS PERFORMED ONLY DURING THE DORMANT SEASON, TYPICALLY BETWEEN NOVEMBER 1 AND MARCH 31. HOWEVER, FOR THIS PROJECT ALL HARVESTING AND INSTALLATION OF LIVE STAKES AND LIVE BRUSH SHALL BE PERFORMED DURING CONSTRUCTION WITH THE ANTICIPATION OF A HIGH MORTALITY RATE. THE CLIENT ANTICIPATES HAVING TO RE-INSTALL LIVE STAKES AND LIVE BRUSH DURING DORMANT SEASON.
23. LIVE STAKES SHALL BE INSTALLED WHERE INDICATED ON THE DRAWINGS AND DETAILS. LIVE STAKES SHALL BE INSTALLED IN ACCORDANCE WITH THE DETAILS AND CONSTRUCTION SPECIFICATIONS.
24. TOPSOIL SHALL BE REMOVED FROM EXCAVATION AND SPOIL AREAS PRIOR TO CUT OR FILL AND RE-APPLIED TO AREAS AFTER ROUGH GRADING IS COMPLETE. FOUR INCHES OF TOPSOIL SHALL BE PLACED ON DISTURBED AREAS TO MEET GRADE. STOCKPILING AND PLACEMENT OF TOPSOIL SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.
25. THE CONTRACTOR WILL LIKELY HAVE TO SOURCE ADDITIONAL TOPSOIL FROM OFF-SITE.
26. SPOIL AREAS SHALL BE SEEDED WITH THE TEMPORARY MIX WITHIN 14 DAYS FOLLOWING PLACEMENT.
27. THE PLACEMENT OF STRAW MULCH SHALL OCCUR A MAXIMUM 48 HOURS AFTER PLANTING. MULCH WILL BE SPREAD TO COVER THE INSTALLED AREAS AT A MINIMUM RATE OF 40 BALES PER ACRE.
28. THE CONTRACTOR SHALL NOTIFY THE ENGINEER AND THE OWNER 72 HOURS BEFORE FINISH GRADING AND SEEDING ANY STAGING AREAS ON SITE.
29. THE CONTRACTOR SHALL GRADE ALL CONFLUENCES IN SUCH A WAY TO PROVIDE SMOOTH TRANSITIONS.
30. BANK STABILIZATION PROJECTS THAT UTILIZE NATURAL CHANNEL DESIGN RELY ON VEGETATION TO MINIMIZE EROSION. IF VEGETATION IS NOT ESTABLISHED PRIOR TO WINTER MONTHS OR PRIOR TO LARGE FLOWS SOME EROSION MAY OCCUR WHICH MAY REQUIRE ADDITIONAL SITE WORK, PLANTINGS, SEEDING, AND EROSION CONTROL BLANKET INSTALLATION. CONTRACTOR SHALL MAKE EVERY EFFORT TO SECURE EROSION CONTROL BLANKET QUICKLY AND RE-VEGETATE THE SITE QUICKLY.
31. THE CONTRACTOR SHALL COMMUNICATE CONSTRUCTION ISSUES, PROBLEMS OR DISCREPANCIES IN THE CONSTRUCTION DOCUMENTS TO THE ENGINEER IMMEDIATELY UPON BECOMING AWARE OF SUCH ISSUES. ANY REQUESTS FOR INFORMATION OR CLARIFICATION OF THE CONSTRUCTION DOCUMENTS SHALL BE IN ACCORDANCE TO SECTION 012600 OF THE CONSTRUCTION SPECIFICATIONS.
32. ANY PROPOSED MODIFICATION TO DESIGN FEATURES AS SHOWN (OR DESCRIBED) IN THE CONSTRUCTION DOCUMENTS SHALL BE CONTINGENT UPON ENGINEER APPROVAL. THE ENGINEER SHALL PROVIDE SUPPLEMENTAL INSTRUCTIONS FOR ANY DESIGN CHANGES IN ACCORDANCE WITH SECTION 012600 OF THE CONSTRUCTION SPECIFICATIONS.

AS-BUILT DRAWINGS

DURING CONSTRUCTION, THE CONTRACTOR AND THE ENGINEER SHALL WORK TOGETHER TO MAINTAIN A SET OF PRINTS SHOWING ANY CHANGES OR CORRECTIONS IN RED. THESE PRINTS SHALL BE SUBMITTED TO THE ENGINEER AT THE COMPLETION OF THE WORK.

PROJECT QUANTITIES *				
LINE ITEM NO.	SECTION	ITEM	UNIT	QUANTITY
1	310516	MODOT TYPE 4 ROCK DITCH LINER	TONS	1060
2	310516	MODOT TYPE 1 ROCK DITCH LINER	TONS	240
3	310516	MODOT TYPE 7 AGGREGATE FOR BASE	TONS	180
4	312000	EXCAVATION	CY	1330
5	312000	FILL (INCLUDES CHANNEL AND FILLING VOID SPACE IN BOULDER TOE)	CY	830
6	312000	TOPSOIL (SOURCED FROM OFF-SITE)	CY	330
7	312500	WOVEN EROSION CONTROL BLANKET	SY	1220
8	312500	SILT FENCE	LF	2054
9	312500	STRAW MULCH	Bale	48800
10	313501.2	LIVE BRUSH LAYERING (INCLUDES 3 LIFTS PER RUNNING LF)	LF	48800
11	313501.2	CONTINUOUS WEAVE EROSION CONTROL BLANKET	SY	610
12	313502	ROOT WAD	EACH	46
13	313502	BOULDER TOE WITH ROOT WADS	LF	530
14	314000	GEOTEXTILE FABRIC	SY	310
15	329200	TEMPORARY SEEDING (TOTAL DISTURBED AREA ON SITE)	AC	1.8
16	329200	PERMANENT SEEDING (DISTURBED AREAS WITHIN RIPARIAN)	AC	1.8
17	329300	TREES & SHRUBS	EACH	370
18	329350.1	LIVE STAKES (LBL & GRAVEL BAR)	EACH	11108
19	329350.1	LIVE BRANCHES (LBL)	EACH	15892

* NOT FOR BIDDING PURPOSES - FOR CONTRACTOR INFORMATION ONLY.

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- PROPOSED INTERIM CONTOURS
- EXISTING INDEX CONTOURS
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- LIMITS OF DISTURBANCE
- SF — SF — SILT FENCE
- BOULDER TOE WITH ROOT WADS AND LIVE BRUSH LAYERING
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- TEMPORARY CONSTRUCTION ENTRANCE

PROFILE & SECTION LEGEND

- EXISTING GROUND
- PROPOSED GRADE
- PROPOSED BANKFULL ELEVATION
- PROPOSED INNER BERM ELEVATION

STATE OF MISSOURI
MICHAEL L. PARSON, GOVERNOR

STATE OF MISSOURI — OFFICIAL SEAL — NUMBER PE 2017026130 — PROFESSIONAL ENGINEER
3/24/2020

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OFFICE OF ADMINISTRATION
DIVISION OF FACILITIES MANAGEMENT, DESIGN AND CONSTRUCTION

DEPARTMENT OF NATURAL RESOURCES

CASTLEWOOD STATE PARK
STREAMBANK RESTORATION
PHASE I

BALLWIN, MO

PROJECT # X2002-01
SITE # 5205
ASSET # 7815205028

REVISION:
DATE:
REVISION:
DATE:
REVISION:
DATE:
ISSUE DATE: 03/24/2020

CAD DWG FILE: G-002.dwg
DRAWN BY: DLH
CHECKED BY: OKR
DESIGNED BY: MAS

SHEET TITLE:

GENERAL NOTES

SHEET NUMBER:

G-002

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03/24/2020

CONTROL POINT TABLE				
POINT	NORTHING	EASTING	ELEVATION	DESCRIPTION
1000	990265.02	807021.49	447.81	SL-67 (STAMPED ALUMINUM DISK)

STATE OF MISSOURI
MICHAEL L. PARSON, GOVERNOR

STATE OF MISSOURI
OAKES KEEGAN ROUET
NUMBER PE 2017026130
PROFESSIONAL ENGINEER
3/24/2020

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ISSUE DATE: 03/24/2020

CAD DWG FILE: C-101.dwg
DRAWN BY: DLH
CHECKED BY: OKR
DESIGNED BY: MAS

SHEET TITLE:
ALIGNMENT LAYOUT & CONTROL POINT

SHEET NUMBER:
C-101

3 OF 16 SHEETS
03/24/2020

KIEFER CREEK REACH 1 ALIGNMENT									
NUMBER	START STATION	END STATION	LENGTH	RADIUS	LINE/CHORD DIRECTION	START NORTHING	END NORTHING	START EASTING	END EASTING
L1	10+00.0	10+18.4	18.37		N89° 27' 10.58"E	989382.548	989382.72	807508.573	807526.943
C1	10+18.4	10+77.7	59.37	150.00	N78° 06' 50.45"E	989382.723	989394.87	807526.943	807584.662
L2	10+77.7	11+14.3	36.55		N66° 46' 30.31"E	989394.872	989409.28	807584.662	807618.246
C2	11+14.3	12+33.8	119.54	110.40	N35° 45' 18.13"E	989409.283	989501.62	807618.246	807684.734
L3	12+33.8	12+85.0	51.17		N4° 44' 05.95"E	989501.623	989552.62	807684.734	807688.958

KIEFER CREEK REACH 2 ALIGNMENT									
NUMBER	START STATION	END STATION	LENGTH	RADIUS	LINE/CHORD DIRECTION	START NORTHING	END NORTHING	START EASTING	END EASTING
L4	20+00.0	20+18.1	18.13		N79° 49' 55.36"E	989739.797	989743.00	807616.064	807633.905
C3	20+18.1	20+27.6	9.49	20.00	N66° 14' 09.68"E	989742.997	989746.79	807633.905	807642.511
L5	20+27.6	20+38.6	10.93		N52° 38' 24.00"E	989746.786	989753.42	807642.511	807651.202
C4	20+38.6	21+17.5	78.99	75.50	N82° 36' 44.91"E	989753.421	989763.12	807651.202	807726.013
L6	21+17.5	21+26.1	8.56		S67° 24' 54.18"E	989763.120	989759.83	807726.013	807733.917
C5	21+26.1	21+34.4	8.26	50.00	S72° 08' 52.01"E	989759.833	989757.30	807733.917	807741.770
L7	21+34.4	21+48.5	14.13		S76° 52' 49.83"E	989757.304	989754.10	807741.770	807755.531

KIEFER CREEK REACH 3 ALIGNMENT									
NUMBER	START STATION	END STATION	LENGTH	RADIUS	LINE/CHORD DIRECTION	START NORTHING	END NORTHING	START EASTING	END EASTING
L8	30+00.0	30+38.2	38.19		S67° 56' 21.30"E	989686.251	989671.91	808001.048	808036.442
C6	30+38.2	30+50.8	12.61	100.00	S71° 33' 03.00"E	989671.907	989667.92	808036.442	808048.393
L9	30+50.8	30+55.9	5.06		S75° 09' 44.69"E	989667.920	989666.62	808048.393	808053.283
C7	30+55.9	31+47.5	91.63	90.40	S46° 07' 25.52"E	989666.625	989605.80	808053.283	808116.544
L10	31+47.5	31+48.8	1.32		S17° 05' 06.36"E	989605.798	989604.53	808116.544	808116.933
C8	31+48.8	31+79.0	30.18	49.60	S34° 30' 48.99"E	989604.533	989580.05	808116.933	808133.768
L11	31+79.0	31+83.4	4.44		S51° 56' 31.62"E	989580.050	989577.31	808133.768	808137.268

COORDINATE SYSTEM NOTE:

SURVEY COORDINATES REFERENCES TO MISSOURI STATE PLAN EAST COORDINATE SYSTEM NAD83.
ELEVATIONS ARE BASED ON NAVD88.

STATE OF MISSOURI
MICHAEL L. PARSON, GOVERNOR

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OKR
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ISSUE DATE: 03/24/2020

CAD DWG FILE: C-102.dwg
DRAWN BY: DLH
CHECKED BY: OKR
DESIGNED BY: MAS

SHEET TITLE:

ALIGNMENT LAYOUT TABLES

SHEET NUMBER:

C-102

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03/24/2020

STATE OF MISSOURI
MICHAEL L. PARSON, GOVERNOR

STATE OF MISSOURI
JAMES KEEFE
NUMBER
PE 2017026130
PROFESSIONAL ENGINEER
3/24/2020

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CAD DWG FILE: C-103.dwg
DRAWN BY: DLH
CHECKED BY: OKR
DESIGNED BY: MAS

SHEET TITLE:

KIEFER CREEK
PROPOSED PLAN

SHEET NUMBER:

C-103

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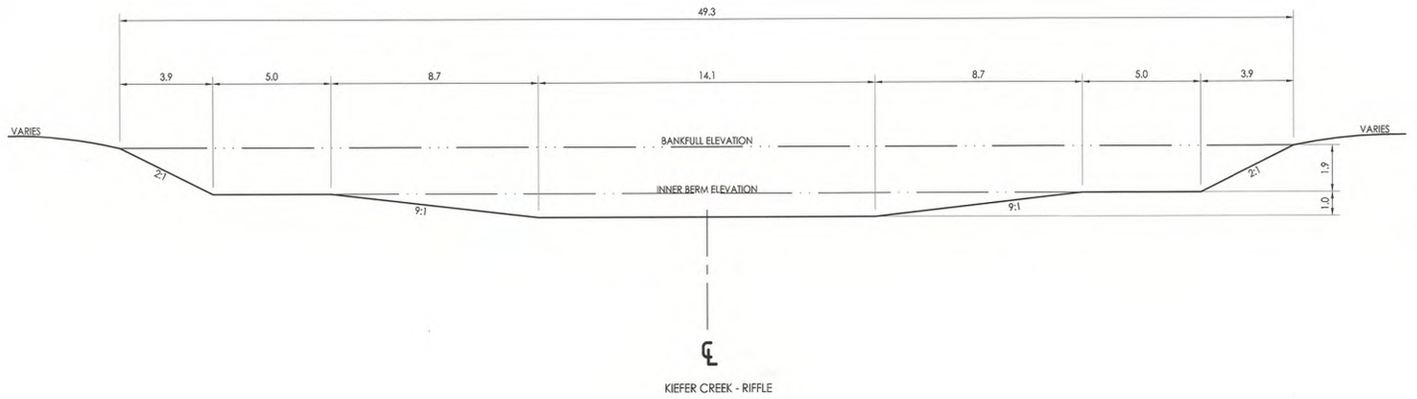
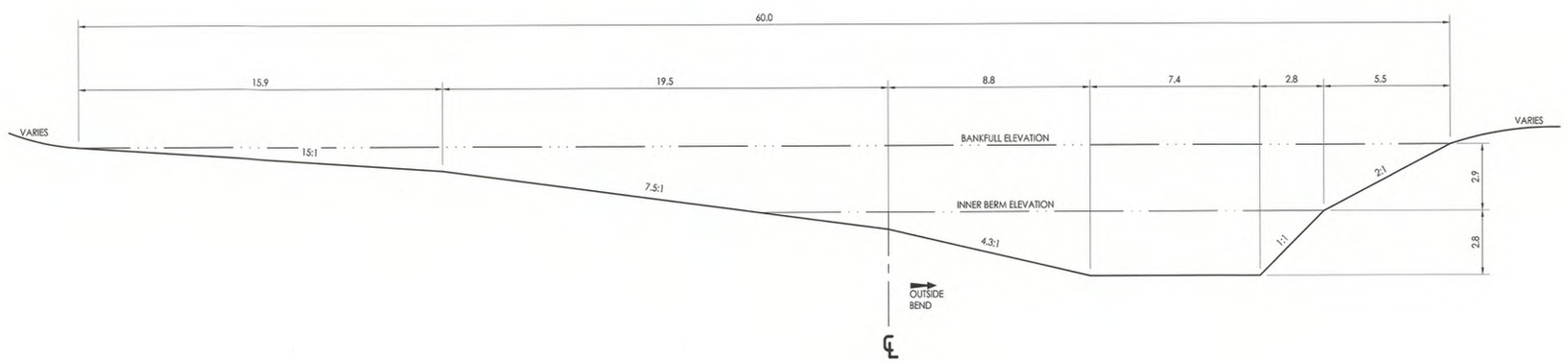
03/24/2020



KIEFER CREEK - RIFFLE



KIEFER CREEK - POOL

0 1.5' 3'
1"=3'

STATE OF MISSOURI
MICHAEL L. PARSON,
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STATE OF MISSOURI
OKKES KRESLIK
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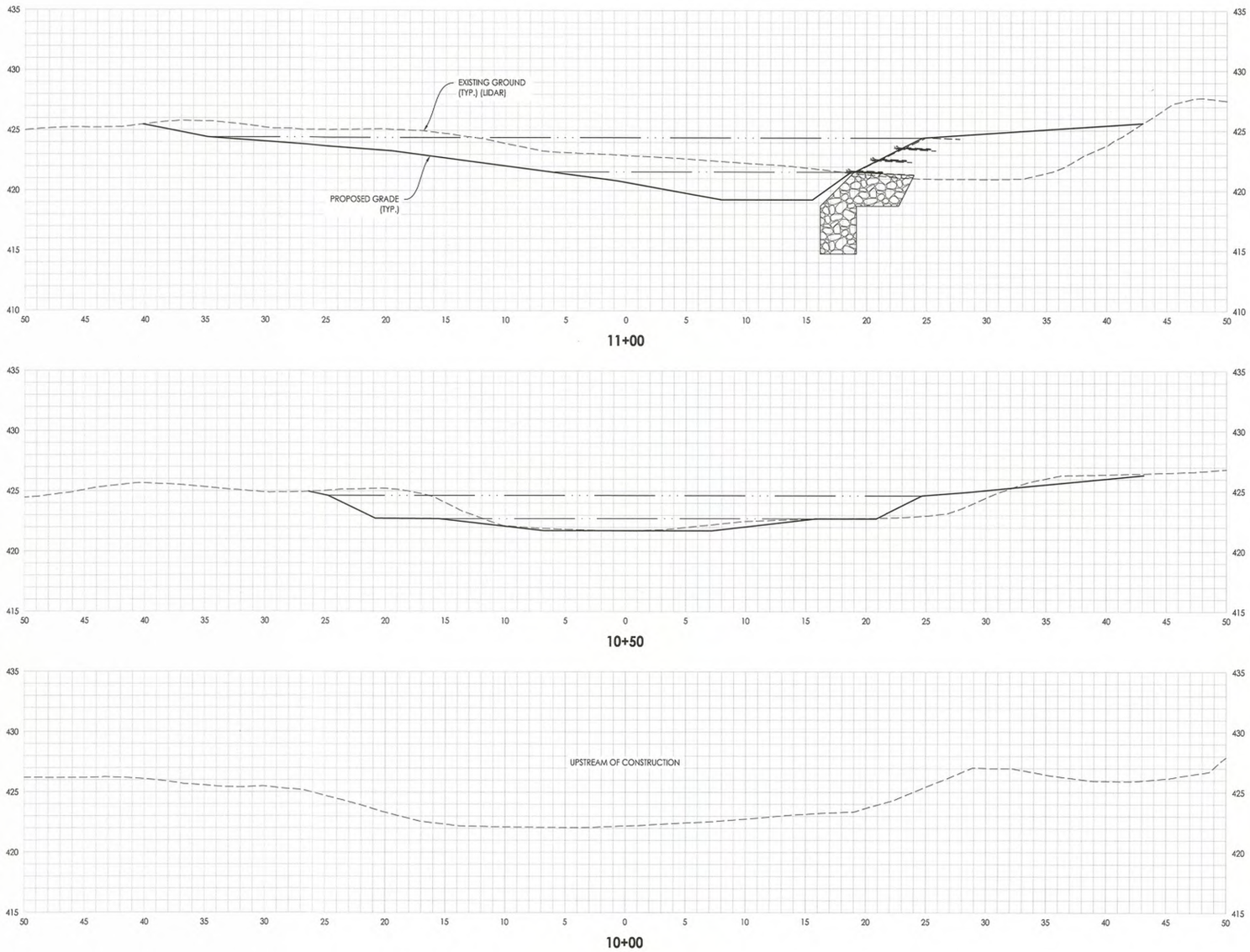
ISSUE DATE: 03/24/2020

CAD DWG FILE: C-104.dwg
DRAWN BY: DLH
CHECKED BY: OKR
DESIGNED BY: MAS

SHEET TITLE:
TYPICAL
CROSS SECTIONS

SHEET NUMBER:
C-104

6 OF 16 SHEETS
03/24/2020



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1"=5'V

STATE OF MISSOURI
MICHAEL L. PARSON,
GOVERNOR

STATE OF MISSOURI
OWEN KENNETH RIDDLE
NUMBER
PE 2017026130
PROFESSIONAL ENGINEER
3/24/2020

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DEPARTMENT OF
NATURAL RESOURCES

CASTLEWOOD STATE PARK
STREAMBANK RESTORATION
PHASE I

BALLWIN, MO

PROJECT # X2002-01
SITE # 5205
ASSET # 7815205028

REVISION:
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CAD DWG FILE: C-105.dwg
DRAWN BY: DLH
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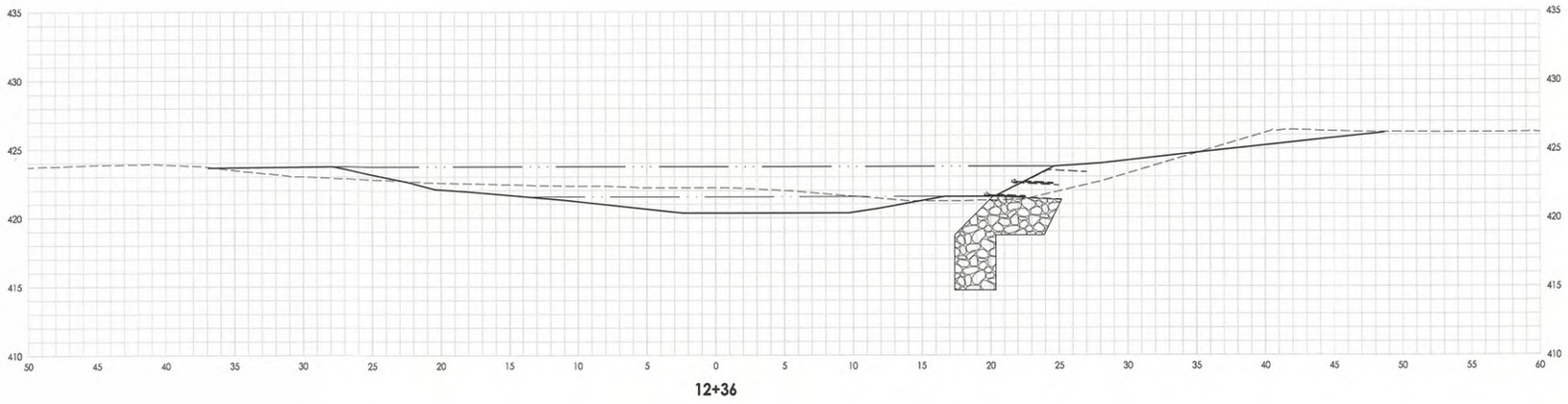
SHEET TITLE:

PROPOSED
CROSS SECTIONS
REACH 1

SHEET NUMBER:

C-105

7 OF 16 SHEETS
03/24/2020



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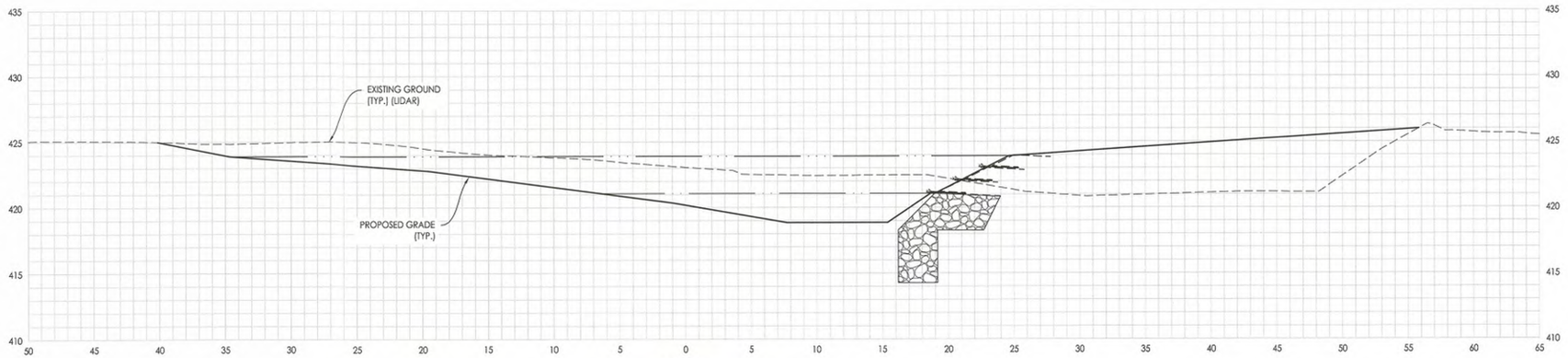

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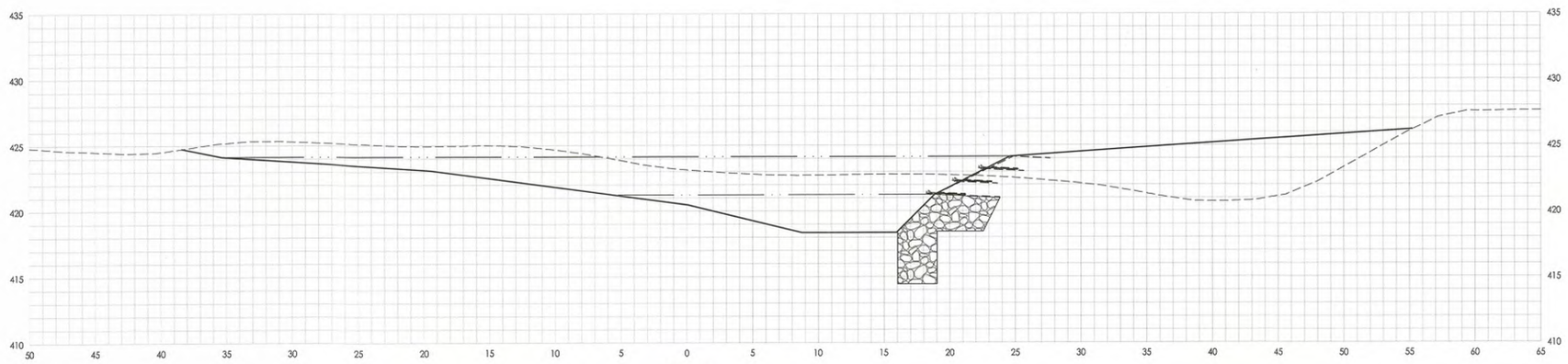

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1"=5'V

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GOVERNOR

STATE OF MISSOURI
JAMES MICHAEL HOUSTON
NUMBER
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CAD DWG FILE: C-106.dwg
DRAWN BY: DLH
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SHEET TITLE:

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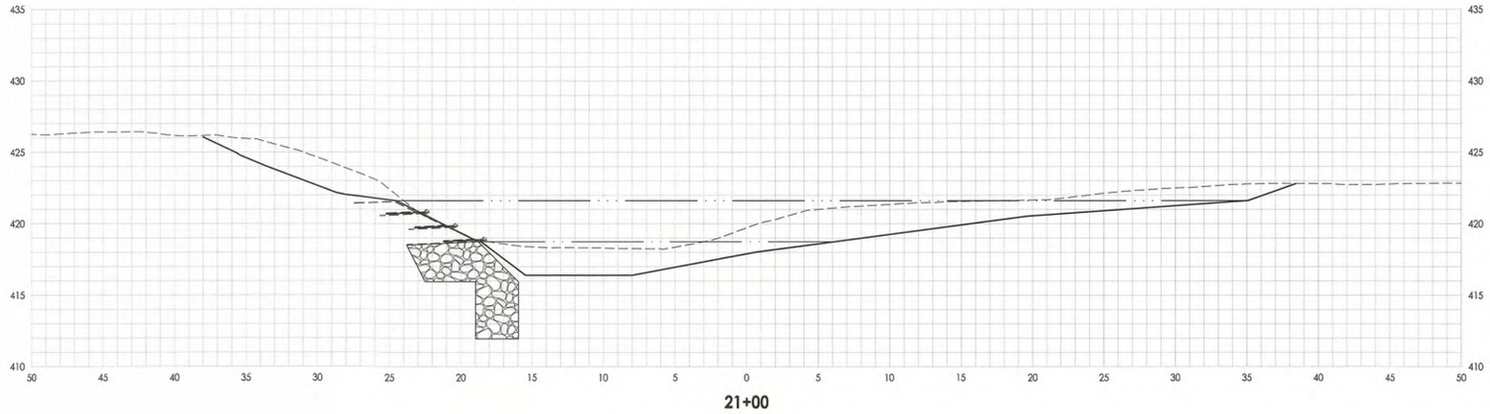
CROSS SECTIONS
REACH 1

SHEET NUMBER:

C-106

8 OF 16 SHEETS
03/24/2020



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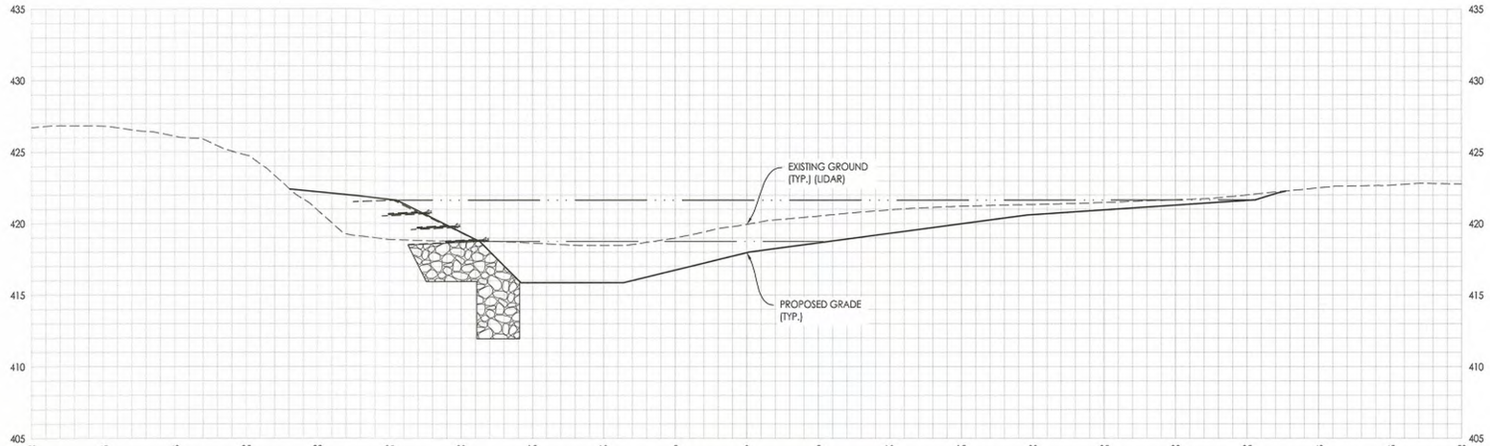

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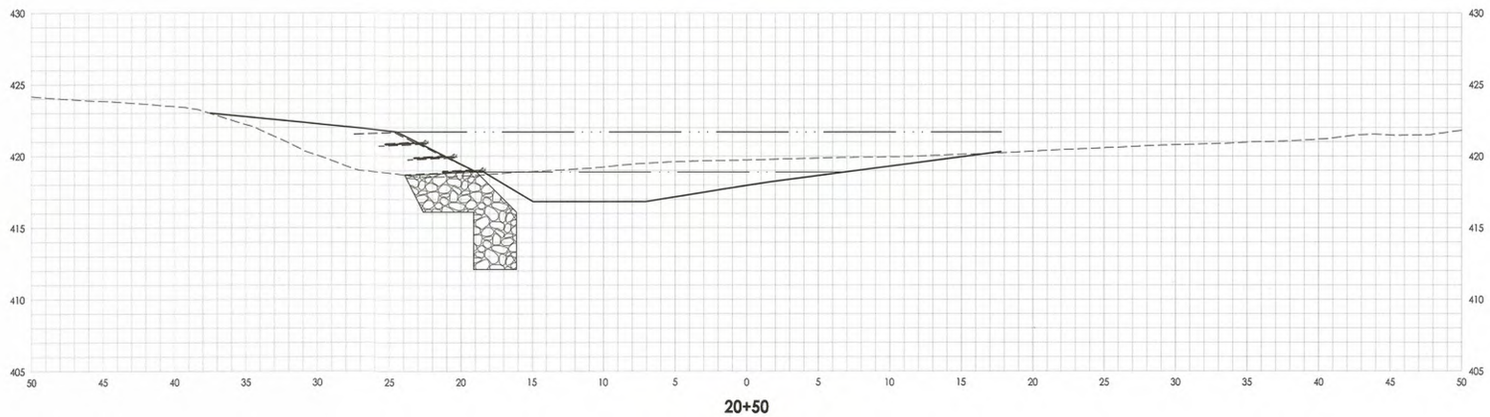

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1"=5'V

STATE OF MISSOURI
MICHAEL L. PARSON,
GOVERNOR

STATE OF MISSOURI
JAMES WESLEY
BOYD
NUMBER
PE 2017026130
PROFESSIONAL ENGINEER
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CAD DWG FILE: C-107.dwg
DRAWN BY: DLH
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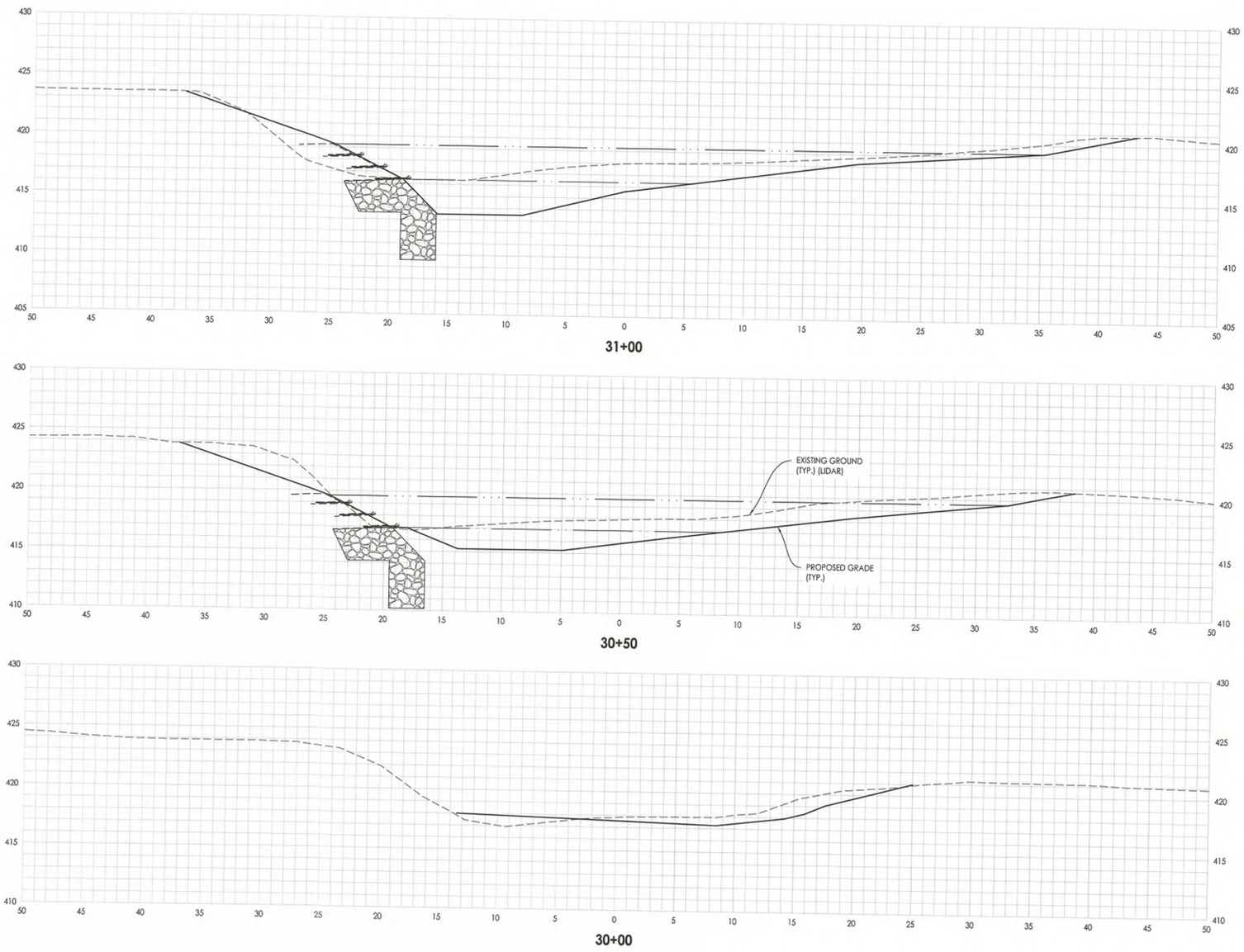
SHEET TITLE:

PROPOSED
CROSS SECTIONS
REACH 2

SHEET NUMBER:

C-107

9 OF 16 SHEETS
03/24/2020



31+00

30+50

30+00

1"=5'H 0 2.5' 5' 10'
1"=5'V

STATE OF MISSOURI
MICHAEL L. PARSON,
GOVERNOR

STATE OF MISSOURI
JAMES KEEFAUVER
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ISSUE DATE: 03/24/2020

CAD DWG FILE: C-108.dwg
DRAWN BY: DLH
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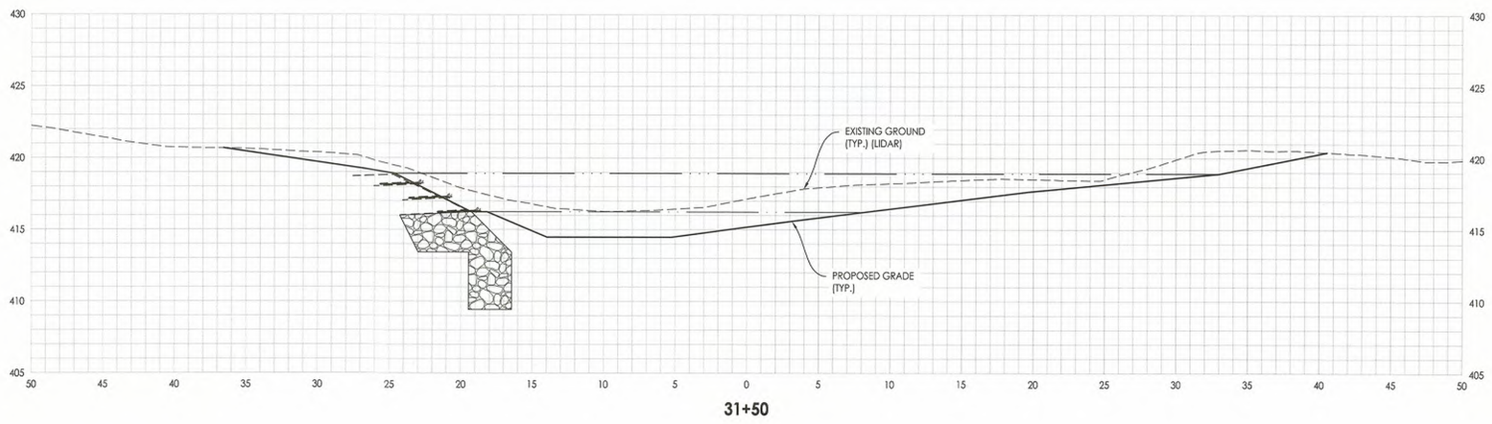
SHEET TITLE:

PROPOSED
CROSS SECTIONS
REACH 3

SHEET NUMBER:

C-108

10 OF 16 SHEETS
03/24/2020



31+50

1"=5'H 0 2.5' 5'
1"=5'V

STATE OF MISSOURI
MICHAEL L. PARSON,
GOVERNOR

STATE OF MISSOURI
JAMES KEELIN CARTER
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PE 2017026130
PROFESSIONAL ENGINEER
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SHEET TITLE:

PROPOSED
CROSS SECTIONS
REACH 3

SHEET NUMBER:

C-109

11 OF 16 SHEETS
03/24/2020

PLANTING PLAN

ZONE 1

GRAVEL BAR LIVE STAKES

ZONE 2

All Zones and Disturbed Areas Temporary Seed Mix (October - April) (1.8 acres total)

Common Name	Scientific Name	Wetland Indicator Status	Composition %	Pounds per Acre in Seedmix	Total Pounds in Zones 1 & 2
Winter Wheat	*Triticum aestivum*	n/a	100%	80.00	144.00

All Zones and Disturbed Areas Temporary Seed Mix (May - September) (1.8 acres)

Common Name	Scientific Name	Wetland Indicator Status	Composition %	Pounds per Acre in Seedmix	Total Pounds in Zones 1 & 2
Browntop Millet	*Urochloa ramosa*	n/a	100%	10.00	18.00

Zone 1 (Low Flow to Bankfull): Permanent Seed Mix (0.08 acres)

Common Name	Scientific Name	Wetland Indicator Status	Composition %	Pounds per Acre in Seedmix	Total Pounds in Zone 1
Fowl Mannagrass	*Glyceria striata*	OBL	15%	0.392	0.03
Virginia Wild Rye	*Elymus virginicus*	FACW	15%	3.920	0.31
Switchgrass	*Panicum virgatum*	FAC	5%	0.841	0.07
Little Bluestem	*Schizachyrium scoparium*	FACU	15%	2.723	0.22
Fox Sedge	*Carex vulpinoidea*	FACW	15%	0.603	0.05
Alternate Wingstem	*Verbesina alternifolia*	FACW	5%	0.901	0.07
Beggars Ticks	*Bidens frondosa*	FACW	5%	1.005	0.08
Common Rush	*Juncus effusus*	OBL	5%	0.058	0.00
Boneset	*Eupatorium perfoliatum*	OBL	5%	0.131	0.01
Mistflower	*Conoclinium coelestinum*	FACW	5%	0.174	0.01
Grass-Leaved Goldenrod	*Euthamia graminifolia*	FACW	5%	0.871	0.07
Cutleaf Coneflower	*Rudbeckia laciniata*	FACW	5%	0.864	0.07
		TOTAL	100%	12.484	1.00

Zone 1 (Low Flow to Bankfull): Live Stakes (0.08 acres)

Common Name	Scientific Name	Wetland Indicator Status	Composition %	Stems per Acre (1 per ft2)	Total Stems in Zone 1
TREES & SHRUBS					
Buttonbush	*Cephalanthus occidentalis*	OBL	25%	10890	871
Silky Dogwood	*Cornus amomum*	FACW	25%	10890	871
Black Willow	*Salix nigra*	OBL	25%	10890	871
Elderberry	*Sambucus nigra*	FAC	25%	10890	871
		TOTAL	100%	43560	3485

Zone 2 (Above Bankfull), Haul Routes, and Staging Areas: Permanent Seed Mix (1.72 acres)

Common Name	Scientific Name	Wetland Indicator Status	Composition %	Pounds per Acre in Seedmix	Total Pounds in Zone 2
Bottlebrush Grass	*Elymus hystrix*	UPL	15%	3.403	5.85
Big Bluestem	*Andropogon gerardii*	FAC	5%	0.908	1.56
River Oats	*Chasmanthium latifolium*	FACW	15%	4.356	7.49
Purple Top	*Tridens flavus*	UPL	10%	0.937	1.61
Silky Wild Rye	*Elymus villosus*	FACU	20%	5.227	8.99
Indiangrass	*Sorghastrum nutans*	FACU	5%	1.245	2.14
Common Milkweed	*Asclepias syriaca*	FACU	5%	2.723	4.68
Bergamot	*Monarda fistulosa*	FACU	5%	0.209	0.36
Illinois Bundleflower	*Desmanthus illinoiensis*	FACU	5%	1.089	1.87
Partridge Pea	*Chamaecrista fasciculata*	FACU	5%	1.742	3.00
Black Eyed Susan	*Rudbeckia hirta*	FACU	5%	0.163	0.28
Tall Goldenrod	*Solidago altissima*	FACU	5%	0.373	0.64
		TOTAL	100%	22.375	38.48

Zone 2 (Above Bankfull): Bare-Root or Containerized Plantings (0.54 acres)

Common Name	Scientific Name	Wetland Indicator Status	Composition %	Stems per Acre	Total Stems in Zone 2
SHRUBS					
Redbud	*Cercis canadensis*	FACU	20%	31	17
Ironwood	*Carpinus caroliniana*	FAC	20%	31	17
Roughleaf Dogwood	*Cornus drummondii*	FAC	20%	31	17
Carolina Buckthorn	*Rhamnus caroliniana*	FAC	20%	31	17
Bladdernut**	*Staphylea trifolia***	FAC	20%	31	17
		TOTAL	100%	155	84
TREES					
Sugar Maple	*Acer saccharum*	FACU	15%	42	23
Shellbark Hickory	*Carya laciniosa*	FACW	15%	42	23
Burr Oak	*Quercus macrocarpa*	FAC	15%	42	23
Shumard Oak	*Quercus shumardii*	FACW	15%	42	23
Black Walnut	*Juglans nigra*	FACU	10%	28	15
Sycamore	*Platanus occidentalis*	FACW	10%	28	15
Cottonwood	*Populus deltoides*	FAC	10%	28	15
American Elm	*Ulmus americana*	FACW	10%	28	15
		TOTAL	100%	280	151

** If unavailable, Bladdernut (Staphylea trifolia) may be substituted with Hoptree (Ptelea trifoliata)

Gravel Bar: Live Stakes (0.35 acres)

Common Name	Scientific Name	Wetland Indicator Status	Composition %	Stems per Acre (see detail - 1/10)	Total Stems
TREES & SHRUBS					
Buttonbush	*Cephalanthus occidentalis*	OBL	25%	5445	1906
Silky Dogwood	*Cornus amomum*	FACW	25%	5445	1906
Black Willow	*Salix nigra*	OBL	25%	5445	1906
Elderberry	*Sambucus nigra*	FAC	25%	5445	1906
		TOTAL	100%	21780	7623

NOTE: ALL VEGETATION OUTSIDE OF THE LIMITS OF DISTURBANCE SHALL BE PRESERVED TO PROVIDE NATURAL BUFFERING.

STATE OF MISSOURI
MICHAEL L. PARSON, GOVERNOR

STATE OF MISSOURI
JAMES KEITH [illegible]
NUMBER PE 2017026130
PROFESSIONAL ENGINEER
3/24/2020

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CASTLEWOOD STATE PARK
STREAMBANK RESTORATION
PHASE I

BALLWIN, MO

PROJECT # X2002-01
SITE # 5205
ASSET # 7815205028

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CAD DWG FILE: C-110.dwg
DRAWN BY: DLH
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DESIGNED BY: MAS

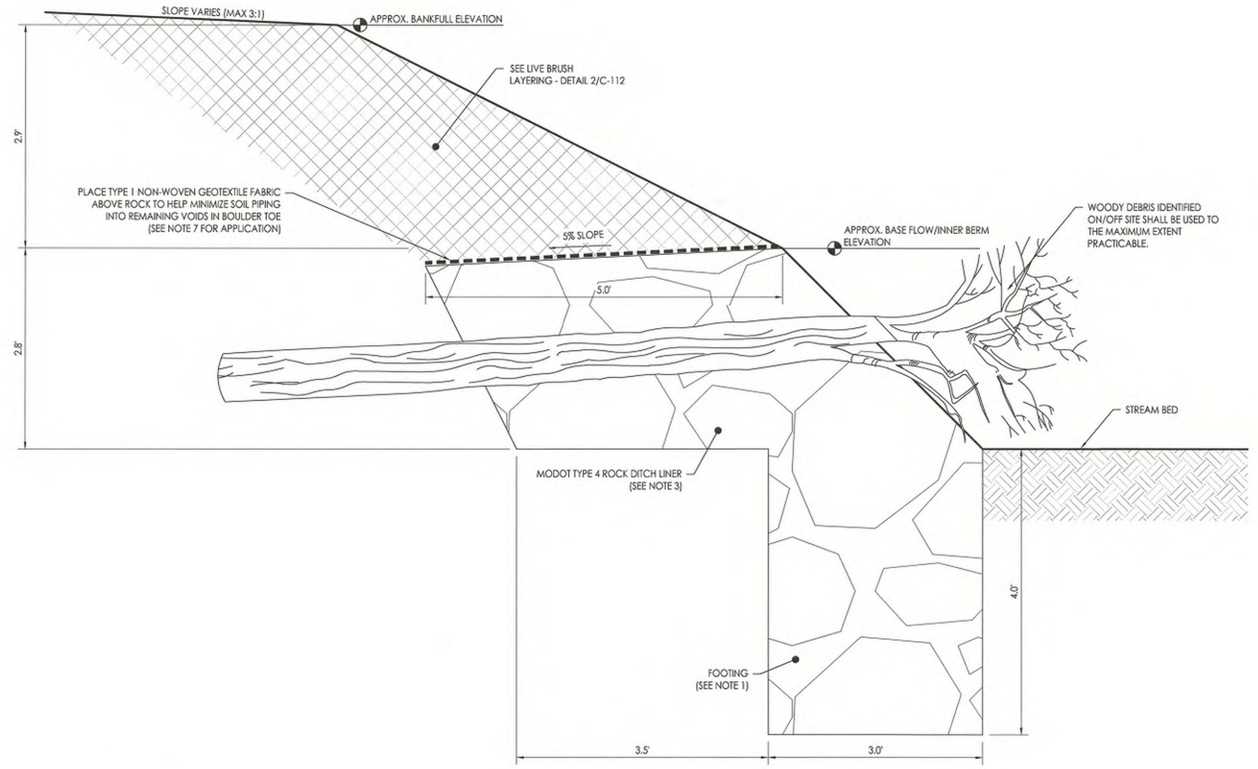
SHEET TITLE:

PLANTING PLAN

SHEET NUMBER:

C-110

12 OF 16 SHEETS
03/24/2020



NOTES:

1. A 4-FEET DEEP BY 3-FEET WIDE FOOTING CONSISTING OF MODOT TYPE 4 ROCK DITCH LINER SHALL BE CONSTRUCTED BENEATH THE CHANNEL BOTTOM ELEVATION RELATIVE TO THE TYPICAL SECTION.
2. PLACE A MINIMUM OF 2.8 FEET OF MODOT TYPE 4 ROCK DITCH LINER, STARTING AT CHANNEL BOTTOM, TO PROVIDE BASE TO RECONSTRUCT SLOPE. THE OUTER FACE OF THE ROCK SHALL BE STACKED IN A 1:1 SLOPE OR FLATTER. THE ROCK, AFTER PLACEMENT, SHOULD OCCUPY THE FIRST 6.5 FEET OF RECONSTRUCTED BANK WIDTH AT THE TOE AND 5 FEET BANK WIDTH AT THE APPROXIMATE BASE FLOW ELEVATION, AT TRANSITIONS AT BOTH ENDS OF THE LIVE BRUSH LAYERING.
3. BOULDER TOE SHALL BE COMPLETED BY FIRST PLACING A LAYER OF MACHINED STONE (MODOT TYPE 4 ROCK DITCH LINER) AND THEN TOP DRESSING WITH NATIVE COBBLE/GRAVEL MATERIAL TO HELP FILL VOID SPACE. THIS SEQUENCE SHALL BE FOLLOWED UNTIL REACHING APPROXIMATE BASEFLOW ELEVATION. THE INTENT OF USING NATIVE COBBLE/GRAVEL MATERIAL TO HELP FILL VOID SPACE IS TO PROVIDE A MORE STABLE MATRIX OF BANK MATERIAL AND TO ALSO FUNCTION AS A FILTER THAT SHOULD HELP PREVENT LOSS OF SOIL BACKFILL MATERIAL FROM THE LIVE BRUSH LAYERING.
4. ROOT WADS AND ACCOMPANYING WOODY DEBRIS SHALL BE PLACED ON APPROXIMATE 25' SPACING AS SHOWN IN THE PLAN SHEETS, OR AS INSTRUCTED BY THE ENGINEER BASED ON SITE AVAILABILITY. ROOT WADS SHOULD BE PLACED IN PAIRS AT APPROXIMATE ELEVATION SHOWN IN THE DETAIL CROSS SECTION. THE ENTIRE UPSTREAM ROOT WAD SHALL PROTRUDE FROM THE BANK TO ADD ROUGHNESS AND SLOW NEAR BANK VELOCITIES WHILE THE IMMEDIATE DOWNSTREAM ROOT WAD SHALL BE PLACED FLUSH WITH THE BANK TO HELP REDUCE POTENTIAL SCOUR FROM TURBULENCE CREATED BY THE IMMEDIATE UPSTREAM ROOT WAD.
5. TREES USED FOR ROOT WADS SHALL, ON AVERAGE, BE A MINIMUM OF 6 INCHES IN DIAMETER AT BREAST HEIGHT. ACCOMPANYING WOODY DEBRIS DOES NOT HAVE A MINIMUM DIAMETER REQUIREMENT. TREES USED FOR ROOT WADS SHALL BE HARDWOOD SPECIES FREE OF ANY DECAY THAT WOULD RESULT IN RISK OF STABILITY.
6. ROOT WADS SHALL TIE BACK INTO THE BANK A MINIMUM OF 10' AND SHALL BE ANGLED UPSTREAM AS SHOWN IN THE PROPOSED PLAN SHEETS.
7. PLACE TYPE I NON-WOVEN GEOTEXTILE FABRIC ON TOP OF THE FINISHED BOULDER TOE BEGINNING 6 INCHES FROM THE FACE OF THE PROPOSED BANK AND EXTENDING BACK A MINIMUM OF 3 FEET INTO THE PROPOSED BANK TO HELP PREVENT PIPING OF SOIL MATERIAL INTO ANY REMAINING VOID SPACE WITHIN THE BOULDER TOE.
8. INSTALL LIVE BRUSH LAYERING ON TOP OF THE GEOTEXTILE FABRIC. LIVE BRUSH LAYERING SHALL BE INSTALLED IN ACCORDANCE WITH DETAIL 2 ON SHEET C-112.
9. STRUCTURE MAY BE MODIFIED IN FIELD BY ENGINEER.

1 / C-111 DETAIL – BOULDER TOE WITH ROOT WADS
NOT TO SCALE

STATE OF MISSOURI
MICHAEL L. PARSON,
GOVERNOR

STATE OF MISSOURI
OAKES KERGAN
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CAD DWG FILE: C-111.dwg
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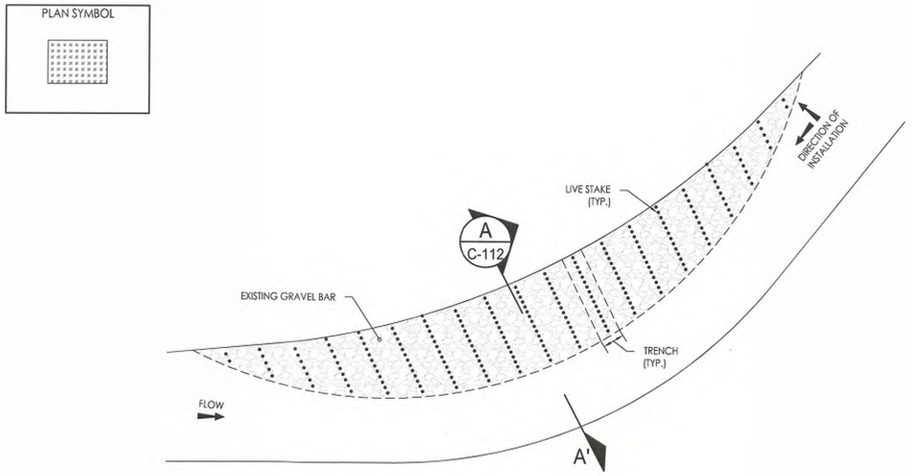
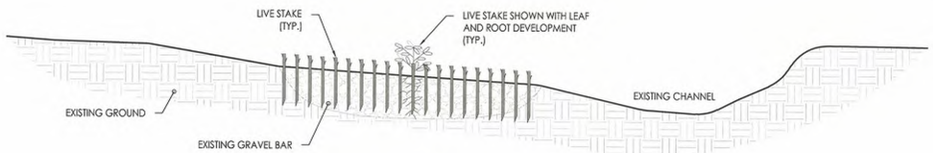
DETAILS

SHEET NUMBER:
C-111

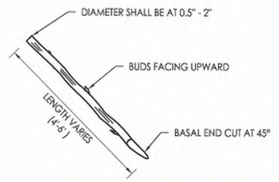
13 OF 16 SHEETS
03/24/2020



PLAN VIEW



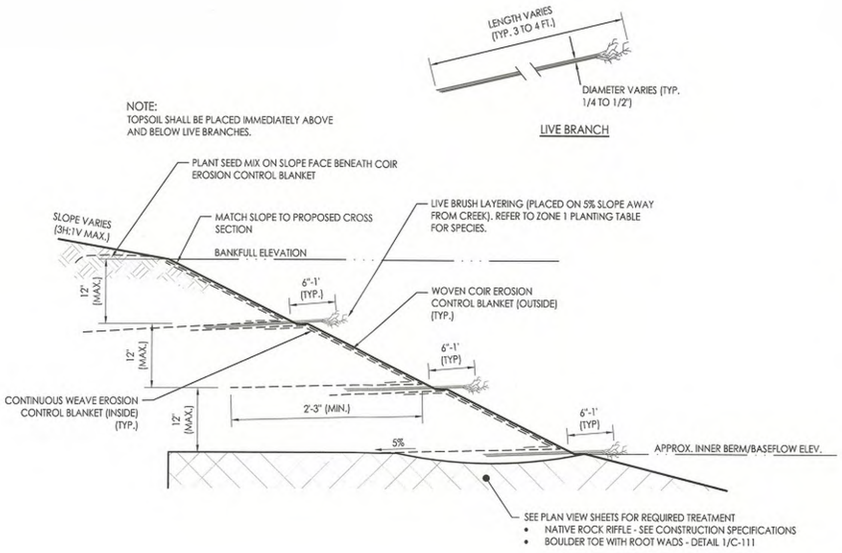
SECTION A-A'



NOTES:

1. GRAVEL BAR LIVE STAKES SHALL BE INSTALLED IN LOCATIONS SPECIFIED ON THE PLANS.
2. STAKES SHALL BE CUT FROM AN APPROVED SOURCE WITH A SHARP TOOL. STAKES SHALL BE FREE FROM DISEASE OR EXCESS DEAD TWIGS, 4 - 6 FEET IN LENGTH WITH A BASAL END AT 0.5 - 2 INCHES IN DIAMETER. PRIOR TO INSTALLATION BASAL END SHALL BE CUT AT A 45 DEGREE ANGLE AND THE OPPOSITE END SHALL BE CUT FLAT WITHOUT CRACKS.
3. STARTING FROM THE DOWNSTREAM END OF THE EXISTING GRAVEL BAR, THE CONTRACTOR SHALL EXCAVATE TRENCHES RUNNING PERPENDICULAR TO THE CHANNEL, FOR THE ENTIRE WIDTH OF THE GRAVEL BAR. THESE TRENCHES SHALL BE SPACED FOUR (4) FEET ON CENTER.
4. THE CONTRACTOR SHALL USE AN EXCAVATOR WITH A MAXIMUM BUCKET WIDTH OF 2.0 FEET TO EXCAVATE TRENCHES.
5. THE TRENCHES SHALL BE EXCAVATED TO A DEPTH AND ANGLE WHICH ALLOWS LIVE STAKES TO BE INSTALLED AT A 45° ANGLE DOWNSTREAM AND BURIED WITH 1/4 OF THE TOTAL STAKE LENGTH EXPOSED.
6. LIVE STAKES SHALL BE PLANTED TWO (2) PER RUNNING LINEAR FOOT OF TRENCH.
7. THE EXCAVATED MATERIAL SHALL THEN BE USED TO COVER THE PLACED STAKES.
8. PLANTING SHALL BEGIN ON THE DOWNSTREAM, STREAMWARD SIDE OF RESPECTIVE PLANTING AREA AND SHALL BE COMPLETED PERPENDICULARLY ACROSS THE EXISTING GRAVEL BAR. ONCE A ROW OF PLANTINGS HAVE BEEN COMPLETED ACROSS THE AREA, THE EXCAVATOR SHALL TRENCH AND PLANT IN SUCCESSIVE ROWS MOVING UPSTREAM.
7. LIVE STAKES ARE TYPICALLY INSTALLED WHEN THEY ARE DORMANT, WHICH TYPICALLY OCCURS BETWEEN NOVEMBER 1 AND MARCH 31. HOWEVER, FOR THIS PROJECT ALL LIVE STAKES SHALL BE INSTALLED DURING CONSTRUCTION WITH THE ANTICIPATION OF A HIGH MORTALITY RATE.
8. THE CLIENT ANTICIPATES RE-INSTALLING LIVE STAKES DURING DORMANCY.

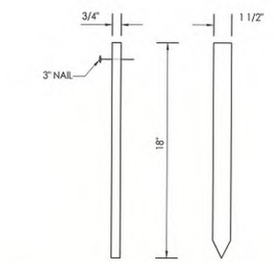
1 C-112 DETAIL - TYPICAL GRAVEL BAR LIVE STAKE
NOT TO SCALE



NOTES:

1. CONSTRUCT REQUIRED TOE TREATMENTS PER CORRESPONDING DETAIL.
2. SOIL BACKFILL USED FOR LIFTS AND TOPSOIL USED FOR LAYERING WITH THE LIVE BRUSH SHALL BE FREE OF ANY LARGE ROOTS OR WOODY DEBRIS AND COBBLE MATERIAL.
3. BACKFILL ON TOP OF ROCK/GEOTEXTILE WITH SOIL TO CREATE A PLANTING SURFACE SLOPE APPROXIMATELY 5% AWAY FROM CREEK. WIDTH OF PLANTING SURFACE SHOULD BE A MINIMUM OF 2 FEET. PLACE TOPSOIL ON PLANTING SURFACE AND PLACE LIVE BRUSH SUCH THAT 2/3 OF THE BRUSH WILL BE COVERED WITH SOIL AND 1/3 OF THE BRUSH IS EXPOSED, EXTENDING BEYOND THE FACE OF THE BANK. PLACE A MINIMUM OF 8 TO 12 STEMS PER RUNNING FOOT OF BANK IN A SLIGHT CRISS-CROSS PATTERN. BACKFILL ABOVE LIVE BRUSH WITH A 4 INCH LAYER OF TOPSOIL.
4. PLACE A LAYER OF 6.5 FT WIDE (MIN.) GEOCOIR DEKOWE 700 WOVEN EROSION CONTROL BLANKET, OR APPROVED EQUIVALENT, ON TOP OF THE TOPSOIL AND LIVE BRANCHES SUCH THAT A MINIMUM OF 2 FEET OF THE BLANKET WILL BE BURIED BELOW THE NEXT SOIL LIFT. ALLOW THE EXCESS BLANKET TO LAY OVER THE BANK, TOWARD THE CHANNEL.
5. PLACE A LAYER OF 3.3 FT WIDE (MIN.) C-125BN CONTINUOUS WEAVE EROSION CONTROL BLANKET, OR APPROVED EQUIVALENT, OVER THE WOVEN EROSION CONTROL BLANKET SUCH THAT IT COVERS THE ENTIRE FACE OF THE LIFT BENEATH THE WOVEN EROSION CONTROL BLANKET. ALLOW EXCESS BLANKET TO LAY OVER THE BANK, ON TOP OF THE WOVEN EROSION CONTROL BLANKET.
6. PLACE SOIL BACKFILL UP TO THE LIFT HEIGHT SPECIFIED OF NO GREATER THAN 1.0 FOOT BEING CAREFUL NOT TO PUSH/PULL OR TEAR THE BLANKET PREVIOUSLY PLACED.
7. THE TOP OF THE SOIL BACKFILL SHALL BE FLAT WITHIN THE LIFT SETBACK DISTANCE SPECIFIED. BEYOND THE LIFT SETBACK DISTANCE, THE SOIL BACKFILL SHALL BE SLOPED AT AN APPROXIMATE 5% SLOPE AWAY FROM THE STREAM.
8. FOR THE TOP COURSE, TOP DRESS THE SOIL LIFT WITH TOPSOIL FROM THE FACE OF THE SOIL LIFT BACK INTO THE FLOODPLAIN AT LEAST 4FT.
9. SPRINKLE SEED MIX ON SOIL AT THE SEEDING RATE SHOWN IN PLANTING PLAN WHERE IT WILL BE EXPOSED AND APPLY STRAW MULCH.
10. WRAP THE FACE AND TOP OF THE SOIL LIFT USING THE WOVEN AND CONTINUOUS WEAVE EROSION CONTROL BLANKET HANGING OVER THE PREVIOUS LIFT OR BOULDER TOE.
11. THE EROSION CONTROL BLANKET SHALL BE PULLED AS TIGHT AS POSSIBLE WITHOUT TEARING OR EXCESSIVELY DISTORTING THE BLANKET.
12. SECURE THE WOVEN EROSION CONTROL AND CONTINUOUS WEAVE EROSION CONTROL BLANKET IN PLACE BY STAKING THE END OF THE EROSION CONTROL BLANKET WITH WOOD STAKES ON 3-FOOT CENTERS. SEE WOOD STAKE DETAIL FOR SPECIFICATIONS.
13. BEGIN CONSTRUCTION OF THE NEXT SOIL LIFT BY REPEATING THE PREVIOUS NOTES STARTING WITH NOTE 3.
14. THE OVERALL SLOPE CREATED BY THE LIVE BRUSH LAYERING SHALL MATCH THE PROPOSED CROSS SECTION SHAPE FOR THE OUTER BANK OF THE TYPICAL POOL CROSS-SECTION.
15. THE EROSION CONTROL BLANKETS USED FOR THE UPPER MOST SOIL LIFT WILL BE SECURED BY STAKING THE END OF THE BLANKET APPROXIMATELY 4 INCHES BELOW FINISH GRADE ELEVATION AS SHOWN IN THE DETAIL AND BACKFILLING OVER THE END OF THE BLANKET AND STAKE DURING FINISH GRADING OPERATIONS.
16. THE SURFACE OF THIS STRUCTURE SHALL BE FINISHED TO A SMOOTH AND COMPACT SURFACE IN ACCORDANCE WITH THE LINES, GRADES, AND CROSS-SECTIONS OR ELEVATIONS SHOWN ON THE DRAWINGS. THE DEGREE OF FINISH FOR ELEVATIONS SHALL BE WITHIN 0.1 FT OF THE GRADES AND ELEVATIONS INDICATED.
7. LIVE BRUSH IS TYPICALLY INSTALLED WHEN THEY ARE DORMANT, WHICH TYPICALLY OCCURS BETWEEN NOVEMBER 1 AND MARCH 31. HOWEVER, FOR THIS PROJECT ALL LIVE BRUSH SHALL BE INSTALLED DURING CONSTRUCTION WITH THE ANTICIPATION OF A HIGH MORTALITY RATE.
8. THE CLIENT ANTICIPATES RE-INSTALLING LIVE BRUSH DURING DORMANCY.

2 C-112 LIVE BRUSH LAYERING
NOT TO SCALE



NOTES:

1. WOOD STAKES SHALL BE OF MINIMUM DIMENSIONS SHOWN AND SHALL BE GENERALLY FREE OF ANY KNOTS.
2. ALL WOOD STAKES SHALL BE RELATIVELY STRAIGHT AND WITHOUT ANY ROT OR WATER DAMAGE.
3. ONE 3-INCH NAIL SHALL BE DRIVEN THROUGH A PRE-DRILLED HOLE 1" TO 2" BELOW THE TOP OF THE WOOD STAKE.
4. THE PRE-DRILLED HOLE SHALL BE SMALL ENOUGH THAT THE NAIL MUST BE DRIVEN INTO THE STAKE, YET LARGE ENOUGH TO PREVENT SPLITTING OF THE STAKE WHILE DRIVING THE NAIL.
5. THE NAIL SHALL BE DRIVEN SUCH THAT AN EQUAL AMOUNT OF THE NAIL PROTRUDES THROUGH BOTH SIDES OF THE WOOD STAKE.
6. IN-LIEU OF PREDRILING HOLES THROUGH THE WOOD STAKES, A NEUMATIC NAIL-GUN MAY BE USED; HOWEVER, THE AIR PRESSURE MUST BE ADJUSTED SUCH THAT NO SPLITTING OF THE WOOD STAKE OCCURS.

3 C-112 TYPICAL WOOD STAKE
NTS

STATE OF MISSOURI
MICHAEL L. PARSON,
GOVERNOR

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DEPARTMENT OF
NATURAL RESOURCES

CASTLEWOOD STATE PARK
STREAMBANK RESTORATION
PHASE I

BALLWIN, MO

PROJECT # X2002-01
SITE # 5205
ASSET # 7815205028

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CAD DWG FILE: C-112.dwg
DRAWN BY: DLH
CHECKED BY: OKR
DESIGNED BY: MAS

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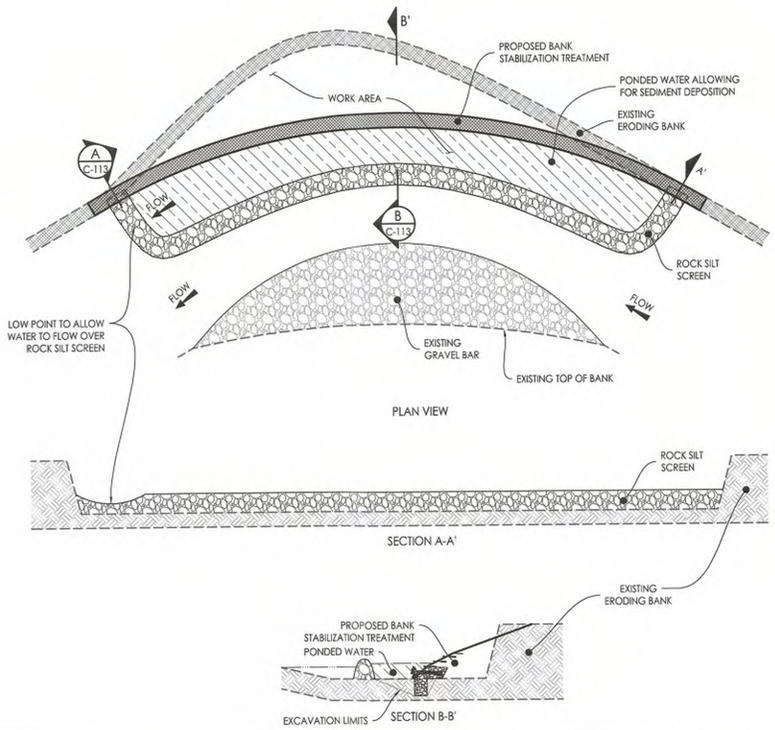
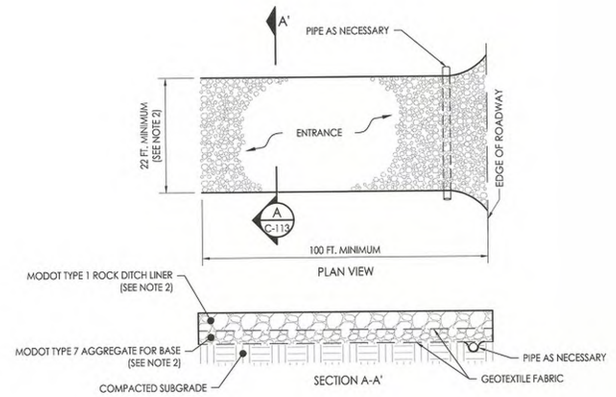


NOTES:

1. ROCK SILT SCREENS WILL BE INSTALLED, IF NEEDED, AT ACTIVE CHANNEL WORK AREAS.
2. EXCAVATE ENOUGH CHANNEL MATERIAL FROM WORK AREA TO CONSTRUCT ROCK SILT SCREEN AS SHOWN TO SEPARATE MAIN CHANNEL FLOW FROM WORK AREA.
3. THE DOWNSTREAM END OF THE ROCK SILT SCREEN SHALL BE CONSTRUCTED WITH A LOW POINT SUCH THAT THE PONDED WATER IS ABLE TO FLOW OVER THE LOW POINT, BUT NOT ABLE TO FLOW OVER ANY OTHER LOCATION OF THE ROCK SILT SCREEN DURING BASEFLOW CONDITIONS.
4. EXCAVATE CHANNEL MATERIAL FROM WORK AREA WHERE BOULDER TOE WILL BE CONSTRUCTED.
5. ONCE THE TOE STABILIZATION TREATMENT HAS BEEN COMPLETED, THE ROCK SILT SCREEN SHALL BE LEFT IN PLACE UNTIL THE OBSERVED TURBIDITY OF THE PONDED WATER IN THE WORK AREA RETURNS TO THE NORMAL LEVEL.
6. REMOVE THE SILT SCREEN BY USING THE ROCK MATERIAL AS BACKFILL FOR THE REMAINING BANK STABILIZATION WORK.

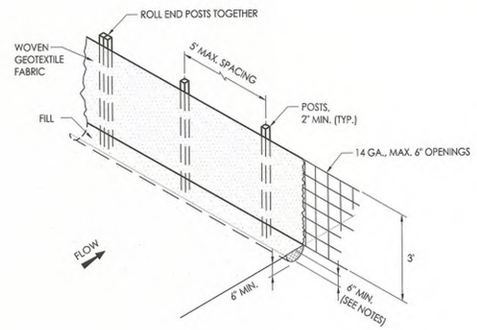
1 C-113 ROCK SILT SCREEN
NTS



NOTES:

1. ALL THE DIMENSIONS IN THE DRAWING ARE RECOMMENDED MINIMUMS.
2. THE CONTRACTOR SHALL INSTALL TWO SEPARATE LAYERS OF ROCK SEPARATED BY GEOTEXTILE FABRIC. THE TOP LAYER SHALL CONSIST OF 8 INCHES OF MACHINED STONE (MODOT TYPE 1 ROCK DITCH LINER) AND THE BOTTOM LAYER SHALL BE 6 INCHES OF MODOT TYPE 7 AGGREGATE FOR BASE.
3. THE ENTRANCE SHOULD BE A MINIMUM OF 100 FEET IN LENGTH AND 22 FEET IN WIDTH.
4. THE CONTRACTOR SHALL MAKE EVERY EFFORT TO MINIMIZE THE AMOUNT OF SOIL AND MUD LEAVING THE CONSTRUCTION SITE. STONE IN THE ENTRANCE SHOULD BE ADDED OR CLEANED WHENEVER THE ENTRANCE FAILS TO PREVENT MUD TRACKING ON THE PUBLIC ROADWAY.
5. THE CONTRACTOR SHALL RESTORE GROUND BACK TO ORIGINAL CONDITION POST CONSTRUCTION.
6. PIPING SHALL BE OF SUFFICIENT DIAMETER AND SLOPE TO PASS ROADSIDE DITCH FLOWS.

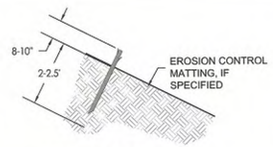
2 C-113 TEMPORARY CONSTRUCTION ENTRANCE
NOT TO SCALE



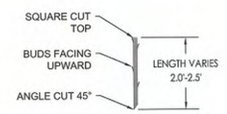
NOTES:

1. SILT FENCE SHALL BE INSTALLED ACROSS SLOPES ON THE CONTOUR LINE.
2. ATTACH FILTER FABRIC TO POSTS WITH STAPLES, HOGRINGS OR OTHER MATERIALS APPROVED BY THE ENGINEER.
3. POSTS SHALL BE WOOD, STEEL, OR SYNTHETIC.
4. POSTS SHALL BE INSTALLED ON THE DOWNHILL SIDE OF FILTER FABRIC.
5. BURY THE BOTTOM 12 INCHES OF FILTER FABRIC IN A 6"X6" TRENCH (TO PREVENT SEDIMENT FROM ESCAPING UNDER THE FENCE) AND BACK FILL WITH SOIL.
6. JOIN SILT FENCE SECTIONS BY ROLLING END POSTS TOGETHER TO CREATE AN UNBROKEN SEDIMENT BARRIER.
7. MULCH BERMS MAY BE APPROVED BY THE ENGINEER ON A CASE-BY-CASE BASIS.

3 C-113 SILT FENCE
NOT TO SCALE



INSTALLED LIVE STAKE DETAIL

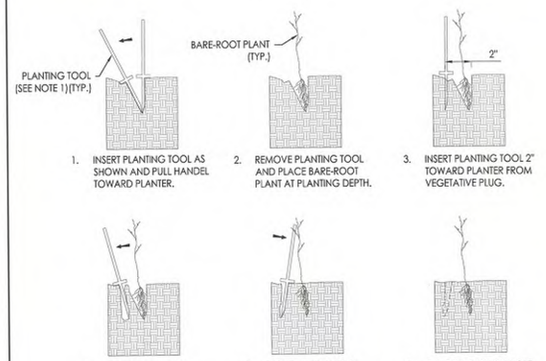


LIVE STAKE DETAIL

NOTES:

1. LIVE STAKES SHALL BE INSTALLED AS SPECIFIED IN THE PLANTING PLAN.
2. LIVE STAKES SHALL BE CUT FROM AN APPROVED SOURCE WITH A SHARP TOOL. STAKES SHALL BE FREE FROM DISEASE OR EXCESS DEAD TWIGS, 2 TO 2.5 FEET IN LENGTH WITH A BASAL END 0.5 TO 1.5 INCH IN DIAMETER. PRIOR TO INSTALLATION BASAL END SHALL BE CUT AT A 45 DEGREE ANGLE AND THE OPPOSITE END SHALL BE CUT FLAT WITHOUT CRACKS.
3. LIVE STAKES SHALL BE INSTALLED BY GENTLY TAMPING INTO THE SOIL LEAVING 8 TO 10 INCHES EXPOSED (I.E. 8 INCHES FOR 2 FEET LONG STAKES).
4. STAKES SHALL BE PLACED IN A RANDOM PATTERN AT A RATE OF 1 LIVE STAKE PER 3 LINEAR FEET PER LIFT.
7. LIVE STAKES ARE TYPICALLY INSTALLED WHEN THEY ARE DORMANT, WHICH TYPICALLY OCCURS BETWEEN NOVEMBER 1 AND MARCH 31. HOWEVER, FOR THIS PROJECT ALL LIVE STAKES SHALL BE INSTALLED DURING CONSTRUCTION WITH THE ANTICIPATION OF A HIGH MORTALITY RATE.
8. THE CLIENT ANTICIPATES RE-INSTALLING LIVE STAKES DURING DORMANCY.

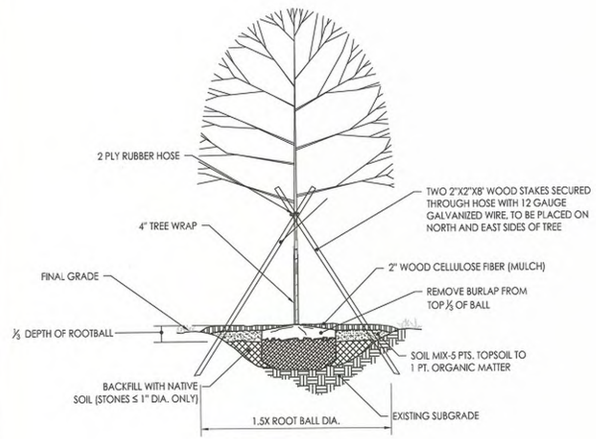
4 C-113 DORMANT LIVE STAKE
NTS



NOTES:

1. PLANTING HOLES SHALL BE EXCAVATED BY HAND USING A DIBBLE BAR, MATTOCK, PICK, OR IRON BAR.
2. PLANTING HOLES SHALL BE EXCAVATED DEEP ENOUGH TO ACCOMMODATE THE ENTIRETY OF THE TAP ROOT VERTICALLY WITHOUT "J-ROOTING" THE PLANT, AND TO ALLOW THE FIRST LATERAL ROOT OF THE ROOT MASS TO BE FLUSH WITH THE EXISTING GRADE.
3. ROOTS PROTRUDING ABOVE THE SOIL SURFACE WILL BE REJECTED.
4. ENSURE THAT PLANT REMAINS STRAIGHT WHILE PLACING BACKFILL, BEING CAREFUL TO AVOID BREAKING ROOTS.
5. PRUNE IN ACCORDANCE WITH THE CONSTRUCTION SPECIFICATIONS.

5 C-113 BARE-ROOT PLANTING
NOT TO SCALE



NOTES:

1. PRUNE AS DIRECTED BY PRODUCER.
2. STAKING SCHEDULE:
   - 1.5"-2.5" CALIPERR
   - 2 STAKES

6 C-113 TREE STAKING AND PLANTING
NOT TO SCALE

STATE OF MISSOURI
MICHAEL L. PARSON, GOVERNOR

STATE OF MISSOURI
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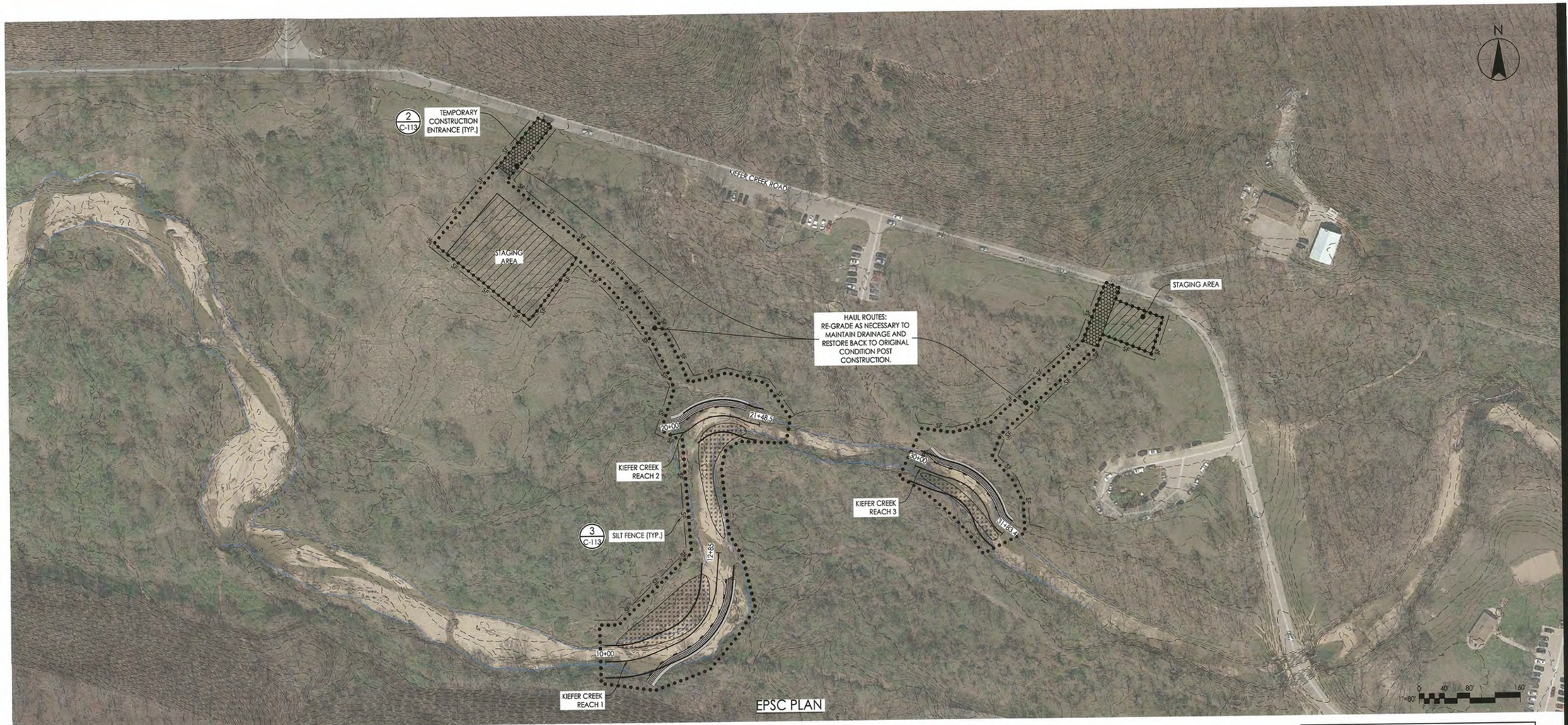

EPSC PLAN

EROSION AND SEDIMENT CONTROL NOTES:

ANY LAND CLEARING, CONSTRUCTION, OR DEVELOPMENT INVOLVING THE MOVEMENT OF EARTH SHALL BE IN ACCORDANCE WITH THE SWPPP, AND THE APPLICANT SHALL ASSUME AND ACKNOWLEDGE RESPONSIBILITY FOR COMPLIANCE WITH THE CODE AND THE APPROVED SWPPP AT THE SITE OF THE PERMITTED ACTIVITY.

ALL AREAS NOT WITHIN THE LIMITS OF DISTURBANCE WITH EXISTING VEGETATION WILL BE PRESERVED TO PROVIDE NATURAL BUFFERING.

THE TIME PERIOD FOR DISTURBED AREAS TO BE WITHOUT VEGETATIVE COVER IS TO BE MINIMIZED TO THE MAXIMUM EXTENT PRACTICABLE AND SHALL BE IN ACCORDANCE WITH THE SWPPP.

PERIPHERAL OR BORDER BMPS TO CONTROL RUNOFF FROM DISTURBED AREAS SHALL BE INSTALLED OR MARKED FOR PRESERVATION BEFORE GENERAL SITE CLEARING IS STARTED.

NATURAL CONTOURS WILL BE UTILIZED TO DIRECT STORM WATER RUNOFF TO VEGETATED AREAS SUCH THAT CONCENTRATED FLOW IS CONVERTED TO SHEET FLOW BEFORE ENTERING THE CHANNEL.

ALL STREAM BANKS ABOVE BANKFULL ELEVATION WILL BE GRADED AT A 3:1 OR FLATTER SLOPE AND STABILIZED WITH SEED, STRAW AND EROSION CONTROL BLANKET.

THE CHANGE IN THE RUNOFF COEFFICIENT FOR THE SITE FROM PRE-CONSTRUCTION TO POST-CONSTRUCTION WILL BE NEGLIGIBLE DUE TO RE-VEGETATION OF DISTURBED AREAS.

ALL EROSION CONTROL MEASURES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE SWPPP AND ALL LOCAL, STATE, AND FEDERAL REGULATIONS.

EROSION AND SEDIMENT CONTROL MEASURES SHALL BE MAINTAINED CONTINUOUSLY, RELOCATED AS NECESSARY, AND SHALL BE INSPECTED IN ACCORDANCE WITH THE SWPPP AND CONSTRUCTION SPECIFICATIONS. SEEDED AREAS SHALL BE CHECKED REGULARLY AND SHALL BE WATERED, RE-SEEDED, AND MULCHED AS NECESSARY TO OBTAIN A DENSE STAND OF GRASS.

STABILIZATION IS THE BEST FORM OF EROSION CONTROL. ALL DISTURBED AREAS THAT ARE NOT OTHERWISE STABILIZED SHALL BE AMENDED AND SEEDED, TEMPORARILY OR PERMANENTLY IN ACCORDANCE WITH THE SWPPP AND CONSTRUCTION SPECIFICATIONS.

ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHALL BE REMOVED WITHIN 14 DAYS AFTER FINAL SITE STABILIZATION OR AFTER THE TEMPORARY MEASURES ARE NO LONGER NEEDED. TRAPPED SEDIMENT AND THE DISTURBED SOIL AREAS RESULTING FROM THE DEPOSITION OF TEMPORARY MEASURES SHALL BE PERMANENTLY STABILIZED TO PREVENT FURTHER EROSION AND SEDIMENTATION.

WHERE SEDIMENT IS TRANSPORTED ONTO A PAVED OR PUBLIC ROAD SURFACE, THE ROAD SURFACE SHALL BE CLEANED THOROUGHLY AT THE END OF EACH DAY. SEDIMENT SHALL BE REMOVED FROM THE ROADS BY SHOVELING OR SWEEPING AND TRANSPORTED TO A SEDIMENT CONTROL DISPOSAL AREA. STREET WASHING SHALL BE ALLOWED ONLY AFTER SEDIMENT IS REMOVED IN THIS MANNER, AND WHEN THE WATER CAN BE DISCHARGED TO A SEDIMENT TRAP OR BASIN.

SITE PRESERVATION AGREEMENT:

THE CONTRACTOR SHALL BE RESPONSIBLE FOR REPAIRING ANY DAMAGE TO EXISTING PATHS, ROADS, GATES, FENCES, ETC. CONSTRUCTION ENTRANCES SHALL BE INSTALLED/MAINTAINED AT ALL ACCESS LOCATIONS PER THE PLANS AND SPECIFICATIONS.

THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY IMPROVEMENT TO THE ROAD/PATH CONDITION, GATES, AND FENCES, REQUIRED FOR ACCESS DURING CONSTRUCTION.

EROSION CONTROL MEASURES DURING CONSTRUCTION:

DURING CONSTRUCTION THE CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING ADDITIONAL EROSION CONTROL MEASURES NOT SHOWN ON THE PLANS BUT NECESSARY TO CONTROL ERODING SEDIMENT, IF DETERMINED BY THE ENGINEER OR MISSOURI DEPARTMENT OF NATURAL RESOURCES PERSONNEL.

STAGING AND STOCKPILE AREAS:

SPECIFIED AREAS SHOWN ON THE PLANS HAVE BEEN ESTABLISHED AS STAGING AREAS AND STOCKPILING AREAS. THE CONTRACTOR MAY ESTABLISH ADDITIONAL STAGING AND STOCKPILING AREAS ALONG THE PROJECT, AS NECESSARY, TO CARRY OUT THE WORK. ALL STAGING AND STOCKPILING AREAS MUST BE APPROVED BY THE ENGINEER. SILT FENCE SHALL BE REQUIRED IN AREAS WHERE LOOSE SOIL HAS BEEN PLACED IN THE STAGING AND STOCKPILING AREAS.

SPECIAL NOTES:

ACTIVITIES ASSOCIATED WITH CONSTRUCTION OF THE NEW CHANNEL BED, BANKS, IN-STREAM STRUCTURES, AND STABILIZATION MEASURES REQUIRE THAT CONSTRUCTION OCCUR IN THE ACTIVE CHANNEL (FLOWING WATER): EXCESS CHANNEL MATERIAL SHALL BE PLACED AROUND THE IN-STREAM WORK AREA TO DIVERT FLOW AND REDUCE SEDIMENT INTRODUCTION TO THE STREAM. MATERIAL USED FOR THIS PURPOSE WILL BE REPLACED AFTER COMPLETION OF WORK IN THE RESPECTIVE AREA. CONTRACTOR WILL LIMIT WORK IN CHANNEL TO ONLY WHAT IS NECESSARY TO COMPLETE THE PROJECT.

ALL REFUELING AND EQUIPMENT MAINTENANCE ACTIVITIES MUST OCCUR OUTSIDE OF THE ACTIVE CHANNEL.

CONTRACTOR MUST KEEP ON SITE AN EMERGENCY SPILL KIT CAPABLE OF RESPONDING TO A POTENTIAL SPILL ASSOCIATED WITH THE SIZE EQUIPMENT BEING USED ON SITE. SPILL PREVENTION SHALL BE IN ACCORDANCE WITH THE SWPPP.

ALL EQUIPMENT MUST BE REMOVED FROM THE ACTIVE CHANNEL AND GRAVEL BAR AT THE END OF EACH WORKING DAY.

MISCELLANEOUS:

CONTRACTOR SHALL BE RESPONSIBLE FOR HAVING A RAIN GAUGE ON THE PROJECT SITE AND FOR RECORDING DAILY RAINFALL AMOUNT DURING CONSTRUCTION.

THE HOLDER OF A MAJOR LAND DISTURBANCE PERMIT, OR HIS / HER AGENT, SHALL PERFORM REGULAR AND AFTER-RAIN INSPECTIONS OF LAND DISTURBANCE SITES BY A QUALIFIED SPECIAL INSPECTOR APPROVED BY THE COUNTY. ALL INSPECTIONS SHALL BE DOCUMENTED AND SUBMITTED IN ACCORDANCE WITH THE SWPPP.

CONSTRUCTION SEQUENCE:

THE CONTRACTOR IS RESPONSIBLE FOR FOLLOWING THE SEQUENCE OF CONSTRUCTION IN ACCORDANCE WITH THE PLANS AND THE FOLLOWING PROVISIONS, AND AS DIRECTED BY THE ENGINEER. DEVIATIONS FROM THE SEQUENCE DESCRIBED BELOW MAY BE ALLOWED WITH APPROVAL BY THE ENGINEER.

GENERAL SITE NOTE:
THE CONTRACTOR SHALL CONDUCT WORK SUCH AT A MAXIMUM OF 500 LINEAR FEET OF CHANNEL IS OPENED UP AT ANY TIME (I.E. IN A STATE OF ACTIVE CONSTRUCTION). SOIL STOCKPILE AREAS WILL ONLY BE PLACED OUTSIDE THE ACTIVE CHANNEL AND SHALL HAVE SILT FENCE INSTALLED AROUND THE PERIMETER.

PHASE 1: INITIAL SITE PREPARATION
1. IDENTIFY PROJECT BOUNDARY, LIMITS OF DISTURBANCE, SENSITIVE AREAS, STAGING AREAS, STABILIZED ENTRANCES, HAUL ROUTES, AND ACCESS POINTS WITH THE ENGINEER.
3. INSTALL EROSION CONTROL MEASURES IN ACCORDANCE WITH THE EROSION AND SEDIMENT CONTROL PLANS, CONSTRUCTION SPECIFICATIONS, SWPPP, AND AS DIRECTED BY THE ENGINEER.
4. CONSTRUCT STAGING AREAS IN A MANNER TO SUPPORT EXECUTION OF THE WORK ON EACH REACH AS INDICATED IN THE PLANS AND AS DIRECTED BY THE ENGINEER.

PHASE 2: BANK STABILIZATION MEASURES
1. EXCAVATE PROPOSED CHANNEL AND/OR BANKS. INSTALL HABITAT AND BANK STABILIZATION FEATURES AS REQUIRED, GRADE FLOODPLAIN, AND COVER WITH STRAW, SEED MIX, AND EROSION CONTROL BLANKET.

PHASE 3: PROJECT COMPLETE/DEMOBILIZE
1. UPON PROJECT APPROVAL, REMOVE EROSION AND SEDIMENT CONTROL MEASURES. PROVIDE FINAL STABILIZATION AND ADD ADDITIONAL SEED AS NECESSARY.

DISTURBED AREA SOIL TYPES

SOIL TYPE	AREA ACRES	COMPOSITION %
Freeburg silt loam, 2 to 5 percent slopes, occasionally flooded	0.100	2.0
Haymond silt loam, 0 to 3 percent slopes, frequently flooded	3.000	61.2
Wilbur silt loam, 0 to 2 percent slopes, frequently flooded	0.600	12.2
Horsecreek silt loam, 2 to 5 percent slopes, occasionally flooded	1.200	24.5
*SOIL DATA PER USDA NRCS WEB SOIL SURVEY		

PLAN LEGEND

- 100 EXISTING INDEX CONTOURS
- EXISTING INTERIM CONTOURS
- LIMITS OF DISTURBANCE
- SF SF SILT FENCE
- STAGING AREAS

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