



Extraction Oil & Gas, Inc

TOPSOIL PROTECTION PLAN

FOR

Draco Pad

Prepared For:



1120 Lincoln Street, Suite 801
Denver, CO 80203
www.ecmc.state.co.us

Prepared By:



1720 South Bellaire Street, Suite 202
Denver, CO 80222
www.rpgres.com

Date Prepared: October 2023

Table of Contents

1.	INTRODUCTION	3
2.	SITE DESCRIPTION	3
2.1.	General	3
2.2.	Topography and Land use	3
2.3.	Natural Features	3
3.	FIELD OBSERVATIONS	3
3.1.	Methodology	3
3.2.	Soil Physical & Morphological Characteristics	4
Table 1.	Soil Test Pit Characteristics	4
3.3.	Conclusions	5
Table 2.	Weighted Average Calculation	5
4.	OPERATIONAL PHASES	5
4.1.	Construction Activities	5
4.1.1.	Soil Removal and Segregation	5
4.1.2.	Horizons Too Rocky or Too Thin	5
4.2.	Drilling and Completions	6
4.2.1.	Protection of Soils	6
4.2.2.	Weed Management	6
4.2.3.	Maintenance & Repairs	6
4.3.	Interim Reclamation	6
5.	MONITORING & INSPECTIONS	7
5.1.	Stockpile Management	7
5.2.	Inspections	7
6.	SITE-SPECIFIC BMPS	7

APPENDIX A – Soil Sample Results and Photos

APPENDIX B – Topsoil Protection Plan Exhibit

APPENDIX C – BMP Datasheets

APPENDIX D – Seed Mix

INTRODUCTION

This Topsoil Protection Plan (Plan) was prepared by RPG Resources, LLC (RPG) to support Extraction Oil and Gas, Inc (Civitas Resources, Inc.; hereafter Extraction or the Operator) in preparing Form 2A to permit the development of the Draco Pad Oil and Gas development.

The intent of this plan is to provide site-specific guidance and recommended best management practices (BMPs) for topsoil management throughout the construction and interim reclamation project phases. The Operator has developed this plan to comply with federal, state, and local criteria and guidelines, as they relate to topsoil management. The following procedures will be implemented to ensure protection of soils through all oil and gas exploration and production phases.

1. SITE DESCRIPTION

1.1. General

The Draco Pad (Site) will be located entirely within privately owned property in Township 1N, Range 68W, Section 21 in Weld County, Colorado. For the purposes of this plan, the limit of disturbance refers to the proposed Oil and Gas Location and is hereafter referred to as the Site.

1.2. Topography and Land use

The Site slopes to the southeast at a 1-4% grade. The Site is located on agricultural land, classified for the purposes of this plan as cropland. The Site is located within the Western Great Plains Range and Irrigated Region Land Resource Region (LRR) of the Central High Plains, southern part Major Land Resource Region (MLRA).

1.3. Natural Features

One NHD-mapped canal ditch is located approximately 15 feet northwest of the proposed oil and gas location. There are no National Wetland Inventory (NWI) wetland features mapped within 500 feet of the proposed oil and gas location. No unmapped wetlands or waterways were identified at the time of the field survey. Stormwater best management practices (BMPs) will be installed prior to initiating construction, as necessary. Impacts to wetlands or waterways are not anticipated as a part of this development.

2. FIELD OBSERVATIONS

2.1. Methodology

Topsoil depth was evaluated using physical and morphological soil characteristics. As described below, ten (10) soil test pits, each measuring approximately 36 inches in total depth, were evaluated across the proposed disturbance area for the Draco Pad (see Appendix B). Soil colors were evaluated using a Munsell Soil Color Book. Five (5) of the ten (10) test pit locations had soil samples collected within the proposed topsoil salvage depths. Soil samples were submitted to Weld Laboratories in Greeley, CO for analysis of baseline agronomic soil properties. The results will be used to apply topsoil reclamation amendments as needed. See Appendix A for laboratory results.

2.2. Soil Physical & Morphological Characteristics

Two soil types were identified by the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) Web Soil Survey (WSS): Wiley-Colby complex, 3-5% slopes (83) and Nunn clay loam, 1-3% slopes (42). Naming conventions of the test pits discussed within the subsections below refer to the WSS map symbology.

Wiley-Colby complex (83) covers approximately 9.3 acres of land within the proposed disturbance area, and five (5) test pits were dug within the mapped limits of soil type 83, described below as DRA-83-001, DRA-83-002, DRA-83-003, DRA-83-007, DRA-83-008. Nunn clay loam (42) covers approximately 10.2 acres of land within the proposed disturbance area, and five (5) test pits were dug within the mapped limits of soil type 42, described below as DRA-42-004, DRA-42-005, and DRA-42-006, DRA-42-009, DRA-42-010.

Table 1. Soil Test Pit Characteristics

Test Pit	A Horizon (topsoil)	B Horizon (subsoil)	C Horizon (substratum)
DRA-83-001	Depth: 0-14 inches Color: 10YR 4/4 Texture: loam	Depth: 14-36 Color: 10YR 5/6 Texture: loam CaCO ₃ observed at 14"	Not observed
DRA-83-002	Depth: 0-9 inches Color: 10YR 4/4 Texture: loam	Depth: 9-36 inches Color: 10YR 5/4 Texture: clay loam	Not observed
DRA-83-003	Depth: 0-11 inches Color: 10YR 3/3 Texture: clay loam	Depth: 11-36 inches Color: 10YR 5/3 Texture: clay	Not observed.
DRA-42-004	Depth: 0-9 inches Color: 10YR 3/4 Texture: clay loam	Depth: 9-14 inches Color: 10YR 4/4 Texture: loam	Depth: 14-36 inches Color: 10YR 5/4 Texture: clay CaCO ₃ observed at 14"
DRA-42-005	Depth: 0-10 inches Color: 10YR 3/3 Texture: loam	Depth: 10-16 inches Color: 10YR 3/6 Texture: loam	Depth: 16-36 inches Color: 10YR 5/4 Texture: clay loam
DRA-42-006	Depth: 0-5 inches Color: 10YR 3/4 Texture: loam	Depth: 5-11 inches Color: 10YR 5/4 Texture: clay loam	Depth: 11-36 inches Color: 10YR 6/3 Texture: clay loam
DRA-83-007	Depth: 0-15 inches Color: 10YR 4/4 Texture: silt loam	Depth: 15-36 inches Color: 10YR 4/4 Texture: silty clay	Not observed.

DRA-83-008	Depth: 0-15 inches Color: 10YR 4/4 Texture: silt loam	Depth: 15-36 inches Color: 10YR 5/4 Texture: silty clay	Not observed.
DRA-42-009	Depth: 0-18 inches Color: 10YR 4/4 Texture: silt loam	Depth: 18-36 inches Color: 10YR 5/4 Texture: silty clay	Not observed.
DRA-42-010	Depth: 0-6 inches Color: 10YR 4/4 Texture: silt loam	Depth: 6-16 inches Color: 10YR 6/6 Texture: silty clay	Depth: 16-36 inches Color: 10YR 5/8 Texture: silty clay

2.3. Conclusions

Observed topsoil color was recorded as 10YR 4/4, 10YR 3/3, and 10YR 3/4. Topsoil Texture was recorded as silt loam, loam and clay loam. Based on a calculated weighted average of acres of land within each soil type and the number of inches of topsoil observed within each test pit, we recommend salvaging approximately 10 inches of topsoil across the Site. The weighted average calculation can be found within Table 2, below.

Table 2. Weighted Average Calculation

Soil Type	Acres within LOD	Number of Samples Taken	Average A Horizon depth within soil type	Product	Weighted Average
42	10.2	5	12	60	
83	9.3	5	9	45	
Totals	19.5	10		105	10

3. OPERATIONAL PHASES

3.1. Construction Activities

3.1.1. Soil Removal and Segregation

During all excavation activities on Site, the Operator shall separate and store the topsoil horizon as defined above, and mark or document stockpile locations to facilitate subsequent reclamation. When separating the soil horizons, the Operator shall segregate the horizon based upon noted changes in physical characteristics such as organic content, color, texture, density, or consistency.

3.1.2. Horizons Too Rocky or Too Thin

This Site is not expected to have rocky soil horizons within any of the proposed excavation areas. However, if encountered, the Operator shall use best practices to properly segregate and store the topsoil to the extent practicable.

Too rocky shall mean that the soil horizon consists of greater than thirty-five percent (35%) by volume rock fragments larger than ten (10) inches in diameter. Too thin shall mean soil horizons that are less than six (6) inches in thickness. The Operator shall segregate remaining soils to the extent practical to a depth of three (3) feet below the ground surface or bedrock, whichever is shallower, based upon noted changes in physical characteristics such as color, texture, density or consistency and such soils shall be stockpiled to avoid loss and mixing with other soils.

It is anticipated that topsoil will be stockpiled on location for a duration greater than 30 days. All stockpiled topsoil shall be stabilized as soon as possible, but no later than 14 days after completion of construction activities. All topsoil stockpiles will be drill seeded and mulched using a certified weed free mixture or similar hydroseeding application with binding agent to ensure seed takes to soil. Surface roughening should occur prior to seeding to assist the holding seed/mulch and or hydroseed, particularly after rain events.

Approximately 414,045 cubic feet (15,335 cubic yards) of total topsoil will be segregated and stockpiled along the eastern edge of the pad. The stockpile will measure approximately 10 feet in height and be staged at a ratio of 4:1.

3.2. Drilling and Completions

3.2.1. Protection of Soils

All stockpiled soils shall be protected from degradation due to contamination, compaction and, to the extent practical, from wind and water erosion during drilling and production operations. BMPs to prevent weed establishment and to maintain soil microbial activity shall be implemented.

3.2.2. Weed Management

During normal operations and stormwater inspections, Extraction employees and contractors will monitor the stockpile for erosion and establishment of undesirable and noxious weeds. Weeds will be treated mechanically with a mower whenever plant height exceeds 6 inches or before seed development. Chemical treatment of weeds with broad-leaf herbicides will only occur in spot-specific situations where prostrate weed growth or other site conditions preventing mechanical treatment are encountered. Soil sterilant and non-selective herbicides will not be used.

3.2.3. Maintenance & Repairs

Any identified erosion will be repaired as soon as practical, typically within 72 hours. Additional stormwater control measures will be deployed as needed. All deployed temporary stormwater control measures will be maintained and will remain in place until the disturbance achieves final stabilization as defined in the Colorado Department of Public Health and Environment (CDPHE) Water Quality Control Division COR400000 permit.

3.3. Interim Reclamation

When the Site enters the production phase of operations, areas no longer in use, totaling approximately 13.97 acres, will be interim reclaimed. At least ten (10) inches of topsoil will be redistributed throughout the interim reclamation area and contoured to match pre-disturbance topography. The redistributed soils

will be tilled to adequately prepare the seedbed for seeding operations. Approximately 201,420 cubic feet (7,460 cubic yards) of total topsoil will be used during the interim reclamation phase.

4. MONITORING & INSPECTIONS

4.1. Stockpile Management

Prior to the stockpile being adequately stabilized, perimeter sediment BMPs should be utilized to minimize any topsoil migration off Site due to a rain event. Perimeter BMPs can be removed after stabilization is achieved. Once vegetation coverage begins, the stockpile should be mowed periodically to help promote even vegetative growth. Weeds should be removed if present. Soil sampling and chemical or mechanical remedies such as pH additives or aeration, respectively, may be needed if grass growth is not achieved during the growing season. Additional seeding might also be required to achieve widespread coverage.

4.2. Inspections

Inspection of BMPs shall occur for as long as they remain installed onsite. As per the CDPHE guidance, over the course of active construction, inspection shall occur every seven (7) days; or every fourteen (14) days with post-storm inspections completed within 24 hours of precipitation accumulation or snow melt. When the construction Site is considered idle, routine inspections must be performed minimally every 14 days and within 72 hours following storm events. When construction is complete and the Site is awaiting vegetative growth, inspections shall be conducted once every 30 days. Post storm inspections are not required during this phase of construction. During all inspections, necessary repairs to BMPs will be noted and corrective actions shall be immediately implemented. If noted deficiencies cannot be immediately addressed, the reasoning shall be noted, and repairs will be scheduled.

Topsoil will continue to be monitored during 30-day stormwater inspections. Inspections will not cease until the disturbance area meets 80% of reference area vegetative cover specified for achieving final stabilization under applicable stormwater CDPHE stormwater permit requirements. Topsoil protection, weed management, and erosion control/repair will continue throughout the life of the Location per Colorado Energy and Carbon Management Commission (ECMC) 1000 Series Rules.

5. SITE-SPECIFIC BMPS

Each of the BMPs listed below are intended for use at this Site specifically (see Topsoil Protection Plan Exhibit in Appendix B). These BMPs are also consistent with the field-wide Stormwater Management Plan (SWMP) for Crestone

- Sediment Trap
 - Sediment traps will be installed along the east side of the stockpile and south of the detention basin to allow sediment laden stormwater to settle out prior to migration offsite. The installation of sediment traps will mitigate sedimentation to nearby waterways.
- Stockpile Management
 - Topsoil will be stockpiled along the northeastern border of the pad, within the limit of disturbance. To mitigate topsoil loss and migration of soil offsite, the stockpile will undergo surface roughening, seeding, and mulching.
- Surface Roughening

- Once topsoil segregation and stockpiling are complete, the stockpile surface will undergo surface roughening. A tracked vehicle will drive over the surface to imprint horizontal ridges, encourage sediment entrapment, improve infiltration, and reduce runoff velocity.
- Seeding
 - Once topsoil segregation, stockpiling, and surface roughening are complete, the stockpile will be seeded to mitigate erosion. Establishing vegetative cover will help to stabilize the soil, reduce wind and water erosion, minimize rill erosion, and reduce overall surface runoff. The stockpile will be regularly monitored for noxious weed growth. Re-seeding will occur as necessary, over the course of active construction in order to achieve wide spread uniform vegetative cover.
- Mulching
 - Post seeding: a layer of straw or hay mulch will be installed via crimping along the stockpile in order to promote seed germination and further stabilization of the soil. Mulching helps to mitigate the impacts of rainfall and increase soil moisture retention. Mulching will be monitored and re-applied as necessary until vegetative growth is established.

APPENDIX A

Soil Sample Results and Photos

Lab results will be forwarded upon receipt.

PHOTOS



1. DRA-83-001 Soil Test Pit Location



2. DRA-83-002 Soil Test Pit Location.

PHOTOS



3. DRA-83-003 Soil Test Pit Location.



4. DRA-42-004 Soil Test Pit Location.

PHOTOS



5. DRA-42-005 Soil Test Pit Location.



6. DRA-42-006 Soil Test Pit Location.

PHOTOS



7. DRA-83-007 Soil Test Pit Location.



8. DRA-83-008 Soil Test Pit Location

PHOTOS



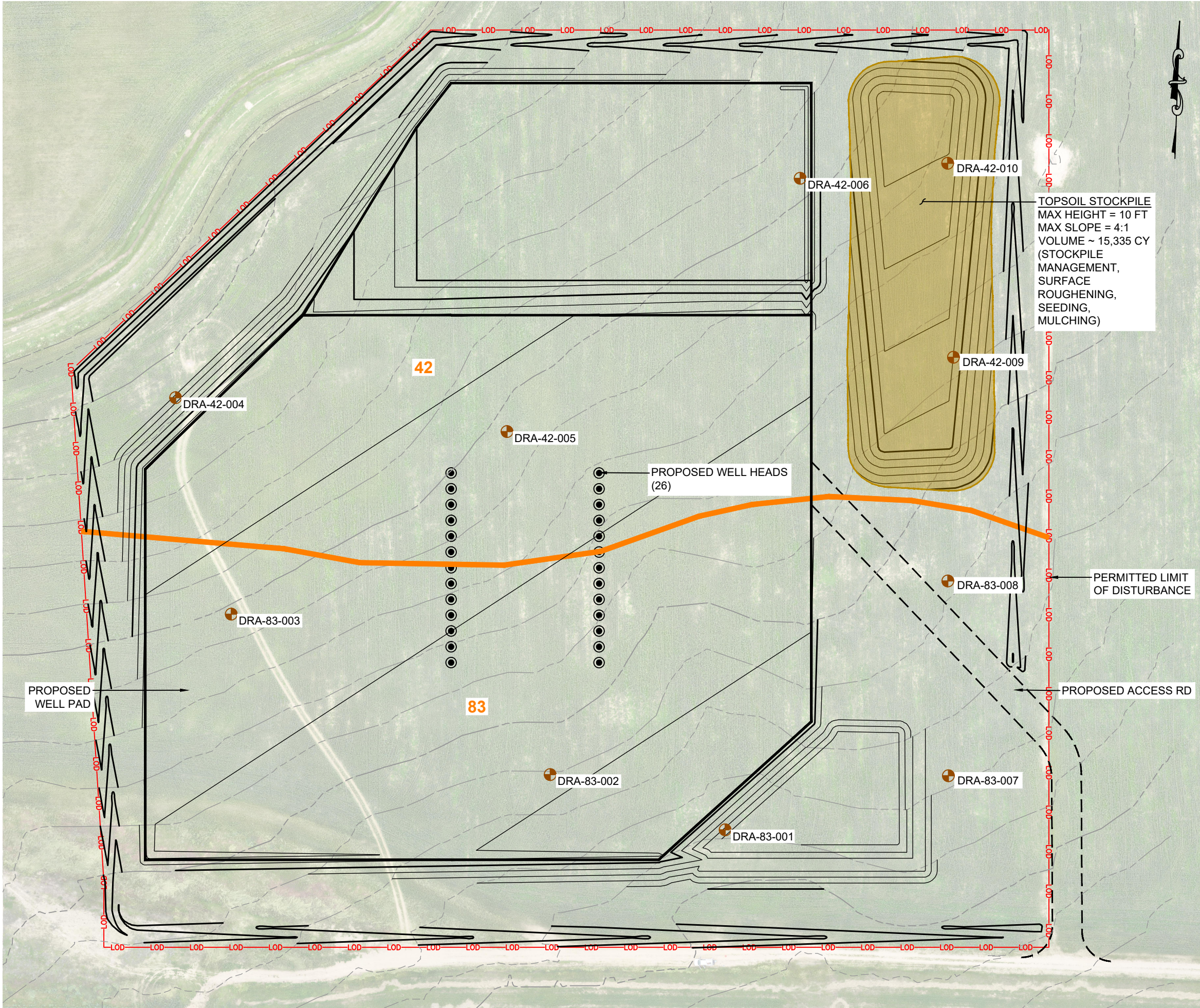
9. DRA-42-009 Soil Test Pit Location.



10. DRA-42-010 Soil Test Pit Location

APPENDIX B

Topsoil Protection Plan Exhibit



MAP UNIT SYMBOL	MAP UNIT NAME	RATING	ACRES IN AOI	PERCENTAGE OF AOI
42	NUNN CLAY LOAM, 1-3% SLOPES	N/A	10.20	52.2%
83	WILEY-COLBY COMPLEX, 3-5% SLOPES	N/A	9.30	47.8%
TOTALS FOR AREA OF INTEREST			19.50	100%

LEGEND

- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- PROPOSED WELL PAD EDGE
- ACCESS ROAD
- PERMITTED LIMIT OF DISTURBANCE
- PROPOSED WELL HEAD
- PROPOSED TOPSOIL STOCKPILE
- SOIL UNIT BOUNDARY
- SOIL UNIT SYMBOL
- SOIL SAMPLE LOCATION

0100200FEET

CIVITAS
CRESTONE PEAK RESOURCES LLC

DATE PREPARED: JULY 2023

DRACO PAD

TOPSOIL MANAGEMENT PLAN
EXHIBIT

1 OF 1

APPENDIX C

BMP Datasheets

18. Sediment Trap (ST)



COLORADO
Department of Transportation

1. DESCRIPTION:

A Sediment Trap is a temporary control measure constructed by excavating a basin or building an earthen or rock berm lined with geotextile downgradient of a drainage basin. They are used to temporarily detain sediment-laden runoff and allowing sediment to settle out before releasing runoff onto a stabilized area.

2. CONTROL MEASURE USES

- ☒ Erosion Control
- ☒ Sediment Control
- ☒ Site/Materials Management

3. RELEVANT SPECIFICATION SECTIONS

[Section 208](#) - Erosion Control

- a) [208.04 \(g\)](#) - Materials
- b) [208.05 \(k\)](#) - Construction BMPs
- c) [208.11](#) - Method of Measurement
- d) [208.12](#) - Basis of Payment

4. RELEVANT M-STANDARD DETAILS

[M-208-1](#), Sheet 9 of 11 (Sediment Trap)

5. BASIS OF PAYMENT

Pay item	Description	Pay Unit
208-00033	Sediment Trap	EACH

6. APPLICATIONS

- Used in areas of concentrated flow or points for discharge during construction activities.
- May be used as a temporary control measure during construction in locations with relatively small drainage basins and that are accessible for easy cleanout.
- May be used in combination with other sediment control measures to increase capture capacity.



Sediment Trap downstream of rock check dams

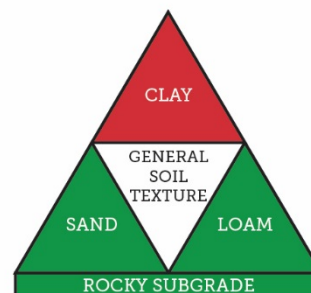
7. LIMITATIONS

- Do not use within drainage ways that have high-flow volumes or velocities.
- This sediment control measure is not appropriate for drainage basins larger than 5 acres or for long-term sediment control uses.
- A large surface area is required to properly settle runoff sediment.
- This sediment control measure is most effective at removing medium- and coarse-grained particle size.

8. CONTROL MEASURE SOILS TRIANGLE

SOIL TEXTURE AND SUBGRADE CONDITIONS

- APPROPRIATE
- SOMEWHAT APPROPRIATE
- NOT APPROPRIATE



18. Sediment Trap (ST)



9. SWMP ADMINISTRATOR FOR DESIGN CRITERIA

- Divert runoff from undisturbed areas away from sediment traps.
- Provide the appropriate surface area and storage depth for these structures.
- Provide a minimum 20-foot setback from all structures and maintain an edge of road clear zone.
- The basin inlet shall be located to maximize travel distance to the basin outlet.
- Sediment Traps should be used on nearly level ground and the height of groundwater must be considered.
- Consider impact to downgradient areas from the weir overflow when locating Sediment Traps. Sediment Traps should not be used where weir failure could cause sediment deposition on travel lanes or damage to private property.

Sediment Trap Geometry:

- The recommended surface area measured at the elevation of the outlet weir can be calculated with the following equations:

Soils Type	Minimum Required Surface Area (square feet)
Coarse (Loamy Sand, Sandy Loam and Sand)	Area = 625 x (Drainage Basin Area ^a)
Medium (Loam, Silt Loam and Silt)	Area = 1560 x (Drainage Basin Area ^a)

^a Drainage basin area in acres

- Ensure a minimum capacity of 1,800 cubic feet per acre of drainage basin treated is provided measured from the Sediment Trap invert to the outlet weir crest elevation (wet storage depth).

Sediment Trap Embankment:

- The Sediment Trap embankment must not exceed 5 feet in height measured between the downgradient toe of the embankment to the top of the embankment.

Sediment Trap Outlet Structure:

- The outlet size depends on the drainage basin area; recommended weir lengths are listed in this table:

Drainage Basin Area (Acres)	1	2	3	4	5
Weir Length (Feet)	4	6	8	10	12

- The sediment trap must be designed to properly pass the 10-year flood event without overtopping the basin.
- Use a minimum of 12-inch D50 rock for the outlet weir structure and spillway.
- As an alternative, flows may be released using an outlet pipe leading to a riprap dissipation pad.

Other Design Considerations

- Confirm that outflows have nonerosive velocities before reaching the existing ground; if velocities are higher; provide a riprap dissipation pad at the end of the outlet spillway.
- The final Sediment Trap design must be approved by the Engineer working directly with the Erosion Control Supervisor or Regional Environmental Staff.

18. Sediment Trap (ST)



COLORADO
Department of Transportation

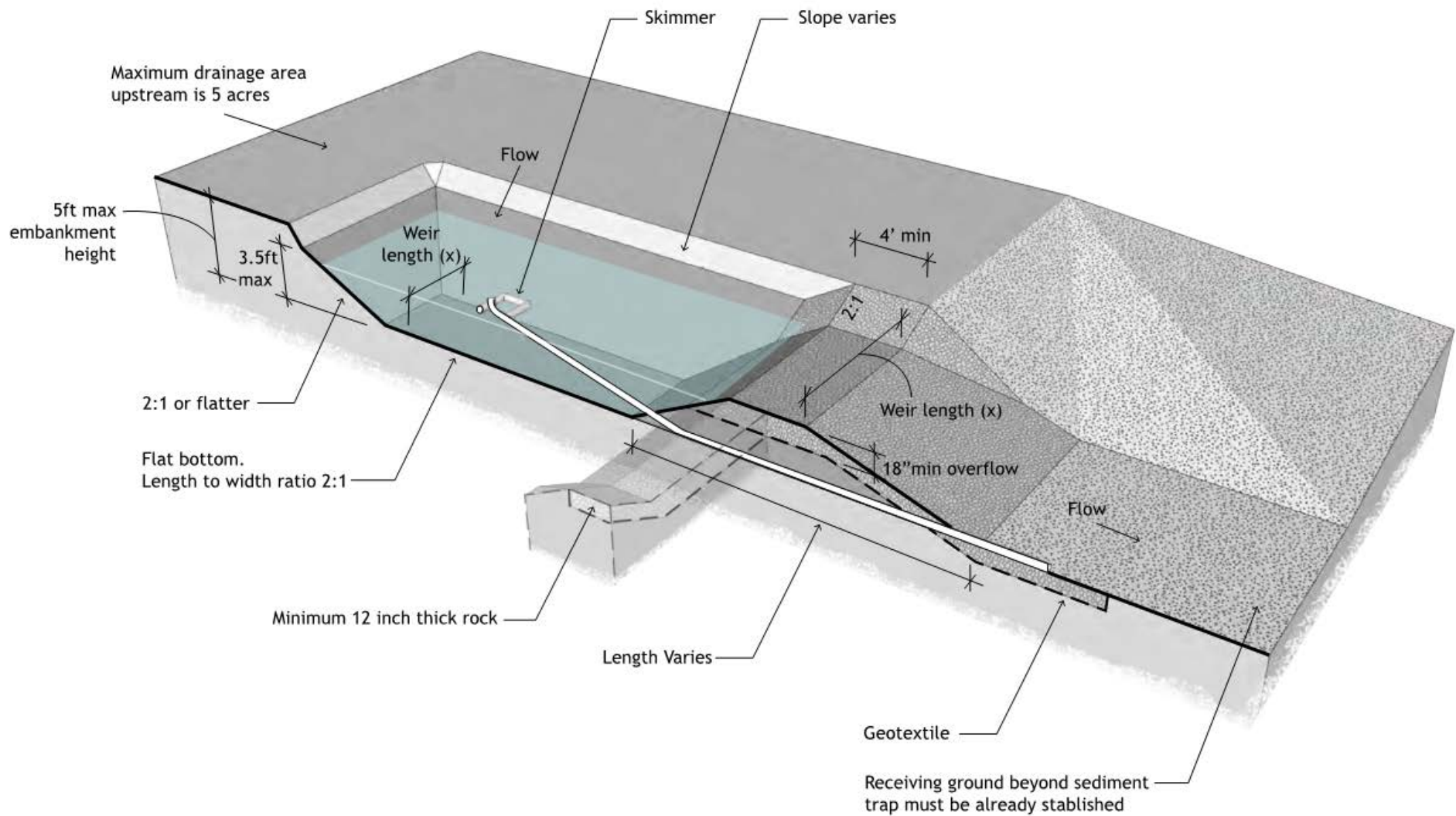
10. INSTALLATION CRITERIA

- Install Sediment Traps prior to starting disturbance activities in locations receiving upgradient flows.
- The area under the embankment shall be cleared, grubbed, and stripped of any vegetation or roots prior to installation.
- Direct Sediment Trap outflows to a moderately flat vegetated or stabilized area.
- Additional measures should be used if turbidity leaving the site served by this practice is an issue

11. MAINTENANCE AND REMOVAL

- Inspect Sediment Traps before, during, and after every storm event and at regular intervals for proper functioning, presence of any embankment damage, or damage to the outlet structure.
- Repair any damage to structure and remove any outlet obstructions immediately after inspection.
- If captured runoff has not completely infiltrated within 72 hours, Sediment Trap must be dewatered.
- When sediment volume has reached half of the wet storage depth (bottom to top of weir), remove and dispose of accumulated sediment.
- Remove Sediment Trap only when the disturbed area upstream has been fully stabilized; sediment and rock may be dispersed onsite at locations approved by the Engineer. All other materials must be removed from the site and disposed of at a landfill or recycling facility.
- The area disturbed by this control measure should be covered with topsoil and stabilized.

18. Sediment Trap (ST)



29. Stockpile Management (SM)



COLORADO
Department of Transportation

1. DESCRIPTION:

Stockpile areas are used for temporary storage of construction materials and must be managed to minimize erosion and sediment transport from erodible material stockpiles.

2. CONTROL MEASURE USES

- ☐ Erosion Control
- ☐ Sediment Control
- ☒ Site/Materials Management

3. RELEVANT SPECIFICATION SECTIONS

[Section 208](#) - Erosion Control

a) **208.07** - Stockpile Management

4. RELEVANT M-STANDARD DETAILS

No Standard Details exist for this Management Strategy.

5. BASIS OF PAYMENT

Pay item	Description	Pay Unit
208-00028	Plastic Sheeting	SY
213	Mulching	VARIES
208	Various items to contain perimeter	

6. APPLICATIONS

Areas where active and nonactive stockpiles of construction materials are stored.

7. LIMITATIONS

- Stockpiles should not be placed on paved areas unless no other practical alternative exists on-site.

8. APPROVED PRODUCTS LIST

Refer to: <https://www.codot.gov/business/apl>



Erosion Logs used for stockpile management practices

9. PROCEDURES

- Stockpiles should be placed a minimum of 50 feet away from State Waters and shall be confined so that no potential pollutants will enter State Waters and other sensitive areas. Stockpiles shall also be protected with a temporary perimeter control measure. Level-to-gently-sloping grassed areas provide good stockpile sites and should not be placed in or along wetlands, ditches, swales, or against slopes that are more than 2:1.
- Stockpiling of contaminated soils should be avoided. If unavoidable, these stockpiles should be covered with plastic sheeting with berms surrounding the stockpile to prevent runoff from leaving the construction site. Contaminated soils should be transported offsite.
- Implement wind erosion control practices in accordance with Wind Erosion Control (fact sheet No. 38) as appropriate on all stockpiles.
- Erodible stockpiles (including topsoil) must be contained with an acceptable control measure at the toe (within 5 to 10 feet of the toe) at all times

29. Stockpile Management (SM)



COLORADO
Department of Transportation

10. PROTECTION OF STOCKPILES FOR PROJECTS TEMPORARILY HALTED FOR 14 DAYS

- Soil Stockpiles:
 - Soil stockpiles should be covered or protected with interim stabilization in accordance with 208.04(e). If no longer needed, the stockpiles should be removed and disposed of properly.
- Stockpiles of aggregate base, or aggregate subbase:
 - These stockpiles should be covered or protected with a perimeter sediment barrier at all times. If no longer needed, the stockpiles should be removed and disposed of properly.
- Stockpiles of "cold mix":
 - Cold mix stockpiles should be placed on and covered with plastic sheeting material at all times and surrounded by a berm.
- Stockpiles/storage of pressure treated wood with copper chromium and arsenic or ammonia, copper, zinc, and arsenate:
 - Treated wood should be covered with plastic sheeting material at all times and placed on pallets.
 - Along with plastic sheeting material, tarps can be used to cover unused materials and materials on pallets.

11. PROTECTION OF ACTIVE STOCKPILES

- Prior to the onset of precipitation, active stockpiles of the identified material should be protected further, as follows:
 - All stockpiles require temporary stabilization at the end of each day in accordance with 2018.04(e), and require a sediment barrier, such as Erosion Logs, Silt Fence, or Compacted Berms.
 - Stockpiles of cold mix should be placed on and covered with plastic sheeting material.

12. MAINTENANCE AND REMOVAL

- Routinely spot-check stockpile areas for compliance. Repair perimeter control and covers as needed. Sediment should be removed when sediment accumulation reaches half of the barrier height.
- Inspect containment structures or other perimeter controls routinely and repair when signs of degradation are visible.
- Remove stockpiles and dispose of properly if no longer needed.
- Re-vegetate or install other approved methods of final stabilization in areas where stockpiles and access roads are located.

6. Surface Roughening and Vertical Tracking (SR)



COLORADO
Department of Transportation

1. DESCRIPTION:

Surface Roughening and Vertical Tracking (also referred to as temporary stabilization) are control measure practices that manipulate the subsoil by either creating different textures over the unfinished grade or using a tracked vehicle to drive over the surface, creating horizontal grooves and ridges. Surface roughening texture to the soil surface will reduce runoff velocity, encourage infiltration, and trap sediment..

2. CONTROL MEASURE OBJECTIVES

- ☒ Erosion Control
- ☐ Sediment Control
- ☐ Site/Materials Management

3. RELEVANT SPECIFICATION SECTIONS

[Section 208](#) - Erosion Control

- a) [208.04 \(e\).1](#) - Temporary Stabilization
- b) [208.05 \(s\)/\(t\)](#) - Construction of Control Measures

4. RELEVANT M-STANDARD DETAILS

Section not applicable for this control measure.

5. BASIS OF PAYMENT

Not measured or paid for separately but shall be included in the work.

6. APPLICATIONS

- Used to temporarily stabilize disturbed areas during construction and prior to final stabilization activities.
- Used along disturbed slopes, temporary stockpiles, sediment basins, and/or compacted soil diversion berms.



Vertical tracking on disturbed side slope

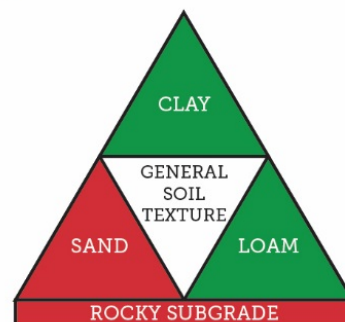
7. LIMITATIONS

- Not intended to be used as a standalone control measure. Will require a secondary erosion control measure.
- Only to be used as a temporary means of erosion control.
- Cannot be used on topsoil (spread out on the surface or in stockpiles) because of the compaction.
- Special care must be given to existing utilities around the area when performing roughening operations.

8. SOILS TRIANGLE

SOIL TEXTURE AND SUBGRADE CONDITIONS

- APPROPRIATE
- SOMEWHAT APPROPRIATE
- NOT APPROPRIATE



6. Surface Roughening and Vertical Tracking (SR)



COLORADO
Department of Transportation

9. SWMP ADMINISTRATOR FOR DESIGN CRITERIA

- Surface Roughening is recommended for all smooth graded slopes steeper than 5H:1V.
- Track walking texture must be parallel to the slope contour.
- Surface Roughening techniques may include:
 - **Machine Tracking** on cut or fill slopes in conjunction with grading operations by equipment heavy enough to texture the soil.
 - **Stair-step grading** on erodible material soft enough to be ripped with a bulldozer. Soft rock subgrades with subsoil are optimal for this technique.
 - **Grooving** on cut or fill slopes by tilling, disking, or harrowing, ensuring that grooves are less than 10 inches apart and at least 1 inch deep.

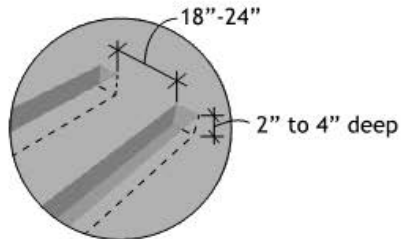
10. INSTALLATION CRITERIA

- Surface Roughening and Vertical Tracking must be provided on disturbed subsoils at the end of each day.
- Where topsoil is to be placed immediately after grading or where topsoil has already been placed, Surface Roughening or Vertical Tracking is **PROHIBITED**.
- Farming disks may not be used to provide surface roughening. It is preferred that ripping or tilling equipment be used along the contours.

11. MAINTENANCE AND REMOVAL

- Inspect site frequently, and before and after storm events, to ensure erosion or riling is not occurring within the small depressions created by tracking or roughening.
- Surface roughening is a temporary control measure and it may be necessary to continue to roughen the area multiple times until topsoil placement and permanent stabilization measures can be implemented.
- When revegetation is planned, subgrade preparation (ripping) is required prior to placing topsoil.

6. Surface Roughening and Vertical Tracking (SR)

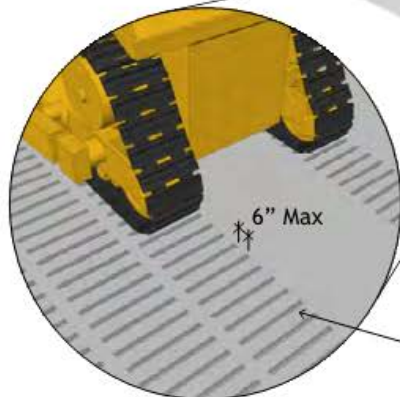


DETAIL

Roughly graded slope

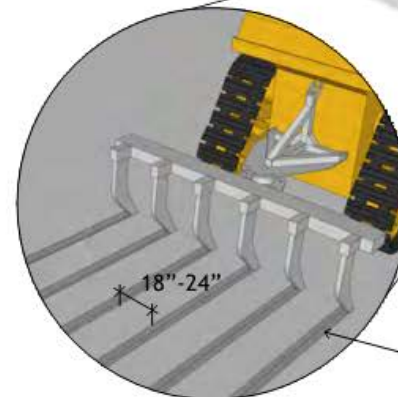
May use machine tracking, stair-step grading or grooving depending on soil conditions

May use machine tracking, stair-step grading or grooving depending on soil conditions



SR - 1. VERTICAL TRACKING
FOR STEEP SLOPES (3:1 OR STEEPER)

Vertical tracks are spaced a maximum of 6 inches and can be up to 4 inches deep



SR - 2. SURFACE ROUGHENING
FOR LOW SLOPES (LESS THAN 3:1)

Roughened rows are spaced a maximum of 6 inches and can be up to 4 inches deep

7. Seeding (TS)



1. DESCRIPTION:

This control measure practice involves the establishment of a permanent, perennial vegetative cover over areas disturbed during construction activities. The main goal of seeding is to stabilize the soil, reduce wind and water erosion, minimize sheet flow and rill erosion, increase infiltration rates, and reduce overall surface runoff.

2. CONTROL MEASURE OBJECTIVES

- ☒ Erosion Control
- ☒ Sediment Control
- ☐ Site/Materials Management

3. RELEVANT SPECIFICATION SECTIONS

[Section 212](#) - Seeding, Fertilizer, Soil Conditioner, and Sodding

[Section 207](#) - Topsoil

4. RELEVANT M-STANDARD DETAILS

Section not applicable for this control measure.

5. BASIS OF PAYMENT

Pay Item	Description	Pay Unit
212-00005	Seeding (Native)	LB
212-00006	Seeding (Native)	ACRE
212-00007	Seeding (Native)(Hydraulic)	ACRE
212-00009	Seeding (Temporary)	ACRE
212-00010	Seeding (Lawn)	LB
212-00011	Seeding (Lawn)	ACRE
212-00015	Seeding (Forbs)	LB
212-00020	Seeding (Forbs)	OZ
212-00022	Seeding (Riparian)	ACRE
212-00025	Seeding (Shrubs)	LB
212-00027	Seeding (Trees)	LB
212-00028	Seeding (Wetlands)	ACRE
212-00009	Seeding (Temporary)	ACRE



Drill Seeder Calibration

6. APPLICATIONS

- Used as part of the permanent stabilization steps for disturbed areas after construction activities are completed.
- Used only after topsoil has been dispersed on the site and soil conditioning amendments are applied.

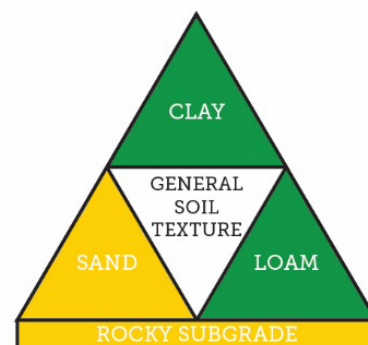
7. LIMITATIONS

- Permanent stabilization seeding can only be done in the approved seeding season windows for the different elevation ranges in Colorado.

8. SOILS TRIANGLE

SOIL TEXTURE AND SUBGRADE CONDITIONS

- APPROPRIATE
- SOMEWHAT APPROPRIATE
- NOT APPROPRIATE



This Control Measure may be appropriate for all soil types with the appropriate installation procedures for topsoil requirements, and other considerations as directed by the Transportation Erosion Control Supervisor or Regional Environmental Staff

7. Seeding (TS)



COLORADO
Department of Transportation

9. SWMP ADMINISTRATOR FOR DESIGN CRITERIA

- Soil surface preparation must be completed before application of seed.
- To select species for the permanent stabilization see mixes, the Designer should utilize the CDOT Landscape Architecture Section's Native Seed Calculator, found at: <https://www.codot.gov/programs/environmental/news/native-seed-calculator>
- Topsoil management strategies must be included in the Stormwater Management Plan. These should include locations for the salvaged topsoil as either stock piles or windrow.
- Ground surface should not be compacted nor too loose.
- Temporary seeding consists of planting an annual grass.
- Drill seeding rates for temporary annual grasses are as follows:

Common Name	Botanical Name	Application Time	Seeding Rates (LBS PLS/acre)	Planting Depth (inches)
Oats	Avena sativa	October 1 - May 1	35	1 - 2
Foxtail Millet	Setaria italica	May 2 - September 30	30	1/2 - 3/4

- CDOT has created training videos demonstrating best field practices for landscape architecture pertaining to reclamation, revegetation, and stormwater management to help ensure compliance with CDOT Standard Specifications and CDPHE's regulations for transportation projects. These videos include guidance for:
 - [Percent Vegetation Cover](#)
 - [Soil Preparation, Ripping and Tilling](#)
 - [Composting and Fertilizers](#)
 - [Drill Seeding Application Rate](#)
 - [Straw Mulching](#)
 - [Crimping and Tackifier](#)

For more information visit the Landscape Architecture Program web page at:
<https://www.codot.gov/programs/environmental/landscape-architecture>

10. INSTALLATION CRITERIA

- Drill seeding is the most desirable method.
- Seeding seasons (Section 212.03) must be followed for native seeding.

11. MAINTENANCE AND REMOVAL

- Seeded areas require monitoring to ensure successful germination.
- Seeded areas require protection from vehicle and pedestrian traffic

2. Mulching, Agricultural Straw or Hay, and Mulch Tackifier (MU)



COLORADO
Department of Transportation

1. DESCRIPTION:

Mulching is a temporary control measure used for interim and permanent stabilization that consists of mechanically placing a uniform layer of agricultural straw or hay mulch that is crimped in and sprayed with tackifiers over disturbed construction areas. It protects disturbed areas immediately after seeding from the forces of rainfall impacts; it also increases infiltration. Mulching assists with germination success of seeded areas by conserving moisture and protecting against temperature extremes until permanent vegetation is established.



Straw Mulching on disturbed side slope

2. CONTROL MEASURE OBJECTIVES

- ☒ Erosion Control
- ☐ Sediment Control
- ☐ Site/Materials Management

3. RELEVANT SPECIFICATION SECTIONS

[Section 213](#) - Mulching

- a) [213.02.\(a\)/\(c\)/\(f\)](#) - Materials
- b) [213.03.\(a\)/\(d\)/\(g\)](#) - Construction Requirements
- c) [213.04](#) - Method of Measurement
- d) [213.05](#) - Basis of Payment

4. RELEVANT M-STANDARD DETAILS

Section not applicable for this control measure.

7. LIMITATIONS

- Material availability can impact feasibility of this control measure.
- Potential for introduction of weeds and other non-native plant materials.
- Potentially costlier due to increased labor requirements
- Permanent stabilization strategies for slope applications steeper than 2.5H:1V should consider Soil Retention Blanket or Mulching (Hydraulically applied)

5. BASIS OF PAYMENT

Pay item	Description	Pay Unit
213-00002	Mulching (Weed Free Hay)	ACRE
213-00004	Mulching (Weed Free Straw)	ACRE
213-00061	Mulch Tackifier	LB

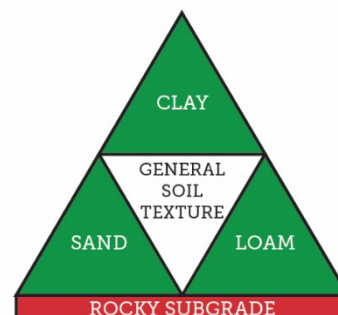
6. APPLICATIONS

- Use in conjunction with seeding to protect and stabilize disturbed soil.
- Use to cover disturbed areas for extended periods of time as a stabilization strategy.

8. SOILS TRIANGLE

SOIL TEXTURE AND SUBGRADE CONDITIONS

- APPROPRIATE
- SOMEWHAT APPROPRIATE
- NOT APPROPRIATE



2. Mulching, Agricultural Straw or Hay, and Mulch Tackifier (MU)



COLORADO
Department of Transportation

9. SWMP ADMINISTRATOR FOR DESIGN CRITERIA

- Tackifier must be used in conjunction with straw mulch in accordance with Section 213.02(c).
- Apply simultaneously or immediately after mulching and crimping to provide uniform coverage.
- Agricultural hay or straw should not be specified in concentrated flow areas either as interim or permanent stabilization. Hay and straw can also clog inlets and should not be used within water quality extended detention basins or sand filter structures.
- Agricultural hay or straw should not be specified in concentrated flow areas either as interim or permanent stabilization.
- Hay and straw can also clog inlets and should not be used within water quality extended detention basins or sand filter structures.

10. INSTALLATION CRITERIA

- Projects within Forest Service ROW or adjacent to sensitive areas might need special approval for the use of agricultural weed free straw or hay.
- Mulch materials should be air-dried and free of impurities in accordance with Section 213.
- For mulched areas to be seeded, native topsoil or approved equal (free of rocks, woody debris or soil clumps) shall be applied to disturbed areas in accordance with Section 207, or a Project Special Provision for Topsoil Management.
- Apply straw mulch at a rate of 1.5 to 2 tons per acre, in accordance with Section 213.
- Mechanically apply mulch at a depth of 1-2 inches. Hand application will require a thicker layer (2-3 inches, or as needed depending upon site conditions).
- Evenly distribute mulch over entire area, with at least 90% coverage.
- Apply mulch according to Section 213 using approved organic tackifier, crimping and anchoring within 4 hours.
- Do not place mulch on drainage channels, walls, sidewalks, pathways, or over existing vegetation.

11. MAINTENANCE AND REMOVAL

- Visually inspect at regular intervals and after every storm event to ensure mulch meets required coverage on all disturbed areas and slopes.
- Apply additional mulch as needed to meet the required soil coverage.
- Apply mulch tackifier with each additional mulching application.
- Manual inspection might be required to ensure appropriate adhesion has occurred.
- Mulching does not need to be removed as it will biodegrade with time.

APPENDIX D

Seed Mix

Seed Mix / Soil Amendments

The selected seed mix for the Location is the Loamy Plains Seed Mix that will be applied at the rate specified in the table below. All seed will be certified weed-free and pure live seed (PLS) rated per federal, state, county, and municipal standards.

Loamy Plains Seed Mix					
Common Name	Scientific Name	Variety	% of Seeds/square foot	Live seeds/square foot	lbs. PLS/Acre
Buffalograss	<i>Bouteloua doctylodes</i>	Cody or Bison	7%	4.03	3.1
Blue Grama	<i>Bouteloua gracilis</i>	Bad River or Birdseye	19%	11.25	0.59
Blue Grama	<i>Bouteloua gracilis</i>	Alma	4%	2.25	0.12
Russian Wildrye	<i>Psathyrostachys juncea</i>	Bozoikey Select	12%	6.83	1.7
Green Needlegrass	<i>Nasella viridula</i>	Lodorm	11%	6.3	1.52
Slender Wheatgrass	<i>Elymus trachycaulus</i>	San Luis or Revenue	16%	9.15	2.5
Western Wheatgrass	<i>Pascopyrum smithii</i>	Arriba	19%	11.25	4.46
Sand Dropseed	<i>Sporobolus cryptandrus</i>	Colorado origin if possible	12%	6.75	0.05
Total (Drill Rate)			100%	57.81	14.04

Note: The seed mix may be adjusted based on seed availability, seeding dates, or other variables.