Stormwater Regulation Guide
ESC Plan Template
BMP Details

ADAMS COUNTY COLORADO

National Pollutant Discharge Elimination System
MS4 Phase II Permit

ADAMS COUNTY
COLORADO

Public Works Department

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1-1 Purpose

This document shall be used as a guide to create an Erosion and Sediment Control Plan (ESC Plan) that is required to obtain an Adams County Stormwater Quality Permit necessary for construction sites that disturb one or more acres or is part of a larger development or sale.

1-2 Erosion and Sediment Control Plan Preparation

It is the expectation of the County that the Erosion and Sediment Control Plan Template be used when creating an ESC Plan for the County. This plan shall include the following items in the *ESC Plan Template Appendices*:

A. Appendix 1 – Project Vicinity Map (Section 1.1)
B. Appendix 2 – State CDPS Stormwater Construction Permit Certification (Section 1.2)
C. Appendix 3 – Pre-disturbance Photos (Section 1.4)
D. Appendix 4 – Copy of Demolition Permit and State Asbestos Permit (Section 1.9)
E. Appendix 5 – Erosion and Sediment Control BMP Details (Section 1.10)
F. Appendix 6 – Erosion and Sediment Control Plan - Site Map (Section 2.10)
G. Appendix 7 – Standard Stormwater Quality Inspection Form (Section 5.1)
H. Appendix 8 – Delegation of Authority (optional) (Section 5.2)
I. Appendix 9 – Completed Stormwater Quality Inspections (Sections 5.3 & 5.5)
J. Appendix 10 – Subcontractor Certifications/Agreements (optional) (Section 9.1)

1-3 Cost Estimation for Financial Surety

In accordance with the County's Standards and Regulations, specifically *Section 9-05-07 Financial Surety* in the form of an Irrevocable Letter of Credit shall be posted. Both Irrevocable Letter of Credits for Subdivision Improvement or Site Improvement can be found in Appendix A of the County's Standards and Regulations. The permittee shall provide financial surety for the duration of the Stormwater Quality Permit. To calculate the cost to be posted, the applicant shall use the *Figure 1.1 Cost Opinion Worksheet* provided herein.

Figure 1.1 Cost Opinion Worksheet

Probable Cost Spreadsheet for all BMPs

Project Name:	Date:

BMP No.	BMP	Detail	ID	Unit	Installation Unit Cost	Quantity		Cost
1	Check Dam	EC-12	CD	LF	$24.00			$0.00
2	Construction Fence	SM-3	AF	LF	$2.00			$0.00
3	Earth Dike	EC-10	DD	LF	$1.60			$0.00
4	Erosion Control Blanket	EC-6	ECB	SY	$5.00			$0.00
5	Inlet Protection	SC-6	IP	LF	$20.00			$0.00
6	Mulching	EC-4	MU	AC				$0.00
7	Reinforced Check Dam	EC-12	RCD	LF	$36.00			$0.00
8	Rock Socks	SC-5	RS	LF	$10.00			$0.00
9	Sediment Control Log	SC-2	SCL	LF	$2.00			$0.00
10	Permanent Seeding	EC-2	PS	AC	$2,500.00			$0.00
11	Silt Fence	SC-1	SF	LF	$2.00			$0.00
13	Surface Roughening	EC-1	SR	AC	$600.00			$0.00
14	Temporary Outlet Protection	EC-8	TOP	EA	$250.00			$0.00
15	Vehicle Tracking Control	SM-4	VTC	Ea	$1,000.00			$0.00
					Subtotal			$0.00
					Contingency (10% of Subtotal)			$0.00
					Total Cost of BMPs			**$0.00**

2-1 Erosion and Sediment Control Plan Template

Always use the County's *Erosion and Sediment Control Plan Template* that is provided here in. This Erosion and Sediment Control Plan template shall be completed and submitted to the County prior to authorization of a Stormwater Quality Permit. A copy of the Erosion and Sediment Control Plan Template has been placed on the County's website separate of this document, which can be downloaded and filled in electronically. Refer to Appendix B-1 of this Stormwater Regulation Guide for the ESC Plan template.

3-1 Construction Best Management Practices Details

In order to prevent erosion and capture sediment as required by the County's Stormwater Quality Regulations, it is necessary to implement best management practices (BMPs). The following are construction BMPs to be used by the ESC Plan designer to be included in the ESC Plan, specifically in Appendix F. Construction BMPs include, at minimum:

3-1.1 Sediment Control BMPs

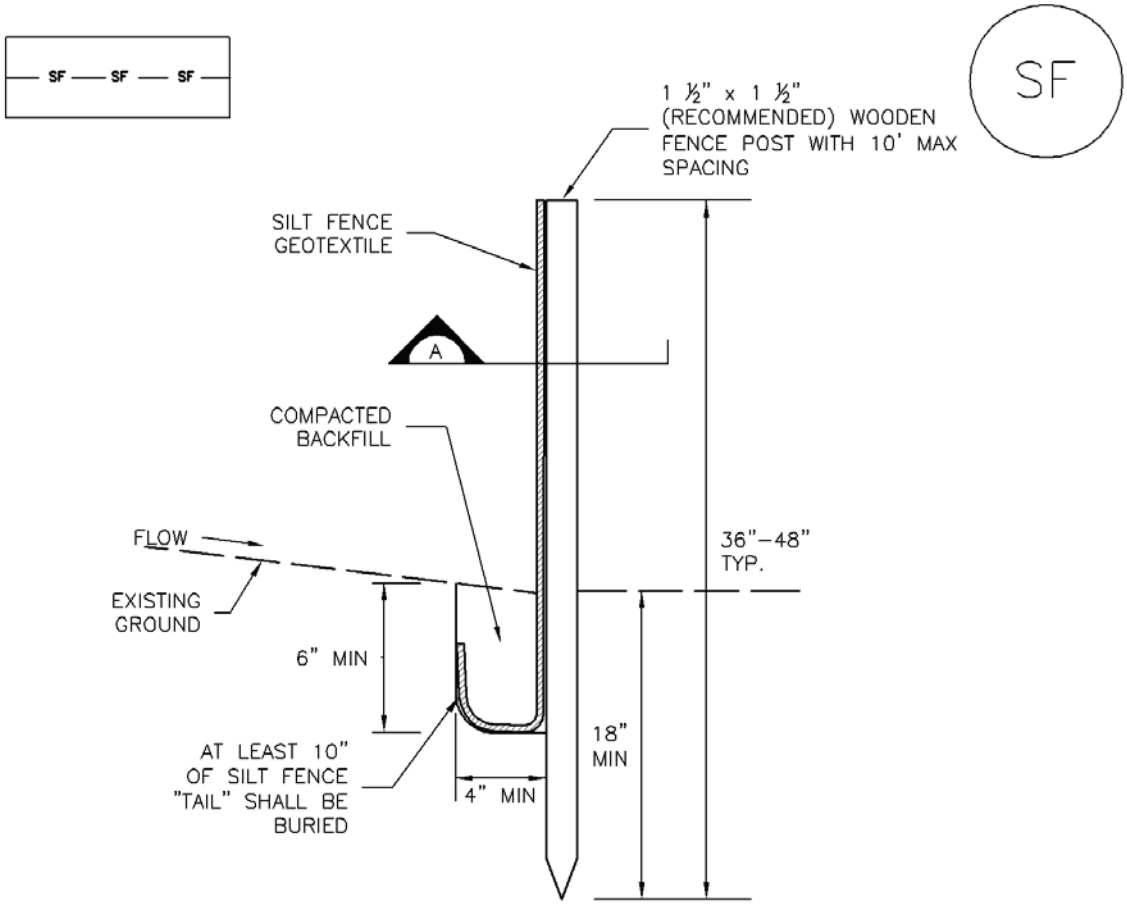
Sediment control measures limit transport of sediment off0site to downstream properties and receiving waters. Sediment controls are the second line of defense, capturing soil that has been eroded. The County uses the following BMP details for sediment containment:

a. SC-1 Silt Fence (SF)
b. SC-2 Sediment Control Log (SCL)
c. SC-3 Straw Bale Barrier (SBB)
d. SC-5 Rock Sock (RS)
e. SC-6 Inlet Protection (IP)
f. SC-7 Sediment Basin (SB)
g. SC-8 Sediment Trap (ST)
h. SC-9 Vegetated Buffers (VB)

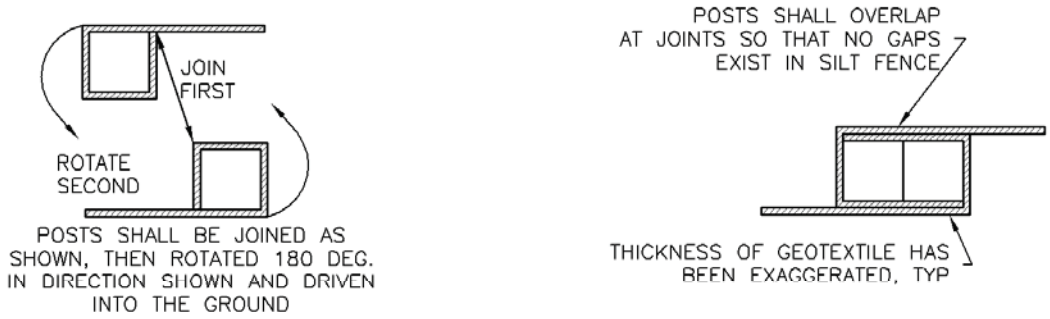
3-1.2 Erosion Control BMPs

Erosion control measures are source controls used to limit erosion of soil. The County uses the following BMP details for erosion control:

a. EC-1 Surface Roughening (SR)
b. EC-2 Temporary and Permanent Seeding (TS/PS)
c. EC-3 Soil Binders (SB)
d. EC-4 Mulching (MU)
e. EC-6 Rolled Erosion Control Products (RECP)
f. EC-7 Temporary Slope Drains (TSD)
g. EC-8 Temporary Outlet Protection (TOP)
h. EC-10 Earth Dikes and Drainage Swales (ED/DS)
i. EC-11 Terracing (TER)
j. EC-12 Check Dams (CD)
k. EC-13 Streambank Stabilization (SS)
l. EC-14 Wind Erosion/Dust Control (DC)



SILT FENCE



SECTION A

SF–1. SILT FENCE

SILT FENCE INSTALLATION NOTES

1. SILT FENCE MUST BE PLACED AWAY FROM THE TOE OF THE SLOPE TO ALLOW FOR WATER PONDING. SILT FENCE AT THE TOE OF A SLOPE SHOULD BE INSTALLED IN A FLAT LOCATION AT LEAST SEVERAL FEET (2–5 FT) FROM THE TOE OF THE SLOPE TO ALLOW ROOM FOR PONDING AND DEPOSITION.

2. A UNIFORM 6" X 4" ANCHOR TRENCH SHALL BE EXCAVATED USING TRENCHER OR SILT FENCE INSTALLATION DEVICE. NO ROAD GRADERS, BACKHOES, OR SIMILAR EQUIPMENT SHALL BE USED.

3. COMPACT ANCHOR TRENCH BY HAND WITH A "JUMPING JACK" OR BY WHEEL ROLLING. COMPACTION SHALL BE SUCH THAT SILT FENCE RESISTS BEING PULLED OUT OF ANCHOR TRENCH BY HAND.

4. SILT FENCE SHALL BE PULLED TIGHT AS IT IS ANCHORED TO THE STAKES. THERE SHOULD BE NO NOTICEABLE SAG BETWEEN STAKES AFTER IT HAS BEEN ANCHORED TO THE STAKES.

5. SILT FENCE FABRIC SHALL BE ANCHORED TO THE STAKES USING 1" HEAVY DUTY STAPLES OR NAILS WITH 1" HEADS. STAPLES AND NAILS SHOULD BE PLACED 3" ALONG THE FABRIC DOWN THE STAKE.

6. AT THE END OF A RUN OF SILT FENCE ALONG A CONTOUR, THE SILT FENCE SHOULD BE TURNED PERPENDICULAR TO THE CONTOUR TO CREATE A "J–HOOK." THE "J–HOOK" EXTENDING PERPENDICULAR TO THE CONTOUR SHOULD BE OF SUFFICIENT LENGTH TO KEEP RUNOFF FROM FLOWING AROUND THE END OF THE SILT FENCE (TYPICALLY 10' – 20').

7. SILT FENCE SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.

SILT FENCE MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. SEDIMENT ACCUMULATED UPSTREAM OF THE SILT FENCE SHALL BE REMOVED AS NEEDED TO MAINTAIN THE FUNCTIONALITY OF THE BMP, TYPICALLY WHEN DEPTH OF ACCUMULATED SEDIMENTS IS APPROXIMATELY 6".

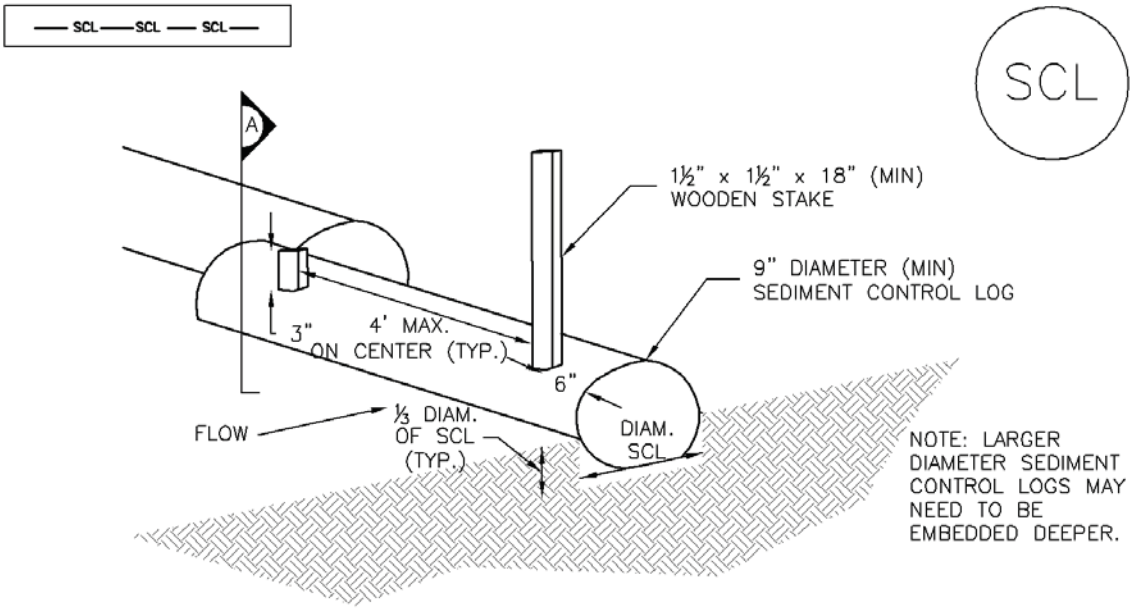
5. REPAIR OR REPLACE SILT FENCE WHEN THERE ARE SIGNS OF WEAR, SUCH AS SAGGING, TEARING, OR COLLAPSE.

6. SILT FENCE IS TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION, OR IS REPLACED BY AN EQUIVALENT PERIMETER SEDIMENT CONTROL BMP.

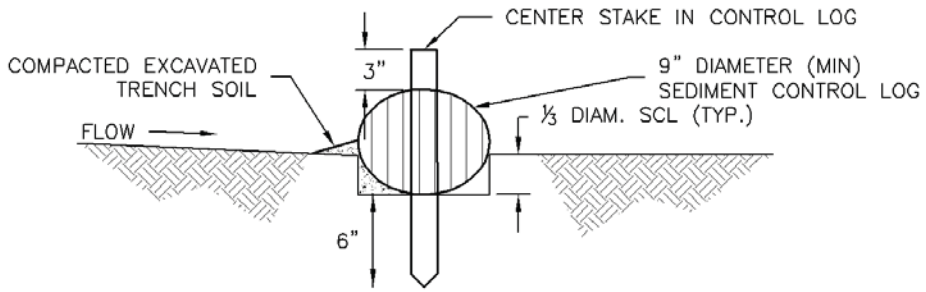
7. WHEN SILT FENCE IS REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAIL ADAPTED FROM TOWN OF PARKER, COLORADO AND CITY OF AURORA, NOT AVAILABLE IN AUTOCAD)

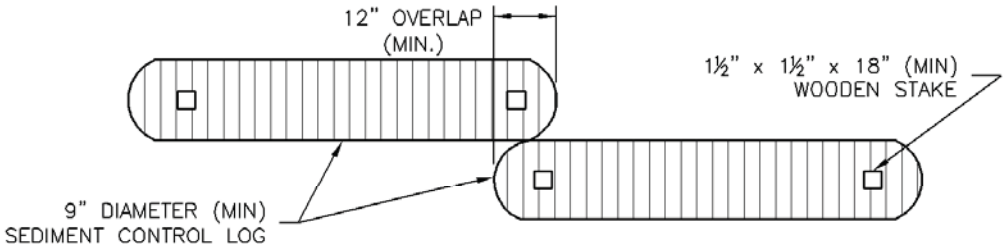
NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.



SEDIMENT CONTROL LOG

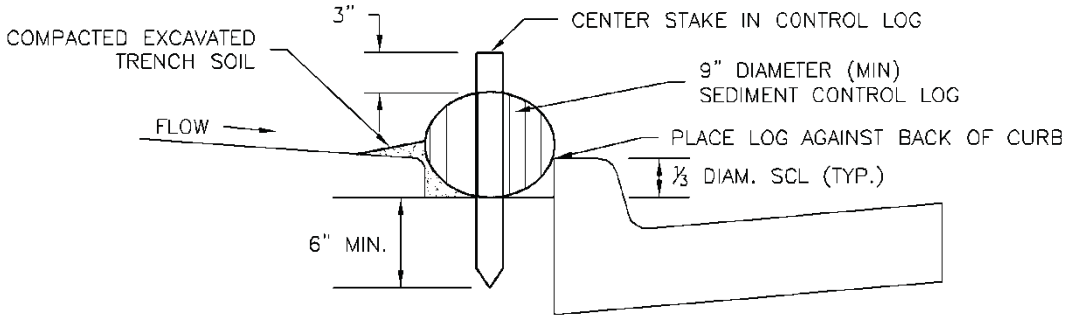


SECTION A

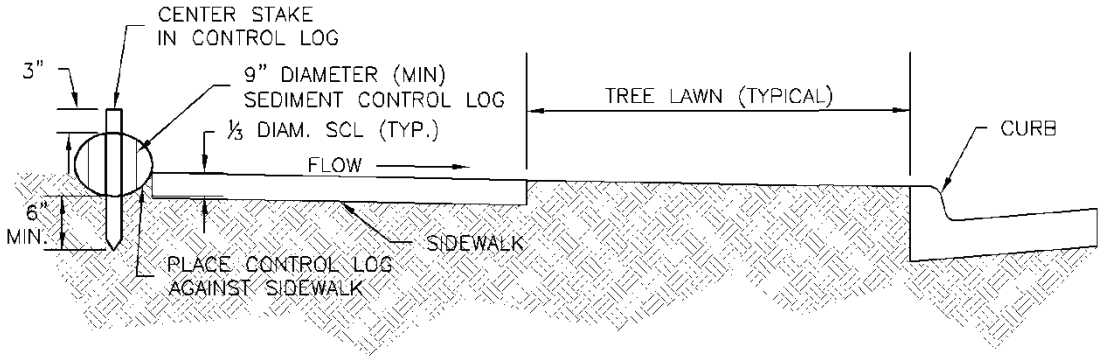


SEDIMENT CONTROL LOG JOINTS

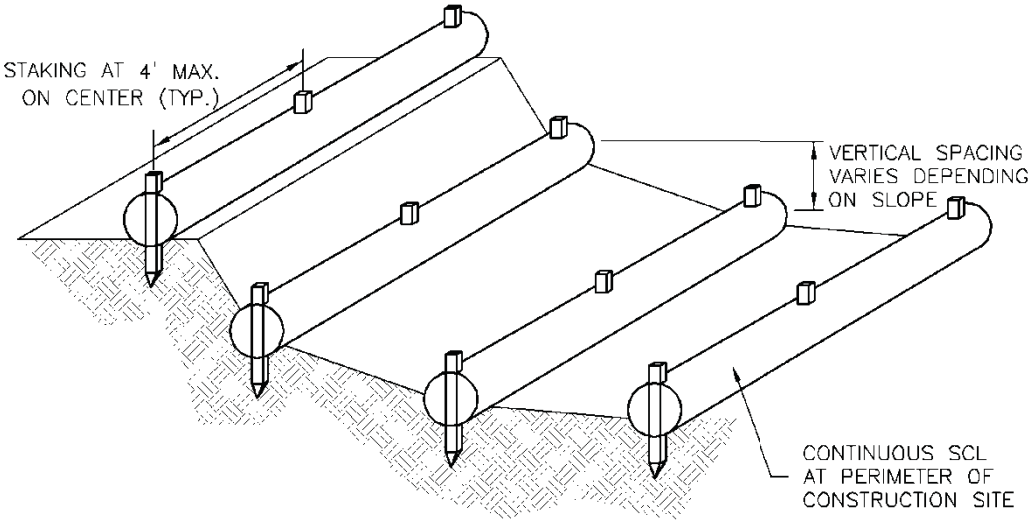
SCL–1. SEDIMENT CONTROL LOG



SCL–2. SEDIMENT CONTROL LOG AT BACK OF CURB



SCL–3. SEDIMENT CONTROL LOG AT SIDEWALK WITH TREE LAWN



SCL–4. SEDIMENT CONTROL LOGS TO CONTROL SLOPE LENGTH

SEDIMENT CONTROL LOG INSTALLATION NOTES

1. SEE PLAN VIEW FOR LOCATION AND LENGTH OF SEDIMENT CONTROL LOGS.

2. SEDIMENT CONTROL LOGS THAT ACT AS A PERIMETER CONTROL SHALL BE INSTALLED PRIOR TO ANY UPGRADIENT LAND-DISTURBING ACTIVITIES.

3. SEDIMENT CONTROL LOGS SHALL CONSIST OF STRAW, COMPOST, EXCELSIOR OR COCONUT FIBER, AND SHALL BE FREE OF ANY NOXIOUS WEED SEEDS OR DEFECTS INCLUDING RIPS, HOLES AND OBVIOUS WEAR.

4. SEDIMENT CONTROL LOGS MAY BE USED AS SMALL CHECK DAMS IN DITCHES AND SWALES. HOWEVER, THEY SHOULD NOT BE USED IN PERENNIAL STREAMS OR HIGH VELOCITY DRAINAGE WAYS.

5. IT IS RECOMMENDED THAT SEDIMENT CONTROL LOGS BE TRENCHED INTO THE GROUND TO A DEPTH OF APPROXIMATELY ⅓ OF THE DIAMETER OF THE LOG. IF TRENCHING TO THIS DEPTH IS NOT FEASIBLE AND/OR DESIRABLE (SHORT TERM INSTALLATION WITH DESIRE NOT TO DAMAGE LANDSCAPE) A LESSER TRENCHING DEPTH MAY BE ACCEPTABLE WITH MORE ROBUST STAKING

6. THE UPHILL SIDE OF THE SEDIMENT CONTROL LOG SHALL BE BACKFILLED WITH SOIL THAT IS FREE OF ROCKS AND DEBRIS. THE SOIL SHALL BE TIGHTLY COMPACTED INTO THE SHAPE OF A RIGHT TRIANGLE USING A SHOVEL OR WEIGHTED LAWN ROLLER.

7. FOLLOW MANUFACTURERS' GUIDANCE FOR STAKING. IF MANUFACTURERS' INSTRUCTIONS DO NOT SPECIFY SPACING, STAKES SHALL BE PLACED ON 4' CENTERS AND EMBEDDED A MINIMUM OF 6" INTO THE GROUND. 3" OF THE STAKE SHALL PROTRUDE FROM THE TOP OF THE LOG. STAKES THAT ARE BROKEN PRIOR TO INSTALLATION SHALL BE REPLACED.

SEDIMENT CONTROL LOG MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

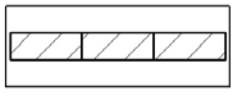
3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

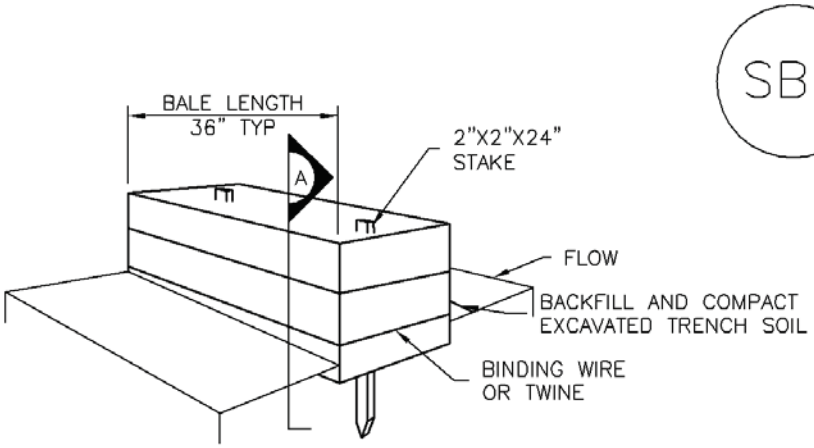
4. SEDIMENT ACCUMULATED UPSTREAM OF SEDIMENT CONTROL LOG SHALL BE REMOVED AS NEEDED TO MAINTAIN FUNCTIONALITY OF THE BMP, TYPICALLY WHEN DEPTH OF ACCUMULATED SEDIMENTS IS APPROXIMATELY ½ OF THE HEIGHT OF THE SEDIMENT CONTROL LOG.

5. SEDIMENT CONTROL LOG SHALL BE REMOVED AT THE END OF CONSTRUCTION. IF DISTURBED AREAS EXIST AFTER REMOVAL, THEY SHALL BE COVERED WITH TOP SOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

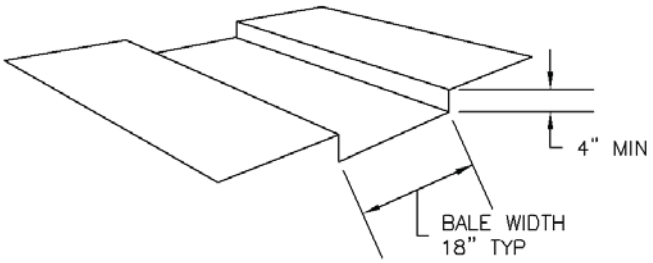
(DETAILS ADAPTED FROM TOWN OF PARKER, COLORADO, JEFFERSON COUNTY, COLORADO, DOUGLAS COUNTY, COLORADO, AND CITY OF AURORA, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

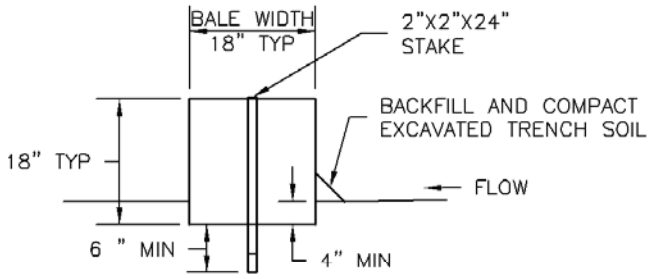




STRAW BALE



TRENCH FOR STRAW BALE



SECTION A

SBB–1. STRAW BALE

STRAW BALE INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –LOCATION(S) OF STRAW BALES.

2. STRAW BALES SHALL CONSIST OF CERTIFIED WEED FREE STRAW OR HAY. LOCAL JURISDICTIONS MAY REQUIRE PROOF THAT BALES ARE WEED FREE.

3. STRAW BALES SHALL CONSIST OF APPROXIMATELY 5 CUBIC FEET OF STRAW OR HAY AND WEIGH NOT LESS THAN 35 POUNDS.

4. WHEN STRAW BALES ARE USED IN SERIES AS A BARRIER, THE END OF EACH BALE SHALL BE TIGHTLY ABUTTING ONE ANOTHER.

5. STRAW BALE DIMENSIONS SHALL BE APPROXIMATELY 36"X18"X18".

6. A UNIFORM ANCHOR TRENCH SHALL BE EXCAVATED TO A DEPTH OF 4". STRAW BALES SHALL BE PLACED SO THAT BINDING TWINE IS ENCOMPASSING THE VERTICAL SIDES OF THE BALE(S). ALL EXCAVATED SOIL SHALL BE PLACED ON THE UPHILL SIDE OF THE STRAW BALE(S) AND COMPACTED.

7. TWO (2) WOODEN STAKES SHALL BE USED TO HOLD EACH BALE IN PLACE. WOODEN STAKES SHALL BE 2"X2"X24". WOODEN STAKES SHALL BE DRIVEN 6" INTO THE GROUND.

STRAW BALE MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. STRAW BALES SHALL BE REPLACED IF THEY BECOME HEAVILY SOILED, ROTTEN, OR DAMAGED BEYOND REPAIR.

5. SEDIMENT ACCUMULATED UPSTREAM OF STRAW BALE BARRIER SHALL BE REMOVED AS NEEDED TO MAINTAIN FUNCTIONALITY OF THE BMP, TYPICALLY WHEN DEPTH OF ACCUMULATED SEDIMENTS IS APPROXIMATELY ¼ OF THE HEIGHT OF THE STRAW BALE BARRIER.

6. STRAW BALES ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.

7. WHEN STRAW BALES ARE REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAILS ADAPTED FROM TOWN OF PARKER, COLORADO, NOT AVAILABLE IN AUTOCAD)

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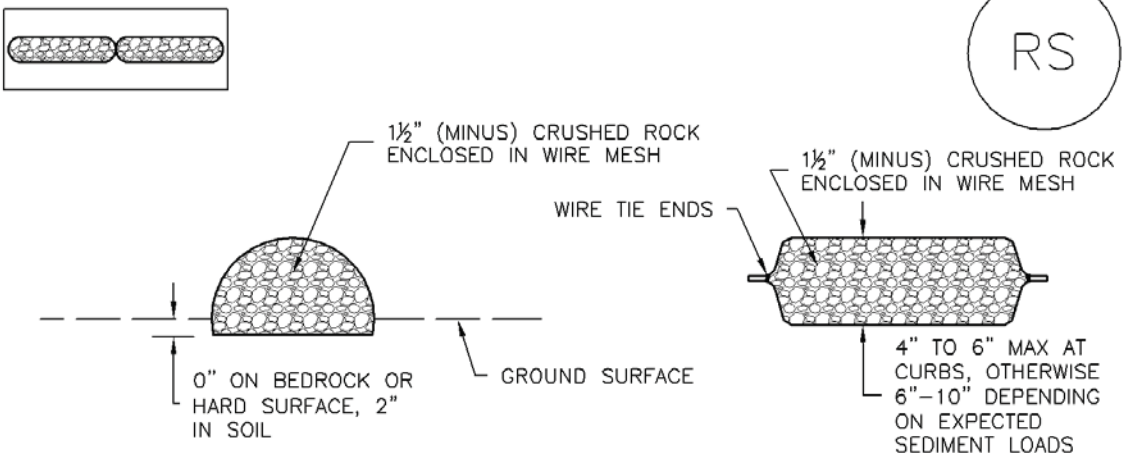
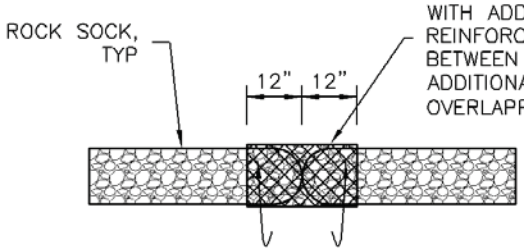


ROCK SOCK SECTION

ROCK SOCK PLAN



ANY GAP AT JOINT SHALL BE FILLED WITH AN ADEQUATE AMOUNT OF 1½" (MINUS) CRUSHED ROCK AND WRAPPED WITH ADDITIONAL WIRE MESH SECURED TO ENDS OF ROCK REINFORCED SOCK. AS AN ALTERNATIVE TO FILLING JOINTS BETWEEN ADJOINING ROCK SOCKS WITH CRUSHED ROCK AND ADDITIONAL WIRE WRAPPING, ROCK SOCKS CAN BE OVERLAPPED (TYPICALLY 12–INCH OVERLAP) TO AVOID GAPS.

ROCK SOCK JOINTING

GRADATION TABLE	
SIEVE SIZE	MASS PERCENT PASSING SQUARE MESH SIEVES
	NO. 4
2"	100
1½"	90 – 100
1"	20 – 55
¾"	0 – 15
⅜"	0 – 5
MATCHES SPECIFICATIONS FOR NO. 4 COARSE AGGREGATE FOR CONCRETE PER AASHTO M43. ALL ROCK SHALL BE FRACTURED FACE, ALL SIDES.	

ROCK SOCK INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –LOCATION(S) OF ROCK SOCKS.

2. CRUSHED ROCK SHALL BE 1½" (MINUS) IN SIZE WITH A FRACTURED FACE (ALL SIDES) AND SHALL COMPLY WITH GRADATION SHOWN ON THIS SHEET (1½" MINUS).

3. WIRE MESH SHALL BE FABRICATED OF 10 GAGE POULTRY MESH, OR EQUIVALENT, WITH A MAXIMUM OPENING OF ½", RECOMMENDED MINIMUM ROLL WIDTH OF 48"

4. WIRE MESH SHALL BE SECURED USING "HOG RINGS" OR WIRE TIES AT 6" CENTERS ALONG ALL JOINTS AND AT 2" CENTERS ON ENDS OF SOCKS.

5. SOME MUNICIPALITIES MAY ALLOW THE USE OF FILTER FABRIC AS AN ALTERNATIVE TO WIRE MESH FOR THE ROCK ENCLOSURE.

RS–1. ROCK SOCK PERIMETER CONTROL

ROCK SOCK MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. ROCK SOCKS SHALL BE REPLACED IF THEY BECOME HEAVILY SOILED, OR DAMAGED BEYOND REPAIR.

5. SEDIMENT ACCUMULATED UPSTREAM OF ROCK SOCKS SHALL BE REMOVED AS NEEDED TO MAINTAIN FUNCTIONALITY OF THE BMP, TYPICALLY WHEN DEPTH OF ACCUMULATED SEDIMENTS IS APPROXIMATELY ½ OF THE HEIGHT OF THE ROCK SOCK.

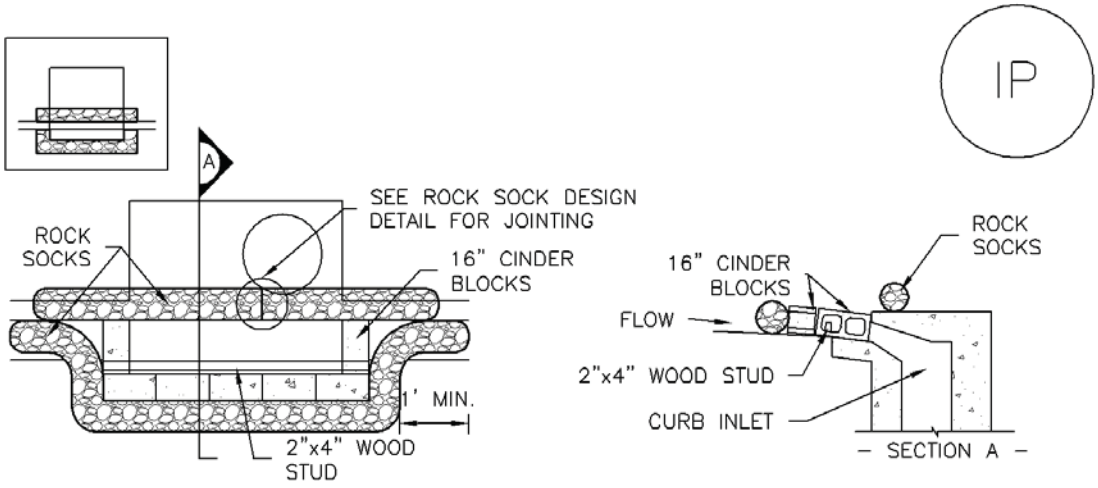
6. ROCK SOCKS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.

7. WHEN ROCK SOCKS ARE REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAIL ADAPTED FROM TOWN OF PARKER, COLORADO AND CITY OF AURORA, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

NOTE: THE DETAILS INCLUDED WITH THIS FACT SHEET SHOW COMMONLY USED, CONVENTIONAL METHODS OF ROCK SOCK INSTALLATION IN THE DENVER METROPOLITAN AREA. THERE ARE MANY OTHER SIMILAR PROPRIETARY PRODUCTS ON THE MARKET. UDFCD NEITHER NDORSES NOR DISCOURAGES USE OF PROPRIETARY PROTECTION PRODUCTS; HOWEVER, IN THE EVENT PROPRIETARY METHODS ARE USED, THE APPROPRIATE DETAIL FROM THE MANUFACTURER MUST BE INCLUDED IN THE SWMP AND THE BMP MUST BE INSTALLED AND MAINTAINED AS SHOWN IN THE MANUFACTURER'S DETAILS.



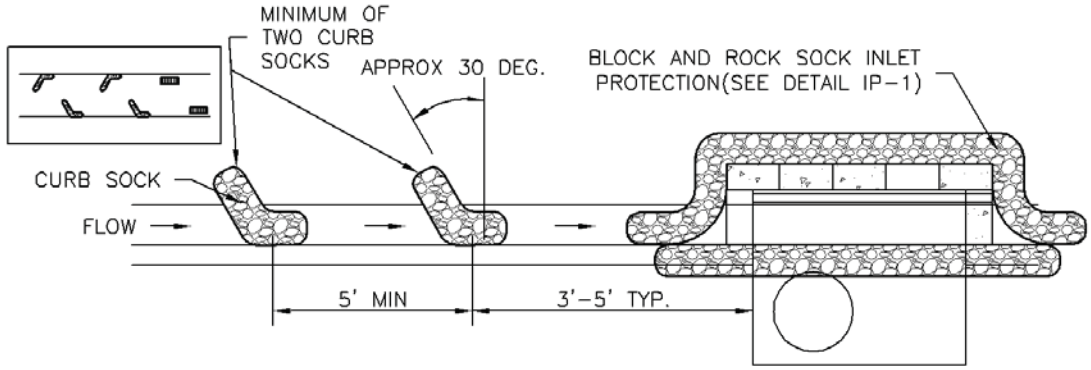
IP–1. BLOCK AND ROCK SOCK SUMP OR ON GRADE INLET PROTECTION

BLOCK AND CURB SOCK INLET PROTECTION INSTALLATION NOTES

1. SEE ROCK SOCK DESIGN DETAIL FOR INSTALLATION REQUIREMENTS.

2. CONCRETE "CINDER" BLOCKS SHALL BE LAID ON THEIR SIDES AROUND THE INLET IN A SINGLE ROW, ABUTTING ONE ANOTHER WITH THE OPEN END FACING AWAY FROM THE CURB.

3. GRAVEL BAGS SHALL BE PLACED AROUND CONCRETE BLOCKS, CLOSELY ABUTTING ONE ANOTHER AND JOINTED TOGETHER IN ACCORDANCE WITH ROCK SOCK DESIGN DETAIL.



IP–2. CURB ROCK SOCKS UPSTREAM OF INLET PROTECTION

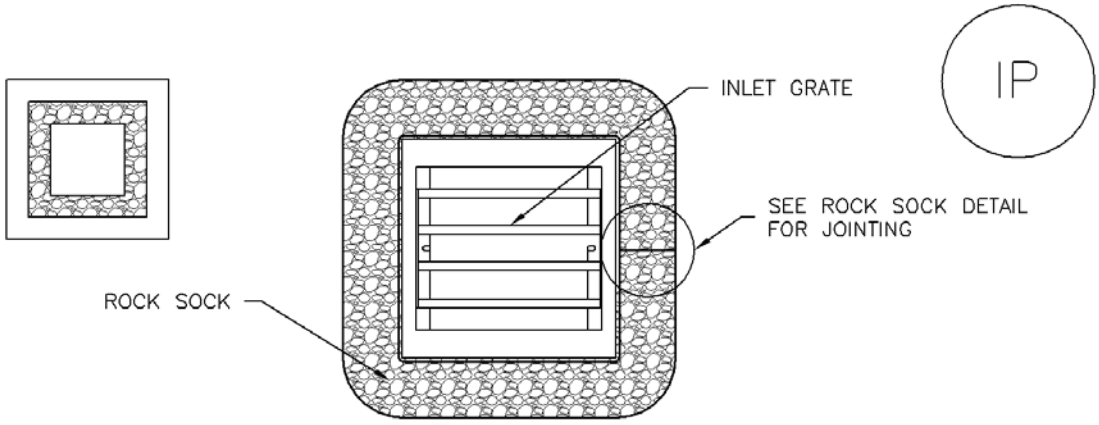
CURB ROCK SOCK INLET PROTECTION INSTALLATION NOTES

1. SEE ROCK SOCK DESIGN DETAIL INSTALLATION REQUIREMENTS.

2. PLACEMENT OF THE SOCK SHALL BE APPROXIMATELY 30 DEGREES FROM PERPENDICULAR IN THE OPPOSITE DIRECTION OF FLOW.

3. SOCKS ARE TO BE FLUSH WITH THE CURB AND SPACED A MINIMUM OF 5 FEET APART.

4. AT LEAST TWO CURB SOCKS IN SERIES ARE REQUIRED UPSTREAM OF ON–GRADE INLETS.

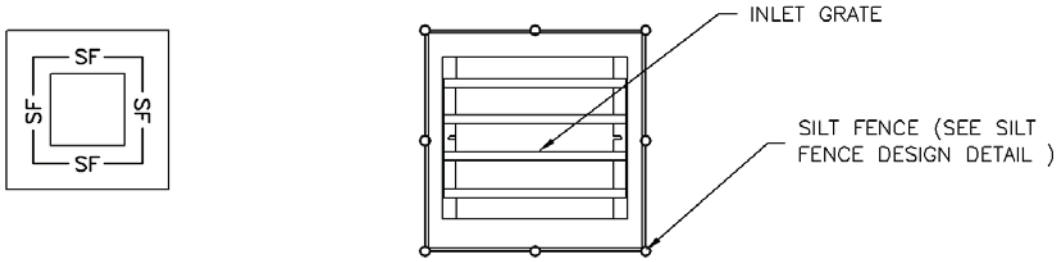


IP–3. ROCK SOCK SUMP/AREA INLET PROTECTION

ROCK SOCK SUMP/AREA INLET PROTECTION INSTALLATION NOTES

1. SEE ROCK SOCK DESIGN DETAIL FOR INSTALLATION REQUIREMENTS.

2. STRAW WATTLES/SEDIMENT CONTROL LOGS MAY BE USED IN PLACE OF ROCK SOCKS FOR INLETS IN PERVIOUS AREAS. INSTALL PER SEDIMENT CONTROL LOG DETAIL.



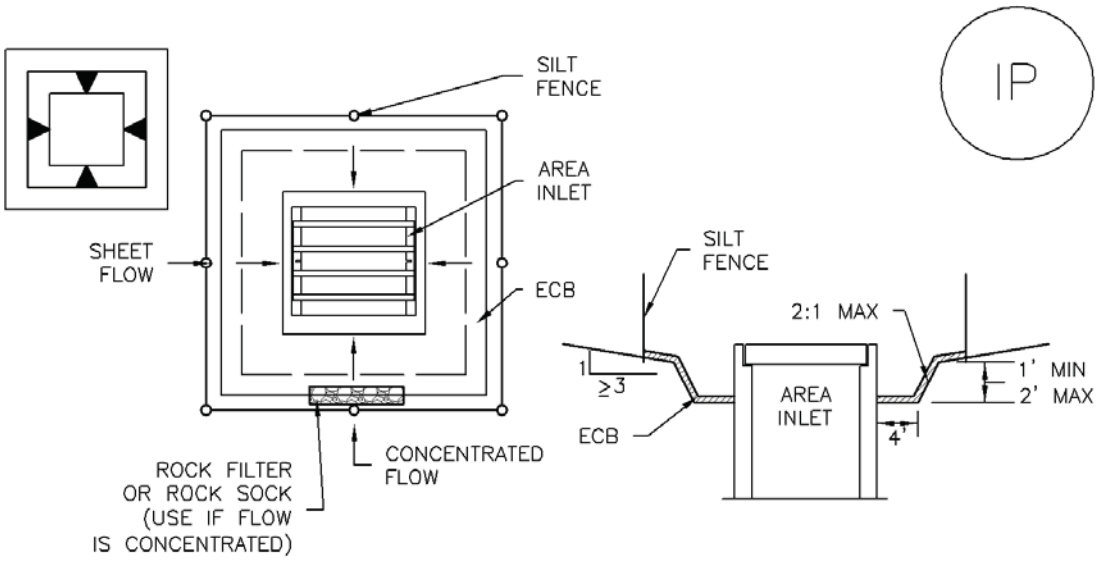
IP–4. SILT FENCE FOR SUMP INLET PROTECTION

SILT FENCE INLET PROTECTION INSTALLATION NOTES

1. SEE SILT FENCE DESIGN DETAIL FOR INSTALLATION REQUIREMENTS.

2. POSTS SHALL BE PLACED AT EACH CORNER OF THE INLET AND AROUND THE EDGES AT A MAXIMUM SPACING OF 3 FEET.

3. STRAW WATTLES/SEDIMENT CONTROL LOGS MAY BE USED IN PLACE OF SILT FENCE FOR INLETS IN PERVIOUS AREAS. INSTALL PER SEDIMENT CONTROL LOG DETAIL.



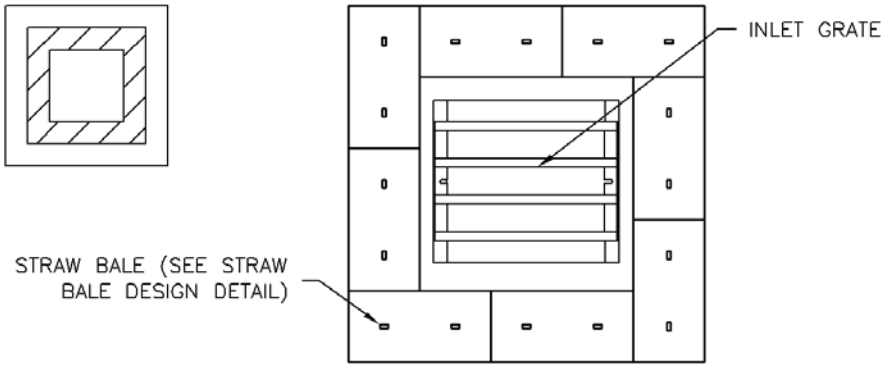
IP–5. OVEREXCAVATION INLET PROTECTION

OVEREXCAVATION INLET PROTECTION INSTALLATION NOTES

1. THIS FORM OF INLET PROTECTION IS PRIMARILY APPLICABLE FOR SITES THAT HAVE NOT YET REACHED FINAL GRADE AND SHOULD BE USED ONLY FOR INLETS WITH A RELATIVELY SMALL CONTRIBUTING DRAINAGE AREA.

2. WHEN USING FOR CONCENTRATED FLOWS, SHAPE BASIN IN 2:1 RATIO WITH LENGTH ORIENTED TOWARDS DIRECTION OF FLOW.

3. SEDIMENT MUST BE PERIODICALLY REMOVED FROM THE OVEREXCAVATED AREA.



IP–6. STRAW BALE FOR SUMP INLET PROTECTION

STRAW BALE BARRIER INLET PROTECTION INSTALLATION NOTES

1. SEE STRAW BALE DESIGN DETAIL FOR INSTALLATION REQUIREMENTS.

2. BALES SHALL BE PLACED IN A SINGLE ROW AROUND THE INLET WITH ENDS OF BALES TIGHTLY ABUTTING ONE ANOTHER.

GENERAL INLET PROTECTION INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –LOCATION OF INLET PROTECTION.
   –TYPE OF INLET PROTECTION (IP.1, IP.2, IP.3, IP.4, IP.5, IP.6)

2. INLET PROTECTION SHALL BE INSTALLED PROMPTLY AFTER INLET CONSTRUCTION OR PAVING IS COMPLETE (TYPICALLY WITHIN 48 HOURS). IF A RAINFALL/RUNOFF EVENT IS FORECAST, INSTALL INLET PROTECTION PRIOR TO ONSET OF EVENT.

3. MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

INLET PROTECTION MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. SEDIMENT ACCUMULATED UPSTREAM OF INLET PROTECTION SHALL BE REMOVED AS NECESSARY TO MAINTAIN BMP EFFECTIVENESS, TYPICALLY WHEN STORAGE VOLUME REACHES 50% OF CAPACITY, A DEPTH OF 6" WHEN SILT FENCE IS USED, OR ¼ OF THE HEIGHT FOR STRAW BALES.

5. INLET PROTECTION IS TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS PERMANENTLY STABILIZED, UNLESS THE LOCAL JURISDICTION APPROVES EARLIER REMOVAL OF INLET PROTECTION IN STREETS.

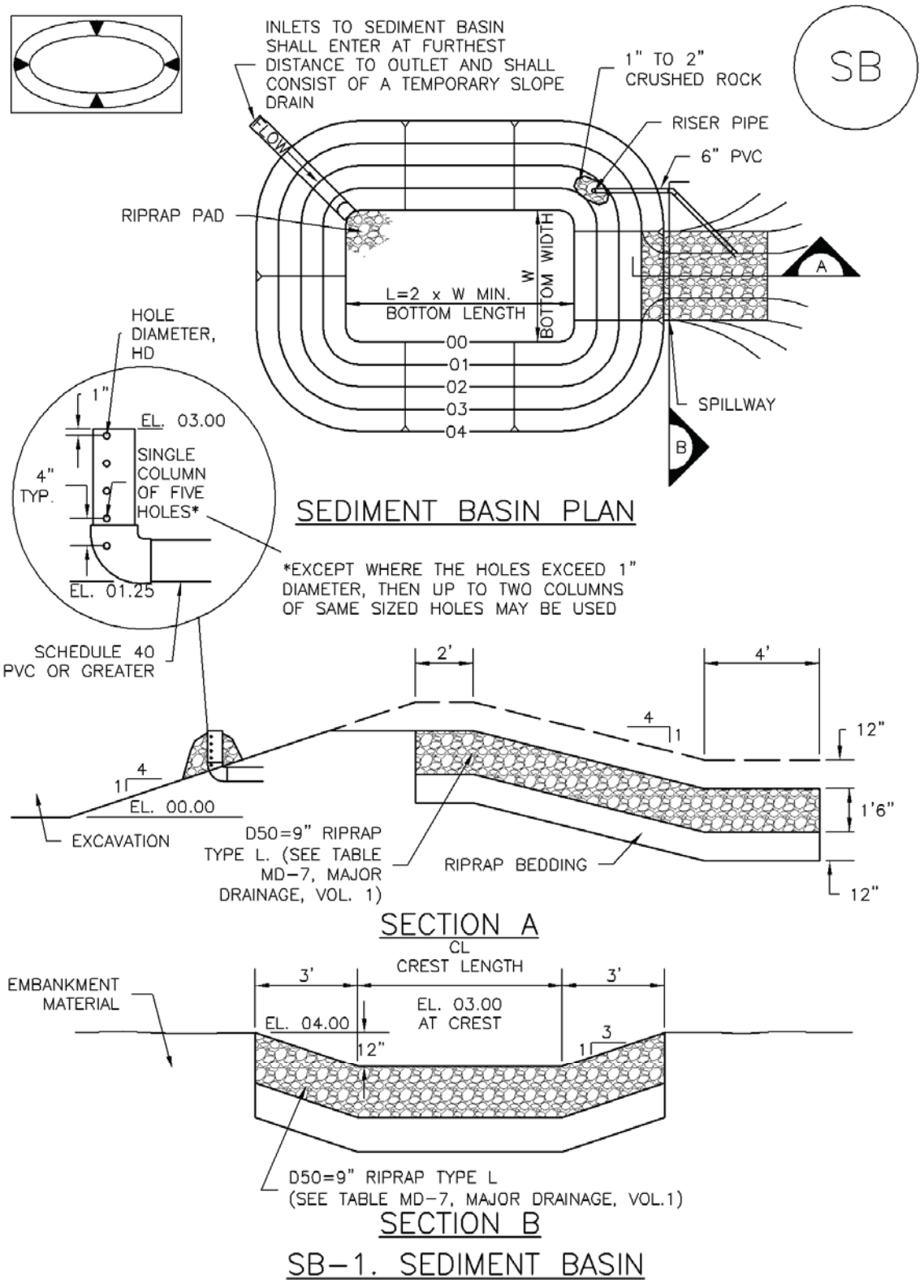
6. WHEN INLET PROTECTION AT AREA INLETS IS REMOVED, THE DISTURBED AREA SHALL BE COVERED WITH TOP SOIL, SEEDED AND MULCHED, OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

(DETAIL ADAPTED FROM TOWN OF PARKER, COLORADO AND CITY OF AURORA, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

NOTE: THE DETAILS INCLUDED WITH THIS FACT SHEET SHOW COMMONLY USED, CONVENTIONAL METHODS OF INLET PROTECTION IN THE DENVER METROPOLITAN AREA. THERE ARE MANY PROPRIETARY INLET PROTECTION METHODS ON THE MARKET. UDFCD NEITHER ENDORSES NOR DISCOURAGES USE OF PROPRIETARY INLET PROTECTION; HOWEVER, IN THE EVENT PROPRIETARY METHODS ARE USED, THE APPROPRIATE DETAIL FROM THE MANUFACTURER MUST BE INCLUDED IN THE SWMP AND THE BMP MUST BE INSTALLED AND MAINTAINED AS SHOWN IN THE MANUFACTURER'S DETAILS.

NOTE: SOME MUNICIPALITIES DISCOURAGE OR PROHIBIT THE USE OF STRAW BALES FOR INLET PROTECTION. CHECK WITH LOCAL JURISDICTION TO DETERMINE IF STRAW BALE INLET PROTECTION IS ACCEPTABLE.



SB-1. SEDIMENT BASIN

TABLE SB–1. SIZING INFORMATION FOR STANDARD SEDIMENT BASIN			
Upstream Drainage Area (rounded to nearest acre), (ac)	Basin Bottom Width (W), (ft)	Spillway Crest Length (CL), (ft)	Hole Diameter (HD), (in)
1	12 ½	2	9/32
2	21	3	13/16
3	28	5	½
4	33 ½	6	9/16
5	38 ½	8	21/32
6	43	9	21/32
7	47 ¼	11	25/32
8	51	12	27/32
9	55	13	⅞
10	58 ¼	15	15/16
11	61	16	31/32
12	64	18	1
13	67 ½	19	1 1/16
14	70 ½	21	1 ⅛
15	73 ¼	22	1 3/16

SEDIMENT BASIN INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - –LOCATION OF SEDIMENT BASIN.
   - –TYPE OF BASIN (STANDARD BASIN OR NONSTANDARD BASIN).
   - –FOR STANDARD BASIN, BOTTOM WIDTH W, CREST LENGTH CL, AND HOLE DIAMETER, HD.
   - –FOR NONSTANDARD BASIN, SEE CONSTRUCTION DRAWINGS FOR DESIGN OF BASIN INCLUDING RISER HEIGHT H, NUMBER OF COLUMNS N, HOLE DIAMETER HD AND PIPE DIAMETER D.

2. FOR STANDARD BASIN, BOTTOM DIMENSION MAY BE MODIFIED AS LONG AS BOTTOM AREA IS NOT REDUCED.

3. SEDIMENT BASINS SHALL BE INSTALLED PRIOR TO ANY OTHER LAND–DISTURBING ACTIVITY THAT RELIES ON ON BASINS AS AS A STORMWATER CONTROL.

4. EMBANKMENT MATERIAL SHALL CONSIST OF SOIL FREE OF DEBRIS, ORGANIC MATERIAL, AND ROCKS OR CONCRETE GREATER THAN 3 INCHES AND SHALL HAVE A MINIMUM OF 15 PERCENT BY WEIGHT PASSING THE NO. 200 SIEVE.

5. EMBANKMENT MATERIAL SHALL BE COMPACTED TO AT LEAST 95 PERCENT OF MAXIMUM DENSITY IN ACCORDANCE WITH ASTM D698.

6. PIPE SCH 40 OR GREATER SHALL BE USED.

7. THE DETAILS SHOWN ON THESE SHEETS PERTAIN TO STANDARD SEDIMENT BASIN(S) FOR DRAINAGE AREAS LESS THAN 15 ACRES. SEE CONSTRUCTION DRAWINGS FOR EMBANKMENT, STORAGE VOLUME, SPILLWAY, OUTLET, AND OUTLET PROTECTION DETAILS FOR ANY SEDIMENT BASIN(S) THAT HAVE BEEN INDIVIDUALLY DESIGNED FOR DRAINAGE AREAS LARGER THAN 15 ACRES.

SEDIMENT BASIN MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

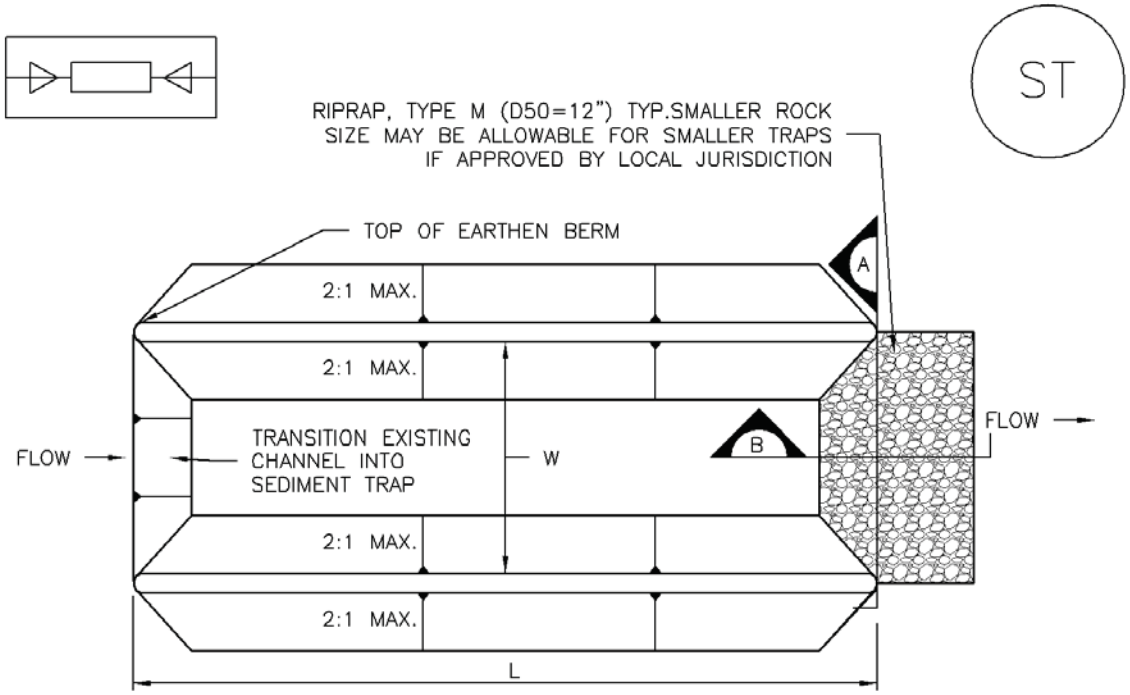
4. SEDIMENT ACCUMULATED IN BASIN SHALL BE REMOVED AS NEEDED TO MAINTAIN BMP EFFECTIVENESS, TYPICALLY WHEN SEDIMENT DEPTH REACHES ONE FOOT (I.E., TWO FEET BELOW THE SPILLWAY CREST).

5. SEDIMENT BASINS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER IS ACCEPTED BY THE LOCAL JURISDICTION.

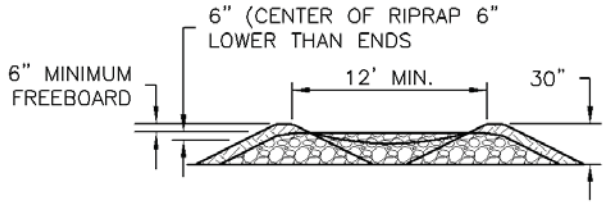
6. WHEN SEDIMENT BASINS ARE REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO)

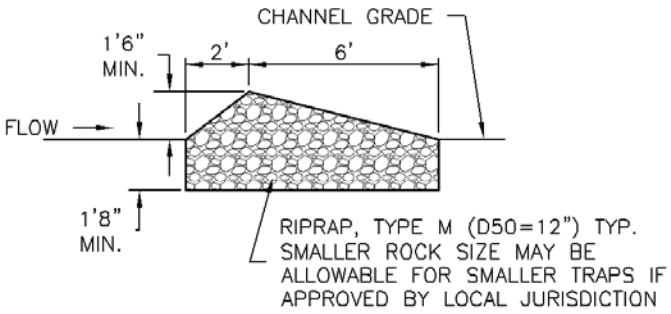
NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.



SEDIMENT TRAP PLAN



SECTION A



SECTION B

ST–1. SEDIMENT TRAP

SEDIMENT TRAP INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –LOCATION, LENGTH AND WIDTH OF SEDIMENT TRAP.

2. ONLY USE FOR DRAINAGE AREAS LESS THAN 1 ACRE.

3. SEDIMENT TRAPS SHALL BE INSTALLED PRIOR TO ANY UPGRADIENT LAND–DISTURBING ACTIVITIES.

4. SEDIMENT TRAP BERM SHALL BE CONSTRUCTED FROM MATERIAL FROM EXCAVATION. THE BERM SHALL BE COMPACTED TO 95% OF THE MAXIMUM DENSITY IN ACCORDANCE WITH ASTM D698.

5. SEDIMENT TRAP OUTLET TO BE CONSTRUCTED OF RIPRAP, TYPE M (D50=12") TYP.SMALLER ROCK SIZE MAY BE ALLOWABLE FOR SMALLER TRAPS IF APPROVED BY LOCAL JURISDICTION.

6. THE TOP OF THE EARTHEN BERM SHALL BE A MINIMUM OF 6" HIGHER THAN THE TOP OF THE RIPRAP OUTLET STRUCTURE.

7. THE ENDS OF THE RIPRAP OUTLET STRUCTURE SHALL BE A MINIMUM OF 6" HIGHER THAN THE CENTER OF THE OUTLET STRUCTURE.

SEDIMENT TRAP MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. REMOVE SEDIMENT ACCUMULATED IN TRAP AS NEEDED TO MAINTAIN THE FUNCTIONALITY OF THE BMP, TYPICALLY WHEN THE SEDIMENT DEPTH REACHES ½ THE HEIGHT OF THE RIPRAP OUTLET.

5. SEDIMENT TRAPS SHALL REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.

6. WHEN SEDIMENT TRAPS ARE REMOVED, THE DISTURBED AREA SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

Description

Buffer strips of preserved natural vegetation or grass help protect waterways and wetlands from land disturbing activities. Vegetated buffers improve stormwater runoff quality by straining sediment, promoting infiltration, and slowing runoff velocities.

Photograph VB-1. A vegetated buffer is maintained between the area of active construction and the drainage swale. Photo courtesy of WWE.

Appropriate Uses

Vegetated buffers can be used to separate land disturbing activities and natural surface waters or conveyances. In many jurisdictions, local governments require some type of setback from natural waterways. Concentrated flow should not be directed through a buffer; instead, runoff should be in the form of sheet flow. Vegetated buffers are typically used in combination with other perimeter control BMPs such as sediment control logs or silt fence for multi-layered protection.

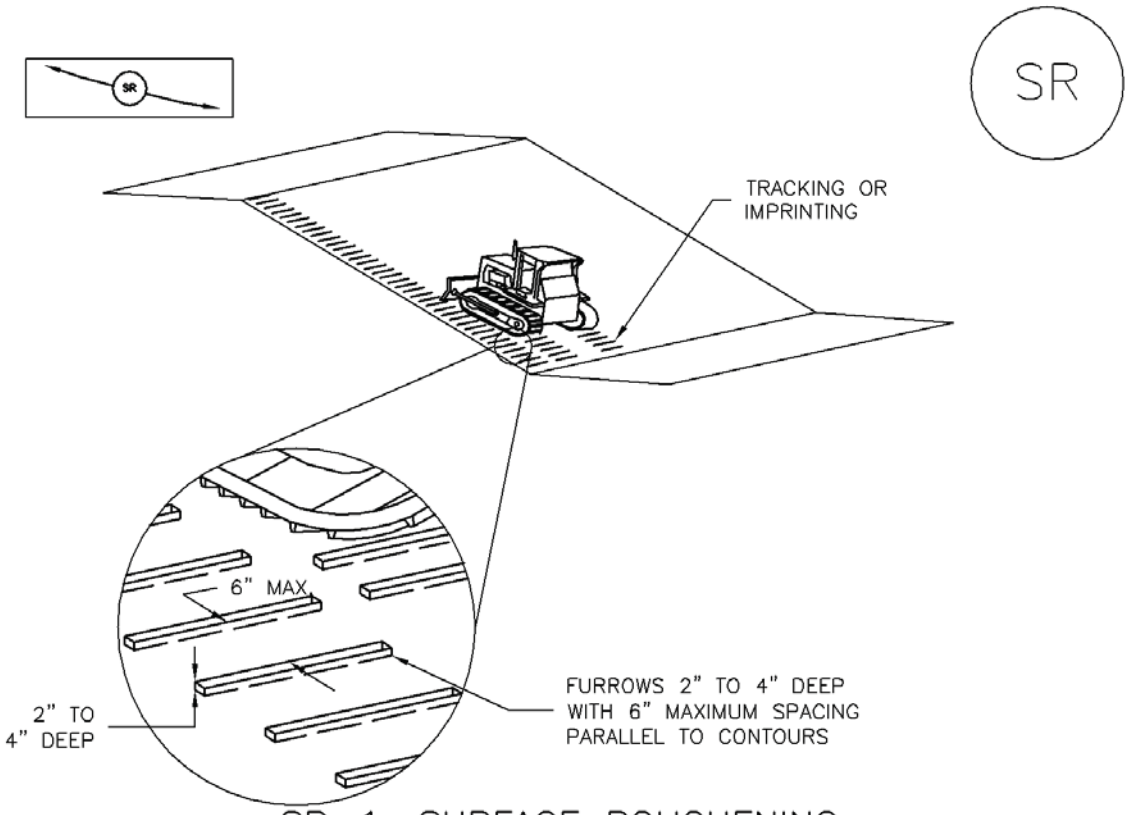
Design and Installation

Minimum buffer widths may vary based on local regulations. Clearly delineate the boundary of the natural buffer area using construction fencing, silt fence, or a comparable technique. In areas that have been cleared and graded, vegetated buffers such as sod can also be installed to create or restore a vegetated buffer around the perimeter of the site.

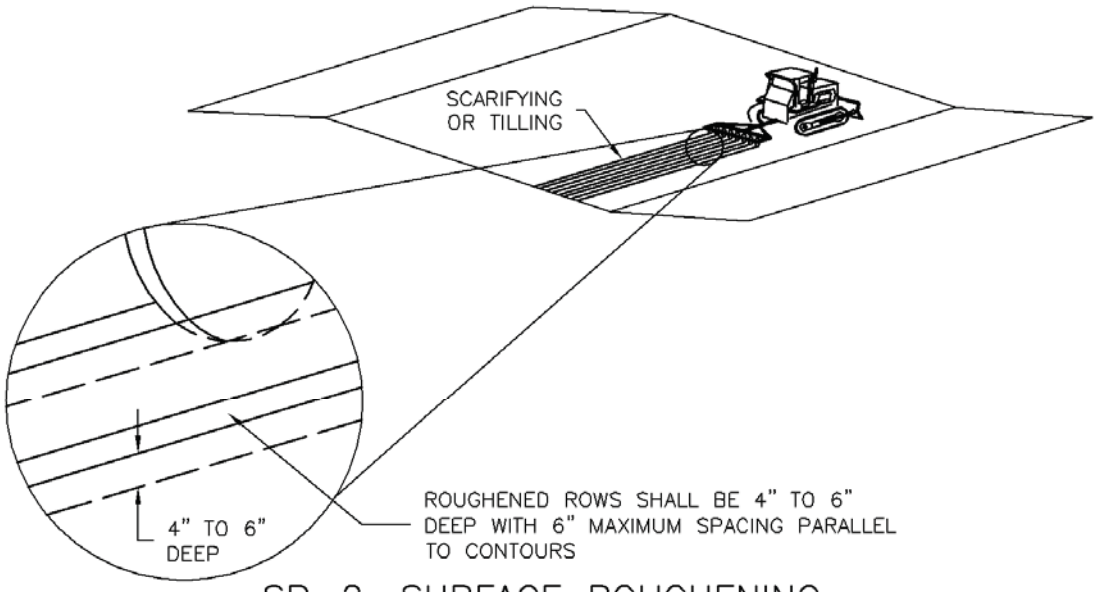
Maintenance and Removal

Inspect buffer areas for signs of erosion such as gullies or rills. Stabilize eroding areas, as needed. If erosion is due to concentrated flow conditions, it may be necessary to install a level spreader or other technique to restore sheet flow conditions. Inspect perimeter controls delineating the vegetative buffer and repair or replace as needed.

Vegetated Buffers	
Functions	
Erosion Control	Moderate
Sediment Control	Yes
Site/Material Management	Yes



SR–1. SURFACE ROUGHENING
FOR STEEP SLOPES (3:1 OR STEEPER)



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

SURFACE ROUGHENING INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   -LOCATION(S) OF SURFACE ROUGHENING.

2. SURFACE ROUGHENING SHALL BE PROVIDED PROMPTLY AFTER COMPLETION OF FINISHED GRADING (FOR AREAS NOT RECEIVING TOPSOIL) OR PRIOR TO TOPSOIL PLACEMENT OR ANY FORECASTED RAIN EVENT.

3. AREAS WHERE BUILDING FOUNDATIONS, PAVEMENT, OR SOD WILL BE PLACED WITHOUT DELAY IN THE CONSTRUCTION SEQUENCE, SURFACE ROUGHENING IS NOT REQUIRED.

4. DISTURBED SURFACES SHALL BE ROUGHENED USING RIPPING OR TILLING EQUIPMENT ON THE CONTOUR OR TRACKING UP AND DOWN A SLOPE USING EQUIPMENT TREADS.

5. A FARMING DISK SHALL NOT BE USED FOR SURFACE ROUGHENING.

SURFACE ROUGHENING MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACE UPON DISCOVERY OF THE FAILURE.

4. VEHICLES AND EQUIPMENT SHALL NOT BE DRIVEN OVER AREAS THAT HAVE BEEN SURFACE ROUGHENED.

5. IN NON-TURF GRASS FINISHED AREAS, SEEDING AND MULCHING SHALL TAKE PLACE DIRECTLY OVER SURFACE ROUGHENED AREAS WITHOUT FIRST SMOOTHING OUT THE SURFACE.

6. IN AREAS NOT SEEDED AND MULCHED AFTER SURFACE ROUGHENING, SURFACES SHALL BE RE-ROUGHENED AS NECESSARY TO MAINTAIN GROOVE DEPTH AND SMOOTH OVER RILL EROSION.

(DETAILS ADAPTED FROM TOWN OF PARKER, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

Temporary and Permanent Seeding (TS/PS) EC-2

Description

Temporary seeding can be used to stabilize disturbed areas that will be inactive for an extended period. Permanent seeding should be used to stabilize areas at final grade that will not be otherwise stabilized. Effective seeding includes preparation of a seedbed, selection of an appropriate seed mixture, proper planting techniques, and protection of the seeded area with mulch, geotextiles, or other appropriate measures.

Photograph TS/PS -1. Equipment used to drill seed. Photo courtesy of Douglas County.

Appropriate Uses

When the soil surface is disturbed and will remain inactive for an extended period (typically 30 days or longer), proactive stabilization measures should be implemented. If the inactive period is short-lived (on the order of two weeks), techniques such as surface roughening may be appropriate. For longer periods of inactivity, temporary seeding and mulching can provide effective erosion control. Permanent seeding should be used on finished areas that have not been otherwise stabilized.

Typically, local governments have their own seed mixes and timelines for seeding. Check jurisdictional requirements for seeding and temporary stabilization.

Design and Installation

Effective seeding requires proper seedbed preparation, selection of an appropriate seed mixture, use of appropriate seeding equipment to ensure proper coverage and density, and protection with mulch or fabric until plants are established.

The USDCM Volume 2 *Revegetation* Chapter contains detailed seed mix, soil preparations, and seeding and mulching recommendations that may be referenced to supplement this Fact Sheet.

Drill seeding is the preferred seeding method. Hydroseeding is not recommended except in areas where steep slopes prevent use of drill seeding equipment, and even in these instances it is preferable to hand seed and mulch. Some jurisdictions do not allow hydroseeding or hydromulching.

Seedbed Preparation

Prior to seeding, ensure that areas to be revegetated have soil conditions capable of supporting vegetation. Overlot grading can result in loss of topsoil, resulting in poor quality subsoils at the ground surface that have low nutrient value, little organic matter content, few soil microorganisms, rooting restrictions, and conditions less conducive to infiltration of precipitation. As a result, it is typically necessary to provide stockpiled topsoil, compost, or other

Temporary and Permanent Seeding	
Functions	
Erosion Control	Yes
Sediment Control	No
Site/Material Management	No

Soil Binders (SB) EC-3

Description

Soil binders include a broad range of treatments that can be applied to exposed soils for temporary stabilization to reduce wind and water erosion. Soil binders may be applied alone or as tackifiers in conjunction with mulching and seeding applications.

Acknowledgement: This BMP Fact Sheet has been adapted from the 2003 California Stormwater Quality Association (CASQA) Stormwater BMP Handbook: Construction (www.cabmphandbooks.com).

Photograph SB-1. Tackifier being applied to provide temporary soil stabilization. Photo courtesy of Douglas County.

Appropriate Uses

Soil binders can be used for short-term, temporary stabilization of soils on both mild and steep slopes. Soil binders are often used in areas where work has temporarily stopped, but is expected to resume before revegetation can become established. Binders are also useful on stockpiled soils or where temporary or permanent seeding has occurred.

Prior to selecting a soil binder, check with the state and local jurisdiction to ensure that the chemicals used in the soil binders are allowed. The water quality impacts of some types of soil binders are relatively unknown and may not be allowed due to concerns about potential environmental impacts. Soil binders must be environmentally benign (non-toxic to plant and animal life), easy to apply, easy to maintain, economical, and should not stain paved or painted surfaces.

Soil binders should not be used in vehicle or pedestrian high traffic areas, due to loss in effectiveness under these conditions.

Site soil type will dictate appropriate soil binders to be used. Be aware that soil binders may not function effectively on silt or clay soils or highly compacted areas. Check manufacturer's recommendations for appropriateness with regard to soil conditions. Some binders may not be suitable for areas with existing vegetation.

Design and Installation

Properties of common soil binders used for erosion control are provided in Table SB-1. Design and installation guidance below are provided for general reference. Follow the manufacturer's instructions for application rates and procedures.

Soil Binders	
Functions	
Erosion Control	Yes
Sediment Control	No
Site/Material Management	Moderate

Table SB-1. Properties of Soil Binders for Erosion Control (Source: CASQA 2003)

Evaluation Criteria	Binder Type			
	Plant Material Based (short lived)	**Plant Material Based (long lived)**	**Polymeric Emulsion Blends**	**Cementitious-Based Binders**
Resistance to Leaching	High	High	Low to Moderate	Moderate
Resistance to Abrasion	Moderate	Low	Moderate to High	Moderate to High
Longevity	Short to Medium	Medium	Medium to Long	Medium
Minimum Curing Time before Rain	9 to 18 hours	19 to 24 hours	0 to 24 hours	4 to 8 hours
Compatibility with Existing Vegetation	Good	Poor	Poor	Poor
Mode of Degradation	Biodegradable	Biodegradable	Photodegradable/ Chemically Degradable	Photodegradable/ Chemically Degradable
Specialized Application Equipment	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher	Water Truck or Hydraulic Mulcher
Liquid/Powder	Powder	Liquid	Liquid/Powder	Powder
Surface Crusting	Yes, but dissolves on rewetting	Yes	Yes, but dissolves on rewetting	Yes
Clean Up	Water	Water	Water	Water
Erosion Control Application Rate	Varies	Varies	Varies	4,000 to 12,000 lbs/acre Typ.

Factors to consider when selecting a soil binder generally include:

- **Suitability to situation**: Consider where the soil binder will be applied, if it needs a high resistance to leaching or abrasion, and whether it needs to be compatible with existing vegetation. Determine the length of time soil stabilization will be needed, and if the soil binder will be placed in an area where it will degrade rapidly. In general, slope steepness is not a discriminating factor.

- **Soil types and surface materials**: Fines and moisture content are key properties of surface materials. Consider a soil binder's ability to penetrate, likelihood of leaching, and ability to form a surface crust on the surface materials.

- **Frequency of application**: The frequency of application can be affected by subgrade conditions, surface type, climate, and maintenance schedule. Frequent applications could lead to high costs. Application frequency may be minimized if the soil binder has good penetration, low evaporation, and good longevity. Consider also that frequent application will require frequent equipment clean up.

An overview of major categories of soil binders, corresponding to the types included in Table SB-1 follows.

Plant-Material Based (Short Lived) Binders

- **Guar**: A non-toxic, biodegradable, natural galactomannan-based hydrocolloid treated with dispersant agents for easy field mixing. It should be mixed with water at the rate of 11 to 15 lbs per 1,000 gallons. Recommended minimum application rates are provided in Table SB-2.

Table SB-2. Application Rates for Guar Soil Stabilizer

	Slope (H:V)				
	Flat	4:1	3:1	2:1	1:1
Application Rate (lb/acre)	40	45	50	60	70

- **Psyllium**: Composed of the finely ground muciloid coating of plantago seeds that is applied as a wet slurry to the surface of the soil. It dries to form a firm but rewettable membrane that binds soil particles together but permits germination and growth of seed. Psyllium requires 12 to 18 hours drying time. Application rates should be from 80 to 200 lbs/acre, with enough water in solution to allow for a uniform slurry flow.

- **Starch**: Non-ionic, cold-water soluble (pre-gelatinized) granular cornstarch. The material is mixed with water and applied at the rate of 150 lb/acre. Approximate drying time is 9 to 12 hours.

Plant-Material Based (Long Lived) Binders

- **Pitch and Rosin Emulsion**: Generally, a non-ionic pitch and rosin emulsion has a minimum solids content of 48 percent. The rosin should be a minimum of 26 percent of the total solids content. The soil stabilizer should be a non-corrosive, water dilutable emulsion that upon application cures to a water insoluble binding and cementing agent. For soil erosion control applications, the emulsion is diluted and should be applied as follows:

    - For clayey soil: 5 parts water to 1 part emulsion

- For sandy soil: 10 parts water to 1 part emulsion

Application can be by water truck or hydraulic seeder with the emulsion and product mixture applied at the rate specified by the manufacturer.

Polymeric Emulsion Blend Binders

- **Acrylic Copolymers and Polymers**: Polymeric soil stabilizers should consist of a liquid or solid polymer or copolymer with an acrylic base that contains a minimum of 55 percent solids. The polymeric compound should be handled and mixed in a manner that will not cause foaming or should contain an anti-foaming agent. The polymeric emulsion should not exceed its shelf life or expiration date; manufacturers should provide the expiration date. Polymeric soil stabilizer should be readily miscible in water, non-injurious to seed or animal life, non-flammable, should provide surface soil stabilization for various soil types without inhibiting water infiltration, and should not re-emulsify when cured. The applied compound should air cure within a maximum of 36 to 48 hours. Liquid copolymer should be diluted at a rate of 10 parts water to 1 part polymer and the mixture applied to soil at a rate of 1,175 gallons/acre.

- **Liquid Polymers of Methacrylates and Acrylates**: This material consists of a tackifier/sealer that is a liquid polymer of methacrylates and acrylates. It is an aqueous 100 percent acrylic emulsion blend of 40 percent solids by volume that is free from styrene, acetate, vinyl, ethoxylated surfactants or silicates. For soil stabilization applications, it is diluted with water in accordance with manufacturer's recommendations, and applied with a hydraulic seeder at the rate of 20 gallons/acre. Drying time is 12 to 18 hours after application.

- **Copolymers of Sodium Acrylates and Acrylamides**: These materials are non-toxic, dry powders that are copolymers of sodium acrylate and acrylamide. They are mixed with water and applied to the soil surface for erosion control at rates that are determined by slope gradient, as summarized in Table SB-3.

Table SB-3. Application Rates for Copolymers of Sodium Acrylates and Acrylamides

	Slope (H:V)		
	Flat to 5:1	5:1 to 3:1	2:2 to 1:1
Application Rate (lb/acre)	3.0-5.0	5.0-10.0	10.0-20.0

- **Polyacrylamide and Copolymer of Acrylamide**: Linear copolymer polyacrylamide is packaged as a dry flowable solid. When used as a stand-alone stabilizer, it is diluted at a rate of 11 lb/1,000 gal. of water and applied at the rate of 5.0 lb/acre.

- **Hydrocolloid Polymers**: Hydrocolloid Polymers are various combinations of dry flowable polyacrylamides, copolymers, and hydrocolloid polymers that are mixed with water and applied to the soil surface at rates of 55 to 60 lb/acre. Drying times are 0 to 4 hours.

Cementitious-Based Binders

- **Gypsum**: This formulated gypsum based product readily mixes with water and mulch to form a thin protective crust on the soil surface. It is composed of high purity gypsum that is ground, calcined and processed into calcium sulfate hemihydrate with a minimum purity of 86 percent. It is mixed in a hydraulic seeder and applied at rates 4,000 to 12,000 lb/acre. Drying time is 4 to 8 hours.

Installation

After selecting an appropriate soil binder, the untreated soil surface must be prepared before applying the soil binder. The untreated soil surface must contain sufficient moisture to assist the agent in achieving uniform distribution. In general, the following steps should be followed:

- Follow manufacturer's written recommendations for application rates, pre-wetting of application area, and cleaning of equipment after use.
- Prior to application, roughen embankment and fill areas.
- Consider the drying time for the selected soil binder and apply with sufficient time before anticipated rainfall. Soil binders should not be applied during or immediately before rainfall.
- Avoid over spray onto roads, sidewalks, drainage channels, sound walls, existing vegetation, etc.
- Soil binders should not be applied to frozen soil, areas with standing water, under freezing or rainy conditions, or when the temperature is below 40°F during the curing period.
- More than one treatment is often necessary, although the second treatment may be diluted or have a lower application rate.
- Generally, soil binders require a minimum curing time of 24 hours before they are fully effective. Refer to manufacturer's instructions for specific cure time.
- For liquid agents:
    - Crown or slope ground to avoid ponding.
    - Uniformly pre-wet ground at 0.03 to 0.3 gal/yd^2 or according to manufacturer's recommendations.
    - Apply solution under pressure. Overlap solution 6 to 12 in.
    - Allow treated area to cure for the time recommended by the manufacturer, typically at least 24 hours.
    - Apply second treatment before first treatment becomes ineffective, using 50 percent application rate.
    - In low humidity, reactivate chemicals by re-wetting with water at 0.1 to 0.2 gal/yd^2.

Maintenance and Removal

Soil binders tend to break down due to natural weathering. Weathering rates depend on a variety of site-specific and product characteristics. Consult the manufacturer for recommended reapplication rates and reapply the selected soil binder as needed to maintain effectiveness.

Soil binders can fail after heavy rainfall events and may require reapplication. In particular, soil binders will generally experience spot failures during heavy rainfall events. If runoff penetrates the soil at the top of a slope treated with a soil binder, it is likely that the runoff will undercut the stabilized soil layer and discharge at a point further down slope.

Areas where erosion is evident should be repaired and soil binder or other stabilization reapplied, as needed. Care should be exercised to minimize the damage to protected areas while making repairs.

Most binders biodegrade after exposure to sun, oxidation, heat and biological organisms; therefore, removal of the soil binder is not typically required.

Mulching (MU) EC-4

Description

Mulching consists of evenly applying straw, hay, shredded wood mulch, bark or compost to disturbed soils and securing the mulch by crimping, tackifiers, netting or other measures. Mulching helps reduce erosion by protecting bare soil from rainfall impact, increasing infiltration, and reducing runoff. Although often applied in conjunction with temporary or permanent seeding, it can also be used for temporary stabilization of areas that cannot be reseeded due to seasonal constraints.

Mulch can be applied either using standard mechanical dry application methods or using hydromulching equipment that hydraulically applies a slurry of water, wood fiber mulch, and often a tackifier.

Photograph MU-1. An area that was recently seeded, mulched, and crimped.

Appropriate Uses

Use mulch in conjunction with seeding to help protect the seedbed and stabilize the soil. Mulch can also be used as a temporary cover on low to mild slopes to help temporarily stabilize disturbed areas where growing season constraints prevent effective reseeding. Disturbed areas should be properly mulched and tacked, or seeded, mulched and tacked promptly after final grade is reached (typically within no longer than 14 days) on portions of the site not otherwise permanently stabilized.

Standard dry mulching is encouraged in most jurisdictions; however, hydromulching may not be allowed in certain jurisdictions or may not be allowed near waterways.

Do not apply mulch during windy conditions.

Design and Installation

Prior to mulching, surface-roughen areas by rolling with a crimping or punching type roller or by track walking. Track walking should only be used where other methods are impractical because track walking with heavy equipment typically compacts the soil.

A variety of mulches can be used effectively at construction sites, including the following types:

Mulch	
Functions	
Erosion Control	Yes
Sediment Control	Moderate
Site/Material Management	No

- Clean, weed- and seed-free, long-stemmed grass hay (preferred) or cereal grain straw. Hay is preferred because it is less susceptible to removal by wind. Mulch should be applied evenly at a rate of 2 tons per acre and must be tacked or fastened by an approved method suitable for the type of mulch used. At least 50 percent of the grass hay mulch, by weight, should be 10 inches or more in length.

- Grass hay mulch must be anchored and not merely placed on the surface. This can be accomplished mechanically by crimping or with the aid of tackifiers or nets. Anchoring with a crimping implement is preferred, and is the recommended method for areas flatter than 3:1. Mechanical crimpers must be capable of tucking the long mulch fibers into the soil to a depth of 3 inches without cutting them. An agricultural disk, while not an ideal substitute, may work if the disk blades are dull or blunted and set vertically; however, the frame may have to be weighted to afford proper soil penetration.

- On small areas sheltered from the wind and heavy runoff, spraying a tackifier on the mulch is satisfactory for holding it in place. For steep slopes and special situations where greater control is needed, erosion control blankets anchored with stakes should be used instead of mulch.

- Hydraulic mulching consists of wood cellulose fibers mixed with water and a tackifying agent and should be applied at a rate of no less than 1,500 pounds per acre (1,425 lbs of fibers mixed with at least 75 lbs of tackifier) with a hydraulic mulcher. For steeper slopes, up to 2000 pounds per acre may be required for effective hydroseeding. Hydromulch typically requires up to 24 hours to dry; therefore, it should not be applied immediately prior to inclement weather. Application to roads, waterways and existing vegetation should be avoided.

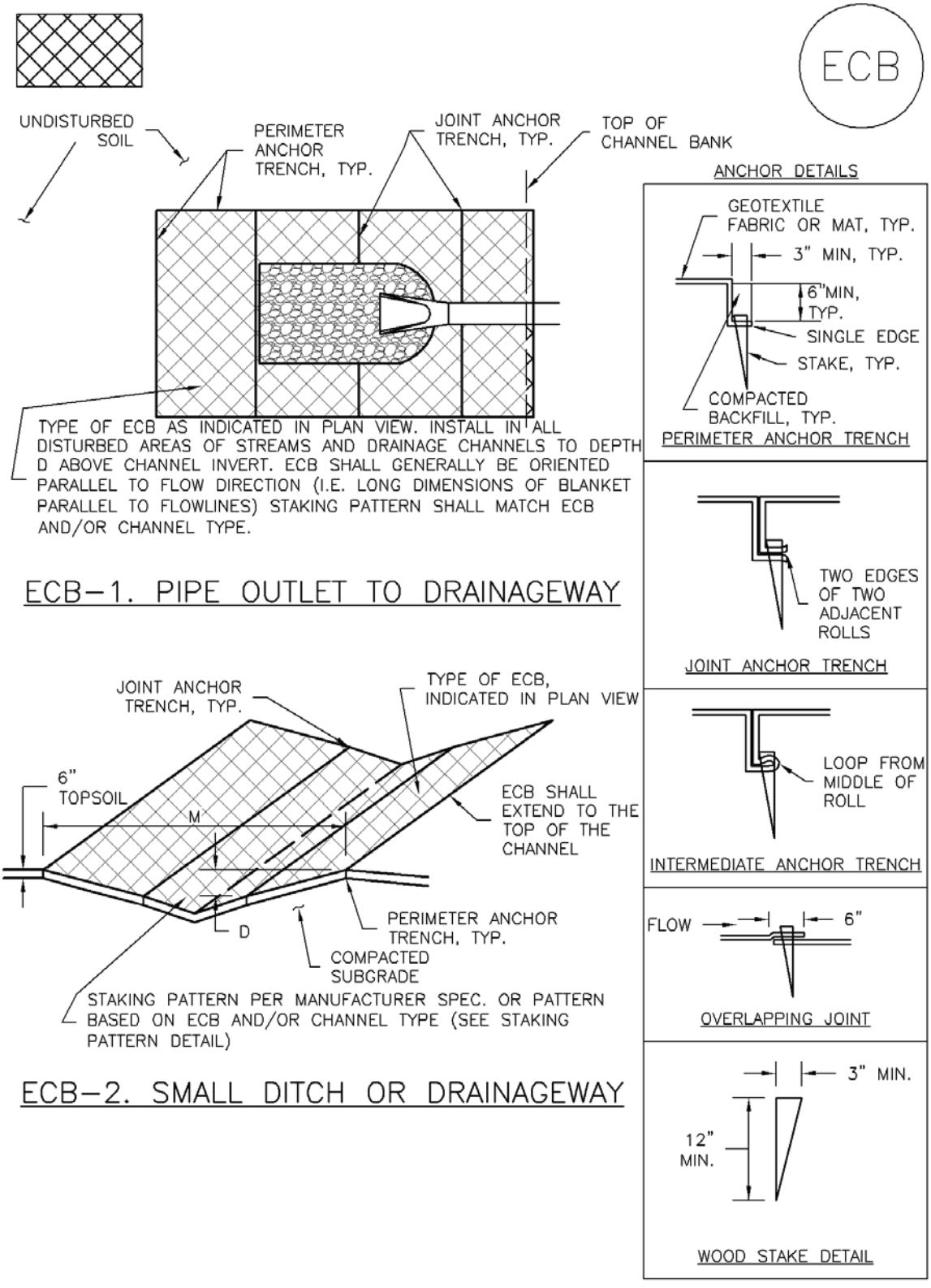
- Erosion control mats, blankets, or nets are recommended to help stabilize steep slopes (generally 3:1 and steeper) and waterways. Depending on the product, these may be used alone or in conjunction with grass or straw mulch. Normally, use of these products will be restricted to relatively small areas. Biodegradable mats made of straw and jute, straw-coconut, coconut fiber, or excelsior can be used instead of mulch. (See the ECM/TRM BMP for more information.)

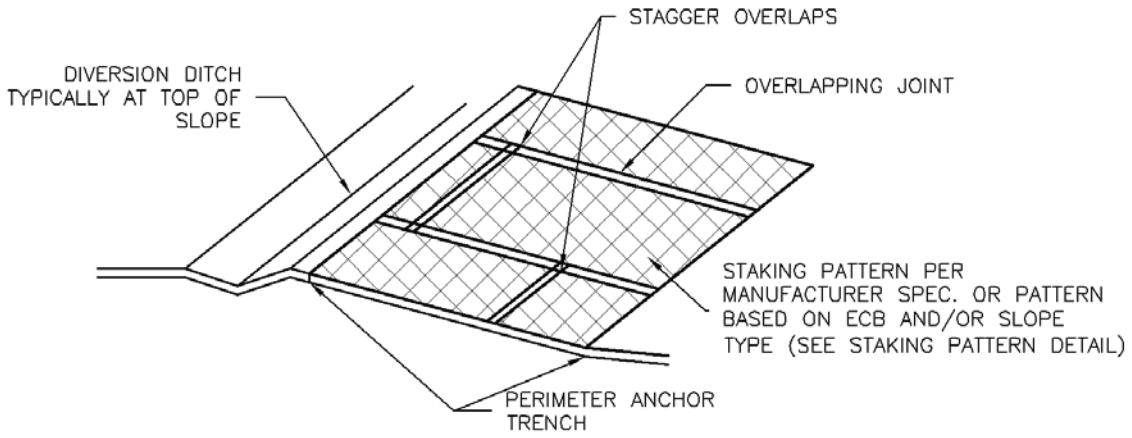
- Some tackifiers or binders may be used to anchor mulch. Check with the local jurisdiction for allowed tackifiers. Manufacturer's recommendations should be followed at all times. (See the Soil Binder BMP for more information on general types of tackifiers.)

- Rock can also be used as mulch. It provides protection of exposed soils to wind and water erosion and allows infiltration of precipitation. An aggregate base course can be spread on disturbed areas for temporary or permanent stabilization. The rock mulch layer should be thick enough to provide full coverage of exposed soil on the area it is applied.

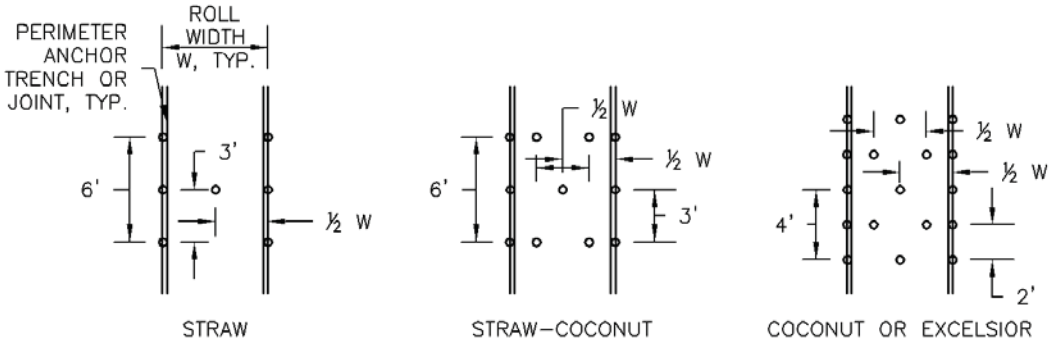
Maintenance and Removal

After mulching, the bare ground surface should not be more than 10 percent exposed. Reapply mulch, as needed, to cover bare areas.

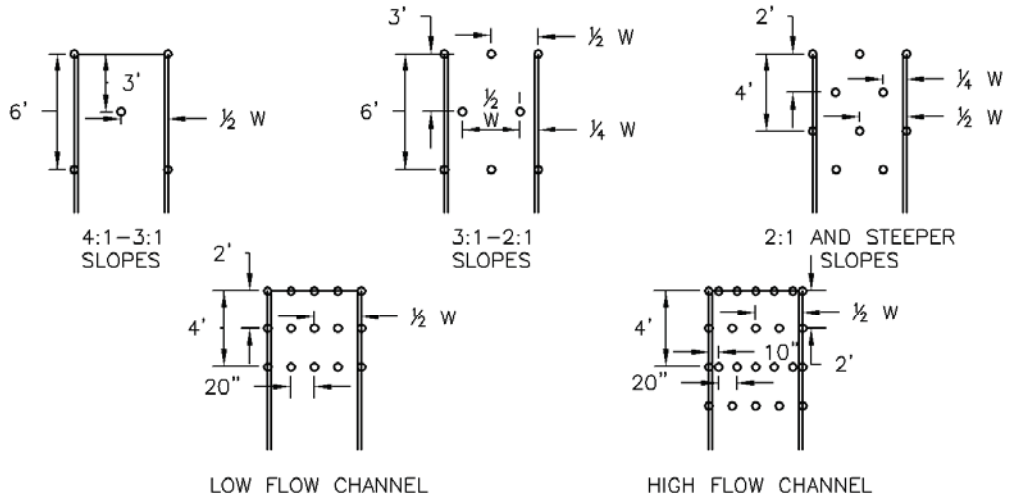

ECB
UNDISTURBED SOIL
PERIMETER ANCHOR TRENCH, TYP.
JOINT ANCHOR TRENCH, TYP.
TOP OF CHANNEL BANK
TYPE OF ECB AS INDICATED IN PLAN VIEW. INSTALL IN ALL DISTURBED AREAS OF STREAMS AND DRAINAGE CHANNELS TO DEPTH D ABOVE CHANNEL INVERT. ECB SHALL GENERALLY BE ORIENTED PARALLEL TO FLOW DIRECTION (I.E. LONG DIMENSIONS OF BLANKET PARALLEL TO FLOWLINES) STAKING PATTERN SHALL MATCH ECB AND/OR CHANNEL TYPE.
ECB–1. PIPE OUTLET TO DRAINAGEWAY
JOINT ANCHOR TRENCH, TYP.
TYPE OF ECB, INDICATED IN PLAN VIEW
6" TOPSOIL
M
ECB SHALL EXTEND TO THE TOP OF THE CHANNEL
D
PERIMETER ANCHOR TRENCH, TYP.
COMPACTED SUBGRADE
STAKING PATTERN PER MANUFACTURER SPEC. OR PATTERN BASED ON ECB AND/OR CHANNEL TYPE (SEE STAKING PATTERN DETAIL)
ECB–2. SMALL DITCH OR DRAINAGEWAY
ANCHOR DETAILS
GEOTEXTILE FABRIC OR MAT, TYP.
3" MIN, TYP.
6" MIN, TYP.
SINGLE EDGE STAKE, TYP.
COMPACTED BACKFILL, TYP.
PERIMETER ANCHOR TRENCH
TWO EDGES OF TWO ADJACENT ROLLS
JOINT ANCHOR TRENCH
LOOP FROM MIDDLE OF ROLL
INTERMEDIATE ANCHOR TRENCH
FLOW
6"
OVERLAPPING JOINT
3" MIN.
12" MIN.
WOOD STAKE DETAIL



ECB–3. OUTSIDE OF DRAINAGEWAY



STAKING PATTERNS BY ECB TYPE



STAKING PATTERNS BY SLOPE OR CHANNEL TYPE

EROSION CONTROL BLANKET INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - –LOCATION OF ECB.
   - –TYPE OF ECB (STRAW, STRAW–COCONUT, COCONUT, OR EXCELSIOR).
   - –AREA, A, IN SQUARE YARDS OF EACH TYPE OF ECB.

2. 100% NATURAL AND BIODEGRADABLE MATERIALS ARE PREFERRED FOR RECPs, ALTHOUGH SOME JURISDICTIONS MAY ALLOW OTHER MATERIALS IN SOME APPLICATIONS.

3. IN AREAS WHERE ECBs ARE SHOWN ON THE PLANS, THE PERMITTEE SHALL PLACE TOPSOIL AND PERFORM FINAL GRADING, SURFACE PREPARATION, AND SEEDING AND MULCHING. SUBGRADE SHALL BE SMOOTH AND MOIST PRIOR TO ECB INSTALLATION AND THE ECB SHALL BE IN FULL CONTACT WITH SUBGRADE. NO GAPS OR VOIDS SHALL EXIST UNDER THE BLANKET.

4. PERIMETER ANCHOR TRENCH SHALL BE USED ALONG THE OUTSIDE PERIMETER OF ALL BLANKET AREAS.

5. JOINT ANCHOR TRENCH SHALL BE USED TO JOIN ROLLS OF ECBs TOGETHER (LONGITUDINALLY AND TRANSVERSELY) FOR ALL ECBs EXCEPT STRAW WHICH MAY USE AN OVERLAPPING JOINT.

6. INTERMEDIATE ANCHOR TRENCH SHALL BE USED AT SPACING OF ONE–HALF ROLL LENGTH FOR COCONUT AND EXCELSIOR ECBs.

7. OVERLAPPING JOINT DETAIL SHALL BE USED TO JOIN ROLLS OF ECBs TOGETHER FOR ECBs ON SLOPES.

8. MATERIAL SPECIFICATIONS OF ECBs SHALL CONFORM TO TABLE ECB–1.

9. ANY AREAS OF SEEDING AND MULCHING DISTURBED IN THE PROCESS OF INSTALLING ECBS SHALL BE RESEEDED AND MULCHED.

10. DETAILS ON DESIGN PLANS FOR MAJOR DRAINAGEWAY STABILIZATION WILL GOVERN IF DIFFERENT FROM THOSE SHOWN HERE.

TABLE ECB–1. ECB MATERIAL SPECIFICATIONS

TYPE	COCONUT CONTENT	STRAW CONTENT	EXCELSIOR CONTENT	RECOMMENDED NETTING**
STRAW*	–	100%	–	DOUBLE/ NATURAL
STRAW–COCONUT	30% MIN	70% MAX	–	DOUBLE/ NATURAL
COCONUT	100%	–	–	DOUBLE/ NATURAL
EXCELSIOR	–	–	100%	DOUBLE/ NATURAL

*STRAW ECBs MAY ONLY BE USED OUTSIDE OF STREAMS AND DRAINAGE CHANNEL.
**ALTERNATE NETTING MAY BE ACCEPTABLE IN SOME JURISDICTIONS

EROSION CONTROL BLANKET MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

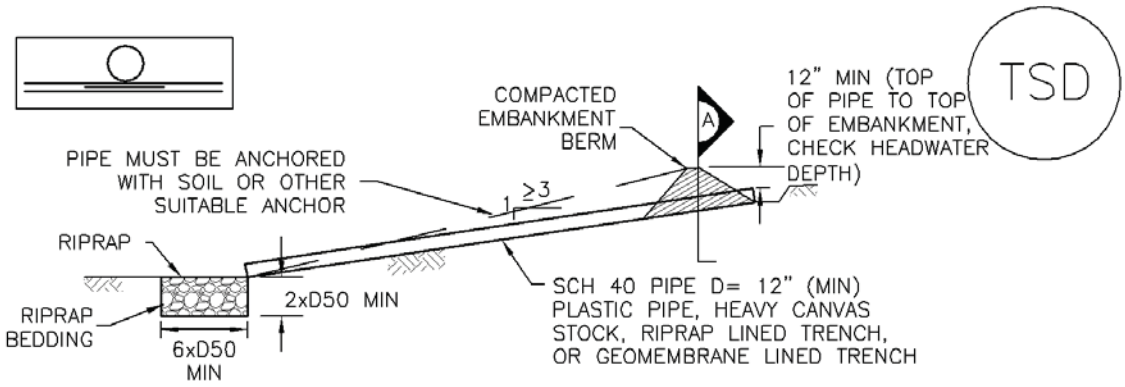
3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. ECBs SHALL BE LEFT IN PLACE TO EVENTUALLY BIODEGRADE, UNLESS REQUESTED TO BE REMOVED BY THE LOCAL JURISDICTION.

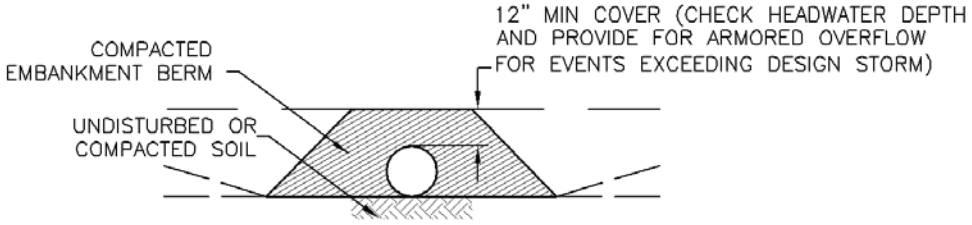
5. ANY ECB PULLED OUT, TORN, OR OTHERWISE DAMAGED SHALL BE REPAIRED OR REINSTALLED. ANY SUBGRADE AREAS BELOW THE GEOTEXTILE THAT HAVE ERODED TO CREATED A VOID UNDER THE BLANKET, OR THAT REMAIN DEVOID OF GRASS SHALL BE REPAIRED, RESEEDED AND MULCHED AND THE ECB REINSTALLED.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

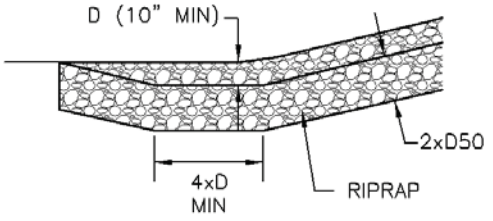
(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO AND TOWN OF PARKER COLORADO, NOT AVAILABLE IN AUTOCAD)



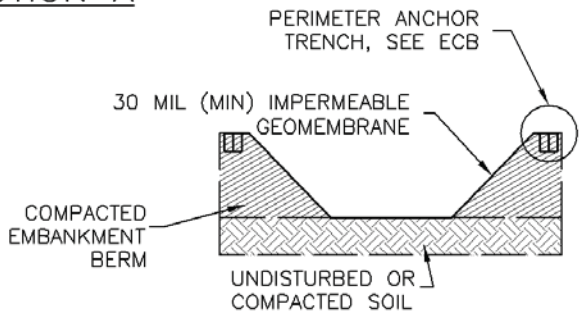
TEMPORARY SLOPE DRAIN PROFILE



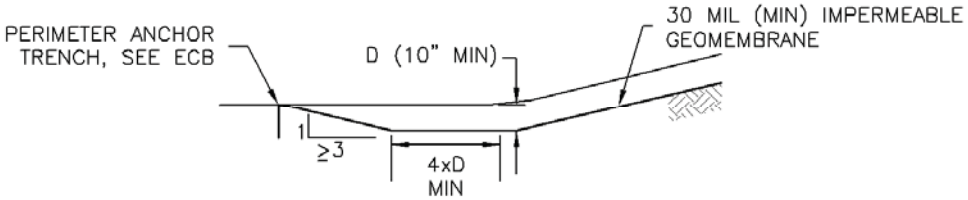
SECTION A



TERMINATION OF RIPRAP LINED SLOPE DRAIN



GEOMEMBRANE LINED SLOPE DRAIN



TERMINATION OF GEOMEMBRANE LINED SLOPE DRAIN

TSD–1. TEMPORARY SLOPE DRAIN PROFILE

SLOPE DRAIN INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –LOCATION AND LENGTH OF SLOPE DRAIN
   –PIPE DIAMETER, D, AND RIPRAP SIZE, D50.

2. SLOPE DRAIN SHALL BE DESIGNED TO CONVEY PEAK RUNOFF FOR 2–YEAR 24–HOUR STORM AT A MINIMUM. FOR LONGER DURATION PROJECTS, LARGER MAY BE APPROPRIATE.

3. SLOPE DRAIN DIMENSIONS SHALL BE CONSIDERED MINIMUM DIMENSIONS; CONTRACTOR MAY ELECT TO INSTALL LARGER FACILITIES.

4. SLOPE DRAINS INDICATED SHALL BE INSTALLED PRIOR TO UPGRADIENT LAND–DISTURBING ACTIVITIES.

5. CHECK HEADWATER DEPTHS FOR TEMPORARY AND PERMANENT SLOPE DRAINS. DETAILS SHOW MINIMUM COVER; INCREASE AS NECESSARY FOR DESIGN HEADWATER DEPTH.

6. RIPRAP PAD SHALL BE PLACED AT SLOPE DRAIN OUTFALL.

7. ANCHOR PIPE BY COVERING WITH SOIL OR AN ALTERNATE SUITABLE ANCHOR MATERIAL.

SLOPE DRAIN MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

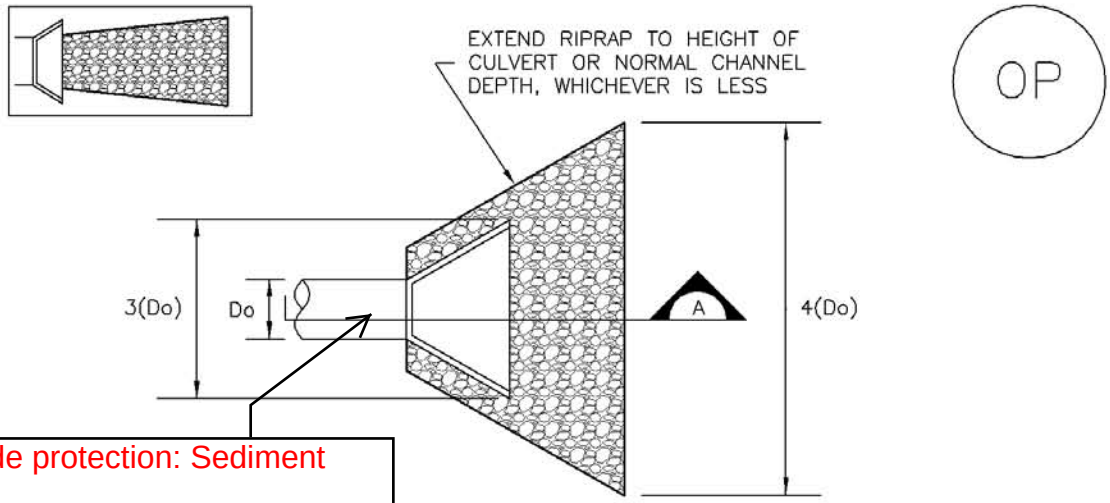
4. INSPECT INLET AND OUTLET POINTS AFTER STORMS FOR CLOGGING OR EVIDENCE OF OVERTOPPING. BREACHES IN PIPE OR OTHER CONVEYANCE SHALL BE REPAIRED AS SOON AS PRACTICABLE IF OBSERVED.

5. INSPECT RIPRAP PAD AT OUTLET FOR SIGNS OF EROSION. IF SIGNS OF EROSION EXIST, ADDITIONAL ARMORING SHALL BE INSTALLED.

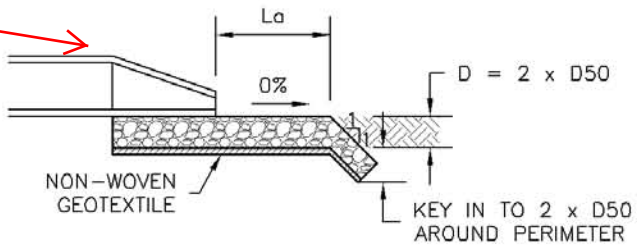
6. TEMPORARY SLOPE DRAINS ARE TO REMAIN IN PLACE UNTIL NO LONGER NEEDED, BUT SHALL BE REMOVED PRIOR TO THE END OF CONSTRUCTION. WHEN SLOPE DRAINS ARE REMOVED, THE DISTURBED AREA SHALL BE COVERED WITH TOP SOIL, SEEDED, MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

(DETAIL ADAPTED FROM DOUGLAS COUNTY, COLORADO AND THE CITY OF COLORADO SPRINGS, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.



TEMPORARY OUTLET PROTECTION PLAN



SECTION A

TABLE OP-1. TEMPORARY OUTLET PROTECTION SIZING TABLE			
PIPE DIAMETER, Do (INCHES)	DISCHARGE, Q (CFS)	APRON LENGTH, La (FT)	RIPRAP D50 DIAMETER MIN (INCHES)
8	2.5 5	5 10	4 6
12	5 10	10 13	4 6
18	10 20 30 40	10 16 23 26	6 9 12 16
24	30 40 50 60	16 26 26 30	9 9 12 16

OP-1. TEMPORARY OUTLET PROTECTION

TEMPORARY OUTLET PROTECTION INSTALLATION NOTES

1. SEE PLAN VIEW FOR
   –LOCATION OF OUTLET PROTECTION.
   –DIMENSIONS OF OUTLET PROTECTION.

2. DETAIL IS INTENDED FOR PIPES WITH SLOPE ≤ 10%. ADDITIONAL EVALUATION OF RIPRAP SIZING AND OUTLET PROTECTION DIMENSIONS REQUIRED FOR STEEPER SLOPES.

3. TEMPORARY OUTLET PROTECTION INFORMATION IS FOR OUTLETS INTENDED TO BE UTILIZED LESS THAN 2 YEARS.

TEMPORARY OUTLET PROTECTION INSPECTION AND MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

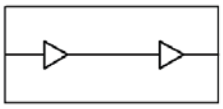
2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

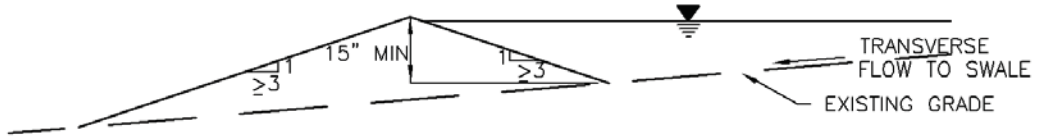
3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

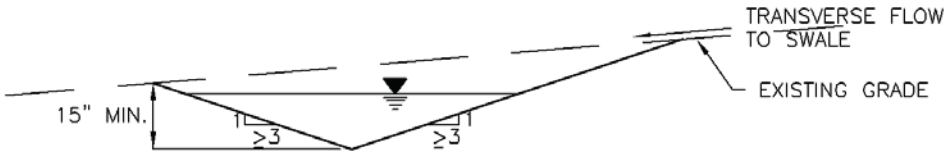
(DETAILS ADAPTED FROM AURORA, COLORADO AND PREVIOUS VERSION OF VOLUME 3, NOT AVAILABLE IN AUTOCAD)

Place a sediment control log at the top of the flared end section to prevent sediment from migrating down into the pipe.
(8/5/11 LR Comment)

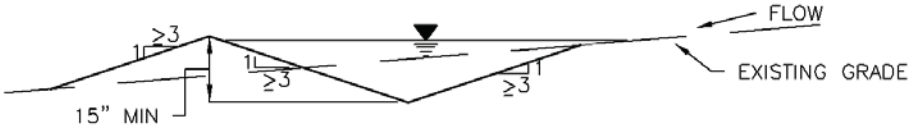




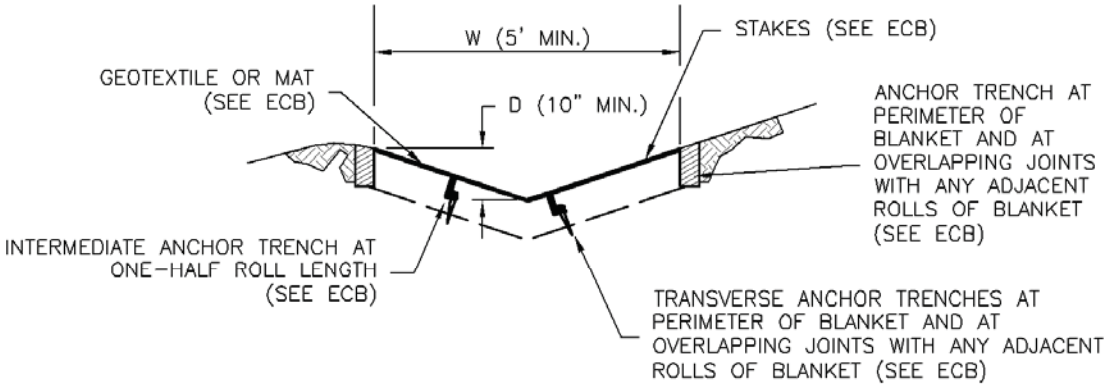
ED–1. COMPACTED UNLINED EARTH DIKE FORMED BY BERM



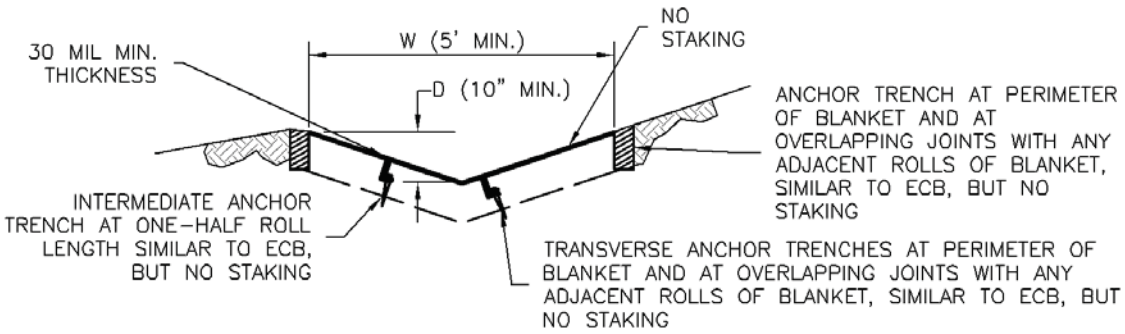
DS–1. COMPACTED UNLINED EXCAVATED SWALE



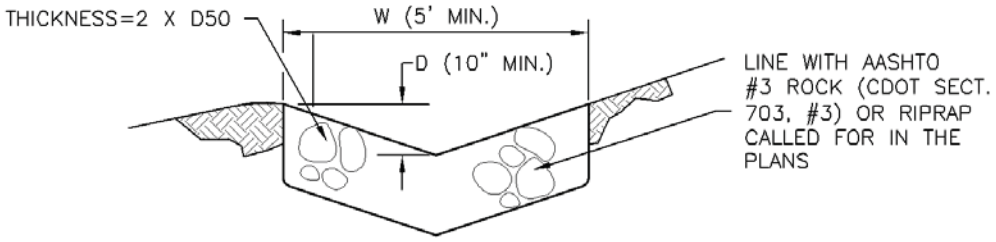
DS–2. COMPACTED UNLINED SWALE FORMED BY CUT AND FILL



DS–3. ECB LINED SWALE (CUT AND FILL OR BERM)



DS-4. SYNTHETIC LINED SWALE



DS-5. RIPRAP LINED SWALE

EARTH DIKE AND DRAINAGE SWALE INSTALLATION NOTES

1. SEE SITE PLAN FOR:
   - LOCATION OF DIVERSION SWALE
   - TYPE OF SWALE (UNLINED, COMPACTED AND/OR LINED).
   - LENGTH OF EACH SWALE.
   - DEPTH, D, AND WIDTH, W DIMENSIONS.
   - FOR ECB/TRM LINED DITCH, SEE ECB DETAIL.
   - FOR RIPRAP LINED DITCH, SIZE OF RIPRAP, D50.

2. SEE DRAINAGE PLANS FOR DETAILS OF PERMANENT CONVEYANCE FACILITIES AND/OR DIVERSION SWALES EXCEEDING 2-YEAR FLOW RATE OR 10 CFS.

3. EARTH DIKES AND SWALES INDICATED ON SWMP PLAN SHALL BE INSTALLED PRIOR TO LAND-DISTURBING ACTIVITIES IN PROXIMITY.

4. EMBANKMENT IS TO BE COMPACTED TO 90% OF MAXIMUM DENSITY AND WITHIN 2% OF OPTIMUM MOISTURE CONTENT ACCORDING TO ASTM D698.

5. SWALES ARE TO DRAIN TO A SEDIMENT CONTROL BMP.

6. FOR LINED DITCHES, INSTALLATION OF ECB/TRM SHALL CONFORM TO THE REQUIREMENTS OF THE ECB DETAIL.

7. WHEN CONSTRUCTION TRAFFIC MUST CROSS A DIVERSION SWALE, INSTALL A TEMPORARY CULVERT WITH A MINIMUM DIAMETER OF 12 INCHES.

EARTH DIKE AND DRAINAGE SWALE MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

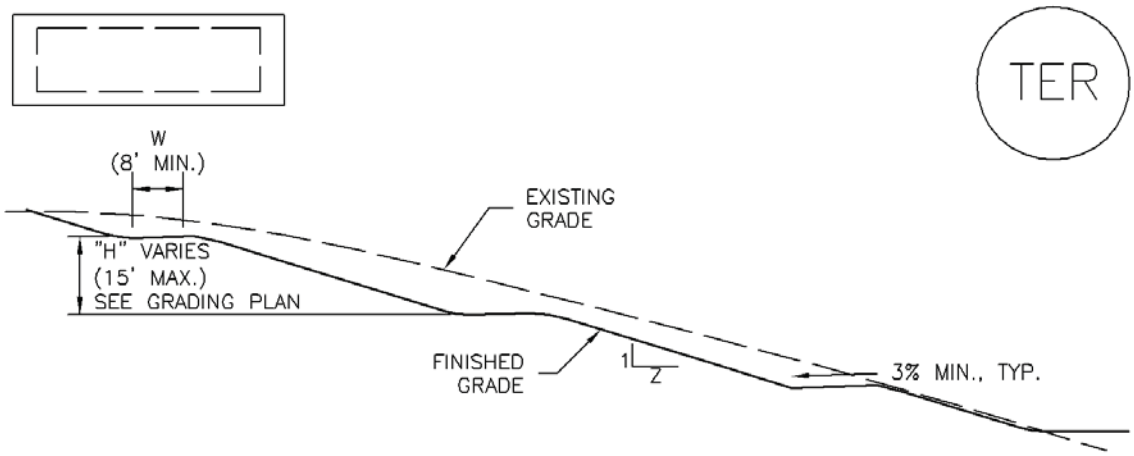
3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. SWALES SHALL REMAIN IN PLACE UNTIL THE END OF CONSTRUCTION; IF APPROVED BY LOCAL JURISDICTION, SWALES MAY BE LEFT IN PLACE.

5. WHEN A SWALE IS REMOVED, THE DISTURBED AREA SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY LOCAL JURISDICTION.

(DETAIL ADAPTED FROM DOUGLAS COUNTY, COLORADO AND THE CITY OF COLORADO SPRINGS, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.



TER–1. TERRACING

TERRACING INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –LOCATION OF TERRACING
   –WIDTH (W), AND SLOPE (Z).

2. TERRACING IS TYPICALLY NOT REQUIRED FOR SLOPES OF 4:1 OR FLATTER.

3. GRADE TERRACES TO DRAIN BACK TO SLOPE AT A MINIMUM OF 3% GRADE.

TERRACING MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

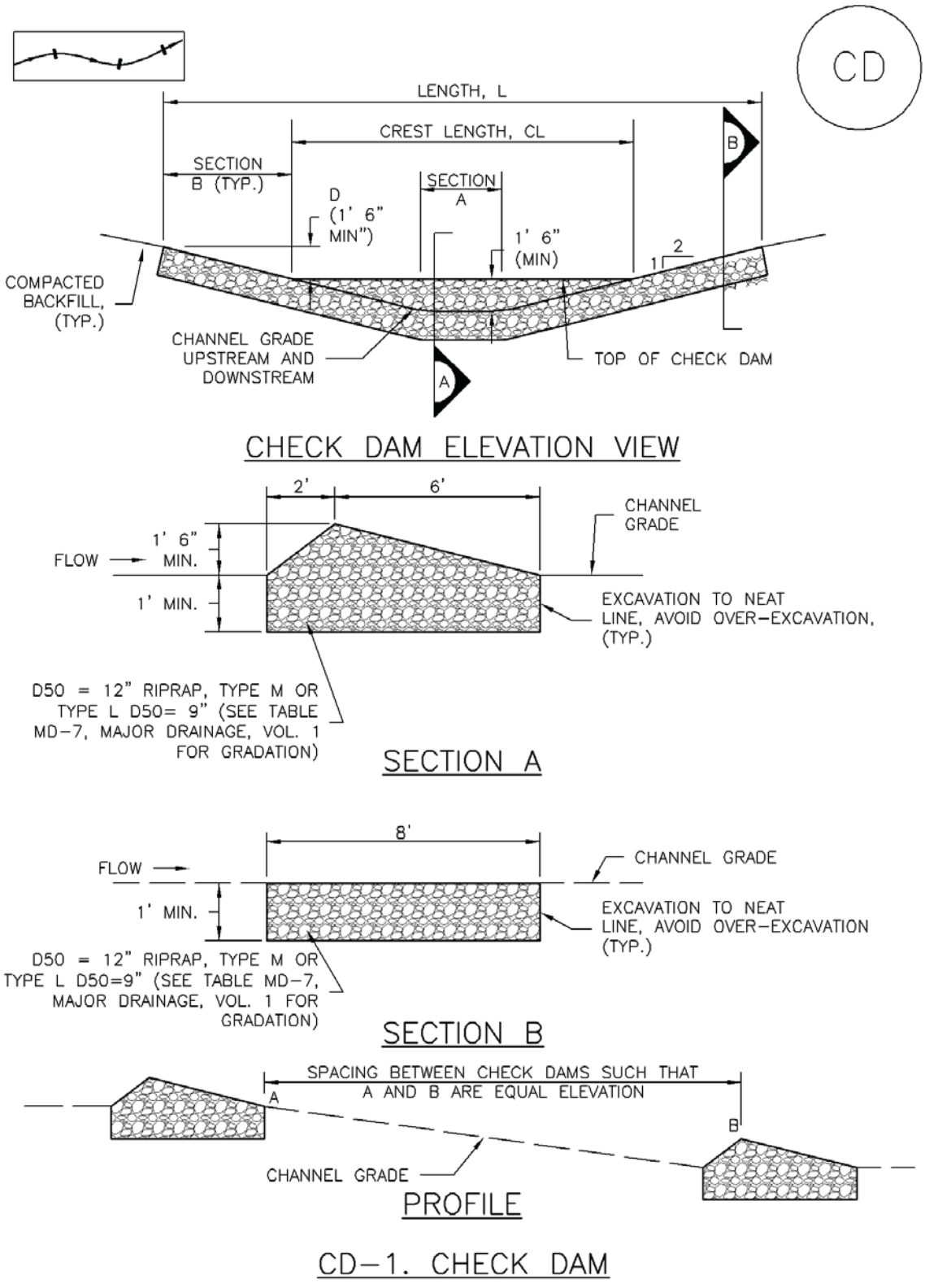
3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. RILL EROSION OCCURRING ON TERRACED SLOPES SHALL BE REPAIRED, RESEEDED, MULCHED OR STABILIZED IN A MANNER APPROVED BY LOCAL JURISDICTION.

5. TERRACING MAY NEED TO BE RE–GRADED TO RETURN THE SLOPE TO THE FINAL DESIGN GRADE. THE SLOPE SHALL THEN BE COVERED WITH TOPSOIL, SEEDED AND MULCHED, OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAIL ADAPTED FROM DOUGLAS COUNTY, COLORADO AND TOWN OF PARKER, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.



CD-1. CHECK DAM

CHECK DAM INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –LOCATION OF CHECK DAMS.
   –CHECK DAM TYPE (CHECK DAM OR REINFORCED CHECK DAM).
   –LENGTH (L), CREST LENGTH (CL), AND DEPTH (D).

2. CHECK DAMS INDICATED ON INITIAL SWMP SHALL BE INSTALLED AFTER CONSTRUCTION FENCE, BUT PRIOR TO ANY UPSTREAM LAND DISTURBING ACTIVITIES.

3. RIPRAP UTILIZED FOR CHECK DAMS SHOULD BE OF APPROPRIATE SIZE FOR THE APPLICATION. TYPICAL TYPES OF RIPRAP USED FOR CHECK DAMS ARE TYPE M (D50 12") OR TYPE L (D50 9").

4. RIPRAP PAD SHALL BE TRENCHED INTO THE GROUND A MINIMUM OF 1'.

5. THE ENDS OF THE CHECK DAM SHALL BE A MINIMUM OF 1' 6" HIGHER THAN THE CENTER OF THE CHECK DAM.

CHECK DAM MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

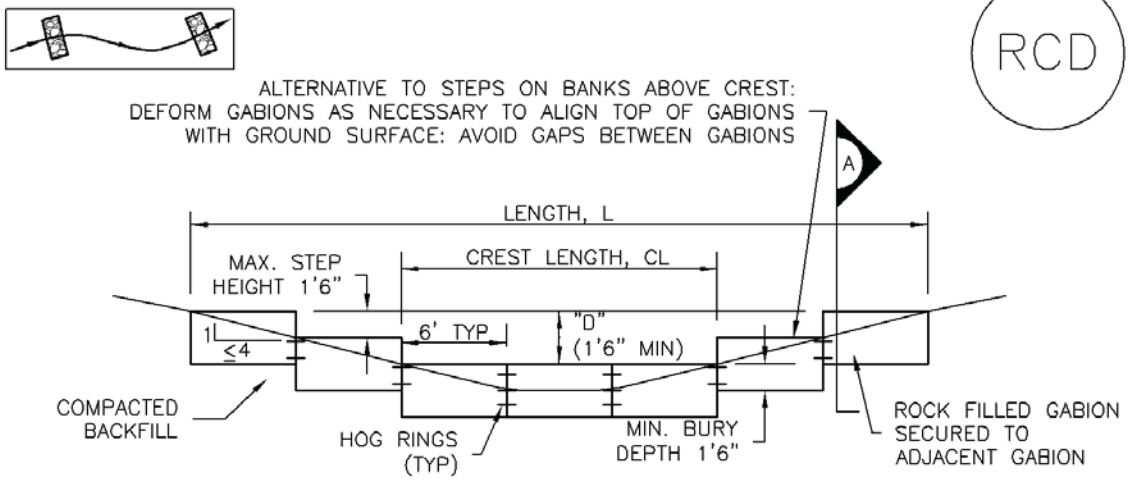
4. SEDIMENT ACCUMULATED UPSTREAM OF THE CHECK DAMS SHALL BE REMOVED WHEN THE SEDIMENT DEPTH IS WITHIN ½ OF THE HEIGHT OF THE CREST.

5. CHECK DAMS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.

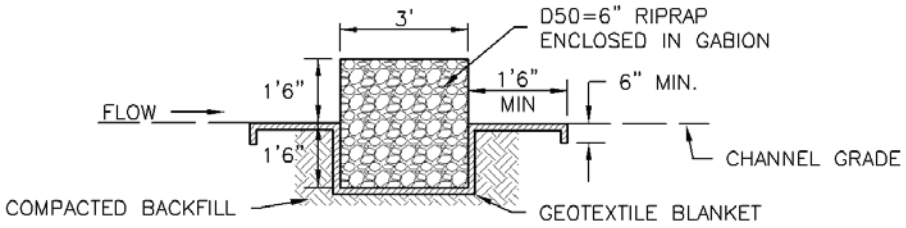
6. WHEN CHECK DAMS ARE REMOVED, EXCAVATIONS SHALL BE FILLED WITH SUITABLE COMPACTED BACKFILL. DISTURBED AREA SHALL BE SEEDED AND MULCHED AND COVERED WITH GEOTEXTILE OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.



REINFORCED CHECK DAM ELEVATION VIEW



SECTION A

REINFORCED CHECK DAM INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - –LOCATIONS OF CHECK DAMS.
   - –CHECK DAM TYPE (CHECK DAM OR REINFORCED CHECK DAM).
   - –LENGTH (L), CREST LENGTH (CL), AND DEPTH (D).

2. CHECK DAMS INDICATED ON THE SWMP SHALL BE INSTALLED PRIOR TO AN UPSTREAM LAND–DISTURBING ACTIVITIES.

3. REINFORCED CHECK DAMS, GABIONS SHALL HAVE GALVANIZED TWISTED WIRE NETTING WITH A MAXIMUM OPENING DIMENSION OF 4½" AND A MINIMUM WIRE THICKNESS OF 0.10". WIRE "HOG RINGS" AT 4" SPACING OR OTHER APPROVED MEANS SHALL BE USED AT ALL GABION SEAMS AND TO SECURE THE GABION TO THE ADJACENT SECTION.

4. THE CHECK DAM SHALL BE TRENCHED INTO THE GROUND A MINIMUM OF 1' 6".

5. GEOTEXTILE BLANKET SHALL BE PLACED IN THE REINFORCED CHECK DAM TRENCH EXTENDING A MINIMUM OF 1' 6" ON BOTH THE UPSTREAM AND DOWNSTREAM SIDES OF THE REINFORCED CHECK DAM.

CD–2. REINFORCED CHECK DAM

REINFORCED CHECK DAM MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. SEDIMENT ACCUMULATED UPSTREAM OF REINFORCED CHECK DAMS SHALL BE REMOVED AS NEEDED TO MAINTAIN THE EFFECTIVENESS OF BMP, TYPICALLY WHEN THE UPSTREAM SEDIMENT DEPTH IS WITHIN ½ THE HEIGHT OF THE CREST.

5. REPAIR OR REPLACE REINFORCED CHECK DAMS WHEN THERE ARE SIGNS OF DAMAGE SUCH AS HOLES IN THE GABION OR UNDERCUTTING.

6. REINFORCED CHECK DAMS ARE TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.

7. WHEN REINFORCED CHECK DAMS ARE REMOVED, ALL DISTURBED AREAS SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED, AND COVERED WITH A GEOTEXTILE BLANKET, OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

(DETAIL ADAPTED FROM DOUGLAS COUNTY, COLORADO AND CITY OF AURORA, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

Streambank Stabilization (SS) EC-13

Description

Streambank stabilization involves a combination of erosion and sediment control practices to protect streams, banks, and in-stream habitat from accelerated erosion. BMPs associated with streambank stabilization may include protection of existing vegetation, check dams/grade control, temporary and permanent seeding, outlet protection, rolled erosion control products, temporary diversions, dewatering operations and bioengineering practices such as brush layering, live staking and fascines.

Photograph SS-1. Streambank stabilization using geotextiles following installation of a permanent in-stream grade control structure.

Appropriate Uses

Streambank stabilization may be a construction activity in and of itself, or it may be in conjunction with a broader construction project that discharges to a waterway that is susceptible to accelerated erosion due to increases in the rate and volume of stormwater runoff. Depending on the health of the stream, water quality sampling and testing may be advisable prior to and/or during construction to evaluate health and stability of the stream and potential effects from adjacent construction activities.

Design and Installation

Streambank stabilization consists of protecting the stream in a variety of ways to minimize negative effects to the stream environment. The following lists the minimum requirements necessary for construction streambank stabilization:

- Protect existing vegetation along the stream bank in accordance with the Vegetated Buffers and Protection of Existing Vegetation Fact Sheets. Preserving a riparian buffer along the streambank will help to remove sediment and decrease runoff rates from the disturbed area.
- Outside the riparian buffer, provide sediment control in the form of a silt fence or equivalent sediment control practice along the entire length of the stream that will receive runoff from the area of disturbance. In some cases, a double-layered perimeter control may be justified adjacent to sensitive receiving waters and wetlands to provide additional protection.
- Stabilize all areas that will be draining to the stream. Use rolled erosion control products, temporary or permanent seeding, or other appropriate measures.
- Ensure all point discharges entering the stream are adequately armored with a velocity dissipation device and appropriate outlet protection.

Streambank Stabilization	
Functions	
Erosion Control	Yes
Sediment Control	No
Site/Material Management	No

See individual design details and notes for the various BMPs referenced in this practice. Additional information on bioengineering techniques for stream stabilization can be

found in the *Major Drainage* chapter of Volume 1 and additional guidance on BMPs for working in waterways can be found in UDFCD's *Best Management Practices for Construction in Waterways Training Manual*.

Maintenance and Removal

Inspect BMPs protecting the stream for damage on a daily basis. Maintain, repair, or replace damaged BMPs following the guidance provided in individual BMP Fact Sheets for practices that are implemented. Some streambank stabilization BMPs are intended to remain in place as vegetation matures (e.g. erosion control blankets protecting seeded stream banks and turf reinforcement mats).

For BMPs that are not to remain in place as a part of final stabilization such as silt fence and other temporary measures, BMPs should be removed when all land disturbing activities have ceased and areas have been permanently stabilized.

Wind Erosion/Dust Control (DC) EC-14

Description

Wind erosion and dust control BMPs help to keep soil particles from entering the air as a result of land disturbing construction activities. These BMPs include a variety of practices generally focused on either graded disturbed areas or construction roadways. For graded areas, practices such as seeding and mulching, use of soil binders, site watering, or other practices that provide prompt surface cover should be used. For construction roadways, road watering and stabilized surfaces should be considered.

Photograph DC-1. Water truck used for dust suppression. Photo courtesy of Douglas County.

Appropriate Uses

Dust control measures should be used on any site where dust poses a problem to air quality. Dust control is important to control for the health of construction workers and surrounding waterbodies.

Design and Installation

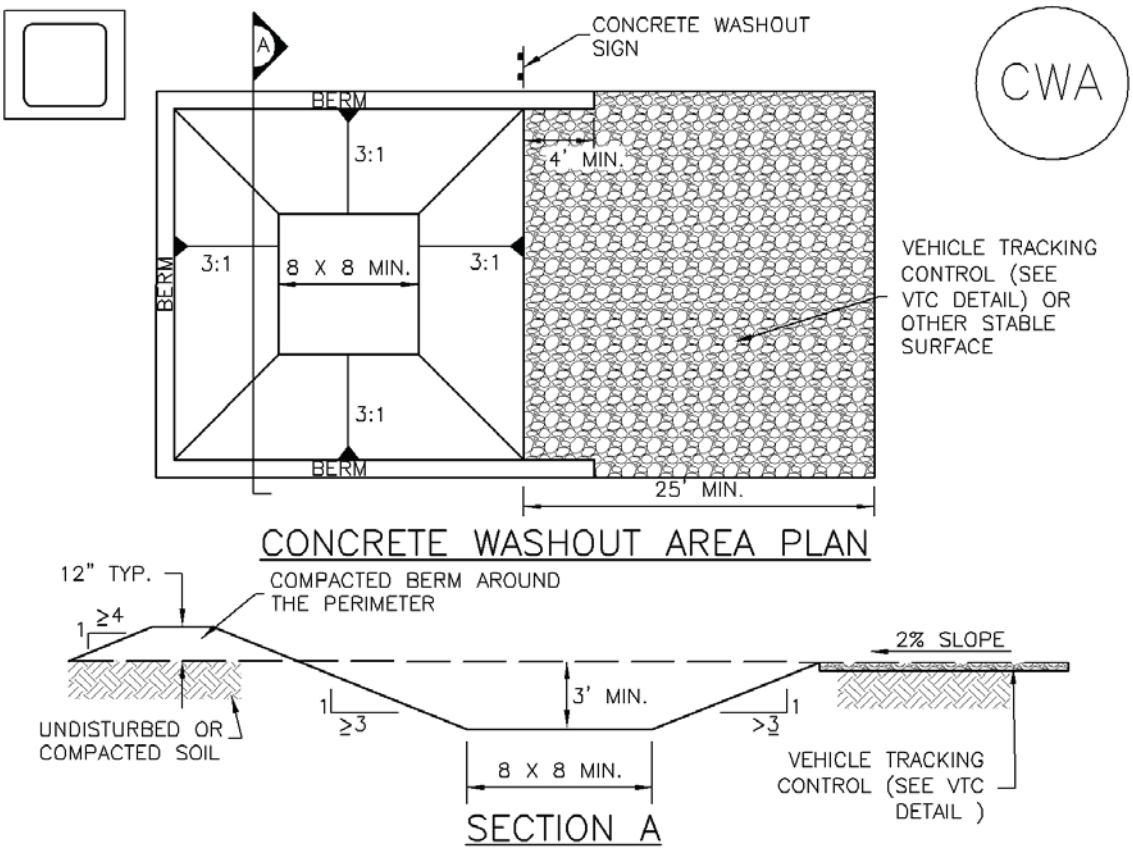
The following construction BMPs can be used for dust control:

- An irrigation/sprinkler system can be used to wet the top layer of disturbed soil to help keep dry soil particles from becoming airborne.
- Seeding and mulching can be used to stabilize disturbed surfaces and reduce dust emissions.
- Protecting existing vegetation can help to slow wind velocities across the ground surface, thereby limiting the likelihood of soil particles to become airborne.
- Spray-on soil binders form a bond between soil particles keeping them grounded. Chemical treatments may require additional permitting requirements. Potential impacts to surrounding waterways and habitat must be considered prior to use.
- Placing rock on construction roadways and entrances will help keep dust to a minimum across the construction site.
- Wind fences can be installed on site to reduce wind speeds. Install fences perpendicular to the prevailing wind direction for maximum effectiveness.

Wind Erosion Control/ Dust Control	
Functions	
Erosion Control	Yes
Sediment Control	No
Site/Material Management	Moderate

Maintenance and Removal

When using an irrigation/sprinkler control system to aid in dust control, be careful not to overwater. Overwatering will cause construction vehicles to track mud off-site.



CWA–1. CONCRETE WASHOUT AREA

CWA INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –CWA INSTALLATION LOCATION.

2. DO NOT LOCATE AN UNLINED CWA WITHIN 400' OF ANY NATURAL DRAINAGE PATHWAY OR WATERBODY. DO NOT LOCATE WITHIN 1,000' OF ANY WELLS OR DRINKING WATER SOURCES. IF SITE CONSTRAINTS MAKE THIS INFEASIBLE, OR IF HIGHLY PERMEABLE SOILS EXIST ON SITE, THE CWA MUST BE INSTALLED WITH AN IMPERMEABLE LINER (16 MIL MIN. THICKNESS) OR SURFACE STORAGE ALTERNATIVES USING PREFABRICATED CONCRETE WASHOUT DEVICES OR A LINED ABOVE GROUND STORAGE ARE SHOULD BE USED.

3. THE CWA SHALL BE INSTALLED PRIOR TO CONCRETE PLACEMENT ON SITE.

4. CWA SHALL INCLUDE A FLAT SUBSURFACE PIT THAT IS AT LEAST 8' BY 8' SLOPES LEADING OUT OF THE SUBSURFACE PIT SHALL BE 3:1 OR FLATTER. THE PIT SHALL BE AT LEAST 3' DEEP.

5. BERM SURROUNDING SIDES AND BACK OF THE CWA SHALL HAVE MINIMUM HEIGHT OF 1'.

6. VEHICLE TRACKING PAD SHALL BE SLOPED 2% TOWARDS THE CWA.

7. SIGNS SHALL BE PLACED AT THE CONSTRUCTION ENTRANCE, AT THE CWA, AND ELSEWHERE AS NECESSARY TO CLEARLY INDICATE THE LOCATION OF THE CWA TO OPERATORS OF CONCRETE TRUCKS AND PUMP RIGS.

8. USE EXCAVATED MATERIAL FOR PERIMETER BERM CONSTRUCTION.

CWA MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. THE CWA SHALL BE REPAIRED, CLEANED, OR ENLARGED AS NECESSARY TO MAINTAIN CAPACITY FOR CONCRETE WASTE. CONCRETE MATERIALS, ACCUMULATED IN PIT, SHALL BE REMOVED ONCE THE MATERIALS HAVE REACHED A DEPTH OF 2'.

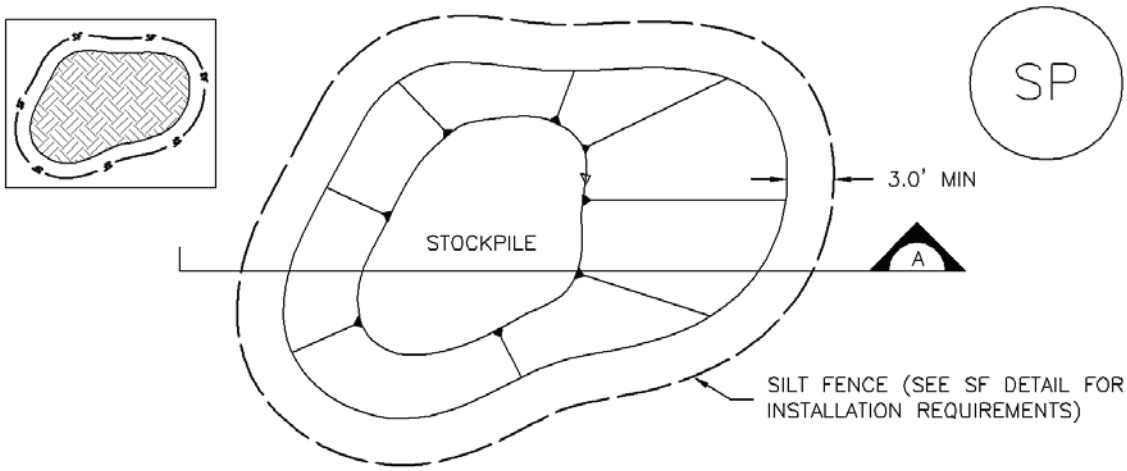
5. CONCRETE WASHOUT WATER, WASTED PIECES OF CONCRETE AND ALL OTHER DEBRIS IN THE SUBSURFACE PIT SHALL BE TRANSPORTED FROM THE JOB SITE IN A WATER–TIGHT CONTAINER AND DISPOSED OF PROPERLY.

6. THE CWA SHALL REMAIN IN PLACE UNTIL ALL CONCRETE FOR THE PROJECT IS PLACED.

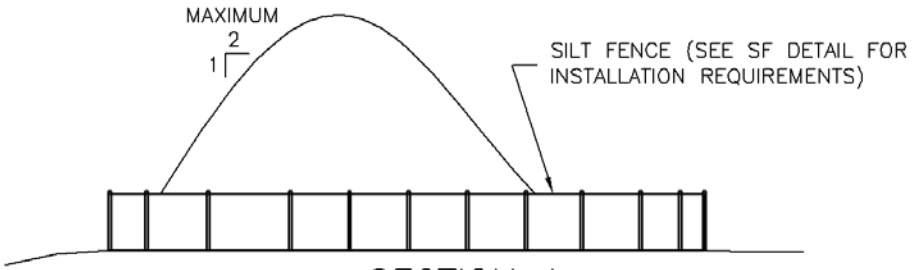
7. WHEN THE CWA IS REMOVED, COVER THE DISTURBED AREA WITH TOP SOIL, SEED AND MULCH OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

(DETAIL ADAPTED FROM DOUGLAS COUNTY, COLORADO AND THE CITY OF PARKER, COLORADO, NOT AVAILABLE IN AUTOCAD).

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.



STOCKPILE PROTECTION PLAN



SECTION A

SP–1. STOCKPILE PROTECTION

STOCKPILE PROTECTION INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –LOCATION OF STOCKPILES.
   –TYPE OF STOCKPILE PROTECTION.

2. INSTALL PERIMETER CONTROLS IN ACCORDANCE WITH THEIR RESPECTIVE DESIGN DETAILS. SILT FENCE IS SHOWN IN THE STOCKPILE PROTECTION DETAILS; HOWEVER, OTHER TYPES OF PERIMETER CONTROLS INCLUDING SEDIMENT CONTROL LOGS OR ROCK SOCKS MAY BE SUITABLE IN SOME CIRCUMSTANCES. CONSIDERATIONS FOR DETERMINING THE APPROPRIATE TYPE OF PERIMETER CONTROL FOR A STOCKPILE INCLUDE WHETHER THE STOCKPILE IS LOCATED ON A PERVIOUS OR IMPERVIOUS SURFACE, THE RELATIVE HEIGHTS OF THE PERIMETER CONTROL AND STOCKPILE, THE ABILITY OF THE PERIMETER CONTROL TO CONTAIN THE STOCKPILE WITHOUT FAILING IN THE EVENT THAT MATERIAL FROM THE STOCKPILE SHIFTS OR SLUMPS AGAINST THE PERIMETER, AND OTHER FACTORS.

3. STABILIZE THE STOCKPILE SURFACE WITH SURFACE ROUGHENING, TEMPORARY SEEDING AND MULCHING, EROSION CONTROL BLANKETS, OR SOIL BINDERS. SOILS STOCKPILED FOR AN EXTENDED PERIOD (TYPICALLY FOR MORE THAN 60 DAYS) SHOULD BE SEEDED AND MULCHED WITH A TEMPORARY GRASS COVER ONCE THE STOCKPILE IS PLACED (TYPICALLY WITHIN 14 DAYS). USE OF MULCH ONLY OR A SOIL BINDER IS ACCEPTABLE IF THE STOCKPILE WILL BE IN PLACE FOR A MORE LIMITED TIME PERIOD (TYPICALLY 30–60 DAYS).

4. FOR TEMPORARY STOCKPILES ON THE INTERIOR PORTION OF A CONSTRUCTION SITE, WHERE OTHER DOWNGRADIENT CONTROLS, INCLUDING PERIMETER CONTROL, ARE IN PLACE, STOCKPILE PERIMETER CONTROLS MAY NOT BE REQUIRED.

STOCKPILE PROTECTION MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

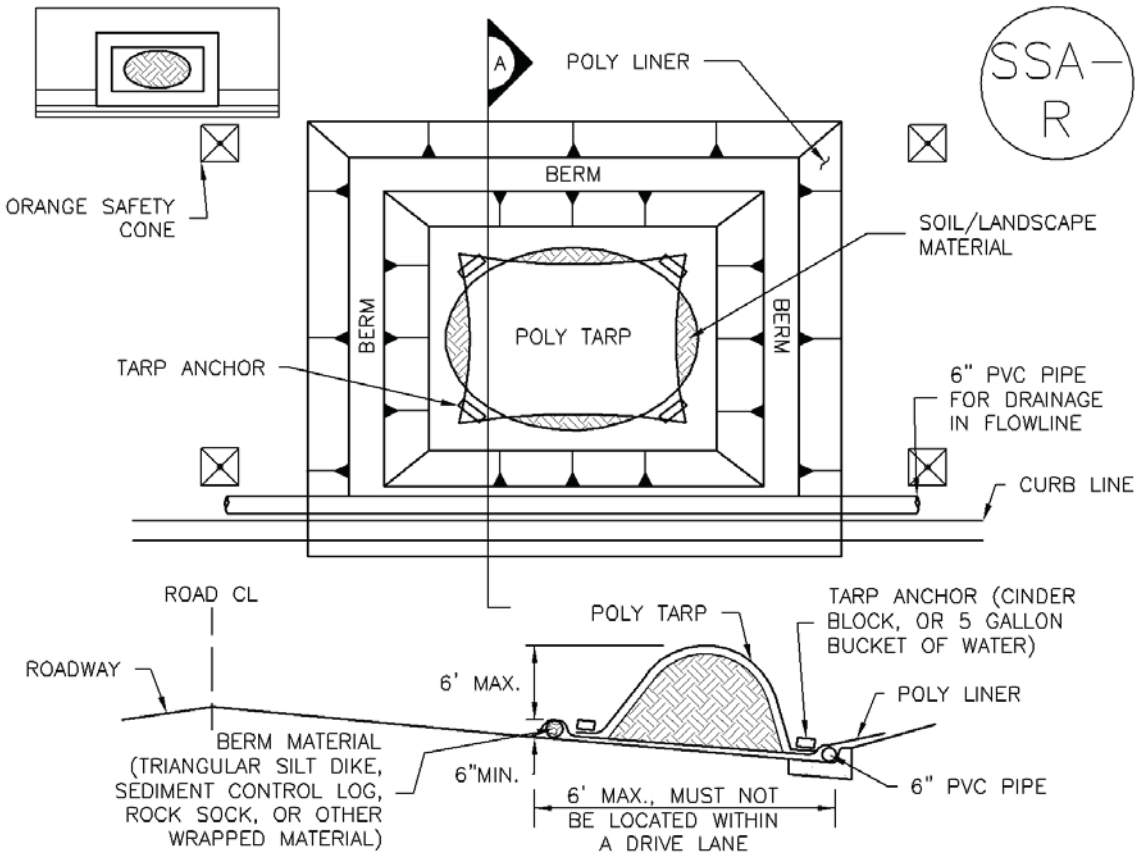
STOCKPILE PROTECTION MAINTENANCE NOTES

4. IF PERIMETER PROTECTION MUST BE MOVED TO ACCESS SOIL STOCKPILE, REPLACE PERIMETER CONTROLS BY THE END OF THE WORKDAY.

5. STOCKPILE PERIMETER CONTROLS CAN BE REMOVED ONCE ALL THE MATERIAL FROM THE STOCKPILE HAS BEEN USED.

(DETAILS ADAPTED FROM PARKER, COLORADO, NOT AVAILABLE IN AUTOCAD)

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.



SP–2. MATERIALS STAGING IN ROADWAY

MATERIALS STAGING IN ROADWAYS INSTALLATION NOTES

1. SEE PLAN VIEW FOR
   –LOCATION OF MATERIAL STAGING AREA(S).
   –CONTRACTOR MAY ADJUST LOCATION AND SIZE OF STAGING AREA WITH APPROVAL FROM THE LOCAL JURISDICTION.

2. FEATURE MUST BE INSTALLED PRIOR TO EXCAVATION, EARTHWORK OR DELIVERY OF MATERIALS.

3. MATERIALS MUST BE STATIONED ON THE POLY LINER. ANY INCIDENTAL MATERIALS DEPOSITED ON PAVED SECTION OR ALONG CURB LINE MUST BE CLEANED UP PROMPTLY.

4. POLY LINER AND TARP COVER SHOULD BE OF SIGNIFICANT THICKNESS TO PREVENT DAMAGE OR LOSS OF INTEGRITY.

5. SAND BAGS MAY BE SUBSTITUTED TO ANCHOR THE COVER TARP OR PROVIDE BERMING UNDER THE BASE LINER.

6. FEATURE IS NOT INTENDED FOR USE WITH WET MATERIAL THAT WILL BE DRAINING AND/OR SPREADING OUT ON THE POLY LINER OR FOR DEMOLITION MATERIALS.

7. THIS FEATURE CAN BE USED FOR:
   –UTILITY REPAIRS.
   –WHEN OTHER STAGING LOCATIONS AND OPTIONS ARE LIMITED.
   –OTHER LIMITED APPLICATION AND SHORT DURATION STAGING.

MATERIALS STAGING IN ROADWAY MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. INSPECT PVC PIPE ALONG CURB LINE FOR CLOGGING AND DEBRIS. REMOVE OBSTRUCTIONS PROMPTLY.

5. CLEAN MATERIAL FROM PAVED SURFACES BY SWEEPING OR VACUUMING.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

(DETAILS ADAPTED FROM AURORA, COLORADO)

Protection of Existing Vegetation (PV) SM-2

Description

Protection of existing vegetation on a construction site can be accomplished through installation of a construction fence around the area requiring protection. In cases where upgradient areas are disturbed, it may also be necessary to install perimeter controls to minimize sediment loading to sensitive areas such as wetlands. Existing vegetation may be designated for protection to maintain a stable surface cover as part of construction phasing, or vegetation may be protected in areas designated to remain in natural condition under post-development conditions (e.g., wetlands, mature trees, riparian areas, open space).

Photograph PV-1. Protection of existing vegetation and a sensitive area. Photo courtesy of CDOT.

Appropriate Uses

Existing vegetation should be preserved for the maximum practical duration on a construction site through the use of effective construction phasing. Preserving vegetation helps to minimize erosion and can reduce revegetation costs following construction.

Protection of wetland areas is required under the Clean Water Act, unless a permit has been obtained from the U.S. Army Corps of Engineers (USACE) allowing impacts in limited areas.

If trees are to be protected as part of post-development landscaping, care must be taken to avoid several types of damage, some of which may not be apparent at the time of injury. Potential sources of injury include soil compaction during grading or due to construction traffic, direct equipment-related injury such as bark removal, branch breakage, surface grading and trenching, and soil cut and fill. In order to minimize injuries that may lead to immediate or later death of the tree, tree protection zones should be developed during site design, implemented at the beginning of a construction project, as well as continued during active construction.

Design and Installation

General

Once an area has been designated as a preservation area, there should be no construction activity allowed within a set distance of the area. Clearly mark the area with construction fencing. Do not allow stockpiles, equipment, trailers or parking within the protected area. Guidelines to protect various types of existing vegetation follow.

Protection of Existing Vegetation	
Functions	
Erosion Control	Yes
Sediment Control	Moderate
Site/Material Management	Yes

Surface Cover During Phased Construction

Install construction fencing or other perimeter controls around areas to be protected from clearing and grading as part of construction phasing.

Maintaining surface cover on steep slopes for the maximum practical duration during construction is recommended.

Open Space Preservation

Where natural open space areas will be preserved as part of a development, it is important to install construction fencing around these areas to protect them from compaction. This is particularly important when areas with soils with high infiltration rates are preserved as part of LID designs. Preserved open space areas should not be used for staging and equipment storage.

Wetlands and Riparian Areas

Install a construction fence around the perimeter of the wetland or riparian (streamside vegetation) area to prevent access by equipment. In areas downgradient of disturbed areas, install a perimeter control such as silt fence, sediment control logs, or similar measure to minimize sediment loading to the wetland.

Tree Protection[1]

- Before beginning construction operations, establish a tree protection zone around trees to be preserved by installing construction fences. Allow enough space from the trunk to protect the root zone from soil compaction and mechanical damage, and the branches from mechanical damage (see Table PV-1). If low branches will be kept, place the fence outside of the drip line. Where this is not possible, place fencing as far away from the trunk as possible. In order to maintain a healthy tree, be aware that about 60 percent of the tree's root zone extends beyond the drip line.

Table PV-1
Guidelines for Determining the Tree Protection Zone
(Source: Matheny and Clark, 1998; as cited in GreenCO and WWE 2008)

	Distance from Trunk (ft) per inch of DBH		
Species Tolerance to Damage	*Young*	*Mature*	*Over mature*
Good	0.5'	0.75'	1.0'
Moderate	0.75'	1.0'	1.25'
Poor	1.0'	1.25'	1.5'
Notes: DBH = diameter at breast height (4.5 ft above grade); Young = <20% of life expectancy; Mature = 20%-80% of life expectancy; Over mature =>80% of life expectancy			

- Most tree roots grow within the top 12 to 18 inches of soil. Grade changes within the tree protection zone should be avoided where possible because seemingly minor grade changes can either smother

[1] Tree Protection guidelines adapted from GreenCO and WWE (2008). *Green Industry Best Management Practices (BMPs) for the Conservation and Protection of Water Resources in Colorado: Moving Toward Sustainability, Third Release*. See www.greenco.org for more detailed guidance on tree preservation.

roots (in fill situations) or damage roots (in cut situations). Consider small walls where needed to avoid grade changes in the tree protection zone.

- Place and maintain a layer of mulch 4 to 6-inch thick from the tree trunk to the fencing, keeping a 6-inch space between the mulch and the trunk. Mulch helps to preserve moisture and decrease soil compaction if construction traffic is unavoidable. When planting operations are completed, the mulch may be reused throughout planting areas.

- Limit access, if needed at all, and appoint one route as the main entrance and exit to the tree protection zone. Within the tree protection zone, do not allow any equipment to be stored, chemicals to be dumped, or construction activities to take place except fine grading, irrigation system installation, and planting operations. These activities should be conducted in consultation with a landscaping professional, following Green Industry BMPs.

- Be aware that soil compaction can cause extreme damage to tree health that may appear gradually over a period of years. Soil compaction is easier to prevent than repair.

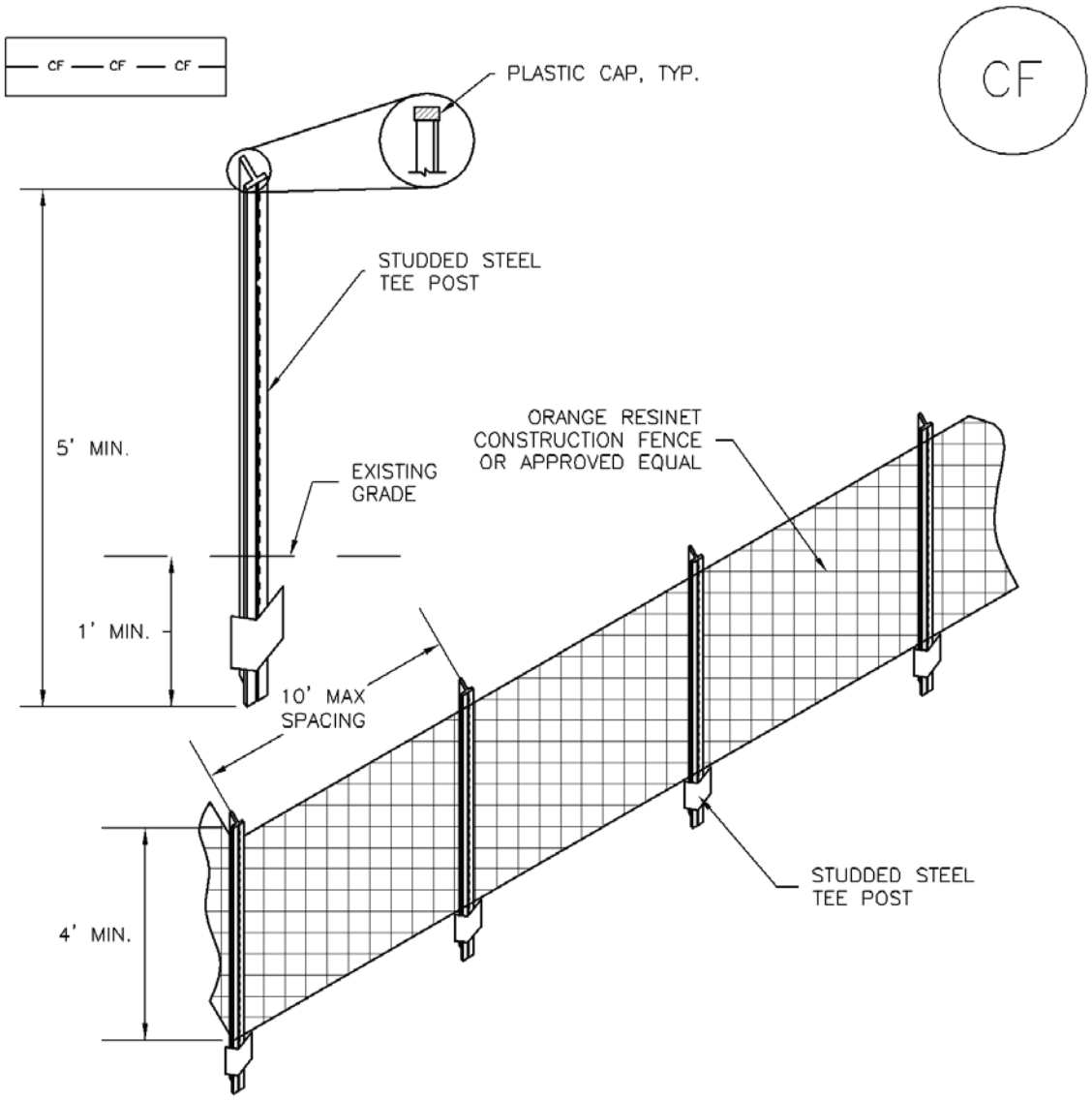
Maintenance and Removal

Repair or replace damaged or displaced fencing or other protective barriers around the vegetated area.

If damage occurs to a tree, consult an arborist for guidance on how to care for the tree. If a tree in a designated preservation area is damaged beyond repair, remove and replace with a 2-inch diameter tree of the same or similar species.

Construction equipment must not enter a wetland area, except as permitted by the U.S. Army Corps of Engineers (USACE). Inadvertent placement of fill in a wetland is a 404 permit violation and will require notification of the USACE.

If damage to vegetation occurs in a protected area, reseed the area with the same or similar species, following the recommendations in the USDCM *Revegetation* chapter.



CF–1. PLASTIC MESH CONSTRUCTION FENCE

CONSTRUCTION FENCE INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   –LOCATION OF CONSTRUCTION FENCE.

2. CONSTRUCTION FENCE SHOWN SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.

3. CONSTRUCTION FENCE SHALL BE COMPOSED OF ORANGE, CONTRACTOR–GRADE MATERIAL THAT IS AT LEAST 4' HIGH. METAL POSTS SHOULD HAVE A PLASTIC CAP FOR SAFETY.

4. STUDDED STEEL TEE POSTS SHALL BE UTILIZED TO SUPPORT THE CONSTRUCTION FENCE. MAXIMUM SPACING FOR STEEL TEE POSTS SHALL BE 10'.

5. CONSTRUCTION FENCE SHALL BE SECURELY FASTENED TO THE TOP, MIDDLE, AND BOTTOM OF EACH POST.

CONSTRUCTION FENCE MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

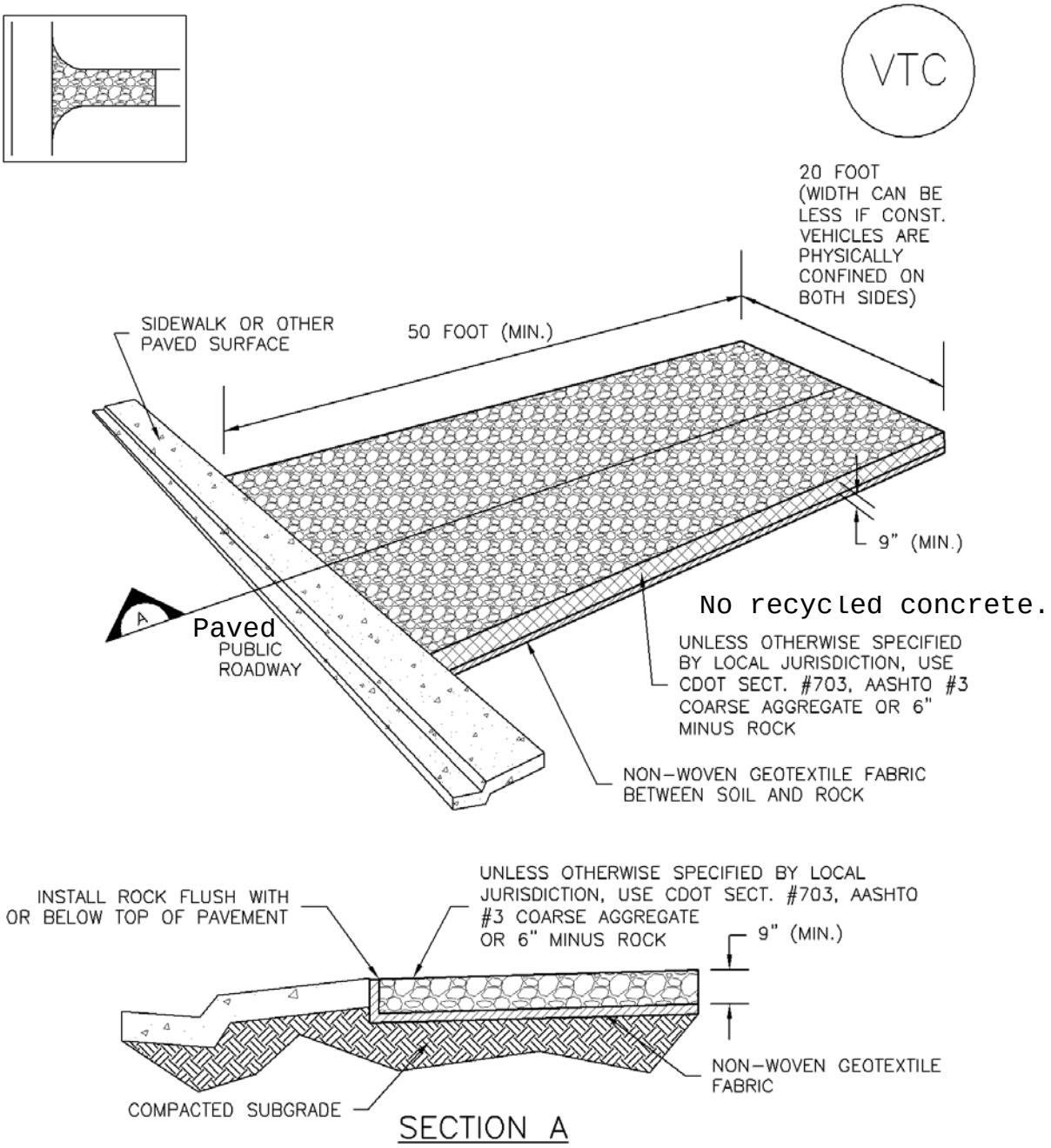
3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. CONSTRUCTION FENCE SHALL BE REPAIRED OR REPLACED WHEN THERE ARE SIGNS OF DAMAGE SUCH AS RIPS OR SAGS. CONSTRUCTION FENCE IS TO REMAIN IN PLACE UNTIL THE UPSTREAM DISTURBED AREA IS STABILIZED AND APPROVED BY THE LOCAL JURISDICTION.

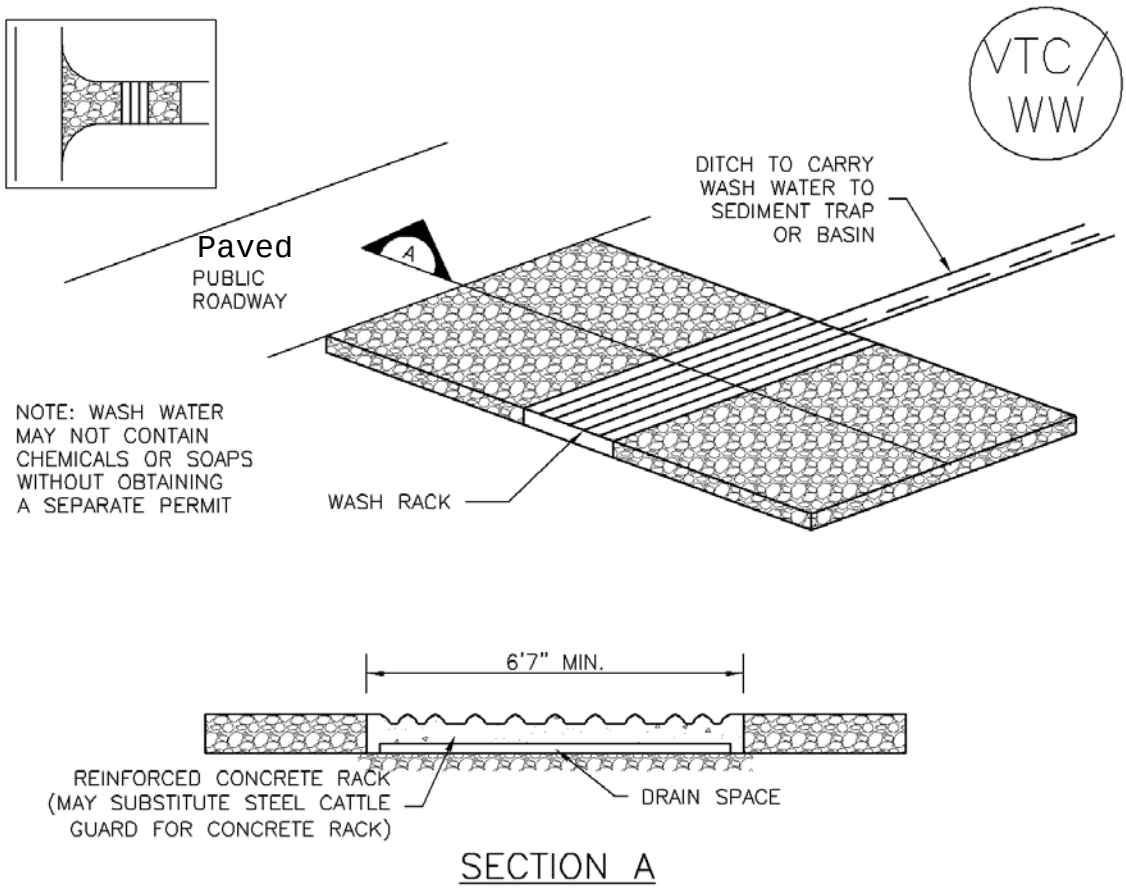
5. WHEN CONSTRUCTION FENCES ARE REMOVED, ALL DISTURBED AREAS ASSOCIATED WITH THE INSTALLATION, MAINTENANCE, AND/OR REMOVAL OF THE FENCE SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED, OR OTHERWISE STABILIZED AS APPROVED BY LOCAL JURISDICTION.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

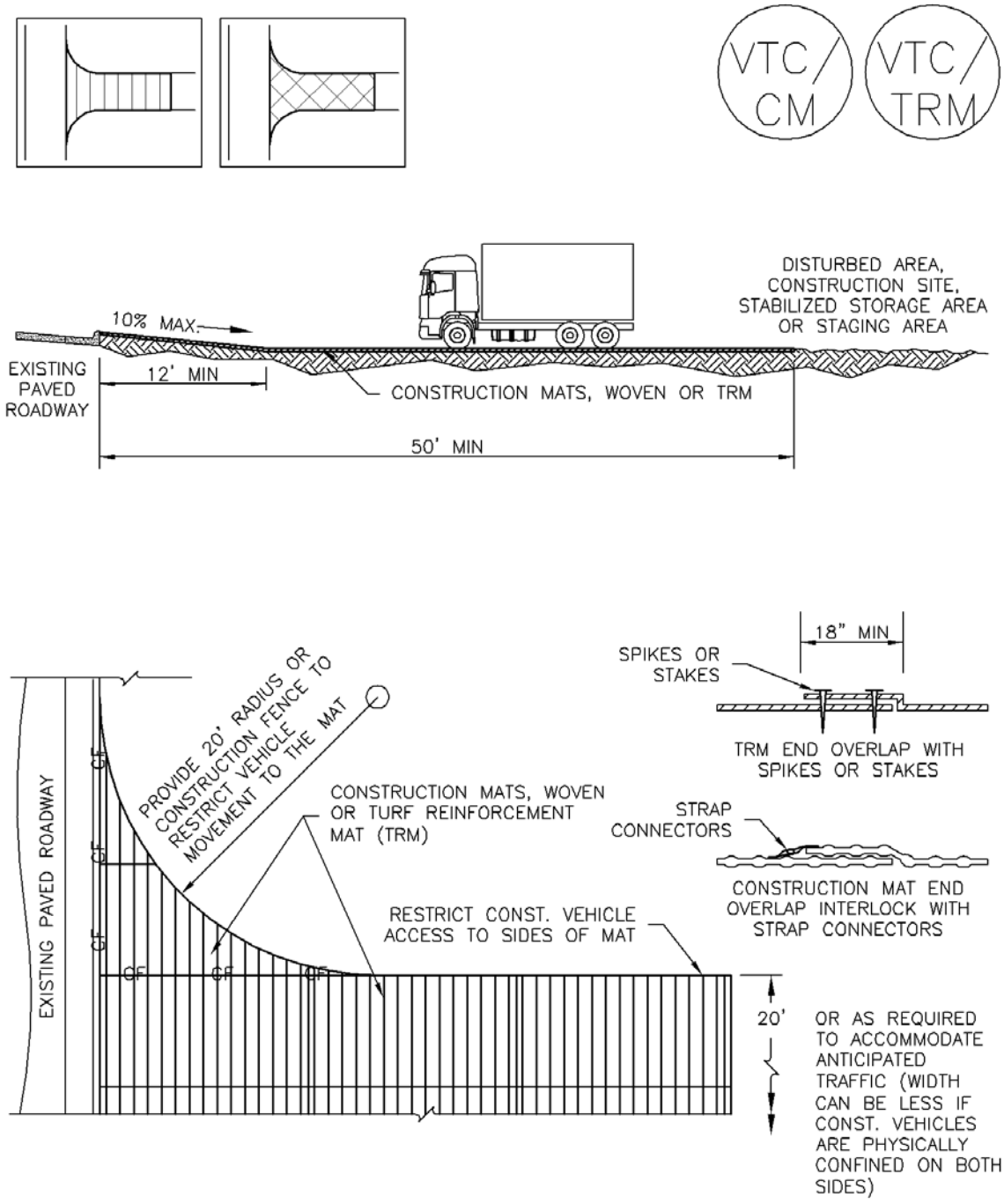
(DETAIL ADAPTED FROM TOWN OF PARKER, COLORADO, NOT AVAILABLE IN AUTOCAD)



VTC-1. AGGREGATE VEHICLE TRACKING CONTROL



VTC–2. AGGREGATE VEHICLE TRACKING CONTROL WITH WASH RACK



VTC–3. VEHICLE TRACKING CONTROL W/ CONSTRUCTION MAT OR TURF REINFORCEMENT MAT (TRM)

STABILIZED CONSTRUCTION ENTRANCE/EXIT INSTALLATION NOTES

1. SEE PLAN VIEW FOR
   -LOCATION OF CONSTRUCTION ENTRANCE(S)/EXIT(S).
   -TYPE OF CONSTRUCTION ENTRANCE(S)/EXITS(S) (WITH/WITHOUT WHEEL WASH, CONSTRUCTION MAT OR TRM).

2. CONSTRUCTION MAT OR TRM STABILIZED CONSTRUCTION ENTRANCES ARE ONLY TO BE USED ON SHORT DURATION PROJECTS (TYPICALLY RANGING FROM A WEEK TO A MONTH) WHERE THERE WILL BE LIMITED VEHICULAR ACCESS.

3. A STABILIZED CONSTRUCTION ENTRANCE/EXIT SHALL BE LOCATED AT ALL ACCESS POINTS WHERE VEHICLES ACCESS THE CONSTRUCTION SITE FROM PAVED RIGHT-OF-WAYS.

4. STABILIZED CONSTRUCTION ENTRANCE/EXIT SHALL BE INSTALLED PRIOR TO ANY LAND DISTURBING ACTIVITIES.

5. A NON-WOVEN GEOTEXTILE FABRIC SHALL BE PLACED UNDER THE STABILIZED CONSTRUCTION ENTRANCE/EXIT PRIOR TO THE PLACEMENT OF ROCK.

6. UNLESS OTHERWISE SPECIFIED BY LOCAL JURISDICTION, ROCK SHALL CONSIST OF DOT SECT. #703, AASHTO #3 COARSE AGGREGATE OR 6" (MINUS) ROCK. Recycled concrete is not allowed.

STABILIZED CONSTRUCTION ENTRANCE/EXIT MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. ROCK SHALL BE REAPPLIED OR REGRADED AS NECESSARY TO THE STABILIZED ENTRANCE/EXIT TO MAINTAIN A CONSISTENT DEPTH.

5. SEDIMENT TRACKED ONTO PAVED ROADS IS TO BE REMOVED THROUGHOUT THE DAY AND AT THE END OF THE DAY BY SHOVELING OR SWEEPING. SEDIMENT MAY NOT BE WASHED DOWN STORM SEWER DRAINS.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

(DETAILS ADAPTED FROM CITY OF BROOMFIELD, COLORADO, NOT AVAILABLE IN AUTOCAD)

Stabilized Construction Roadway (SCR) SM-5

Description

A stabilized construction roadway is a temporary method to control sediment runoff, vehicle tracking, and dust from roads during construction activities.

Photograph SCR-1. Stabilized construction roadway.

Appropriate Uses

Use on high traffic construction roads to minimize dust and erosion.

Stabilized construction roadways are used instead of rough-cut street controls on roadways with frequent construction traffic.

Design and Installation

Stabilized construction roadways typically involve two key components: 1) stabilizing the road surface with an aggregate base course of 3-inch-diameter granular material and 2) stabilizing roadside ditches, if applicable. Early application of road base is generally suitable where a layer of coarse aggregate is specified for final road construction.

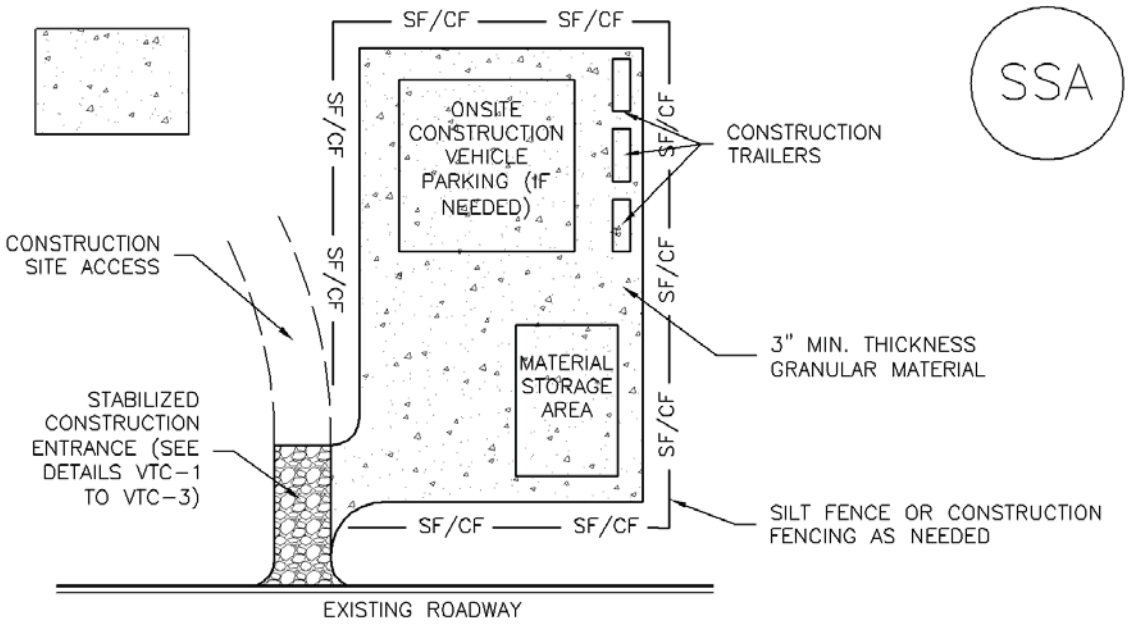
Maintenance and Removal

Apply additional gravel as necessary to ensure roadway integrity.

Inspect drainage ditches along the roadway for erosion and stabilize, as needed, through the use of check dams or rolled erosion control products.

Gravel may be removed once the road is ready to be paved. Prior to paving, the road should be inspected for grade changes and damage. Regrade and repair as necessary.

Stabilized Construction Roadway	
Functions	
Erosion Control	Yes
Sediment Control	Moderate
Site/Material Management	Yes



SSA–1. STABILIZED STAGING AREA

STABILIZED STAGING AREA INSTALLATION NOTES

1. SEE PLAN VIEW FOR
   –LOCATION OF STAGING AREA(S).
   –CONTRACTOR MAY ADJUST LOCATION AND SIZE OF STAGING AREA WITH APPROVAL FROM THE LOCAL JURISDICTION.

2. STABILIZED STAGING AREA SHOULD BE APPROPRIATE FOR THE NEEDS OF THE SITE. OVERSIZING RESULTS IN A LARGER AREA TO STABILIZE FOLLOWING CONSTRUCTION.

3. STAGING AREA SHALL BE STABILIZED PRIOR TO OTHER OPERATIONS ON THE SITE.

4. THE STABILIZED STAGING AREA SHALL CONSIST OF A MINIMUM 3" THICK GRANULAR MATERIAL.

5. UNLESS OTHERWISE SPECIFIED BY LOCAL JURISDICTION, ROCK SHALL CONSIST OF DOT SECT. #703, AASHTO #3 COARSE AGGREGATE OR 6" (MINUS) ROCK.

6. ADDITIONAL PERIMETER BMPs MAY BE REQUIRED INCLUDING BUT NOT LIMITED TO SILT FENCE AND CONSTRUCTION FENCING.

STABILIZED STAGING AREA MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. ROCK SHALL BE REAPPLIED OR REGRADED AS NECESSARY IF RUTTING OCCURS OR UNDERLYING SUBGRADE BECOMES EXPOSED.

STABILIZED STAGING AREA MAINTENANCE NOTES

5. STABILIZED STAGING AREA SHALL BE ENLARGED IF NECESSARY TO CONTAIN PARKING, STORAGE, AND UNLOADING/LOADING OPERATIONS.

6. THE STABILIZED STAGING AREA SHALL BE REMOVED AT THE END OF CONSTRUCTION. THE GRANULAR MATERIAL SHALL BE REMOVED OR, IF APPROVED BY THE LOCAL JURISDICTION, USED ON SITE, AND THE AREA COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY LOCAL JURISDICTION.

NOTE: MANY MUNICIPALITIES PROHIBIT THE USE OF RECYCLED CONCRETE AS GRANULAR MATERIAL FOR STABILIZED STAGING AREAS DUE TO DIFFICULTIES WITH RE-ESTABLISHMENT OF VEGETATION IN AREAS WHERE RECYCLED CONCRETE WAS PLACED.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO, NOT AVAILABLE IN AUTOCAD)

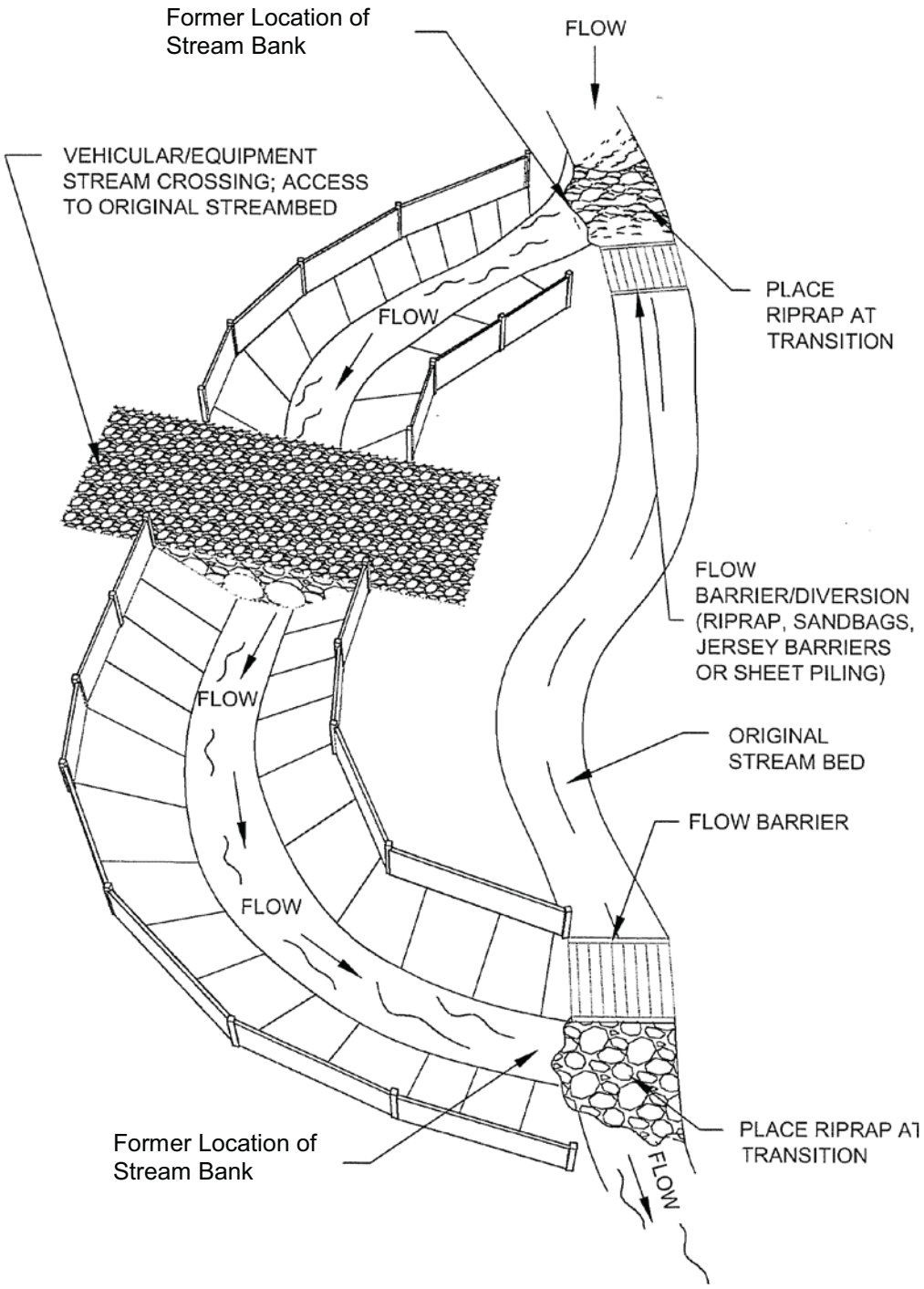
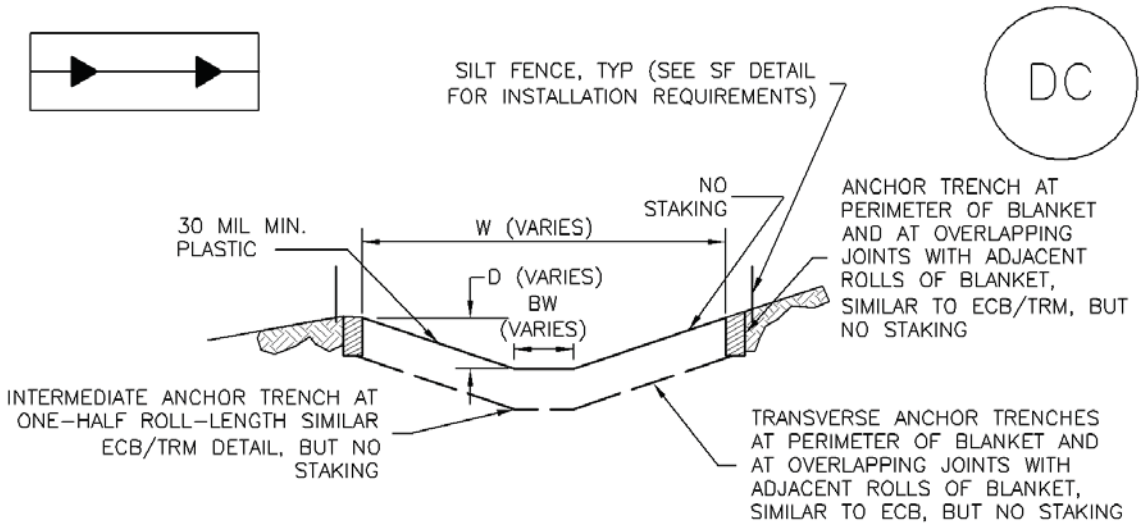
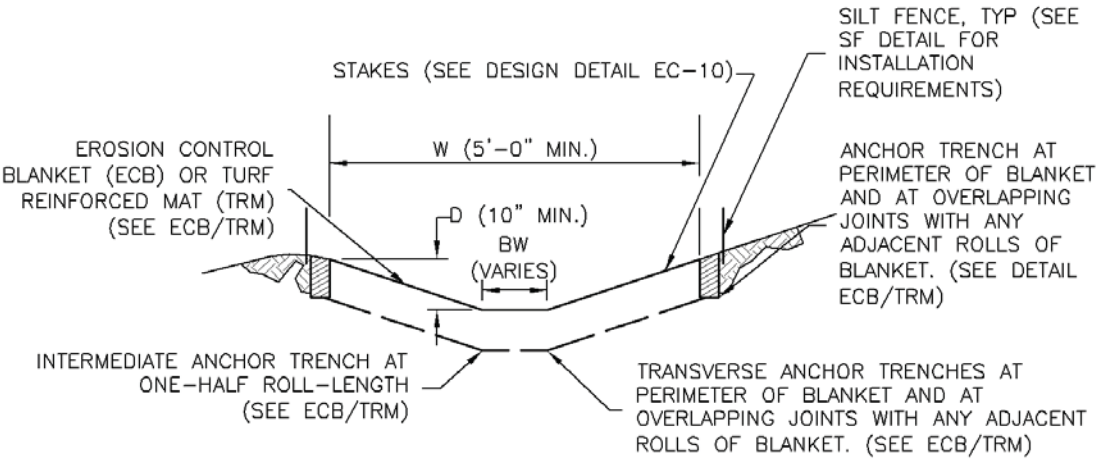


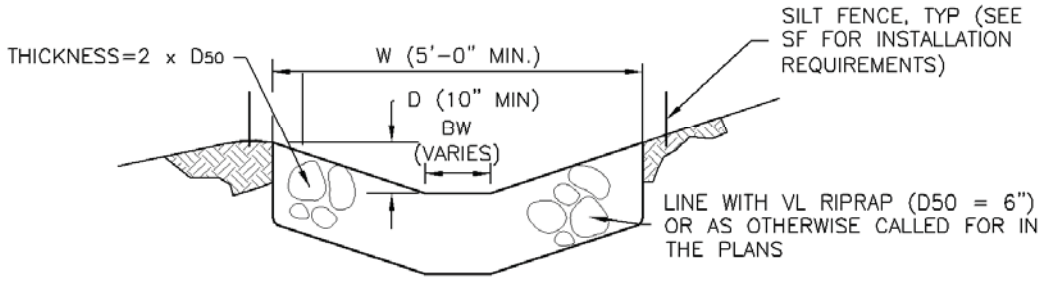
Figure DC-1. Typical Temporary Diversion Channel



DC–1. PLASTIC LINED DIVERSION CHANNEL



DC–2. GEOTEXTILE OR MAT LINED DIVERSION CHANNEL



DC–3. RIPRAP LINED DIVERSION CHANNEL

CHANNEL DIVERSION INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - –LOCATION OF DIVERSION CHANNEL
   - –TYPE OF CHANNEL (UNLINED, GEOTEXTILE OR MAT LINED, PLASTIC LINE, OR RIPRAP LINED).
   - –LENGTH OF EACH TYPE OF CHANNEL.
   - –DEPTH, D, WIDTH, W, AND BOTTOM WIDTH, BW.
   - –FOR RIPRAP LINED CHANNEL, SIZE OF RIPRAP, D50, SHALL BE SHOWN ON PLANS.

2. SEE DRAINAGE PLANS FOR DETAILS OF PERMANENT CONVEYANCE FACILITIES.

3. DIVERSION CHANNELS INDICATED ON THE SWMP PLAN SHALL BE INSTALLED PRIOR TO WORK IN DOWNGRADIENT AREAS OR NATURAL CHANNELS.

4. FOR GEOTEXTILE OR MAT LINED CHANNELS, INSTALLATION OF GEOTEXTILE OR MAT SHALL CONFORM TO THE REQUIREMENTS OF DETAIL ECB, FOR PLASTIC LINED CHANNELS, INSTALLATION OF ANCHOR TRENCHES SHALL CONFORM TO THE REQUIREMENTS OF DETAIL ECB.

5. WHERE CONSTRUCTION TRAFFIC MUST CROSS A DIVERSION CHANNEL, THE PERMITTEE SHALL INSTALL A TEMPORARY STREAM CROSSING CONFORMING TO THE REQUIREMENTS OF DETAIL TSC.

DIVERSION CHANNEL MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

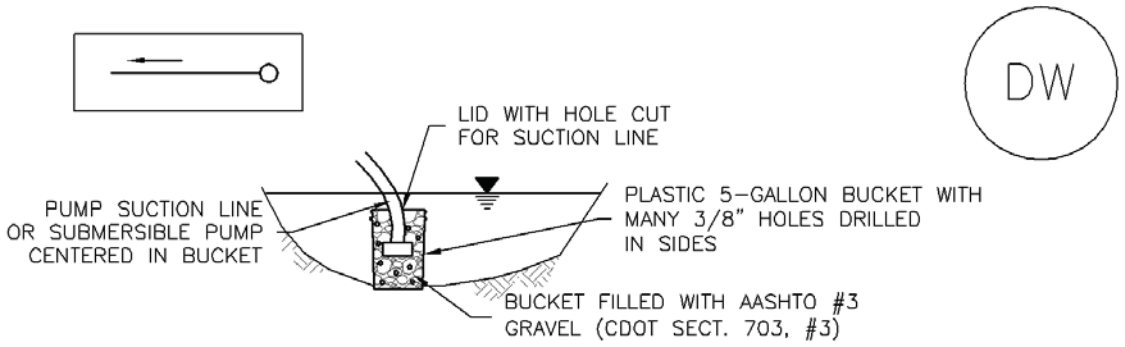
3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. DIVERSION CHANNELS ARE TO REMAIN IN PLACE UNTIL WORK IN THE DOWNGRADIENT AREA OR NATURAL CHANNEL IS NO LONGER REQUIRED. IF APPROVED BY LOCAL JURISDICTION DIVERSION CHANNEL MAY BE LEFT IN PLACE.

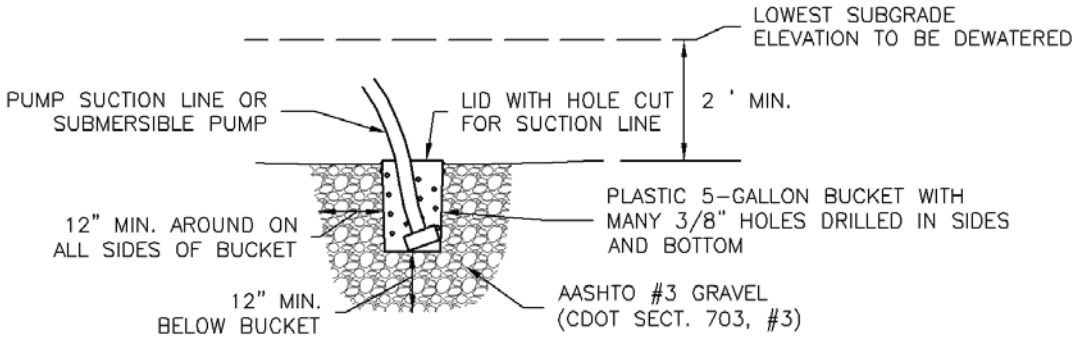
5. IF DIVERSION CHANNELS ARE REMOVED, THE DISTURBED AREA SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY LOCAL JURISDICTION.

(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO)

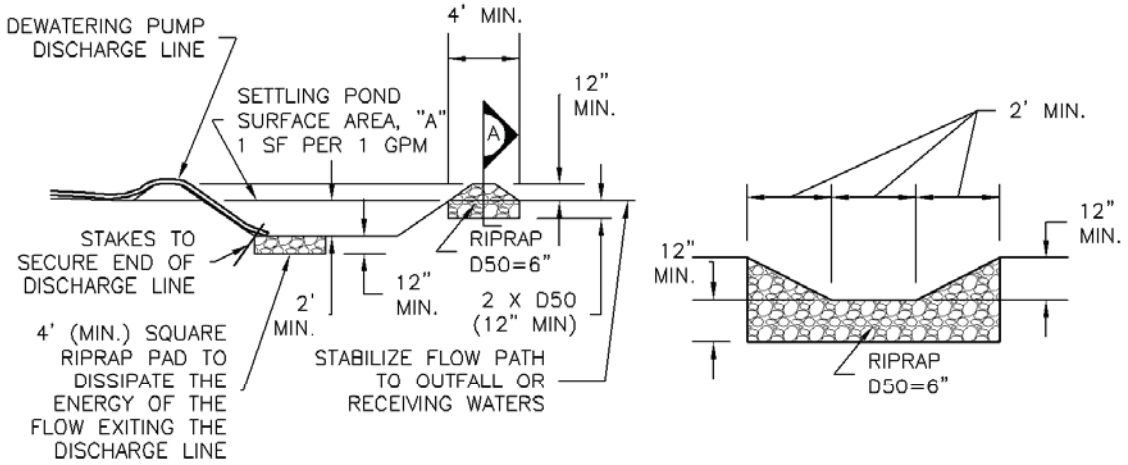
NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.



DW-1. DEWATERING POND ALREADY FILLED WITH WATER

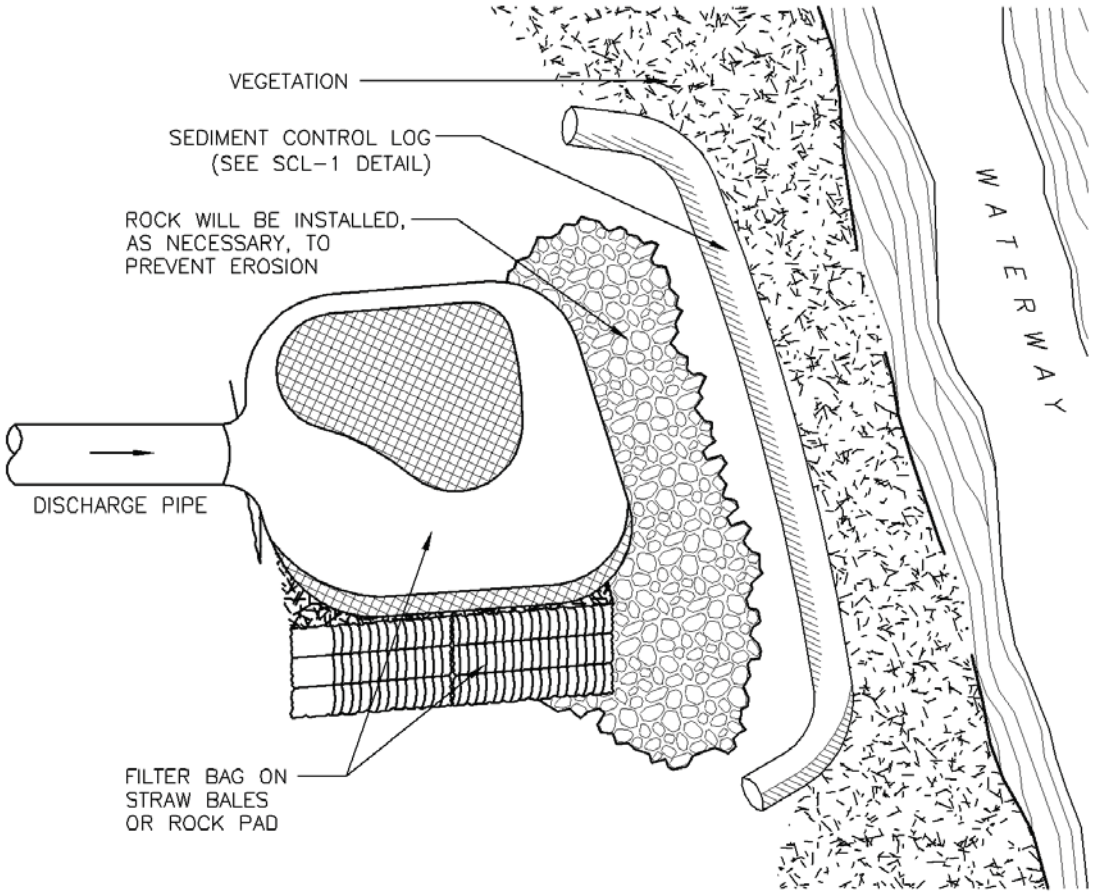


DW-2. DEWATERING SUMP FOR SUBMERSED PUMP



DW-3. SUMP DISCHARGE SETTLING BASIN

SETTLING BASIN SECTION A



DW-4. DEWATERING FILTER BAG

DEWATERING INSTALLATION NOTES

1. SEE PLAN VIEW FOR;
   -LOCATION OF DEWATERING EQUIPMENT.
   -TYPE OF DEWATERING OPERATION (DW-1 TO DW-4).

2. THE OWNER OR CONTRACTOR SHALL OBTAIN A CONSTRUCTION DISCHARGE (DEWATERING) PERMIT FROM THE STATE PRIOR TO ANY DEWATERING OPERATIONS DISCHARGING FROM THE SITE. ALL DEWATERING SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF THE PERMIT.

3. THE OWNER OR OPERATOR SHALL PROVIDE, OPERATE, AND MAINTAIN DEWATERING SYSTEMS OF SUFFICIENT SIZE AND CAPACITY TO PERMIT EXCAVATION AND SUBSEQUENT CONSTRUCTION IN DRY CONDITIONS AND TO LOWER AND MAINTAIN THE GROUNDWATER LEVEL A MINIMUM OF 2-FEET BELOW THE LOWEST POINT OF EXCAVATION AND CONTINUOUSLY MAINTAIN EXCAVATIONS FREE OF WATER UNTIL BACK-FILLED TO FINAL GRADE.

DEWATERING INSTALLATION NOTES

4. DEWATERING OPERATIONS SHALL USE ONE OR MORE OF THE DEWATERING SUMPS SHOWN ABOVE, WELL POINTS, OR OTHER MEANS APPROVED BY THE LOCAL JURISDICTION TO REDUCE THE PUMPING OF SEDIMENT, AND SHALL PROVIDE A TEMPORARY SEDIMENT BASIN OR FILTRATION BMP TO REDUCE SEDIMENT TO ALLOWABLE LEVELS PRIOR TO RELEASE OFF SITE OR TO A RECEIVING WATER. A SEDIMENT BASIN MAY BE USED IN LIEU OF SUMP DISCHARGE SETTLING BASIN SHOWN ABOVE IF A 4-FOOT-SQUARE RIPRAP PAD IS PLACED AT THE DISCHARGE POINT AND THE DISCHARGE END OF THE LINE IS STAKED IN PLACE TO PREVENT MOVEMENT OF THE LINE.

DEWATERING MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

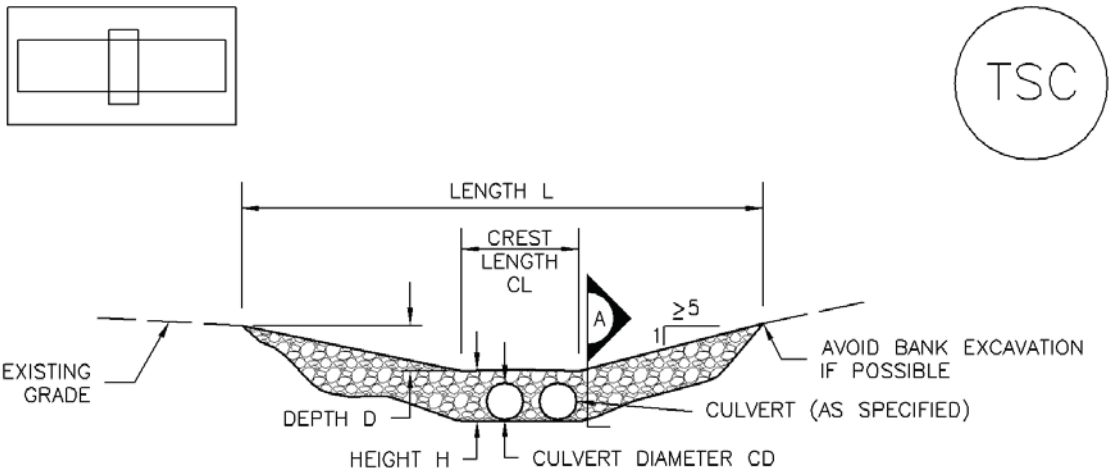
3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. DEWATERING BMPs ARE REQUIRED IN ADDITION TO ALL OTHER PERMIT REQUIREMENTS.

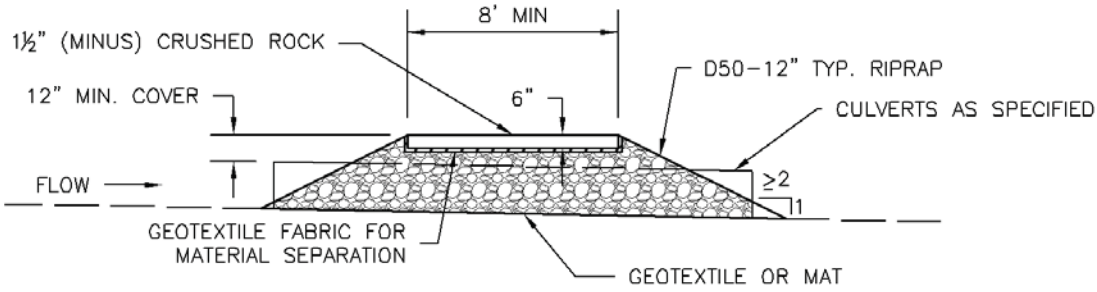
5. TEMPORARY SETTLING BASINS SHALL BE REMOVED WHEN NO LONGER NEEDED FOR DEWATERING OPERATIONS. ANY DISTURBED AREA SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

(DETAILS ADAPTED FROM DOUGLAS COUNTY, COLORADO, NOT AVAILABLE IN AUTOCAD)

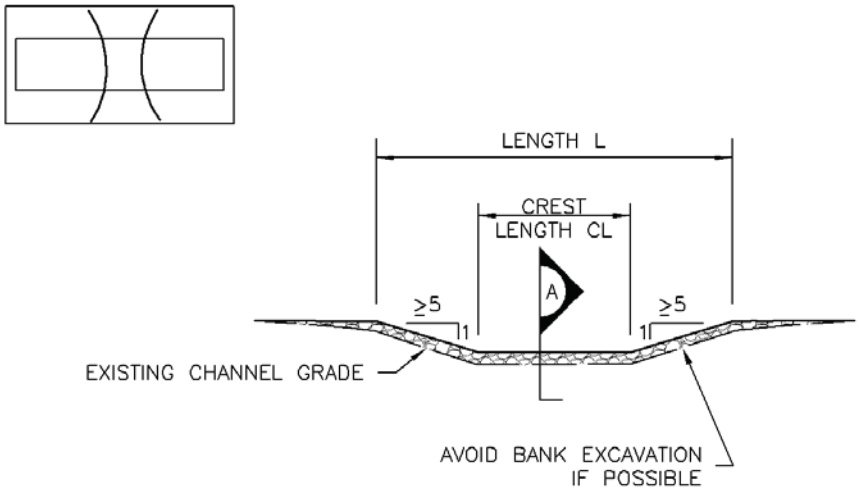


CULVERT CROSSING SECTION

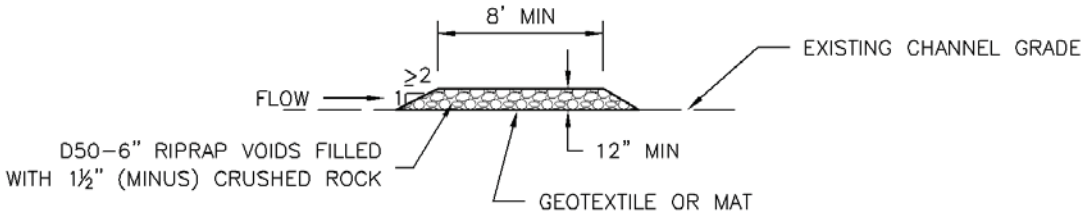


SECTION A

TSC-1. CULVERT CROSSING

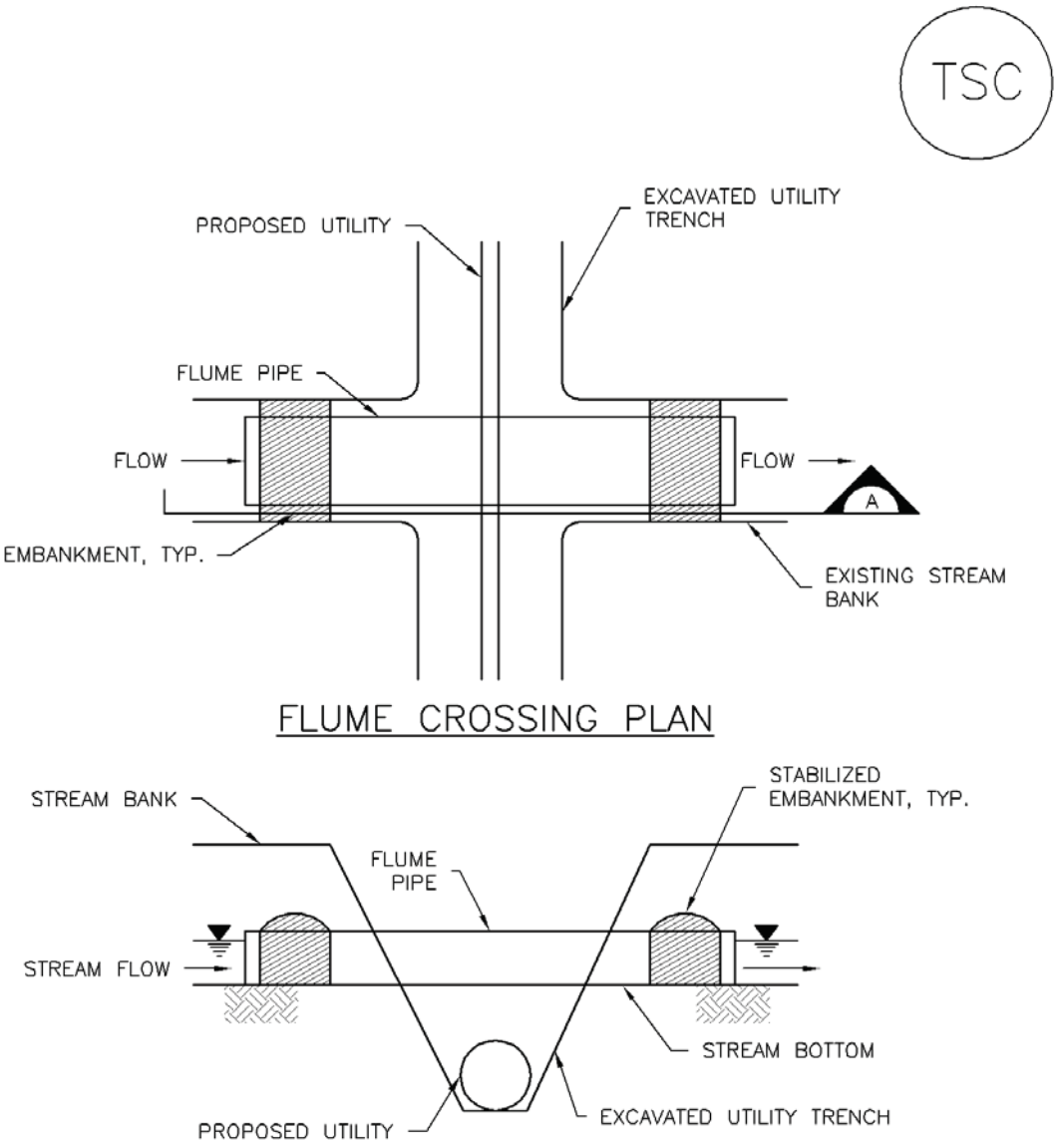


FORD CROSSING SECTION



SECTION A

TSC-2. FORD CROSSING



TSC–3. FLUME CROSSING

TEMPORARY STREAM CROSSING INSTALLATION NOTES

1. SEE PLAN VIEW FOR:
   - –LOCATIONS OF TEMPORARY STREAM CROSSINGS.
   - –STREAM CROSSING TYPE (FORD, CULVERT, OR FLUME).
   - –FOR FORD CROSSING: LENGTH (L), CREST LENGTH (CL), AND DEPTH (D).
   - –FOR CULVERT CROSSING: LENGTH (L), CREST LENGTH (CL), CROSSING HEIGHT (H), DEPTH (D), CULVERT DIAMETER (CD), AND NUMBER, TYPE AND CLASS OR GAUGE OF CULVERTS.

2. TEMPORARY STREAM CROSSING DIMENSIONS, D50, AND NUMBER OF CULVERTS INDICATED (FOR CULVERT CROSSING) SHALL BE CONSIDERED MINIMUM DIMENSIONS; ENGINEER MAY ELECT TO INSTALL LARGER FACILITIES. ANY DAMAGE TO STREAM CROSSING OR EXISTING STREAM CHANNEL DURING BASEFLOW OR FLOOD EVENTS SHALL BE PROMPTLY REPAIRED.

3. SEE MAJOR DRAINAGE CHAPTER FOR RIPRAP GRADATIONS.

4. WHERE FAILURE OF A STREAM CROSSING CAN RESULT IN SIGNIFICANT DAMAGE OR HARM IT MUST BE DESIGNED BY A STRUCTURAL ENGINEER.

TEMPORARY STREAM CROSSING MAINTENANCE NOTES

1. INSPECT BMPs EACH WORKDAY, AND MAINTAIN THEM IN EFFECTIVE OPERATING CONDITION. MAINTENANCE OF BMPs SHOULD BE PROACTIVE, NOT REACTIVE. INSPECT BMPs AS SOON AS POSSIBLE (AND ALWAYS WITHIN 24 HOURS) FOLLOWING A STORM THAT CAUSES SURFACE EROSION, AND PERFORM NECESSARY MAINTENANCE.

2. FREQUENT OBSERVATIONS AND MAINTENANCE ARE NECESSARY TO MAINTAIN BMPs IN EFFECTIVE OPERATING CONDITION. INSPECTIONS AND CORRECTIVE MEASURES SHOULD BE DOCUMENTED THOROUGHLY.

3. WHERE BMPs HAVE FAILED, REPAIR OR REPLACEMENT SHOULD BE INITIATED UPON DISCOVERY OF THE FAILURE.

4. REMOVE SEDIMENT ACCUMULATED UPSTREAM OF CROSSING AS NEEDED TO MAINTAIN THE FUNCTIONALITY OF THE CROSSING.

5. STREAM CROSSINGS ARE TO REMAIN IN PLACE UNTIL NO LONGER NEEDED AND SHALL BE REMOVED PRIOR TO THE END OF CONSTRUCTION.

6. WHEN STREAM CROSSINGS ARE REMOVED, THE DISTURBED AREA SHALL BE COVERED WITH TOPSOIL, SEEDED AND MULCHED AND COVERED WITH GEOTEXTILE OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE LOCAL JURISDICTION.

NOTE: MANY JURISDICTIONS HAVE BMP DETAILS THAT VARY FROM UDFCD STANDARD DETAILS. CONSULT WITH LOCAL JURISDICTIONS AS TO WHICH DETAIL SHOULD BE USED WHEN DIFFERENCES ARE NOTED.

(DETAIL ADAPTED FROM DOUGLAS COUNTY, COLORADO AND CITY OF AURORA, COLORADO (Va. DSWC), NOT AVAILABLE IN AUTOCAD)

Paving and Grinding Operations (PGO) SM-12

Description

Manage runoff from paving and grinding operations to reduce pollutants entering storm drainage systems and natural drainageways.

Appropriate Uses

Use runoff management practices during all paving and grinding operations such as surfacing, resurfacing, and saw cutting.

Photograph PGO-1. Paving operations on a Colorado highway. Photo courtesy of CDOT.

Design and Installation

There are a variety of management strategies that can be used to manage runoff from paving and grinding operations:

- Establish inlet protection for all inlets that could potentially receive runoff.
- Schedule paving operations when dry weather is forecasted.
- Keep spill kits onsite for equipment spills and keep drip pans onsite for stored equipment.
- Install perimeter controls when asphalt material is used on embankments or shoulders near waterways, drainages, or inlets.
- Do not wash any paved surface into receiving storm drain inlets or natural drainageways. Instead, loose material should be swept or vacuumed following paving and grinding operations.
- Store materials away from drainages or waterways.
- Recycle asphalt and pavement material when feasible. Material that cannot be recycled must be disposed of in accordance with applicable regulations.

See BMP Fact Sheets for Inlet Protection, Silt Fence and other perimeter controls selected for use during paving and grinding operations.

Maintenance and Removal

Perform maintenance and removal of inlet protection and perimeter controls in accordance with their respective fact sheets.

Promptly respond to spills in accordance with the spill prevention and control plan.

Paving and Grinding Operations	
Functions	
Erosion Control	No
Sediment Control	No
Site/Material Management	Yes

4-1 Construction Site Stabilization

Final stabilization and release of surety is contingent to all the stabilization and close-out procedures are followed and completed in the correct order.

4-1.1 Stormwater Quality Permit Close-out

In accordance with Adams County Stormwater Quality Regulations 9-05-08:

"In order to close out an Adams County Stormwater Quality permit, all of the following measures must be met:

a. Notify the Stormwater Regulatory Compliance Unit as required in Section 9-05-09 Permit Closeout Notification.

b. When a construction Site is final stabilized, but prior to BMP removal; submit an electronic color copy of the ESC Plan final marked up copy to Adams County Public Works – SRC Unit with all revisions and markups that update the plan during construction for stabilization.

c. Provide Construction Site Stabilization Certification and color photo documentation in compliance with Section 9-05-10-02 Construction Site Stabilization Certification.

d. BMPs will be removed only after a Release of Financial Surety Request has been approved by the SRC Unit."

4-1.2 Permit Closeout Notification

In accordance with Adams County Stormwater Quality Regulations 9-05-09:

"Permittee must contact Adams County Public Works - SRC Unit to set up a Closeout Stormwater Quality Inspection. This notification shall be sent to the Public Works - SRC Unit via e-mail as indicated on the County SWQ Permit. The Public Works – SRC Unit must be contacted by the Permittee at least three (3) business days prior to scheduling the final inspection.

The purpose of the Closeout Inspection is to verify the site is adequately stabilized and/or covered with pavement or structures, per the County accepted plans.

If the Adams County Public Works - SRC Unit needs to conduct more than one Closeout Inspection, an inspection fee will be assessed for each additional closeout inspection, as approved by resolution, by the Board of County Commissioners."

4-1.3 Removal of Temporary Bmps

In accordance with Adams County Stormwater Quality Regulations 9-05-09-01:

"Once the site has met the final stabilization conditions, as specified in Section 9-07-04 Final Construction Site Stabilization, the remaining temporary BMPs such as perimeter controls, inlet protection, silt fence, etc. shall be removed and disposed of properly."

4-1.4 Construction Site Stabilization Certification

In accordance with Adams County Stormwater Quality Regulations 9-05-10-02:

"The responsible Adams County Stormwater Quality Permit holder (permittee) shall provide formal notarized certification in accordance with the stabilization certification page found in the supplemental stormwater guide.

The signed, sealed and notarized Stabilization Certification shall be submitted, in electronic form, to Adams County Public Works - SRC Unit along with documented proof in the form of electronic color photographs, depicting the stabilized site. The photographs must show the materials used for stabilization and that growth of the vegetation is adequate. It must be proved that the vegetation is 70% of pre-disturbance levels and no sediment will erode outside the permitted area. Refer to the supplemental stormwater guide for a copy of the Stabilization Certification Form.

Remove all temporary BMPs in compliance with Section 9-05-09-01 Removal of Temporary BMPs."

4-1.5 Final Construction Site Stabilization

In accordance with Adams County Stormwater Quality Regulations 9-07-04:

"Final Construction Site Stabilization means that all ground disturbing activities are complete, and all disturbed areas have either been built on, paved over or are awaiting uniform vegetative cover per County accepted plans.

Prior to closing out the Adams County Stormwater Quality Permit, all the items listed below must be completed in order for the construction site to be considered to have final stabilization.

1. The site has a uniform vegetative cover with a density of at least seventy percent (70%) compared to the original undisturbed site. Such cover is capable of adequately controlling soil erosion, as determined by the Stormwater Regulatory Compliance Unit.
2. Proper installation of all approved, permanent, post-construction stormwater quality BMPs.
3. Removal of all stockpiles of soil, construction material/debris, construction equipment, etc. from the construction site.
4. Streets, parking lots and other surrounding paved surfaces are clean and free of any sediment or debris.
5. Removal of sediment and debris within the County's MS4 and surrounding property, caused by the construction activity; this includes all pollutants. The Permittee shall restore any damaged public infrastructure caused by the Permittee's construction activities.
6. Provide documentation as required by Section 9-05-08 Permit Closeout and Section 9-05-09 Permit Closeout Notification."

5-1 Post-Construction BMPs

In order to capture pollutant after construction, as required by the County's Stormwater Quality Regulations, it is necessary to implement permanent best management practices (BMPs). The following Post-Construction BMPs are to be used by the design engineer to be included in the Drainage Improvement Plan. Post-Construction BMPs include, at minimum:

5-1.1 Treatment BMPs

Permanent stormwater measures are treatment best management practices that provide stormwater quality protection after construction. All permanent treatment BMPs requires maintenance. The County uses the following BMP details for treatment of post-construction runoff:

a. Grass Buffer
b. Grass Swale
c. Extended Detention Basin
d. Retention Pond – refer to Adams County Zoning and Subdivision Regulations Section 9-01-12 if no discharge
e. Outlet Structures

The Director of Public Works may allow alternate design methods and the selection of alternate post construction BMPs, if in the Director's judgment the nature of the work applied for meets the intent of these standards and specifications. Such approval shall be based upon technical justification, sealed by a Colorado registered professional engineer, submitted with the technical documentation.

Grass Buffer T-1

Description

Grass buffers are densely vegetated strips of grass designed to accept sheet flow from upgradient development. Properly designed grass buffers play a key role in LID, enabling infiltration and slowing runoff. Grass buffers provide filtration (straining) of sediment. Buffers differ from swales in that they are designed to accommodate overland sheet flow rather than concentrated or channelized flow.

Photograph GB-1. A flush curb allows roadway runoff to sheet flow through the grass buffer. Flows are then further treated by the grass swale. Photo courtesy of Muller Engineering.

Site Selection

Grass buffers can be incorporated into a wide range of development settings. Runoff can be directly accepted from a parking lot, roadway, or the roof of a structure, provided the flow is distributed in a uniform manner over the width of the buffer. This can be achieved through the use of flush curbs, slotted curbs, or level spreaders where needed. Grass buffers are often used in conjunction with grass swales. They are well suited for use in riparian zones to assist in stabilizing channel banks adjacent to major drainageways and receiving waters. These areas can also sometimes serve multiple functions such as recreation.

Hydrologic Soil Groups A and B provide the best infiltration capacity for grass buffers. For Type C and D soils, buffers still serve to provide filtration (straining) although infiltration rates are lower.

Grass Buffer	
Functions	
LID/Volume Red.	Yes
WQCV Capture	No
WQCV+Flood Control	No
Fact Sheet Includes EURV Guidance	No
Typical Effectiveness for Targeted Pollutants[3]	
Sediment/Solids	Good
Nutrients	Moderate
Total Metals	Good
Bacteria	Poor
Other Considerations	
Life-cycle Costs	Low

[3] Based primarily on data from the International Stormwater BMP Database (www.bmpdatabase.org).

Designing for Maintenance

Recommended ongoing maintenance practices for all BMPs are provided in Chapter 6 of this manual. During design the following should be considered to ensure ease of maintenance over the long-term:

- Where appropriate (where vehicle safety would not be impacted), install the top of the buffer 1 to 3 inches below the adjacent pavement so that growth of vegetation and accumulation of sediment at the edge of the strip does not prevent runoff from entering the buffer. Alternatively, a sloped edge can be used adjacent to vehicular traffic areas.
- Amend soils to encourage deep roots and reduce irrigation requirements, as well as promote infiltration.

- Design and adjust the irrigation system (temporary or permanent) to provide water in amounts appropriate for the selected vegetation. Irrigation needs will change from month to month and year to year.

- Protect the grass buffer from vehicular traffic when using this BMP adjacent to roadways. This can be done with a slotted curb (or other type of barrier) or by constructing a reinforced grass shoulder (see Fact Sheet T-10.5).

Design Procedure and Criteria

The following steps outline the grass buffer design procedure and criteria. Figure GB-1 is a schematic of the facility and its components:

1. **Design Discharge**: Use the hydrologic procedures described in the *Runoff* chapter of Volume 1 to determine the 2-year peak flow rate (Q_2) of the area draining to the grass buffer.

2. **Minimum Width:** The width (W), normal to flow of the buffer, is typically the same as the contributing basin (see Figure GB-1). An exception to this is where flows become concentrated. Concentrated flows require a level spreader to distribute flows evenly across the width of the buffer. The minimum width should be:

$$W = \frac{Q_2}{0.05} \qquad \text{Equation GB-1}$$

Where:

W = width of buffer (ft)

Q_2 = 2-year peak runoff (cfs)

3. **Length:** The recommended length (L), the distance along the sheet flow direction, should be a minimum of 14 feet. This value is based on the findings of Barrett et al. 2004 in *Stormwater Pollutant Removal in Roadside Vegetated Strips* and is appropriate for buffers with greater than 80% vegetative cover and slopes up to 10%. The study found that pollutant removal continues throughout a length of 14 feet. Beyond this length, a point of diminishing returns in pollutant reduction was found. It is important to note that shorter lengths or slightly steeper slopes will also provide some level of removal where site constraints dictate the geometry of the buffer.

Benefits

- Filters (strains) sediment and trash.
- Reduces directly connected impervious area. (See Chapter 3 for quantifying benefits.)
- Can easily be incorporated into a treatment train approach.
- Provides green space available for multiple uses including recreation and snow storage.
- Straightforward maintenance requirements when the buffer is protected from vehicular traffic.

Limitations

- Frequently damaged by vehicles when adjacent to roadways and unprotected.
- A thick vegetative cover is needed for grass buffers to be effective.
- Nutrient removal in grass buffers is typically low.
- High loadings of coarse solids, trash, and debris require pretreatment.
- Space for grass buffers may not be available in ultra urban areas (lot-line-to-lot-line).

4. **Buffer Slope:** The design slope of a grass buffer in the direction of flow should not exceed 10%. Generally, a minimum slope of 2% or more in turf is adequate to facilitate positive drainage. For slopes less than 2%, consider including an underdrain system to mitigate nuisance drainage.

5. **Flow Characteristics (sheet or concentrated)**: Concentrated flows can occur when the width of the watershed differs from that of the grass buffer. Additionally, when the product of the watershed flow length and the interface slope (the slope of the watershed normal to flow at the grass buffer) exceeds approximately one, flows may become concentrated. Use the following equations to determine flow characteristics:

Use of Grass Buffers

Sheet flow of stormwater through a grassed area provides some benefit in pollutant removal and volume reduction even when the geometry of the BMP does not meet the criteria provided in this Fact Sheet. These criteria provide a design procedure that should be used when possible; however, when site constraints are limiting, this treatment concept is still encouraged.

Sheet Flow: $FL(SI) \leq 1$ Equation GB-2

Concentrated Flow: $FL(SI) > 1$ Equation GB-3

Where:

FL = watershed flow length (ft)

SI = interface slope (normal to flow) (ft/ft)

6. **Flow Distribution:** Flows delivered to a grass buffer must be sheet flows. Slotted or flush curbing, permeable pavements, or other devices can be used to spread flows. The grass buffer should have relatively consistent slopes to avoid concentrating flows within the buffer.

A level spreader should be used when flows are concentrated. A level spreader can be a slotted drain designed to discharge flow through the slot as shown in Photo GB-2. It could be an exfiltration trench filled with gravel, which allows water to infiltrate prior to discharging over a level concrete or rock curb. There are many ways to design and construct a level spreader. They can also be used in series when the length of the buffer allows flows to re-concentrate. See Figure GB-2 for various level spreader sections.

Photograph GB-2. This level spreader carries concentrated flows into a slotted pipe encased in concrete to distribute flows evenly to the grass buffer shown left in the photo. Photo courtesy of Bill Wenk.

Photos GB-3 and GB-4 show a level spreader that includes a basin for sedimentation. Concentrated flows enter the basin via stormsewer. The basin is designed to drain slowly while overflow is spread evenly to the downstream vegetation. A small notch, orifice, or pipe can be used to drain the level spreader completely. The opening should be small to encourage frequent flows to overtop the level spreader but not so small that it is frequently clogged.

Photograph GB-3. This level spreader includes the added benefit of a sedimentation basin prior to even distribution of concentrated flows from the roadway into the grass buffer. Photo courtesy of Bill Wenk.

7. **Soil Preparation**: In order to encourage establishment and long-term health of the selected vegetation, it is essential that soil conditions be properly prepared prior to installation. Following site grading, poor soil conditions often exist. When possible, remove, strip, stockpile, and reuse on-site topsoil. If the site does not contain topsoil, the soils should be amended prior to vegetation. Typically 3 to 5 cubic yards of soil amendment (compost) per 1,000 square feet, tilled 6 inches into the soil is required in order for vegetation to thrive, as well as to enable infiltration of runoff. Additionally, inexpensive soil tests can be conducted to determine required soil amendments. (Some local governments may also require proof of soil amendment in landscaped areas for water conservation reasons.)

Photograph GB-4. Maintenance access is provided via the ramp located at the end of the basin. Photo courtesy of Bill Wenk.

8. **Vegetation:** This is the most critical component for treatment within a grass buffer. Select durable, dense, and drought tolerant grasses to vegetate the buffer. Also consider the size of the watershed as larger watersheds will experience more frequent flows. The goal is to provide a dense mat of vegetative cover. Grass buffer performance falls off rapidly as the vegetation coverage declines below 80% (Barrett et al.2004).

Turf grasses such as Kentucky bluegrass are often selected due to these qualities[1]. Dense native turf grasses may also be selected where a more natural look is desirable. Once established, these provide the benefit of lower irrigation requirements. See the *Revegetation* chapter in Volume 2 of this manual with regard to seed mix selection, planting and ground preparation. Depending on soils and anticipated flows, consider erosion control measures until vegetation has been established.

9. **Irrigation**: Grass buffers should be equipped with irrigation systems to promote establishment and survival in Colorado's semi-arid environment. Systems may be temporary or permanent, depending on the type of vegetation selected. Irrigation application rates and schedules should be developed and adjusted throughout the establishment and growing season to meet the needs of the selected plant species. Initially, native grasses require the same irrigation requirements as bluegrass. After the grass is established, irrigation requirements for native grasses can be reduced. Irrigation practices have a significant effect on the function of the grass buffer. Overwatering decreases the permeability of the soil, reducing the infiltration capacity and contributing to nuisance baseflows. Conversely, under watering may result in delays in establishment of the vegetation in the short term and unhealthy vegetation that provides less filtering and increased susceptibility to erosion and rilling over the long term.

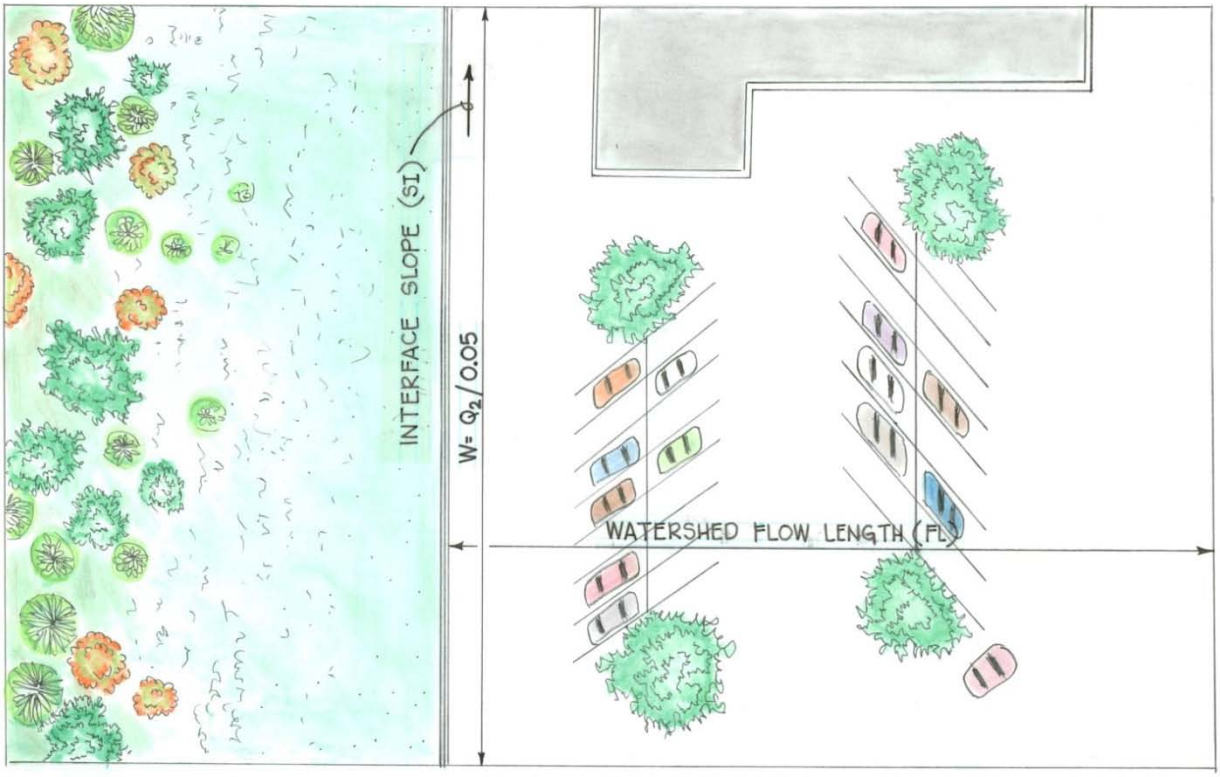
10. **Outflow Collection**: Provide a means for downstream conveyance. A grass swale can be used for this purpose, providing additional LID benefits.

Construction Considerations

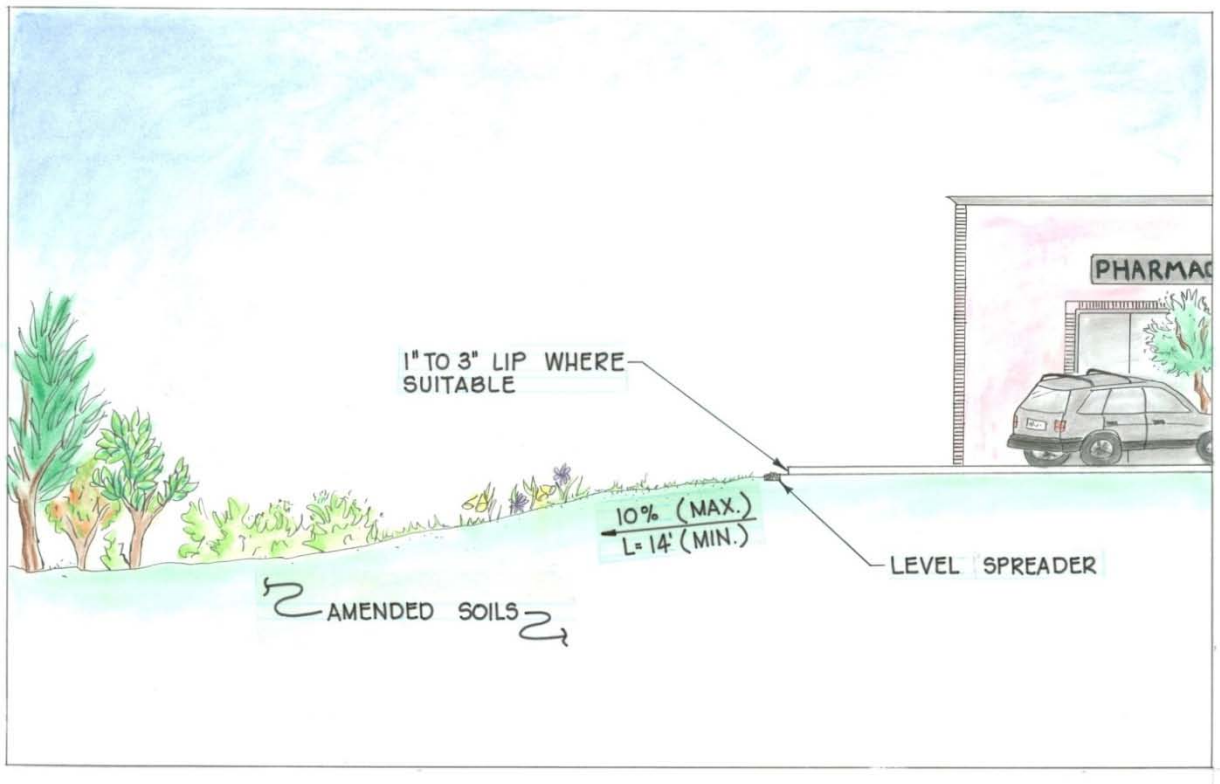
Success of grass buffers depends not only on a good design and long-term maintenance, but also on installing the facility in a manner that enables the BMP to function as designed. Construction considerations include:

- The final grade of the buffer is critical. Oftentimes, following soil amendment and placement of sod, the final grade is too high to accept sheet flow. The buffer should be inspected prior to placement of seed or sod to ensure appropriate grading.
- Perform soil amending, fine grading, and seeding only after tributary areas have been stabilized and utility work crossing the buffer has been completed.
- When using sod tiles stagger the ends of the tiles to prevent the formation of channels along the joints. Use a roller on the sod to ensure there are no air pockets between the sod and soil.
- Avoid over compaction of soils in the buffer area during construction to preserve infiltration capacities.
- Erosion and sediment control measures on upgradient disturbed areas must be maintained to prevent excessive sediment loading to grass buffer.

[1] Although Kentucky bluegrass has relatively high irrigation requirements to maintain a lush, green aesthetic, it also withstands drought conditions by going dormant. Over-irrigation of Kentucky bluegrass is a common problem along the Colorado Front Range, and it can be healthy, although less lush, with much less irrigation than is typically applied.



PLAN



PROFILE

Figure GB-1. Typical Grass Buffer Graphic by Adia Davis.

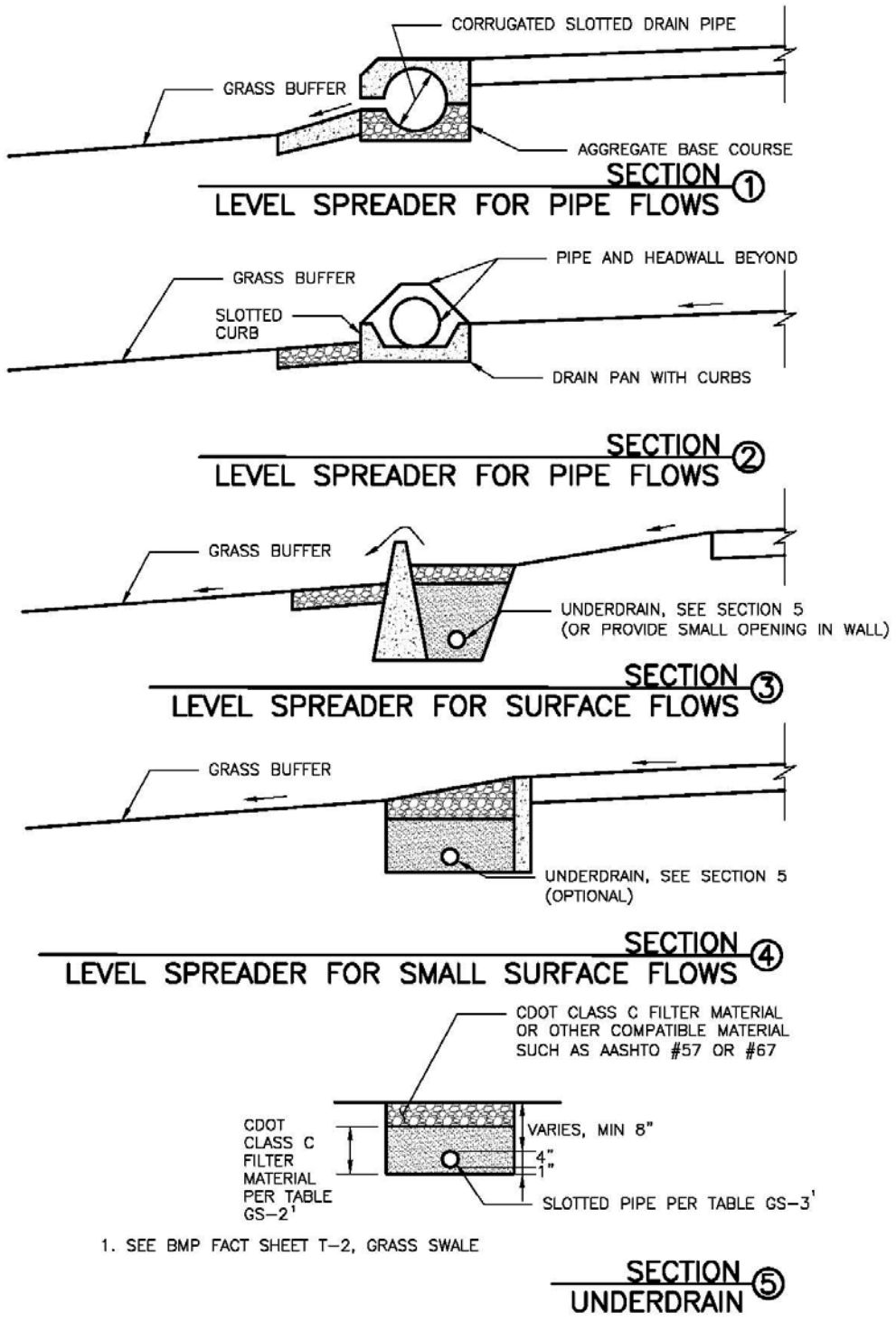


Figure GB-2. Typical Level Spreader Details

Design Example

The *UD-BMP* workbook, designed as a tool for both designer and reviewing agency is available at www.udfcd.org. This section provides a completed design form from this workbook as an example.

Design Procedure Form: Grass Buffer (GB)

Sheet 1 of 1

Designer:	**R. Dunn**
Company:	**BMP, Inc.**
Date:	**November 24, 2010**
Project:	**Filing 37**
Location:	**NE Corner of 34th Ave. and 105th St., north entrance road**

1. Design Discharge A) 2-Year Peak Flow Rate of the Area Draining to the Grass Buffer	Q_2 = 5.0 cfs
2. Minimum Width of Grass Buffer	W_G = 100 ft
3. Length of Grass Buffer (14' or greater recommended)	L_G = 15 ft
4. Buffer Slope (in the direction of flow, not to exceed 0.1 ft / ft)	S_G = 0.100 ft / ft
5. Flow Characteristics (sheet or concentrated) A) Does runoff flow into the grass buffer across the entire width of the buffer?	Choose One: (●) Yes ( ) No
B) Watershed Flow Length	F_L = 20 ft
C) Interface Slope (normal to flow)	S_I = 0.020 ft / ft
D) Type of Flow Sheet Flow: $F_L * S_I \leq 1$ Concentrated Flow: $F_L * S_I > 1$	SHEET FLOW
6. Flow Distribution for Concentrated Flows	Choose One: (●) None (sheet flow) ( ) Slotted Curbing ( ) Level Spreader ( ) Other (Explain):
7 Soil Preparation (Describe soil amendment)	Till 5 CY of compost per 1000 SF to a depth of 6 inches.
8 Vegetation (Check the type used or describe "Other")	Choose One: ( ) Existing Xeric Turf Grass (●) Irrigated Turf Grass ( ) Other (Explain):
9. Irrigation (*Select None if existing buffer area has 80% vegetation AND will not be disturbed during construction.)	Choose One: (●) Temporary ( ) Permanent ( ) None*
10. Outflow Collection (Check the type used or describe "Other")	Choose One: (●) Grass Swale ( ) Street Gutter ( ) Storm Sewer Inlet ( ) Other (Explain):
Notes:	

References

Barrett, M., Lantin, A. and S. Austrheim-Smith. 2004. *Stormwater Pollutant Removal in Roadside Vegetated Buffer Strips.* Prepared for the Transportation Research Board: Washington, DC.

California Stormwater Quality Association (CASQA). 2003. *California Stormwater BMP Handbook, Vegetated Buffer Strip*.

Description

Grass swales are densely vegetated trapezoidal or triangular channels with low-pitched side slopes designed to convey runoff slowly. Grass swales have low longitudinal slopes and broad cross-sections that convey flow in a slow and shallow manner, thereby facilitating sedimentation and filtering (straining) while limiting erosion. Berms or check dams may be incorporated into grass swales to reduce velocities and encourage settling and infiltration. When using berms, an underdrain system should be provided. Grass swales are an integral part of the Low Impact Development (LID) concept and may be used as an alternative to a curb and gutter system.

Photograph GS-1. This grass swale provides treatment of roadway runoff in a residential area. Photo courtesy of Bill Ruzzo.

Site Selection

Grass swales are well suited for sites with low to moderate slopes. Drop structures or other features designed to provide the same function as a drop structures (e.g., a driveway with a stabilized grade differential at the downstream end) can be integrated into the design to enable use of this BMP at a broader range of site conditions. Grass swales provide conveyance so they can also be used to replace curb and gutter systems making them well suited for roadway projects.

Grass Swale	
Functions	
LID/Volume Red.	Yes
WQCV Capture	No
WQCV+Flood Control	No
Fact Sheet Includes EURV Guidance	No
Typical Effectiveness for Targeted Pollutants[3]	
Sediment/Solids	Good
Nutrients	Moderate
Total Metals	Good
Bacteria	Poor
Other Considerations	
Life-cycle Costs	Low

[3] Based primarily on data from the International Stormwater BMP Database (www.bmpdatabase.org).

Designing for Maintenance

Recommended ongoing maintenance practices for all BMPs are provided in Chapter 6 of this manual. During design, the following should be considered to ensure ease of maintenance over the long-term:

- Consider the use and function of other site features so that the swale fits into the landscape in a natural way. This can encourage upkeep of the area, which is particularly important in residential areas where a loss of aesthetics and/or function can lead to homeowners filling in and/or piping reaches of this BMP.

- Provide access to the swale for mowing equipment and design sideslopes flat enough for the safe operation of equipment.
- Design and adjust the irrigation system (temporary or permanent) to provide appropriate water for the selected vegetation.
- An underdrain system will reduce excessively wet areas, which can cause rutting and damage to the vegetation during mowing operations.
- When using an underdrain, do not put a filter sock on the pipe. This is unnecessary and can cause the slots or perforations in the pipe to clog.

Benefits

- Removal of sediment and associated constituents through filtering (straining)
- Reduces length of storm sewer systems in the upper portions of a watershed
- Provides a less expensive and more attractive conveyance element
- Reduces directly connected impervious area and can help reduce runoff volumes.

Limitations

- Requires more area than traditional storm sewers.
- Underdrains are recommended for slopes under 2%.
- Erosion problems may occur if not designed and constructed properly.

Design Procedure and Criteria

The following steps outline the design procedure and criteria for stormwater treatment in a grass swale. Figure GS-1 shows trapezoidal and triangular swale configurations.

1. **Design Discharge**: Determine the 2-year flow rate to be conveyed in the grass swale under fully developed conditions. Use the hydrologic procedures described in the *Runoff* Chapter in Volume 1.

2. **Hydraulic Residence Time**: Increased hydraulic residence time in a grass swale improves water quality treatment. Maximize the length of the swale when possible. If the length of the swale is limited due to site constraints, the slope can also be decreased or the cross-sectional area increased to increase hydraulic residence time.

3. **Longitudinal Slope**: Establish a longitudinal slope that will meet Froude number, velocity, and depth criteria while ensuring that the grass swale maintains positive drainage. Positive drainage can be achieved with a minimum 2% longitudinal slope or by including an underdrain system (see step 8). Use drop structures as needed to accommodate site constraints. Provide for energy dissipation downstream of each drop when using drop structures.

4. **Swale Geometry**: Select geometry for the grass swale. The cross section should be either trapezoidal or triangular with side slopes not exceeding 4:1 (horizontal: vertical), preferably flatter. Increase the wetted area of the swale to reduce velocity. Lower velocities result in improved pollutant removal efficiency and greater volume reduction. If one or both sides of the grass swale are also to be used as a grass buffer, follow grass buffer criteria.

5. **Vegetation**: Select durable, dense, and drought tolerant grasses. Turf grasses, such as Kentucky bluegrass, are often selected due to these qualities[1]. Native turf grasses may also be selected where a more natural look is desirable. This will also provide the benefit of lower irrigation requirements, once established. Turf grass is a general term for any grasses that will form a turf or mat as opposed to bunch grass, which will grow in clumplike fashion. Grass selection should consider both short-term (for establishment) and long-term maintenance requirements, given that some varieties have higher maintenance requirements than others. Follow criteria in the *Revegetation* Chapter of Volume 2, with regard to seed mix selection, planting, and ground preparation.

Native grasses provide a more natural aesthetic and require less water once established.

6. **Design Velocity**: Maximum flow velocity in the swale should not exceed one foot per second. Use the Soil Conservation Service (now the NRCS) vegetal retardance curves for the Manning coefficient (Chow 1959). Determining the retardance coefficient is an iterative process that the UD-BMP workbook automates. When starting the swale vegetation from sod, curve "D" (low retardance) should be used. When starting vegetation from seed, use the "E" curve (very low vegetal retardance).

7. **Design Flow Depth**: Maximum flow depth should not exceed one foot at the 2-year peak flow rate. Check the conditions for the 100-year flow to ensure that drainage is being handled without flooding critical areas, structures, or adjacent streets.

Table GS-1. Grass Swale Design Summary for Water Quality

Design Flow	Maximum Froude Number	Maximum Velocity	Maximum Flow Depth
2-year event	0.5	1 ft/s	1 ft

Use of Grass Swales

Vegetated conveyance elements provide some benefit in pollutant removal and volume reduction even when the geometry of the BMP does not meet the criteria provided in this Fact Sheet. These criteria provide a design procedure that should be used when possible; however, when site constraints are limiting, vegetated conveyance elements designed for stability are still encouraged.

[1] Although Kentucky bluegrass has relatively high irrigation requirements to maintain a lush, green aesthetic, it also withstands drought conditions by going dormant. Over-irrigation of Kentucky bluegrass is a common problem along the Colorado Front Range. It can be healthy, although less lush, with much less irrigation than is typically applied.

8. **Underdrain:** An underdrain is necessary for swales with longitudinal slopes less than 2.0%. The underdrain can drain directly into an inlet box at the downstream end of the swale, daylight through the face of a grade control structure or continue below grade through several grade control structures as shown in Figure GS-1.

   The underdrain system should be placed within an aggregate layer. If no underdrain is required, this layer is not required. The aggregate layer should consist of an 8-inch thick layer of CDOT Class C filter material meeting the gradation in Table GS-2. Use of CDOT Class C Filter material with a slotted pipe that meets the slot dimensions provided in Table GS-3 will eliminate the need for geotextile fabrics. Previous versions of this manual detailed an underdrain system that consisted of a 3- to 4-inch perforated HDPE pipe in a one-foot trench section of AASHTO #67 coarse aggregate surrounded by geotextile fabric. If desired, this system continues to provide an acceptable alternative for use in grass swales. Selection of the pipe size may be a function of capacity or of maintenance equipment. Provide cleanouts at approximately 150 feet on center.

Table GS-2. Gradation Specifications for Class C Filter Material
(Source: CDOT Table 703-7)

Sieve Size	Mass Percent Passing Square Mesh Sieves
19.0 mm (3/4")	100
4.75 mm (No. 4)	60 – 100
300 µm (No. 50)	10 – 30
150 µm (No. 100)	0 – 10
75 µm (No. 200)	0 - 3

Table GS-3. Dimensions for Slotted Pipe

Pipe Diameter	Slot Length[1]	Maximum Slot Width	Slot Centers[1]	Open Area[1] (per foot)
4”	1-1/16”	0.032”	0.413”	1.90 in^2
6”	1-3/8”	0.032”	0.516”	1.98 in^2

[1] Some variation in these values is acceptable and is expected from various pipe manufacturers. Be aware that both increased slot length and decreased slot centers will be beneficial to hydraulics but detrimental to the structure of the pipe.

9. **Soil preparation:** Poor soil conditions often exist following site grading. When the section includes an underdrain, provide 4 inches of sandy loam at the invert of the swale extending up to the 2-year water surface elevation. This will improve infiltration and reduce ponding. For all sections, encourage establishment and long-term health of the bottom and side slope vegetation by properly preparing the soil. If the existing site provides a good layer of topsoil, this should be striped, stockpiled, and then replaced just prior to seeding or placing sod. If not available at the site, topsoil can be imported or the existing soil may be amended. Inexpensive soil tests can be performed following rough grading, to determine required soil amendments. Typically, 3 to 5 cubic yards of soil amendment per 1,000 square feet, tilled 4 to 6 inches into the soil is required in order for vegetation to thrive, as well as to enable infiltration of runoff.

10. **Irrigation:** Grass swales should be equipped with irrigation systems to promote establishment and survival in Colorado's semi-arid environment. Systems may be temporary or permanent, depending on the type of grass selected. Irrigation practices have a significant effect on the function of the grass swale. Overwatering decreases the permeability of the soil, reducing the infiltration capacity of the soil and contributing to nuisance baseflows. Conversely, under watering may result in delays in establishment of the vegetation in the short term and unhealthy vegetation that provides less filtering (straining) and increased susceptibility to erosion and riling over the long term.

Construction Considerations

Success of grass swales depends not only on a good design and maintenance, but also on construction practices that enable the BMP to function as designed. Construction considerations include:

- Perform fine grading, soil amendment, and seeding only after upgradient surfaces have been stabilized and utility work crossing the swale has been completed.
- Avoid compaction of soils to preserve infiltration capacities.
- Provide irrigation appropriate to the grass type.
- Weed the area during the establishment of vegetation by hand or mowing. Mechanical weed control is preferred over chemical weed killer.
- Protect the swale from other construction activities.
- When using an underdrain, ensure no filter sock is placed on the pipe. This is unnecessary and can cause the slots or perforations in the pipe to clog.

Photograph GS-2. This community used signage to mitigate compaction of soils post-construction. Photo courtesy of Nancy Styles.

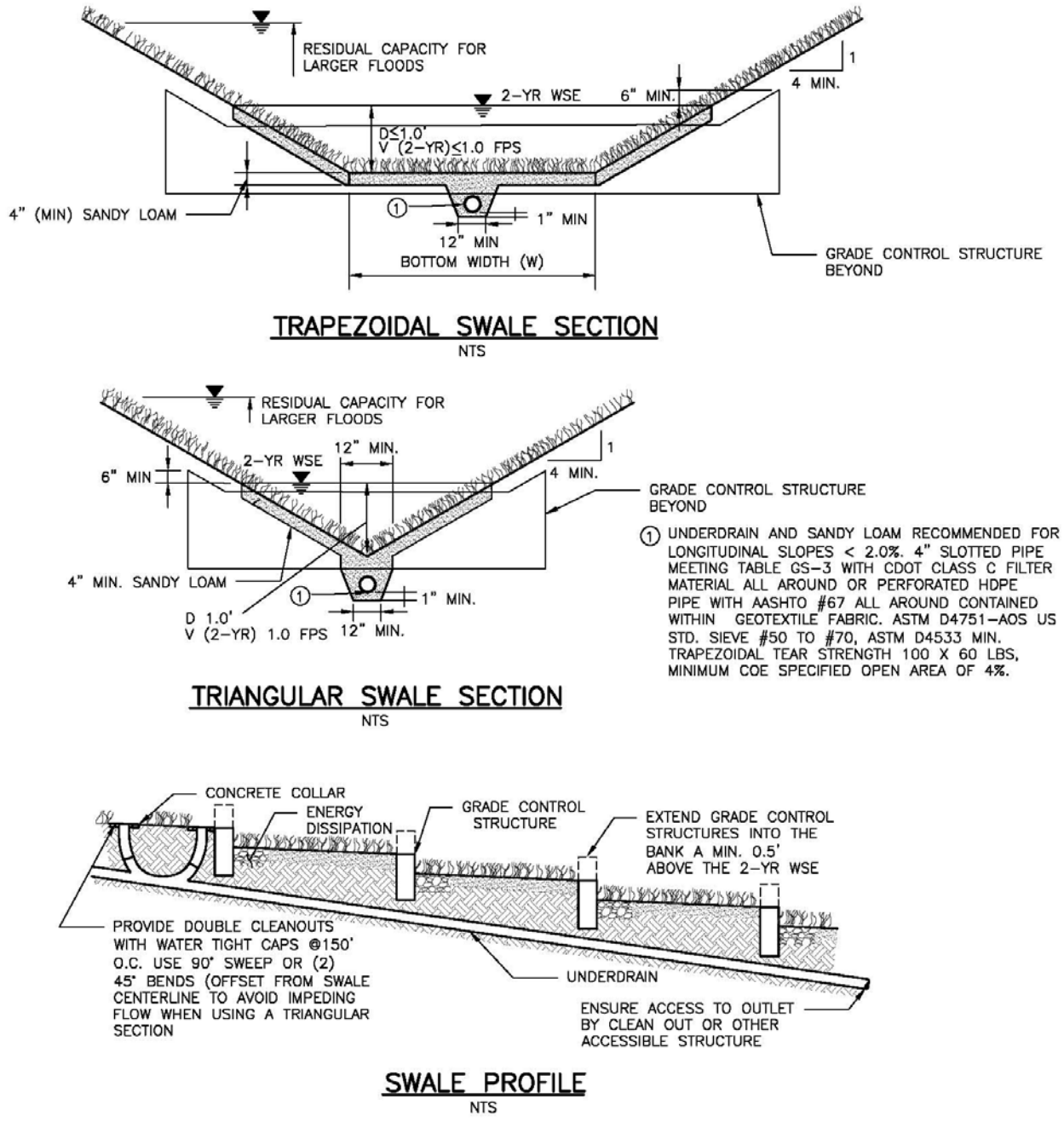


Figure GS-1. Grass Swale Profile and Sections

Design Example

The *UD-BMP* workbook, designed as a tool for both designer and reviewing agency is available at www.udfcd.org. This section provides a completed design form from this workbook as an example.

Design Procedure Form: Grass Swale (GS)

Sheet 1 of 1

Designer: M. Levine
Company: BMP Inc.
Date: November 24, 2010
Project: Filing 30
Location: Swale between north property line and 52nd Ave.

1. Design Discharge for 2-Year Return Period	Q_2 = 4.00 cfs
2. Hydraulic Residence Time	
A) : Length of Grass Swale	L_S = 400.0 ft
B) Calculated Residence Time (based on design velocity below)	T_{HR} = 6.7 minutes
3. Longitudinal Slope (vertical distance per unit horizontal)	
A) Available Slope (based on site constraints)	S_{avail} = 0.020 ft / ft
B) Design Slope	S_D = 0.010 ft / ft
4. Swale Geometry	
A) Channel Side Slopes (Z = 4 min., horiz. distance per unit vertical)	Z = 4.00 ft / ft
B) Bottom Width of Swale (enter 0 for triangular section)	W_B = 4.00 ft
5. Vegetation A) Type of Planting (seed vs. sod, affects vegetal retardance factor)	Choose One: ○ Grass From Seed ◉ Grass From Sod
6. Design Velocity (1 ft / s maximum)	V_2 = 1.00 ft / s
7. Design Flow Depth (1 foot maximum)	D_2 = 0.62 ft
A) Flow Area	A_2 = 4.0 sq ft
B) Top Width of Swale	W_T = 9.0 ft
C) Froude Number (0.50 maximum)	F = 0.26
D) Hydraulic Radius	R_H = 0.44
E) Velocity-Hydraulic Radius Product for Vegetal Retardance	VR = 0.44
F) Manning's n (based on SCS vegetal retardance curve D for sodded grass)	n = 0.088
G) Cumulative Height of Grade Control Structures Required	H_D = 4.00 ft
8. Underdrain (Is an underdrain necessary?)	Choose One: ◉ YES ○ NO — AN UNDERDRAIN IS REQUIRED IF THE DESIGN SLOPE < 2.0%
9. Soil Preparation (Describe soil amendment)	Till 5 CY of compost per 1000 SF to a depth of 6 inches.
10. Irrigation	Choose One: ◉ Temporary ○ Permanent

Notes:

References

Chow, Ven Te. 1959. *Open Channel Flow*. McGraw Hill: New York, NY.

Extended Detention Basin (EDB) T-5

Description

An extended detention basin (EDB) is a sedimentation basin designed to detain stormwater for many hours after storm runoff ends. This BMP is similar to a detention basin used for flood control, however; the EDB uses a much smaller outlet that extends the emptying time of the more frequently occurring runoff events to facilitate pollutant removal. The EDB's 40-hour drain time for the water quality capture volume (WQCV) is recommended to remove a significant portion of total suspended solids (TSS). Soluble pollutant removal is enhanced by providing a small wetland marsh or "micropool" at the outlet to promote biological uptake. The basins are sometimes called "dry ponds" because they are designed not to have a significant permanent pool of water remaining between storm runoff events.

Photograph EDB-1: This EDB includes a concrete trickle channel and a micropool with a concrete bottom and grouted boulder sideslopes. The vegetation growing in the sediment of the micropool adds to the natural look of this facility and ties into the surrounding landscape.

An extended detention basin can also be designed to provide Full Spectrum Detention. In this case, the EDB is sized for 100-year peak reduction and the excess urban runoff volume (EURV) is used instead of the WQCV. The EURV is designed with a drain time of approximately 72 hours. Widespread use of Full Spectrum Detention is anticipated to reduce impacts on major drainageways by reducing post-development peak discharges to better resemble pre-development peaks. Refer to the *Storage* chapter of Volume 2 for additional information on Full Spectrum Detention.

Extended Detention Basin	
Functions	
LID/Volume Red.	Somewhat
WQCV Capture	Yes
WQCV+Flood Control	Yes
Fact Sheet Includes EURV Guidance	Yes
Typical Effectiveness for Targeted Pollutants[3]	
Sediment/Solids	Good
Nutrients	Moderate
Total Metals	Moderate
Bacteria	Poor
Other Considerations	
Life-cycle Costs[4]	Moderate

[3] Based primarily on data from the International Stormwater BMP Database (www.bmpdatabase.org).

[4] Based primarily on BMP-REALCOST available at www.udfcd.org. Analysis based on a single installation (not based on the maximum recommended watershed tributary to each BMP).

Site Selection

EDBs are well suited for watersheds with at least five impervious acres up to approximately one square mile of watershed. Smaller watersheds can result in an orifice size prone to clogging. Larger watersheds and watersheds with baseflows can complicate the design and reduce the level of treatment provided. EBDs are also well suited where flood detention is incorporated into the same basin.

Use the WQCV (or the EURV) when designing an EDB only for water quality. Use the EURV when incorporating water quality into a flood control facility.

The depth of groundwater should be investigated. Groundwater depth should be 2 or more feet below the bottom of the basin in order to keep this area dry and maintainable.

Designing for Maintenance

Recommended maintenance practices for all BMPs are provided in the BMP Maintenance chapter of this manual. During design the following should be considered to ensure ease of maintenance over the long-term:

- Always provide a micropool (see step 7).
- Provide a design slope of at least 3% in the vegetated bottom of the basin (either toward the trickle channel or toward the micropool). This will help maintain the appearance of the turf grass in the bottom of the basin and reduce the possibility of saturated areas that may produce unwanted species of vegetation and mosquito breeding conditions. Verify slopes during construction, prior to vegetation.
- Follow trash rack sizing recommendations to determine the minimum area for the trash rack (see design step 9).
- Provide adequate initial surcharge volume for frequent inundation (see design step 3).
- Provide stabilized access to the forebay, outlet, spillway, and micropool for maintenance purposes.
- Provide access to the well screen. The well screen requires maintenance more often than any other EDB component. Ensure that the screen can be reached from a point outside of the micropool. When the well screen is located inside the outlet structure, provide an access port within the trash rack or use a sloped trash rack that consists of bearing bars (not horizontal) that are 6 inches on center.
- Provide a hard-bottom forebay that allows for removal of sediment.
- Where baseflows are anticipated, consider providing a flow-measuring device (e.g. weir or flume with staff gage and rating curve) at the forebay to assist with future modifications of the water quality plate. Typically, the baseflow will increase as the watershed develops. It is important that the water quality plate continue to function, passing the baseflow while draining the WQCV over approximately 40 hours. Measuring the actual baseflow can be helpful in determining if and when the orifice place should be replaced.

EDBs providing combined water quality and flood control functions can serve multiple uses such as playing fields or picnic areas. These uses are best located at higher elevation within the basin, above the WQCV pool level.

Benefits

- The relatively simple design can make EDBs less expensive to construct than other BMPs, especially for larger basins.
- Maintenance requirements are straightforward.
- The facility can be designed for multiple uses.

Limitations

- Ponding time and depths may generate safety concerns.
- Best suited for tributary areas of 5 impervious acres or more. EDBs are not recommended for sites less than 2 impervious acres.
- Although ponds do not require more total area compared to other BMPs, they typically require a relatively large continuous area.

Design Procedure and Criteria

The following steps outline the design procedure and criteria for an EDB:

1. **Basin Storage Volume**: Provide a design volume equal to 120% of the WQCV or 100% of the EURV. This volume begins at the lowest orifice in the outlet structure. The additional 20% for the WQCV is for sediment accumulation and the resultant loss in storage volume. Additional volume for sediment storage is not necessary when designing for the EURV, as the water quality perforations extend above the depth of the WQCV.

   - Determine the imperviousness of the watershed (or effective imperviousness where LID elements are used upstream).

   - Find the required storage volume. Determine the required WQCV or EURV (watershed inches of runoff) using Figure 3-2 located in Chapter 3 of this manual (for WQCV) or equations provided in the *Storage* chapter of Volume 2 (for EURV).

   - Calculate the design volume as follows:

     For WQCV:

     $$V = \left[\frac{\text{WQCV}}{12}\right] 1.2\, A$$ Equation EDB-1

     For EURV:

     $$V = \left[\frac{\text{EURV}}{12}\right] A$$ Equation EDB-2

     Where:

     V = design volume (acre ft)

     A = watershed area tributary to the extended detention basin (acres)

     1.2 factor = multiplier to accommodate sediment accumulation

2. **Basin Shape**: Always maximize the distance between the inlet and the outlet. It is best to have a basin length (measured along the flow path from inlet to outlet) to width ratio of at least 2:1. A longer flow path from inlet to outlet will minimize short circuiting and improve reduction of TSS. To achieve this ratio, it may be necessary to modify the inlet and outlet points through the use of pipes or swales.

3. **Basin Side Slopes**: Basin side slopes should be stable and gentle to facilitate maintenance and access. Slopes that are 4:1or flatter should be used to allow for conventional maintenance equipment and for improved safety, maintenance, and aesthetics. Side slopes should be no steeper than 3:1. The use of walls is highly discouraged due to maintenance constraints.

4. **Inlet**: Dissipate flow energy at concentrated points of inflow. This will limit erosion and promote particle sedimentation. Inlets should be designed in accordance with UDFCD drop structure criteria

for inlets above the invert of the forebay, impact basin outlet details for at grade inlets, or other types of energy dissipating structures.

5. **Forebay Design**: The forebay provides an opportunity for larger particles to settle out in an area that can be easily maintained. The length of the flow path through the forebay should be maximized, and the slope minimized to encourage settling. The appropriate size of the forebay may be as much a function of the level of development in the tributary area as it is a percentage of the WQCV. When portions of the watershed may remain disturbed for an extended period of time, the forebay size will need to be increased due to the potentially high sediment load. Refer to Table EDB-4 for a design criteria summary. When using this table, the designer should consider increasing the size of the forebay if the watershed is not fully developed.

   The forebay outlet should be sized to release 2% of the undetained peak 100-year discharge. A soil riprap berm with 3:1 sideslopes (or flatter) and a pipe outlet or a concrete wall with a notch outlet should be constructed between the forebay and the main EDB. It is recommended that the berm/pipe configuration be reserved for watersheds in excess of 20 impervious acres to accommodate the minimum recommended pipe diameter of 8 inches. When using the berm/pipe configuration, round up to the nearest standard pipe size and use a minimum diameter of 8 inches. The floor of the forebay should be concrete or lined with grouted boulders to define sediment removal limits. With either configuration, soil riprap should also be provided on the downstream side of the forebay berm or wall if the downstream grade is lower than the top of the berm or wall. The forebay will overtop frequently so this protection is necessary for erosion control. All soil riprap in the area of the forebay should be seeded and erosion control fabric should be placed to retain the seed in this high flow area.

6. **Trickle Channel:** Convey low flows from the forebay to the micropool with a trickle channel. The trickle channel should have a minimum flow capacity equal to the maximum release from the forebay outlet.

   - **Concrete Trickle Channels:** A concrete trickle channel will help to establish the bottom of the basin long-term and may also facilitate regular sediment removal. It can be a "V" shaped concrete drain pan or a concrete channel with curbs. A flat-bottom channel facilitates maintenance. A slope between 0.4% - 1% is recommended to encourage settling while reducing the potential for low points within the pan.

   - **Soft-bottom Trickle Channels**: When designed and maintained properly, soft-bottom trickle channels can allow for an attractive alternative to concrete. They can also improve water quality. However, they are not appropriate for all sites. Be aware, maintenance of soft bottom trickle channels requires mechanical removal of sediment and vegetation. Additionally, this option provides mosquito habitat. For this reason, UDFCD recommends that they be considered on a case-by-case basis and with the approval of the local jurisdiction. It is recommended that soft bottom trickle channels be designed with a consistent longitudinal slope from forebay to micropool and that they not meander. This geometry will allow for reconstruction of the original design when sediment removal in the trickle channel is necessary. The trickle channel may also be located along the toe of the slope if a straight channel is not desired. The recommended minimum depth of a soft bottom trickle channel is 1.5 feet. This depth will help limit potential wetland growth to the trickle channel, preserving the bottom of the basin.

     Riprap and soil riprap lined trickle channels are not recommended due to past maintenance experiences, where the riprap was inadvertently removed along with the sediment during maintenance.

7. **Micropool and Outlet Structure**: Locate the outlet structure in the embankment of the EDB and provide a permanent micropool directly in front of the structure. Submerge the well screen to the bottom of the micropool. This will reduce clogging of the well screen because it allows water to flow though the well screen below the elevation of the lowest orifice even when the screen above the water surface is plugged. This will prevent shallow ponding in front of the structure, which provides a breeding ground for mosquitoes (large shallow puddles tend to produce more mosquitoes than a smaller, deeper permanent pond).

   Basins with micropools have fewer mosquitoes. Micropools reduce shallow wet areas where breeding is most favorable .

   Micropool side slopes may be vertical walls or stabilized slopes of 3:1 (horizontal:vertical). For watersheds with less than 5 impervious acres, the micropool can be located inside the outlet structure (refer to Figures OS-7 and OS-8 provided in Fact Sheet T-12). The micropool should be at least 2.5 feet in depth with a minimum surface area of 10 square feet. The bottom should be concrete unless a baseflow is present or anticipated or if groundwater is anticipated. Riprap is not recommended because it is often inadvertently removed during maintenance operations.

   Where possible, place the outlet in an inconspicuous location as shown in Photo EDB-3. This urban EDB utilizes landscaped parking lot islands connected by a series of culverts (shown in Photo EDB-4) to provide the required water quality and flood control volumes.

   The outlet should be designed to release the WQCV over a 40-hour period. This can be done through an orifice plate as detailed in BMP Fact Sheet T-12. Use reservoir routing calculations as discussed in the *Storage* Chapter of Volume 2 or use equation EDB-3, a simplified orifice sizing equation (see Technical Memorandum dated July 13, 2010 available at www.udfcd.org).

$$A_O = \frac{88V^{(0.95/H^{0.085})}}{T_D\, S^{0.09}\, H^{(2.6S^{0.3})}}$$ Equation EDB-3

   Where:

   A_O = area per row of orifices spaced on 4" centers (in^2)
   V = design volume (WQCV or EURV, acre ft)
   T_D = time to drain the prescribed volume (hrs)
   (i.e., 40 hours for WQCV or 72 hours for EURV)
   H = depth of volume (ft)
   S = slope (ft/ft)

   Refer to BMP Fact Sheet T-12 for schematics pertaining to structure geometry, grates, trash racks, orifice plate, and all other necessary components.

Additional Guidelines for Incorporating Flood Control:

When designing for flood control using Full Spectrum Detention, the outlet is typically designed to drain the EURV in 72 hours. However, the owner may want to modify the design (reduce the EURV drain time) for a number of reasons including wanting to provide larger orifices for maintenance purposes or, when designing BMPs in series, to ensure that the maximum detention time for the system does not exceed 72 hours. Modifications can be permitted as long as the outlet drains the WQCV (not the EURV) over a period of at least 40 hours. The *UD-BMP* workbook can be used to ensure this condition is met while adjusting the drain time for the EURV.

When using Full Spectrum Detention a separate 5- or 10-year orifice or weir is not necessary. In order to best replicate historic release rates, design the outlet structure to overtop at the EURV elevation. The velocity of flows into the structure at the 100-year peak discharge should not exceed a velocity of 2 feet per second. This criterion is a safety precaution, limiting the risk of pinning. Use the continuity equation to ensure this criterion:

$$V = \frac{Q_{100}}{A} \leq 2$$ Equation EDB-4

Where:

V = velocity of flow through the trash rack (ft/s)
Q_{100} = peak discharge through the outlet structure (cfs)
A = open area of the trash rack (ft^2)

The outlet may have flared or parallel wing walls as shown in Figures EDB-1 and EDB-2, respectively. Either configuration should be recessed into the embankment to minimize its profile. Additionally, the trash rack should be sloped with the basin side-slopes.

8. **Initial Surcharge Volume**: Providing a surcharge volume above the micropool for frequently occurring runoff minimizes standing water and sediment deposition in the remainder of the basin. This is critical to turf maintenance and mosquito abatement in the basin bottom. The initial surcharge volume is not provided in the micropool nor does it include the micropool volume. It is the available storage volume that begins at the water surface elevation of the micropool and extends upward to a grade break within the basin (typically the invert of the trickle channel).

Photograph EDB-2. The initial surcharge volume of this EDB is contained within the boulders that surround the micropool.

The area of the initial surcharge volume, when full, is typically the same or slightly larger than that of the micropool. The initial surcharge volume should have a depth of at least 4 inches. For watersheds of at least 5 impervious acres, the initial surcharge volume should also be at least 0.3% of the WQCV. The initial surcharge volume is considered a part of the WQCV and does not need to be provided in addition to the WQCV. It is recommended that this area be shown on the grading plan or in a profile for the EDB. When baseflows are anticipated, it is recommended that the initial surcharge volume be increased. See the inset on page EDB-9 for additional guidelines for designing for baseflows.

9. **Trash Rack**: Provide a trash rack (or screen) of sufficient size at the outlet to provide hydraulic capacity while the rack is partially clogged. Openings should be small enough to limit clogging of the individual orifices. For this reason, it is recommended that a well screen be used when circular orifices are used. Size any overflow trash rack so it does not interfere with the hydraulic capacity of the outlet pipe. See BMP Fact Sheet T-12 for detailed trash rack design guidance.

Photograph EDB-3. Although walls may complicate maintenance access, this outlet structure is relatively hidden from public view. This photo was taken shortly following a storm event.

Photograph EDB-4. A series of landscape islands connected by culverts provide water quality and flood control for this site.

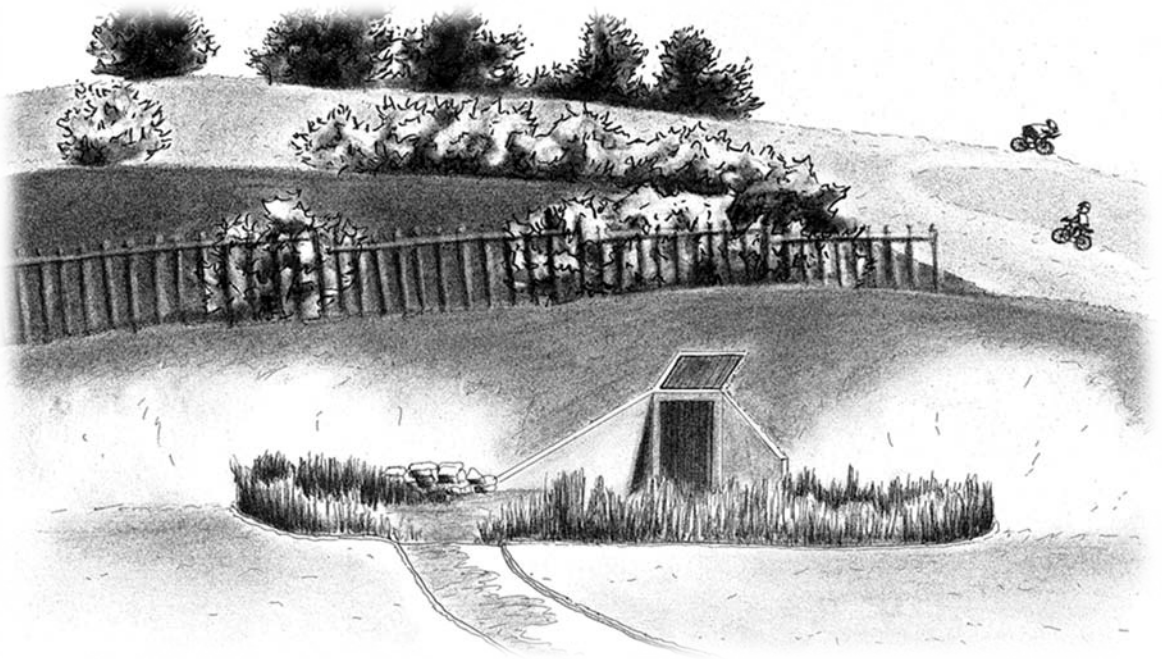


Figure EDB-1. Flared Wall Outlet Structure Configuration. Graphic by Adia Davis.

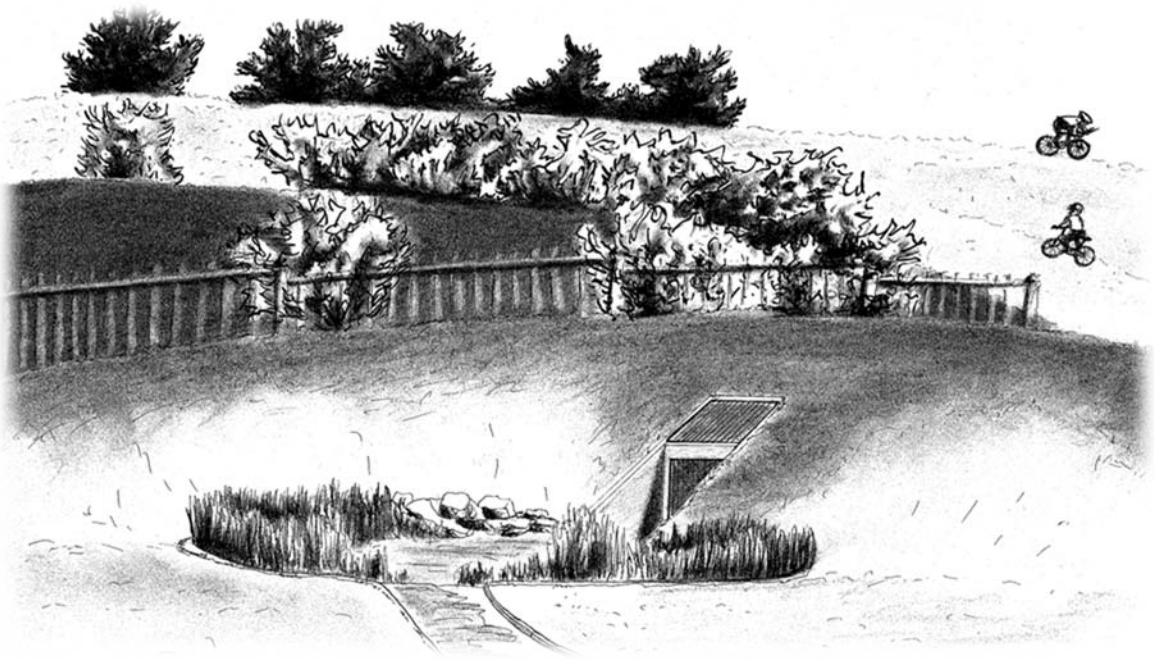


Figure EDB-2. Parallel Wall Outlet Structure Configuration. Graphic by Adia Davis.

10. **Overflow Embankment:** Design the embankment to withstand the 100-year storm at a minimum. If the embankment falls under the jurisdiction of the State Engineer's Office, it must be designed to meet the requirements of the State Engineer's Office. The overflow should be located at a point where waters can best be conveyed downstream. Slopes that are 4:1 or flatter should be used to allow for conventional maintenance equipment and for improved safety, maintenance, and aesthetics. Side slopes should be no steeper than 3:1 and should be planted with turf forming grasses. Poorly compacted native soils should be excavated and replaced. Embankment soils should be compacted to 95% of maximum dry density for ASTM D698 (Standard Proctor) or 90% for ASTM D1557 (Modified Proctor). Spillway structures and overflows should be designed in accordance with the *Storage* Chapter of Volume 2 as well as any local drainage criteria. Buried soil riprap or reinforced turf mats installed per manufacturer's recommendations can provide an attractive and less expensive alternative to concrete.

11. **Vegetation:** Vegetation provides erosion control and sediment entrapment. Basin bottom, berms, and side slopes should be planted with turf grass, which is a general term for any grasses that will form a turf or mat, as opposed to bunch grass which will grow in clumplike fashion. Xeric grasses with temporary irrigation are recommended to reduce maintenance requirements, including maintenance of the irrigation system as well as frequency of mowing. Where possible, place irrigation heads outside the basin bottom because irrigation heads in an EDB can become buried with sediment over time.

12. **Access:** Provide appropriate maintenance access to the forebay and outlet works. For larger basins, this means stabilized access for maintenance vehicles. If stabilized access is not provided, the maintenance plan should provide detail, including recommended equipment, on how sediment and trash will be removed from the outlet structure and micropool. Some communities may require vehicle access to the bottom of the basin regardless of the size of the watershed. Grades

Designing for Baseflows

Baseflows should be anticipated for large tributary areas and can be accommodated in a variety of ways. Consider the following:

- If water rights are available, consider alternate BMPs such as a constructed wetland pond or retention pond.
- Anticipate future modifications to the outlet structure. Following construction, baseflows should be monitored periodically. Intermittent flows can become perennial and perennial flows can increase over time. It may be determined that outlet modifications are necessary long after construction of the BMP is complete.
- Design foundation drains and other groundwater drains to bypass the water quality plate directing these drains to a conveyance element downstream of the EDB. This will reduce baseflows and help preserve storage for the WQCV.
- When the basin is fully developed and an existing baseflow can be approximated prior to design, the water quality orifices should be increased to drain the WQCV in 40 hours (or EURV in 72 hours) while also draining the baseflow. This requires reservoir routing using an inflow hydrograph that includes the baseflow. The *UD-Detention* workbook available at www.udfcd.org may be used for this purpose.
- Increase the initial surcharge volume of the pond to provide some flexibility when baseflows are known or anticipated. Baseflows are difficult to approximate and will continue to increase as the watershed develops. Increasing the initial surcharge volume will accommodate a broader range of flows.

should not exceed 10% for haul road surfaces and 20% for skid-loader and backhoe access. Stabilized access includes gravel, concrete, articulated concrete block, concrete grid pavement, or reinforced grass pavement. The recommended cross slope is 2%.

Aesthetic Design

Since all land owners and managers wish to use land in the most efficient manner possible, it is important that EDBs become part of a multi-use system. This encourages the design of EDBs as an aesthetic part of a naturalized environment or to include passive and/or active open space. Within each scenario, the EDB can begin to define itself as more than just a drainage facility. When this happens, the basin becomes a public amenity. This combination of public amenity and drainage facility is of much greater value to a landowner. Softened and varied slopes, interspersed irrigated fields, planting areas and wetlands can all be part of an EDB.

The design should be aesthetic whether it is considered to be an architectural or naturalized basin. Architectural basins incorporate design borrowed or reflective of the surrounding architecture or urban forms. An architectural basin is intended to appear as part of the built environment, rather than hiding the cues that identify it as a stormwater structure. A naturalized basin is designed to appear as though it is a natural part of the landscape. This section provides suggestions for designing a naturalized basin. The built environment, in contrast to the natural environment, does not typically contain the randomness of form inherent in nature. Constructed slopes typically remain consistent, as do slope transitions. Even dissipation structures are usually a hard form and have edges seldom seen in nature. If the EDB is to appear as though it is a natural part of the landscape, it is important to minimize shapes that provide visual cues indicating the presence of a drainage structure. For example, the side sides should be shaped more naturally and with varying slopes for a naturalized basin.

Suggested Methods for a Naturalized Basin

- Create a flowing form that looks like it was shaped by water.
- Extend one side of the basin higher than the other. This may require a berm.
- Shape the bottom of the basin differently than the top.
- Slope of one side of the basin more mildly than the opposing side.
- Vary slope transitions both at the top of the bank and at the toe.
- Use a soft-surface trickle channel if appropriate and approved.
- When using rock for energy dissipation, the rock should graduate away from the area of hard edge into the surrounding landscape. Other non-functional matching rock should occur in other areas of the basin to prevent the actual energy dissipation from appearing out of context.
- Design ground cover to reflect the type of water regime expected for their location within the basin.

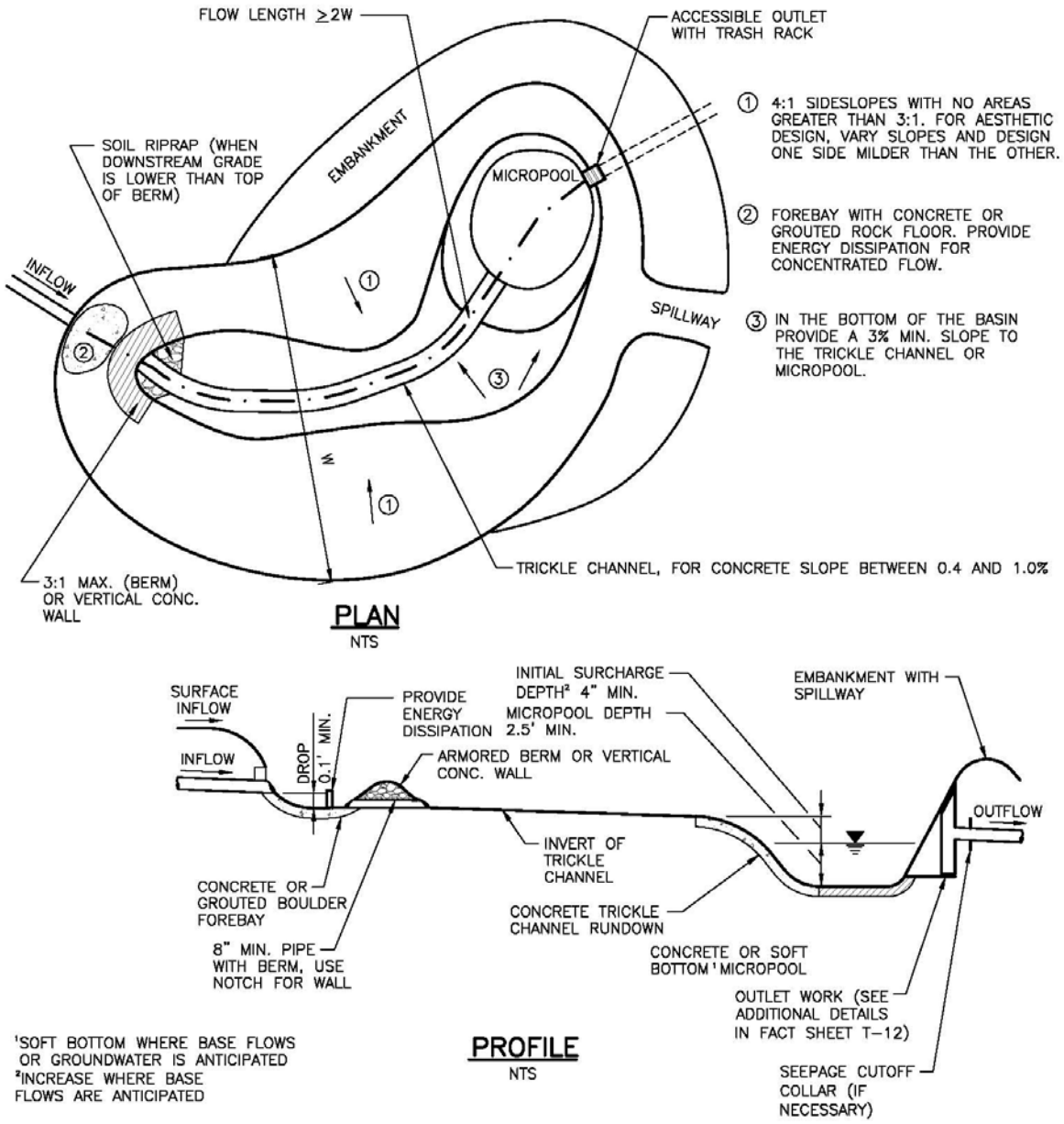


Figure EDB-3. Extended Detention Basin (EDB) Plan and Profile

Additional Details are provided in BMP Fact Sheet T-12. This includes outlet structure details including orifice plates and trash racks.

Table EDB-4. EDB Component Criteria

	On-Site EDBs for Watersheds up to 1 Impervious Acre[1]	EDBs with Watersheds up to 2 Impervious Acres[1]	EDBs with Watersheds up to 5 Impervious Acres	EDBs with Watersheds over 5 Impervious Acres	EDBs with Watersheds over 20 Impervious Acres
Forebay Release and Configuration	A forebay and trickle channel may not be necessary for this size site. Specific site operations should be considered to determine if a forebay will serve to reduce the maintenance requirements.	Release 2% of the undetained 100-year peak discharge by way of a wall/notch configuration	Release 2% of the undetained 100-year peak discharge by way of a wall/notch configuration	Release 2% of the undetained 100-year peak discharge by way of a wall/notch configuration	Release 2% of the undetained 100-year peak discharge by way of a wall/notch or berm/pipe[2] configuration
Minimum Forebay Volume		1% of the WQCV	2% of the WQCV	3% of the WQCV	3% of the WQCV
Maximum Forebay Depth		12 inches	18 inches	18 inches	30 inches
Trickle Channel Capacity		≥ the maximum possible forebay outlet capacity	≥ the maximum possible forebay outlet capacity	≥ the maximum possible forebay outlet capacity	≥ the maximum possible forebay outlet capacity
Micropool	Area ≥ 10 ft^2	Area ≥ 10 ft^2	Area ≥ 10 ft^2	Area ≥ 10 ft^2	Area ≥ 10 ft^2
Initial Surcharge Volume	Depth ≥ 4 inches	Depth ≥ 4 inches	Depth ≥ 4 inches	Depth ≥ 4 in. Volume ≥ 0.3% WQCV	Depth ≥ 4 in. Volume ≥ 0.3% WQCV

[1] EDBs are not recommended for sites with less than 2 impervious acres. Consider a sand filter or rain garden.

[2] Round up to the first standard pipe size (minimum 8 inches).

Design Example

The *UD-BMP* workbook, designed as a tool for both designer and reviewing agency is available at www.udfcd.org. This section provides a completed design form from this workbook as an example.

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 1 of 4

Designer:	**H. Dauel**
Company:	**BMP, Inc.**
Date:	**November 29, 2010**
Project:	**Subdivison D**
Location:	**NE Corner of 34th Ave. and 83rd St.**

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 75.0 %
B) Tributary Area's Imperviousness Ratio (i = I_a / 100)	i = 0.750
C) Contributing Watershed Area	Area = 17.000 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: ○ Water Quality Capture Volume (WQCV) ◉ Excess Urban Runoff Volume (EURV)
F) Design Volume (1.2 WQCV) Based on 40-hour Drain Time (V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area * 1.2)	V_{DESIGN}= 0.509 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER}$ = (d_6*(V_{DESIGN}/0.43))	$V_{DESIGN\ OTHER}$= ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One: ○ A ○ B ◉ C / D
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: EURVA = (0.1878i - 0.0104)*Area For HSG B: $EURV_B$ = (0.1178i - 0.0042)*Area For HSG C/D: $EURV_{C/D}$ = (0.1043i - 0.0031)*Area	EURV = 1.277 ac-f t
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes	
A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet	
A) Describe means of providing energy dissipation at concentrated inflow locations:	Based on UDFCD detail for modified impact stilling basin for conduits 18 to 48 inches.

Design Procedure Form: Extended Detention Basin (EDB)

Designer:	**H. Dauel**
Company:	**BMP, Inc.**
Date:	**November 29, 2010**
Project:	**Subdivison D**
Location:	**NE Corner of 34th Ave. and 83rd St.**

5. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.013 ac-ft
B) Actual Forebay Volume	V_F = 0.015 ac-ft
C) Forebay Depth (D_F = 18 inch maximum)	D_F = 12.0 in
D) Forebay Discharge	
i) Undetained 100-year Peak Discharge	Q_{100} = 50.00 cfs
ii) Forebay Discharge Design Flow ($Q_F = 0.02 * Q_{100}$)	Q_F = 1.00 cfs
E) Forebay Discharge Design	Choose One: ○ Berm With Pipe ◉ Wall with Rect. Notch ○ Wall with V-Notch Weir (flow too small for berm w/ pipe)
F) Discharge Pipe Size (minimum 8-inches)	Calculated D_P = in
G) Rectangular Notch Width	Calculated W_N = 6.0 in
6. Trickle Channel	
A) Type of Trickle Channel	Choose One: ◉ Concrete ○ Soft Bottom
F) Slope of Trickle Channel	S = 0.0100 ft / ft
7. Micropool and Outlet Structure	
A) Depth of Micropool (2.5-feet minimum)	D_M = 2.5 ft
B) Surface Area of Micropool (10 ft² minimum)	A_M = 125 sq ft
C) Outlet Type	Choose One: ◉ Orifice Plate ○ Other (Describe):
D) Depth of Design Volume (EURV or 1.2 WQCV) Based on the Design Concept Chosen Under 1.E.	H = 2.30 feet
E) Volume to Drain Over Prescribed Time	EURV = 1.277 ac-ft
F) Drain Time (Min T_D for WQCV= 40 hours; Max T_D for EURV= 72 hours)	T_D = 72 hours
G) Recommended Maximum Outlet Area per Row, (A_o)	A_o = 1.3 square inches
H) Orifice Dimensions: i) Circular Orifice Diameter or	$D_{orifice}$ = 1 - 5 / 16 inch inches
ii) Width of 2" High Rectangular Orifice	$W_{orifice}$ = inches
I) Number of Columns	n_c = 1 number
J) Actual Design Outlet Area per Row (A_o)	A_o = 1.4 square inches
K) Number of Rows (nr)	n_r = 6 number
L) Total Outlet Area (A_{ot})	A_{ot} = 9.3 square inches
M) Depth of WQCV (H_{WQCV}) (Estimate using actual stage-area-volume relationship and V_{WQCV})	H_{WQCV} = 0.8 feet
N) Ensure Minimum 40 Hour Drain Time for WQCV	$T_{D\ WQCV}$ = 49.7 hours

Design Procedure Form: Extended Detention Basin (EDB)

Sheet 3 of 4

Designer:	**H. Dauel**
Company:	**BMP, Inc.**
Date:	**November 29, 2010**
Project:	**Subdivison D**
Location:	**NE Corner of 34th Ave. and 83rd St.**

8. Initial Surcharge Volume

A) Depth of Initial Surcharge Volume (Minimum recommended depth is 4 inches): D_{IS} = 6.0 in

B) Minimum Initial Surcharge Volume (Minimum volume of 0.3% of the WQCV): V_{IS} = 55.5 cu ft

C) Initial Surcharge Provided Above Micropool: V_s = 62.5 cu ft

9. Trash Rack

A) Type of Water Quality Orifice Used

Choose One
- (●) Circular (up to 2" diameter)
- ( ) Rectangular (2" high)

B) Water Quality Screen Open Area: $A_t = 38.5*(e^{-0.095D})*A_{ot}$: A_t = 317 square inches

C) For 2", or Smaller, **Circular Opening** (See Fact Sheet T-12):

i) Width of Water Quality Screen and Concrete Opening ($W_{opening}$): $W_{opening}$ = 12.0 inches

ii) Height of Water Quality Screen (H_{TR}): H_{TR} = 55.6 inches

iii) Type of Screen, Describe if "Other"

Choose One
- (●) S.S. Well Screen with 60% Open Area*
- ( ) Other (Describe):

D) For 2" High **Rectangular Opening**:

i) Width of Rectangular Opening ($W_{orifice}$): W = inches

ii) Width of Water Quality Screen Opening ($W_{opening}$): $W_{opening}$ = ft

iii) Height of Water Quality Screen (H_{TR}): H_{TR} = ft

iv) Type of Screen, Describe if "Other"

Choose One
- ( ) Aluminum Amico-Klemp SR Series (or equal)
- ( ) Other (Describe):

v) Cross-bar Spacing: inches

vi) Minimum Bearing Bar Size

Design Procedure Form: Extended Detention Basin (EDB)

Designer: H. Dauel
Company: BMP, Inc.
Date: November 29, 2010
Project: Subdivison D
Location: NE Corner of 34th Ave. and 83rd St.

10. Overflow Embankment	
A) Describe embankment protection for 100-year and greater overtopping:	Buried soil riprap at SE corner. Overflow is 12 feet wide and 12 inches lower than the surrounding embankment. Undetained peak velociies are less than 5 fps.
B) Slope of Overflow Embankment (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z_E = 4.00 ft / ft
11. Vegetation	Choose One: ○ Irrigated ◉ Not Irrigated
12. Access	
A) Describe Sediment Removal Procedures	Aggregate turf pavement access at SE corner of basin allows access to the bottom of the basin for all standard maintenance.

Notes:

Retention Pond T-7

Description

Photograph RP-1. Retention ponds treat stormwater though sedimentation and biological processes including uptake.

A retention pond, sometimes called a "wet pond," has a permanent pool of water with capacity above the permanent pool designed to capture and slowly release the water quality capture volume (WQCV) over 12 hours. The permanent pool is replaced, in part, with stormwater during each runoff event so stormwater runoff mixes with the permanent pool water. This allows for a reduced residence time compared to that of the extended detention basin (EDB). The 12-hour drain time helps to both better replicate pre-development flows for frequent events and reduce the potential for short circuiting treatment in smaller ponds. Retention ponds can be very effective in removing suspended solids, organic matter and metals through sedimentation, as well as removing soluble pollutants like dissolved metals and nutrients through biological processes.

Retention ponds can also be designed to provide Full Spectrum Detention. Widespread use of full spectrum detention is anticipated to reduce impacts on major drainageways by reducing post-development peak discharges to better resemble pre-development peaks.

Retention	
Functions	
LID/Volume Red.	Somewhat
WQCV Capture	Yes
WQCV+Flood Control	Yes
Fact Sheet Includes EURV Guidance	Yes
Typical Effectiveness for Targeted Pollutants[3]	
Sediment/Solids	Very Good
Nutrients	Moderate
Total Metals	Moderate
Bacteria	Moderate
Other Considerations	
Life-cycle Costs[4]	Moderate

[3] Based primarily on data from the International Stormwater BMP Database (www.bmpdatabase.org).

[4] Based primarily on BMP-REALCOST available at www.udfcd.org. Analysis is based on a single installation (not based on the maximum recommended watershed tributary to each BMP).

Site Selection

Retention ponds require groundwater or a dry-weather base flow if the permanent pool elevation is to be maintained year-round. They also require legal and physical use of water. In Colorado, the availability of this BMP can be limited due to water rights issues.

The designer should consider the overall water budget to ensure that the baseflow will exceed evaporation, evapotranspiration, and seepage losses (unless the pond is lined). High exfiltration rates can initially make it difficult to maintain a permanent pool in a new pond, but the bottom can eventually seal with fine sediment and become relatively impermeable over time. However, it is best to seal the bottom and the sides of a permanent pool if the pool is located on permeable soils and to leave the areas above the permanent pool unsealed to promote infiltration of the stormwater detained in the surcharge WQCV.

Studies show that retention ponds can cause an increase in temperature from influent to effluent. Retention ponds are discouraged upstream of receiving waters that are sensitive to increases in temperature (e.g., fish spawning or hatchery areas).

Use caution when placing this BMP in a basin where development will not be completed for an extended period, or where the potential for a chemical spill is higher than typical. When these conditions exists, it is critical to provide adequate containment and/or pretreatment of flows. In developing watersheds, frequent maintenance of the forebay may be necessary.

Designing for Maintenance

Recommended ongoing maintenance practices for all BMPs are provided in Chapter 6 of this manual. During design, the following should be considered to ensure ease of maintenance over the long-term.

- Provide pretreatment upstream of the permanent pool.
- Provide maintenance access to the outlet structure as well as the forebay.
- Exceed the minimum criterion for the permanent pool volume. Greater depth will help deter algae growth by reducing temperature and the area of the pond bottom that receives sunlight.

Design Procedure and Criteria

The following steps outline the retention pond design procedure and criteria, and Figure RP-1 shows a typical configuration.

Benefits

- Creates wildlife and aquatic habitat.
- Provides recreation, aesthetics, and open space opportunities.
- Can increase adjacent property values.
- Cost-effective BMP for larger tributary watersheds.

Limitations

- Safety concerns associated with open water.
- Requires both physical supply of water and a legal availability (in Colorado) to impound water.
- Sediment, floating litter, and algae blooms can be difficult to remove or control.
- Ponds can attract water fowl which can add to the nutrients and bacteria leaving the pond.
- Ponds increase water temperature.

1. **Baseflow**: Unless the permanent pool is establish by groundwater, a perennial baseflow that exceeds losses must be physically and legally available. Net influx calculations should be conservative to account for significant annual variations in hydrologic conditions. Low inflow in relation to the pond volume can result in poor water quality. Losses include evaporation, evapotranspiration, and seepage. Evaporation can be estimated from existing local studies or from the National Weather Service (NWS) Climate Prediction website. Data collected from Chatfield Reservoir from 1990 to 1997 show an average annual evaporation of 37 inches, while the NWS shows approximately 40 inches of evaporation per year in the Denver metropolitan area. Potential evapotranspiration (which occurs when water supply to both plant and soil surface is unlimited) is approximately equal to the evaporation from a large, free-water surface such as a lake (Bedient and Huber, 1992). When retention ponds are placed above the groundwater elevation, a pond liner is recommended unless evaluation by a geotechnical engineer determines this to be unnecessary.

2. **Surcharge Volume**: Provide a surcharge volume based on a 12-hour drain time.

   - Determine the imperviousness of the watershed (or effective imperviousness where LID elements are used upstream).
   - Find the required storage volume. Determine the required WQCV or EURV (watershed inches of runoff) using Figure 3-2 located in Chapter 3 of this manual (for WQCV) or equations provided in the *Storage* chapter of Volume 2 (for EURV).
   - Calculate the design volume (surcharge volume above the permanent pool) as follows:

     For WQCV:

     $$V = \left[\frac{\text{WQCV}}{12}\right] A \qquad \text{Equation RP-1}$$

     For EURV:

     $$V = \left[\frac{\text{EURV}}{12}\right] A \qquad \text{Equation RP-2}$$

     Where:

     V = design volume (acre ft)

     A = tributary catchment drainage area (acres)

3. **Basin Shape:** Always maximize the distance between the inlet and the outlet. A basin length to width ratio between 2:1 and 3:1 is recommended to avoid short-circuiting. It may be necessary to modify the inlet and outlet locations through the use of pipes, swales, or channels to accomplish this.

4. **Permanent Pool**: The permanent pool provides stormwater quality enhancement between storm runoff events through biochemical processes and continuing sedimentation.

   - Volume of the permanent pool:

     $$V_p \geq 1.2 \left[\frac{\text{WQCV}}{12}\right] A \qquad \text{Equation RP-3}$$

     Where:

     V_p = permanent pool volume (acre ft)

     A = tributary catchment drainage area (acres)

- Depth Zones: The permanent pool should have two zones:

  - Safety Wetland Bench: This area should be located along the perimeter of the pond, 6 to 12 inches deep and a minimum of 4 feet wide. Aquatic plant growth along the perimeter of the permanent pool can help strain surface flow into the pond, protect the banks by stabilizing the soil at the edge of the pond, and provide biological uptake. The safety wetland bench is also constructed as a safety precaution. It provides a shallow area that allows people or animals who inadvertently enter the open water to gain footing to get out of the pond.

  - Open Water Zone: The remaining pond area should be open, providing a volume to promote sedimentation and nutrient uptake by phytoplankton. To avoid anoxic conditions, the maximum depth in the pool should not exceed 12 feet.

5. **Side Slopes**: Side slopes should be stable and sufficiently gentle to limit rill erosion and to facilitate maintenance. Side slopes above the safety wetland bench should be no steeper than 4:1, preferably flatter. The safety wetland bench should be relatively flat with the depth between 6 to 12 inches. The side slope below this bench should be 3:1 (or flatter when access is required or when the surface could be slippery). The steeper 3:1 slope below the safety wetland bench can be beneficial to deterring algae growth as it will reduce the shallow area of the pond, thus reducing the amount of sunlight that penetrates the pond bottom.

6. **Inlet**: Dissipate energy at the inlet to limit erosion and to diffuse the inflow plume. Inlets should be designed in accordance with the *Hydraulic Structures* chapter of Volume 2. This chapter includes design of impact basins and drop structures.

7. **Forebay**: Forebays provide an opportunity for larger particles to settle out, which will reduce the required frequency of sediment removal in the permanent pool. Install a solid driving surface on the bottom and sides below the permanent water line to facilitate sediment removal. A soil riprap berm should be constructed to contain the forebay opposite of the inlet. This should have a minimum top width of 8 feet and side slopes no steeper than 4:1. The forebay volume within the permanent pool should be sized for anticipated sediment loads from the watershed and should be at least 3% of the WQCV. If the contributing basin is not fully developed, additional measures should be taken to maintain a relatively clean forebay. This includes more frequent maintenance of the forebay and/or providing and maintaining temporary erosion control.

8. **Outlet:** The outlet should be designed to release the WQCV over a 12-hour period. This can be done through an orifice place as detailed in BMP Fact Sheet T-12. Use reservoir routing calculations as discussed in the *Storage* chapter of Volume 2 or use equation RP-4, a simplified orifice sizing equation (see Technical Memorandum dated July 13, 2010 available at www.udfcd.org).

$$A_O = \frac{201V^{\left(0.95/H^{0.085}\right)}}{T_D H^{0.164}} \qquad \text{Equation RP-4}$$

Where:

A_O = area per row of orifices spaced on 4-inch centers (in^2)

V = design volume (WQCV or EURV) (acre ft)

T_D = time to drain the prescribed volume (hrs) (i.e., 12 for WQCV or 72 for EURV)

H = depth of surcharge volume (ft)

Refer to BMP Fact Sheet T-12 for schematics pertaining to structure geometry, grates, trash racks, orifice plate, and all other necessary components.

9. **Trash Rack**: Provide a trash rack of sufficient size to prevent clogging of the primary water quality outlet. Similar to the trash rack design for the extended detention basin, extend the water quality trash rack into the permanent pool a minimum of 28 inches. The benefit of this is documented in Fact Sheet T-5. BMP Fact Sheet T-12 provides additional guidance on trash rack design including standard tables for most designs.

10. **Overflow Embankment**: Design the embankment not to fail during the 100-year storm. If the embankment falls under the jurisdiction of the State Engineer's Office, it should be designed to meet the requirements of the State Engineer's Office. Embankment slopes should be no steeper than 4:1, preferably flatter, and planted with turf grasses. Poorly compacted native soils should be excavated and replaced. Embankment soils should be compacted to 95% of maximum dry density for ASTM D698 (Standard Proctor) or 90% for ASTM D1557 (Modified Proctor). Spillway structures and overflows should be designed in accordance with local drainage criteria and should consider the use of stabilizing materials such as buried soil riprap or reinforced turf mats installed per manufacturer's recommendations.

Providing a buffer of tall native grasses around a retention pond provides treatment through filtering (straining) and helps discourage frequent use of the pond by geese.

11. **Maintenance Considerations:** The design should include a means of draining the pond to permit drying out of the pond when it has to be "mucked out" to restore volume lost due to sediment deposition. A means to drain the pond or a portion of the pond by gravity is preferred but not always practicable. Some level of pumping is typically required. Past versions of this manual included an underdrain at the perimeter of the pond with a valved connection to the outlet structure for this purpose. This remains an acceptable method for draining the pond. Additional alternatives include providing a drywell with a piped connection to the outlet structure or to a downstream conveyance element or connecting a valved pipe directly to the outlet structure. The pipe should include a valve that will only be opened for maintenance.

12. **Vegetation:** Vegetation provides erosion control and enhances site stability. Berms and side-sloping areas should be planted with native grasses or irrigated turf, depending on the local setting and proposed uses for the pond area. The safety wetland bench should be vegetated with aquatic species. This vegetation around the perimeter of an open water body can discourage frequent use of the pond by geese.

Photograph RP-2. This retention pond outlet structure is both accessible and functional while not interfering with the natural aesthetic.

13. **Access:** All weather stable access to the bottom, forebay, and outlet works area should be provided for maintenance vehicles. Grades should not exceed 10% for haul road surfaces and should not exceed 20% for skid-loader and backhoe access. Provide a solid driving surface such as gravel, concrete, articulated concrete block, concrete grid pavement, or reinforced grass pavement. The recommended cross slope is 2%.

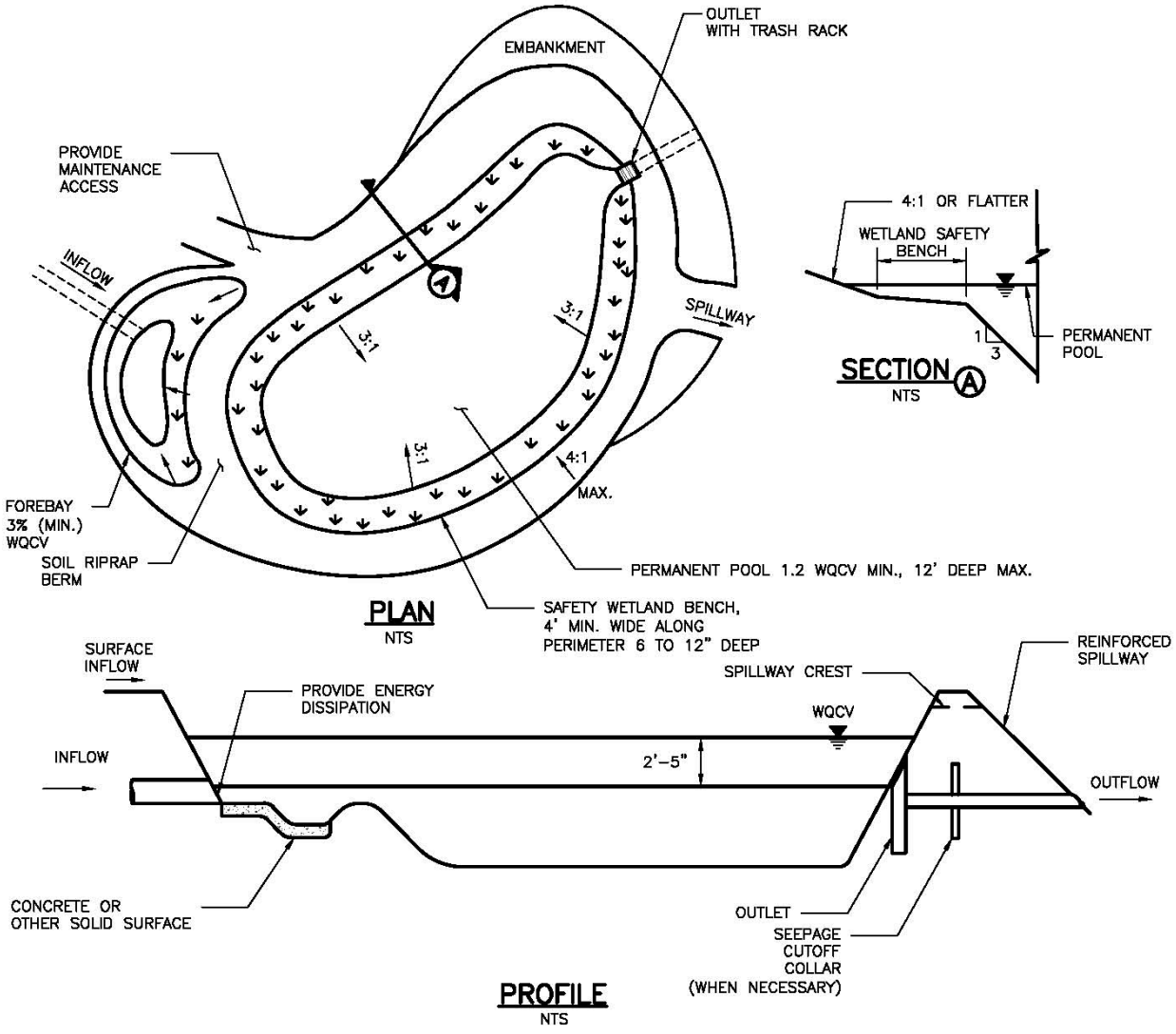


Figure RP-1. Retention Pond Plan and Sections

Aesthetic Design

Since all land owners and managers wish to use land in the most efficient manner possible, it is important that retention basins become part of a multi-use system. This encourages the design of retention ponds as an aesthetic part of a naturalized environment or to be expanded to include passive and/or active open space. Within each scenario, the retention basin can begin to define itself as more than just a drainage facility. When this happens, the basin becomes a public amenity. This combination of public amenity and drainage facility is of much greater value to a landowner. Softened and varied slopes, interspersed irrigated fields, planting areas and wetlands can all be part of a retention pond.

The design should be aesthetic whether it is considered to be an architectural or naturalized basin. Architectural basins incorporate design borrowed or reflective of the surrounding architecture or urban forms. An architectural basin is intended to appear as part of the built environment, rather than hiding the cues that identify it as a stormwater structure. A naturalized basin is designed to appear as though it is a natural part of the landscape. This section provides suggestions for designing a naturalized basin. The built environment, in contrast to the natural environment, does not typically contain the randomness of form inherent in nature. Constructed slopes typically remain consistent, as do slope transitions. Even dissipation structures are usually a hard form and have edges seldom seen in nature. If the retention pond is to appear as though it is a natural part of the landscape, it is important to minimize shapes that provide visual cues indicating the presence of a drainage structure. For example, the pond sides in the area of the surcharge volume should be shaped more naturally and with varying slopes for a naturalized pond. See Figure RP-2 for an example.

Suggested Methods for Creating the Look of a Naturalized Pond:

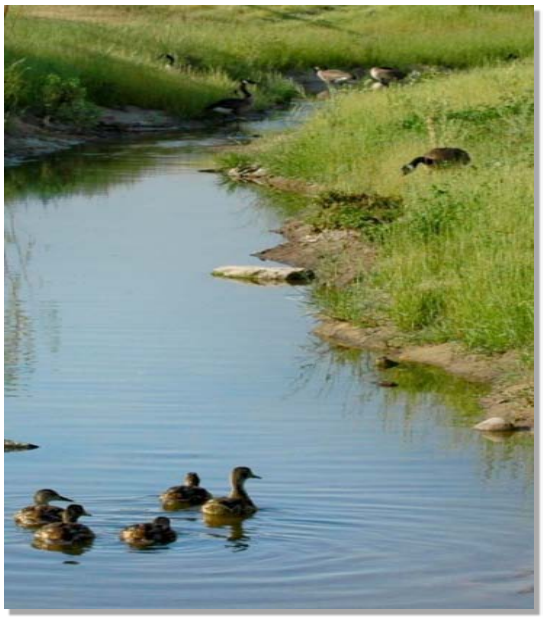
- Create a flowing overall form that looks like it was shaped by water. This includes the banks of the retention pond, which should have an undulating outline rather than a straight line.
- One side of the pond can be higher than the other side. This may require a berm.
- The shape of the permanent pool should vary from the shape of the surcharge volume.
- The slopes on at least three sides of the pond (above the permanent pool) should be varied and gentle. To achieve this, one or more sides of the basin may have to be stabilized by a retaining structure, i.e., stacked boulders and walls.
- Vary slope transitions.

Photograph RP-3. (altered photo) When incorporating rock into a structure, use other matching, functional rock to prevent the structure from looking out of context. Photo courtesy of Design Concepts.

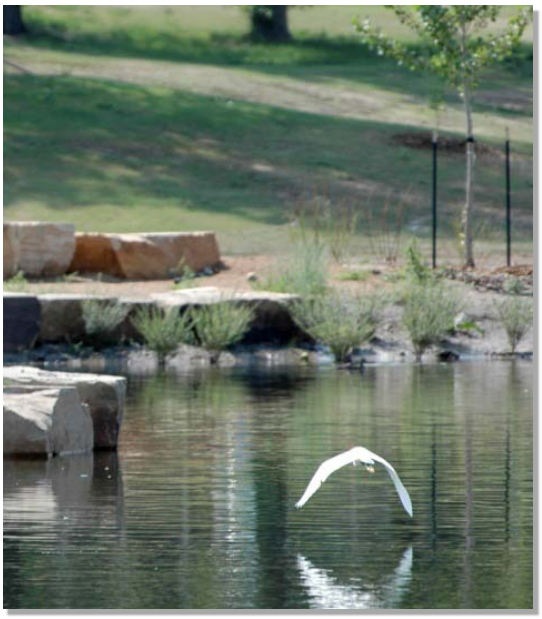
- Any use of rock for energy dissipation or for erosion control should graduate away from the area of hard edge into the surrounding landscape. Other functional matching rock should occur in other areas of the pond to prevent the energy dissipation structure from appearing out of context. Photo RP-3 serves as an example of this.
- If concrete is required in the basin, colored concrete matching the rocks or other site features of the surrounding landscape can be used to prevent the structure from appearing out of context. Colored concrete, form liners and veneers for construction walls are preferred for outlet structures.

Photograph RP-4. (altered photo) Variations in slope and texture around the pond are brought together by mass groupings of local stone boulders. The boulders are placed intermittently around the pond in groups and interspersed with plantings. Photo courtesy of Design Concepts. Note: A minimum 4-foot vegetated buffer (littoral zone) is recommended to strain surface flow into the pond, protect the banks by stabilizing the soil at the edge of the pond, and provide biological uptake.

- Adjust the vegetation to the different uses of the pond surrounding.
- Ground cover should reflect the type of water regime expected for the location within the basin. For example, riparian plants would be placed around the edge of the retention pond, groups of trees and shrubs would be placed in more manicured areas that have no retention or detention function.



Photograph RP-5. A curving stream with vegetated edges provides habitat for wildlife. Photo courtesy of Design Concepts.



Photograph RP-6. Landscape elements such as vegetation and stone highlight the irregularly-shaped pond edge, making it appear more natural. Photo courtesy of Design Concepts.

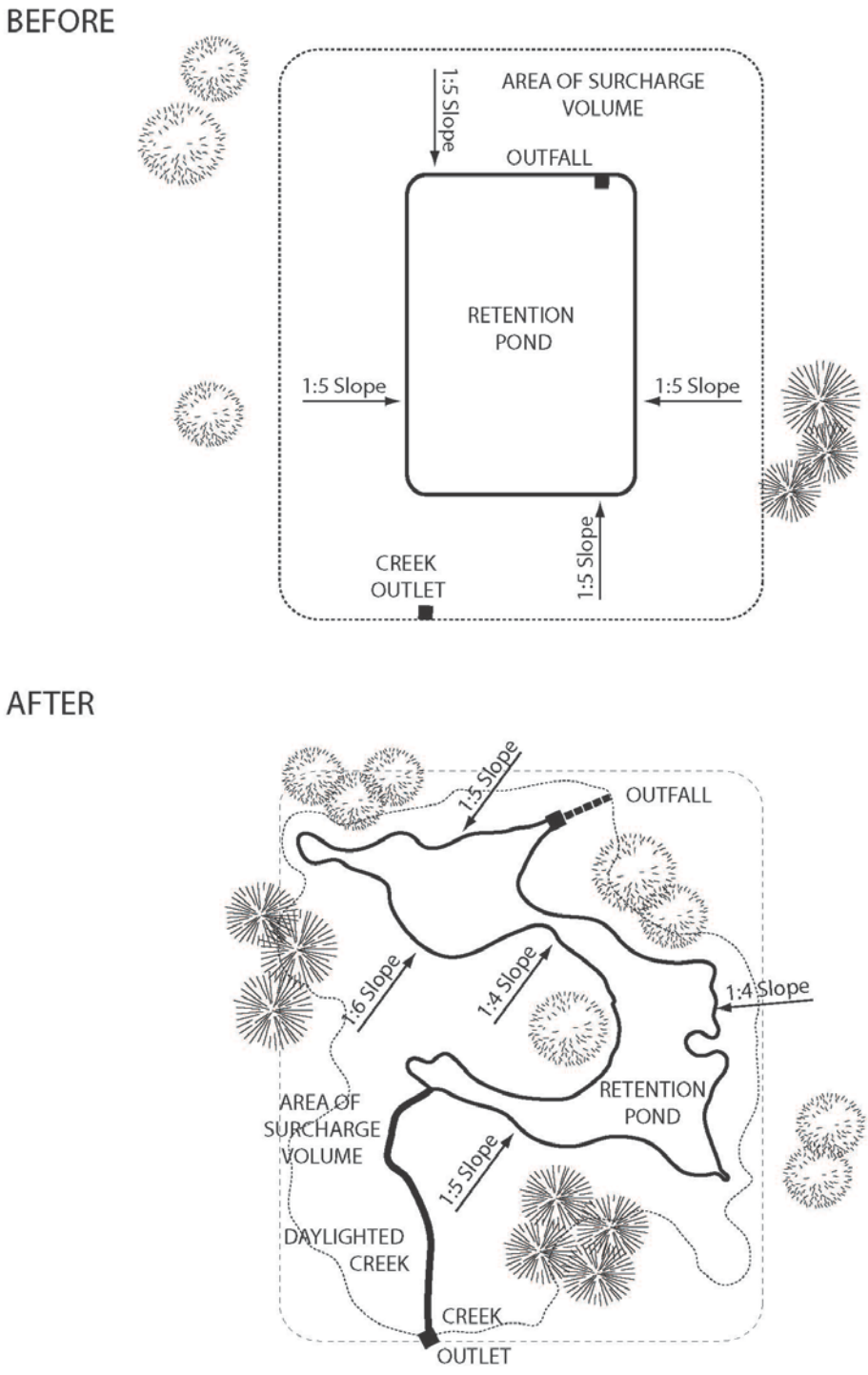


Figure RP-2. Example of a Naturalized Retention Pond

Design Example

The *UD-BMP* workbook, designed as a tool for both designer and reviewing agency is available at www.udfcd.org. This section provides a completed design form from this workbook as an example.

Design Procedure Form: Retention Pond (RP)

Sheet 1 of 3

Designer:	**L. Gibson**
Company:	**BMP, Inc.**
Date:	**November 29, 2010**
Project:	**Subdivision B**
Location:	**NE Corner of 67th Ave. and 88th St.**

1. Baseflow A) Is the permanent pool established by groundwater?	Choose One: (•) YES ( ) NO
2. Surcharge Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 80.0 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.800
C) Contributing Watershed Area	Area = 50.000 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = ____ in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: ( ) Water Quality Capture Volume (WQCV) (•) Excess Urban Runoff Volume (EURV)
F) Water Quality Capture Volume (WQCV) Based on 12-hour Drain Time ($V_{WQCV} = (0.8 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area)$)	V_{WQCV}= 1.094 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) ($V_{WQCV\ OTHER} = (d_6 * (V_{WQCV}/0.43))$)	$V_{WQCV\ OTHER}$= ____ ac-ft
H) User Input of Water Quality Capture Volume (WQCV) (Only if a different WQCV Design Volume is desired)	$V_{WQCV\ USER}$= ____ ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One: ( ) A ( ) B (•) C / D
J) Excess Urban Runoff Volume (EURV) Design Volume For HSG A: $EURV_A = (0.1878i - 0.0104) * Area$ For HSG B: $EURV_B = (0.1178i - 0.0042) * Area$ For HSG C/D: $EURV_{C/D} = (0.1043i - 0.0031) * Area$	EURV = 4.017 ac-f t
3. Basin Shape (It is recommended to have a basin length to width ratio between 2:1 and 3:1)	L : W = 3.0 : 1
4. Permanent Pool	
A) Minimum Permanent Pool Volume	V_{POOL} = 1.313 ac-ft
B) Depth of the Safety Wetland Bench (Recommended to be 6 to 12 inches deep)	D_{LZ} = 6 in
C) Depth of the Open Water Zone (Maximum depth of 12 feet)	D_{OWZ} = 12.0 ft
5. Side Slopes	
A) Maximum Side Slopes Above the Safety Wetland Bench (Horiz. dist. per unit vertical, should be no steeper than 4:1)	Z_{PP} = 5.00 ft / ft
B) Maximum Side Slopes Below the Safety Wetland Bench (Horiz. dist. per unit vertical, should be no steeper than 3:1)	Z_{OWZ} = 3.00 ft / ft
6. Inlet A) Describe means of providing energy dissipation at concentrated inflow locations:	Adequate tailwater during events exceeding the WQCV.

Design Procedure Form: Retention Pond (RP)

Sheet 2 of 3

Designer:	**L. Gibson**
Company:	**BMP, Inc.**
Date:	**November 29, 2010**
Project:	**Subdivision B**
Location:	**NE Corner of 67th Ave. and 88th St.**

7. Forebay	
A) Minimum Forebay Volume (V_{FMIN} = 3% of the WQCV)	V_{FMIN} = 0.033 ac-ft
B) Actual Forebay Volume	V_F = 0.037 ac-ft
8. Outlet	
A) Outlet Type	Choose One: (●) Orifice Plate ( ) Other (Describe):
B) Depth of Surcharge Volume (Depth of WQCV or EURV depending on design concept)	H = 3.0 feet
C) Volume to Drain Over Prescribed Time	EURV = 4.017 ac-ft
D) Drain Time (Min T_D for WQCV= 12 hours; Max T_D for EURV= 72 hours)	T_D = 72 hours
E) Recommended Outlet Area per Row, (A_o)	A_o = 7.77 square inches
F) Orifice Dimensions:	
i) Circular Orifice Diameter or	$D_{orifice}$ = inches
ii) Width of 2" High Rectangular Orifice	$W_{orifice}$ = 3.88 inches
G) Number of Columns	nc = 1 number
H) Actual Design Outlet Area per Row (A_o)	A_o = 7.8 square inches
I) Number of Rows (nr)	nr = 9 number
J) Total Outlet Area (A_{ot})	A_{ot} = 69.8 square inches
K) Depth of WQCV (H_{WQCV}) (Estimate using actual stage-area-volume relationship and V_{WQCV})	H_{WQCV} = feet
L) Ensure Minimum 12 Hour Drain Time for WQCV	$T_{D\ WQCV}$ = hours
9. Trash Rack	
A) Type of Outlet Opening	Choose One: ( ) Circular (up to 2" diameter) (●) Rectangular (2" high)
B) Trash Rack Open Area: $A_t = 0.5 * 77(e^{-0.124D})*A_{ot}$	A_t = 2,224 square inches
C) For 2", or Smaller, Circular **Opening** (Reference figure in Fact Sheet T-12):	
i) Depth of Trash Rack below Permanent Pool WS (28 inch min.)	$D_{inundation}$ = inches
ii) Width of Trash Rack and Concrete Opening ($W_{opening}$)	$W_{opening}$ = inches
iii) Height of Trash Rack Screen (H_{TR})	H_{TR} = inches
iv) Type of Screen, Describe if "Other"	Choose One: ( ) S.S. Well Screen with 60% Open Area* ( ) Other (Describe):

Design Procedure Form: Retention Pond (RP)

Sheet 3 of 3

Designer:	**L. Gibson**
Company:	**BMP, Inc.**
Date:	**November 29, 2010**
Project:	**Subdivision B**
Location:	**NE Corner of 67th Ave. and 88th St.**

D) For 2" High **Rectangular Opening** (See Fact Sheet T-12):

i) Depth of Trash Rack below Permanent Pool WS (28 inch min.) — $D_{inundation}$ = 28.0 inches

ii) Width of Rectangular Opening ($W_{orifice}$) — W = 3.88 inches

iii) Width of Trash Rack Opening ($W_{opening}$) — $W_{opening}$ = 4.1 feet

iv) Height of Trash Rack Screen (H_{TR}) — H_{TR} = 5.3 feet

v) Type of Screen, (Describe if "Other")

Choose One
- (●) Aluminum Amico-Klemp SR Series (or equal)
- ( ) Other (Describe):

vi) Cross-bar Spacing: **2.00**

vii) Minimum Bearing Bar Size: **1-1/4 in x 3/16 in**

10. Overflow Embankment

A) Describe embankment protection for 100-year and greater overtopping: soil riprap

B) Maximum Embankment Side Slopes (Horiz. dist. per unit vertical, should be no steeper than 4:1) — Z_E = 4.00 ft / ft

11. Maintenance Considerations

A) Describe Means of Draining the Pond: The pond can be partially gravity drained with the valve located in the outlet structure. Remaining water must be pumped.

12. Vegetation

Choose One
- ( ) Irrigated
- (●) Not Irrigated

13. Access

A) Describe Sediment Removal Procedures: Sediment may be removed from the forebay via the maintenance access located on the maintenance plan.

Notes:

References

Bedient, Philip B. and Wayne C. Huber. 1992. *Hydrology and Floodplain Analysis (Second Edition).* Addison-Wesley Publishing Company.

United States Environmental Protection Agency (EPA). 1999. *Storm Water Technology Fact Sheet: Wet Detention Ponds.*

Description

This section provides guidance and details for outlet structures for use primarily with BMPs utilizing sedimentation, (i.e., extended detention basins (EDBs), retention ponds, and constructed wetland ponds). The information provided in this section includes guidance for different size watersheds as well as for incorporating Full Spectrum Detention as described in the *Storage* chapter of Volume 2.

The details contained in this Fact Sheet are intended to provide a starting point for design. UDFCD recommends that design details for outlet structures be specific for each site with structural details drawn to scale. The details provided in this Fact Sheet are not intended to be used without modification or additional detail.

Photograph OS-1. Although each site is different, most sedimentation BMPs have similar outlet structures. Each structure should include a partially submerged orifice plate with a screen (or grate) protecting the orifice plate from clogging, and an overflow weir for flows exceeding the WQCV or excess urban runoff volume (EURV), when full spectrum detention is used.

Outlet Design

Large Watershed Considerations

UDFCD recommends that water quality treatment be provided close to the pollutant source. This is a fundamental concept of Low Impact Development (LID). Although flood control facilities, including Full Spectrum Detention facilities, have been shown to be very effective for watersheds exceeding one square mile, this is not the case for water quality facilities. One reason for this is that the baseflow associated with a larger watershed will vary and can be difficult to estimate. The orifice plate should be designed to pass the baseflow while detaining the water quality capture volume (WQCV) for approximately 40 hours. When the baseflow is overestimated, the WQCV is not detained for the recommended time, passing through without treatment. When the baseflow is underestimated, the elevation of the permanent pool will be higher than designed, causing maintenance issues as well as reducing the volume available for detention of the WQCV, which also allows for a portion of this volume to pass through without treatment. For this reason, UDFCD recommends that facilities designed for both water quality and flood control be limited, where possible, to watersheds without a baseflow. The maximum recommended watershed for combined facilities is one square mile. Additional discussion on designing for baseflows is provided in the EDB BMP Fact Sheet (T-5).

Designing for Maintenance

Rather than using the minimum criteria, consider maximizing the width of the trash rack to the geometry of the outlet. This will reduce clogging and frequency of maintenance. Reduced clogging in EDB outlet structures will preserve the initial surcharge volume thus reducing frequency of inundation in the bottom of the basin. This will benefit the grasses and reduce long-term EDB maintenance requirements (including sediment removal in the grassed area) and may reduce the life-cycle cost of the BMP.

Orifice Plates and Trash Racks

An orifice plate is used to release the WQCV slowly over 40 hours. For Full Spectrum Detention, the orifice plate is extended to drain a larger volume, the EURV, over approximately 72 hours. The figures and tables in this section provide recommendations for orifice configurations and trash rack type and size. Guidance is provided for plates using both circular and rectangular orifices.

Orifice Sizing

Follow the design steps included in the BMP Fact Sheet for the appropriate BMP. The UD-BMP workbook, available at www.udfcd.org, can also be used to calculate the required orifice area per row. This is the first step in detailing the outlet structure for sedimentation BMPs. It is good practice to maximize the area of each orifice to avoid clogging. The *UD-BMP* workbook will allow up to two columns of circular orifices before recommending a single rectangular orifice. A rectangular orifice is recommended when the required open area per row is equal to approximately 4 square inches or greater. Details showing orifice configurations are provided in Figure OS-4. Table OS-1 can be used to determine orifice shape and number of columns based on the required area per row.

Photograph OS-2. This trash rack could not be properly attached due to its inadequate flange width.

Trash Rack Sizing

Once the size of the orifice has been determined, this information, along with the total orifice area in the water quality plate, is used to determine the total open area of the grate (see Figure OS-1). The trash rack should be sized using this figure. This Fact Sheet also includes standard tables that can be used when the outlet is designed per UDFCD criteria, including inundation of trash rack into the permanent pool for a depth of approximately 2.5 feet. The standard tables assume the use of the specified stainless steel screen with circular orifices and the specified aluminum bar grate for use with rectangular orifices. Use Figure OS-1 when using a different track rack material or when the geometry of the structure does not fit within the assumptions of the tables. Use Tables OS-2a and OS-2b for circular orifices and Tables OS-3a and OS-3b for rectangular orifices. Be aware, these tables provide the minimum width clear for the trash rack frame. It is also important to provide adequate width for attachment to the outlet structure (see Photos OS-2 and OS-3). Also, consider maximizing the width of the trash rack to the geometry of the outlet. This will reduce clogging and maintenance requirements associated with cleaning the trash rack.

Photograph OS-3. Trash rack after repair.

Table OS-1. Orifice Sizing

Hole Dia. (in) [1]	Hole Dia. (in)	Area per Row (in^2)	
		n = 1	n = 2
1/4	0.250	0.05	-
5/16	0.313	0.08	-
3/8	0.375	0.11	-
7/16	0.438	0.15	-
1/2	0.500	0.2	-
9/16	0.563	0.25	-
5/8	0.625	0.31	-
11/16	0.688	0.37	-
3/4	0.750	0.44	-
13/16	0.813	0.52	-
7/8	0.875	0.6	-
15/16	0.938	0.69	-
1	1.000	0.79	-
1-1/16	1.063	0.89	-
1-1/8	1.125	0.99	-
1-3/16	1.188	1.11	-
1-1/4	1.250	1.23	-
1-5/16	1.313	1.35	-
1-3/8	1.375	1.48	-
1-7/16	1.438	1.62	3.24
1-1/2	1.500	1.77	3.54
1-9/16	1.563	1.92	3.84
1-5/8	1.625	2.07	-
1-11/16	1.688	2.24	-
1-3/4	1.750	2.41	-
1-13/16	1.813	2.58	-
1-7/8	1.875	2.76	-
1-15/16	1.938	2.95	-
2	2.000	3.14	-
n = Number of Columns of Orifices			
Steel Thickness (Min.)		1/4”	5/16”

[1] If desired, interpolate to the nearest 32" to better match the needed area.

Use one column of rectangular orifices when the needed area exceeds 3.84 in^2

Rectangular Height (in) = 2
Rectangular Width (in) = Required Area / 2 in

Rectangular Width (in)	Steel Thickness (in)
≤6	≥1/4
≤8	≥5/16
≤10	≥3/8
>10	≥1/2

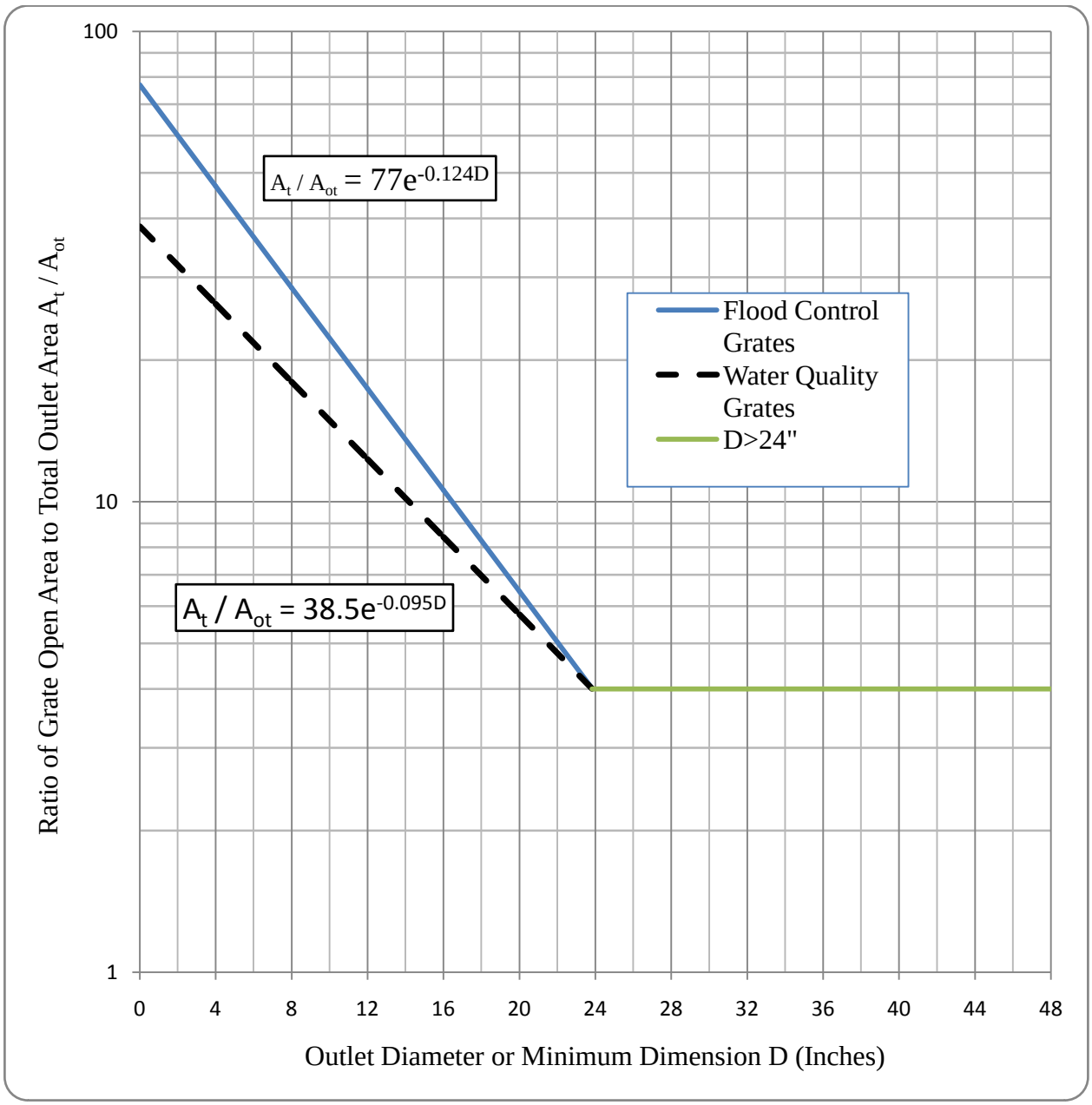


Figure OS-1. Trash Rack Sizing

Table OS-2a. Trash Rack Sizing for Circular Orifices[1,3]

Number of Columns	Diameter of Circular Orifice (in)	Width of Trash Rack Opening ($W_{opening}$) as a Function of Water Depth H Above Lowest Perforation				
		H=2.0’	H=3.0’	H=4.0’	H=5.0’	H=6.0’
1	≤ 1-1/4	12"[2]	12"[2]	12"[2]	12"	13"
1	≤ 1-1/2	12"[2]	14"	16"	17"	18"
1	≤ 1-3/4	15"	18"	21"	22"	24"
1	≤ 2	19"	23"	26"	28"	30"
2	1-7/16	21"	26"	29"	31"	33"
2	1-1/2	23"	28"	31"	34"	35"
2	1-9/16	24"	30"	34"	36"	38"

[1] For use with Johnson VEE WireTM Stainless Steel Screen1 (or equivalent screen with 60% open area). Assumes inundation of well screen into the permanent pool 2'4".

[2] Represents the minimum recommended width of 12 inches, otherwise width is calculated based on Figure OS-1.

[3] This table provides the minimum opening in the concrete, not the minimum width of the well screen. Ensure the well screen is wide enough to properly attach to the structure.

Table OS-2b. Trash Rack Specifications for Circular Orifice Plates

Max. Width of Trash Rack Opening (in)	Screen #93 VEE Wire Slot Opening (in)	Support Rod Type	Support Rod, On Center, Spacing	Total Screen Thickness	Carbon Steel Frame Type
≤9	0.139	#156 VEE	¾"	0.31"	$^3/_8$"x1.0" flat bar
≤18	0.139	TE 0.074"x0.50"	1"	0.655"	¾" x 1.0 angle
≤24	0.139	TE 0.074"x0.75"	1"	1.03"	1.0" x 1½" angle
≤27	0.139	TE 0.074"x0.75"	1"	1.03"	1.0" x 1½" angle
≤30	0.139	TE 0.074"x1.0"	1"	1.155”	1 $^1/_4$"x 1½" angle
≤36	0.139	TE 0.074"x1.0"	1"	1.155”	1 $^1/_4$"x 1½" angle
≤42	0.139	TE 0.105"x1.0"	1"	1.155”	1 $^1/_4$"x 1½" angle

[1] Johnson Screens, St. Paul, Minnesota, USA (1-800-833-9473)

Table OS-3a. Trash Rack Sizing for 2" High Rectangular Orifices

Width (W) of 2" Rectangular Orifice (in)	Minimum Width of Trash Rack Opening ($W_{opening}$) as a Function of Water Depth H Above Lowest Perforation					
	H≤2.0 ft.	H≤3.0 ft.	H≤4.0 ft.	H≤5.0 ft.	H≤6.0 ft.	Spacing of Bearing Bars, Cross Rods
2	1.7'	2.1'	2.4'	2.5'	2.7'	1-3/16", 2"
≤ 2.5	2.2'	2.6'	3'	3.2'	3.4'	1-3/16", 2"
≤ 3.0	2.6'	3.2'	3.5'	3.8'	4.0'	1-3/16", 2"
≤ 3.5	3.0'	3.7'	4.1'	4.5'	4.7'	1-3/16", 2"
≤ 4.0	3.4'	4.2'	4.7'	5.1'	5.4'	1-3/16", 2"
≤ 4.5	3.6'	4.4'	4.9'	5.3'	5.6'	1-3/16", 4"
≤ 5.0	4.0'	4.8'	5.4'	5.9'	6.2'	1-3/16", 4"
≤ 5.5	4.4'	5.3'	6.0'	6.5'	6.8'	1-3/16", 4"
≤ 6.0	4.8'	5.8'	6.5'	7.0'	7.4'	1-3/16", 4"
≤ 6.5	5.2'	6.3'	7.1'	7.6'	8.1'	1-3/16", 4"
≤ 7.0	5.6'	6.8'	7.6'	8.2'	8.7'	1-3/16", 4"
≤ 7.5	6.0'	7.3'	8.2'	8.8'	9.3'	1-3/16", 4"
≤ 8.0	6.4'	7.8'	8.7'	9.4'	9.9'	1-3/16", 4"
≤ 8.5	6.8'	8.2'	9.2'	10'	*	1-3/16", 4"
≤ 9.0	7.2'	8.7'	9.8'	*	*	1-3/16", 4"
≤ 9.5	7.6'	9.2'	*	*	*	1-3/16", 4"
≤ 10.0	8.0'	9.7'	*	*	*	1-3/16", 4"
≤ 10.5	8.3'	*	*	*	*	1-3/16", 4"
≤ 11.0	8.7'	*	*	*	*	1-3/16", 4"
≤ 11.5	9.1'	*	*	*	*	1-3/16", 4"
≤ 12.0	9.5'	*	*	*	*	1-3/16", 4"

* Size trash rack per Figure OS-1. Use 4-inch high staggered rectangular orifices to limit size of the structure.

Notes:

1. Width shown based on Figure OS-1 assuming inundation of trash rack into the permanent pool 2'4".
2. This table provides the minimum opening in the concrete, not the minimum width of the trash rack. Ensure the trash rack is wide enough to properly attach to the structure.

Table OS-3b. Trash Rack Specifications for 2” High Rectangular Orifices

Water Depth Above Lowest Opening, H (ft)	Minimum Bearing Bar Size, Bearing Bars Aligned Vertically (in)
2.0'	1” x 3/16”
3.0'	1-1/4” x 3/16”
4.0'	1-3/4” x 3/16”
5.0'	2” x 3/16”
6.0'	2-1/4” x 3/16”

Outlet Geometry

Outlets for small watersheds will typically be sized for maintenance operations while the geometry of outlets for larger watersheds may be determined based on the required size of the trash rack. For all watershed sizes, the outlet should be set back into the embankment of the pond to better allow access to the structure. This also provides a more attractive BMP. For larger watersheds, this will require wing walls. Wing walls are frequently cast-in-place concrete, although other materials, such as grouted boulders, may be used where appropriate. Consider safety, aesthetics, and maintenance when selecting materials and determining the geometry. A safety rail should be included for vertical drops of 3 feet or more. Depending on the location of the structure in relation to pedestrian trails, safety rails may also be required for lesser drops. Stepped grouted boulders can be used to reduce the height of vertical drops.

As shown in Figures EDB-1 and EDB-2 provided in BMP Fact Sheet T-5, wing walls can be flared or parallel. There are advantages to both configurations. Parallel wing walls may be more aesthetic; however, depending on the geometry of the pond, may limit accessibility to the trash rack. Flared wing walls can call attention to the structure but provide better accessibility and sometimes a vertical barrier from the micropool of an EDB, which can increase safety of the structure. Parallel walls can also be used with a second trash rack that is secured flush with the top of the wall as shown in Photo OS-4. This eliminates the need for a safety rail and may provide additional protection from clogging; however, it creates a maintenance issue by restricting access to the water quality screen. The rack shown in Photo OS-4 was modified after construction due to this problem.

Photograph OS-4. Maintenance access to the water quality trash rack was compromised by the location of a secondary trash rack on this outlet. This may have been included as a safety rack or as additional protection from clogging. The owner modified the structure for better access. A safety rail would have been a better solution.

Photograph OS-5. Interruptions in the horizontal members of this trash rack and the spacing of the vertical members allow easier access to clean the water quality grate. A raking tool can be used to scrape the water quality trash rack.

Micropools within the Outlet Structure

The micropool of an EDB may be placed inside the structure when desired. This is becoming increasingly common for smaller watersheds and near airfields where large bird populations can be problematic. When designing this type of structure, consider maintenance of the water quality trash rack. The secondary trash rack should be designed to allow maintenance of the water quality trash rack similar to that shown in Photo OS-5. This concept can easily be incorporated into smaller outlet structures (see Figures OS-7 and OS-8 for details).

Outlet Structure Details

A number of details are presented in this section to assist designers with detailing outlet structures. Table OS-2 provides a list of details available at www.udfcd.org. These details are not intended to be used in construction plans without proper modifications as indicated in Table OS-4.

Table OS-4. Summary of Outlet Structure Details and Use

Figure	Detail	Use of Detail
OS-2	Typical Outlet Structure for Full Spectrum Detention	Conceptual.
OS-3	Typical Outlet Structure for WQCV Treatment and Attenuation	Conceptual.
OS-4	Orifice Plate and Trash Rack	Outlet section. Modify per true structure geometry and concrete reinforcement. Modify notes per actual design.
OS-5	Typical Outlet Structure with Circular Orifice Plate	Outlet sections. Modify per true structure geometry and concrete reinforcement. Add additional sections and detailing as necessary. Modify notes per actual design.
OS-6	Typical Outlet Structure with Rectangular Orifice Plate	Outlet sections. Modify per true structure geometry and concrete reinforcement. Add additional sections and detailing as necessary. Modify notes per actual design.
OS-7	Full Spectrum Detention Outlet Structure for 5-acre Impervious Area or Less	Outlet profile and section. Modify per true EURV elevation and concrete reinforcement. Add additional sections and detailing as necessary.
OS-8	WQCV Outlet Structure for 5-acre Impervious Area or Less	Outlet sections. Modify per true WQCV elevation and concrete reinforcement. Add additional sections and detailing as necessary.

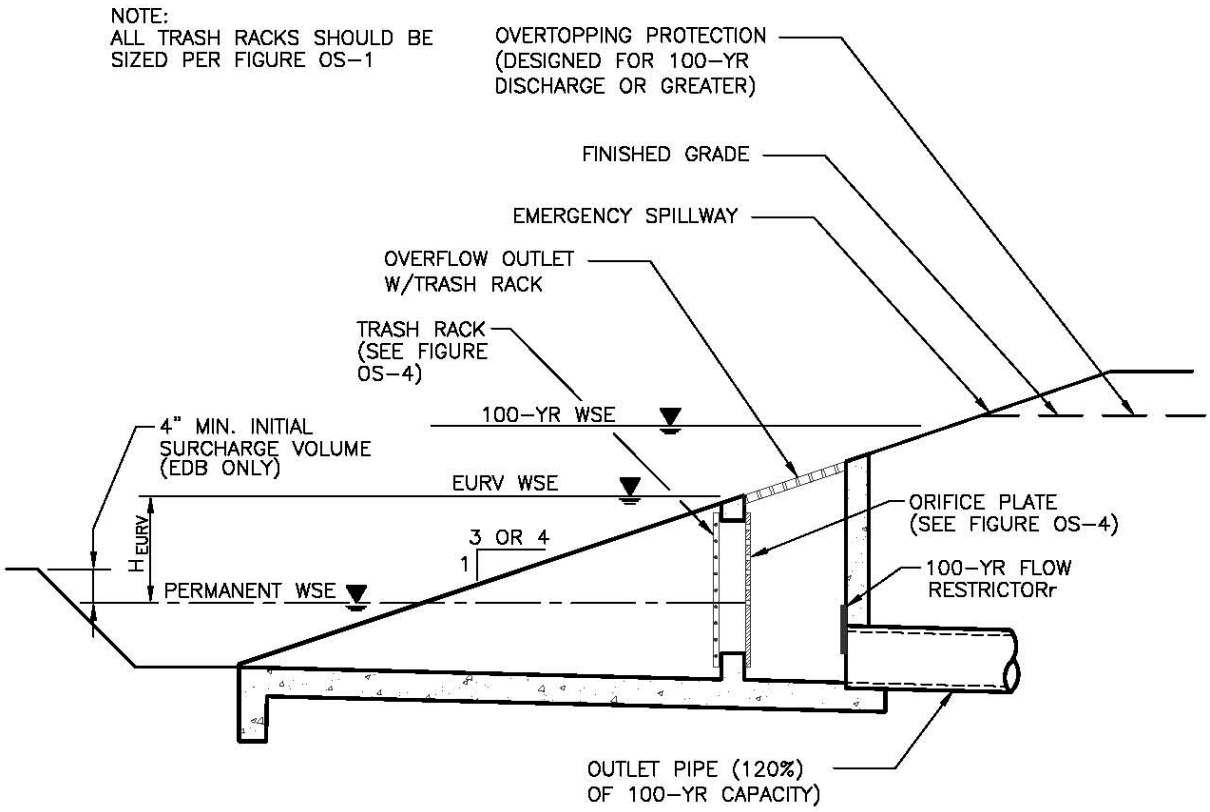


Figure OS-2. Typical Outlet Structure for Full Spectrum Detention

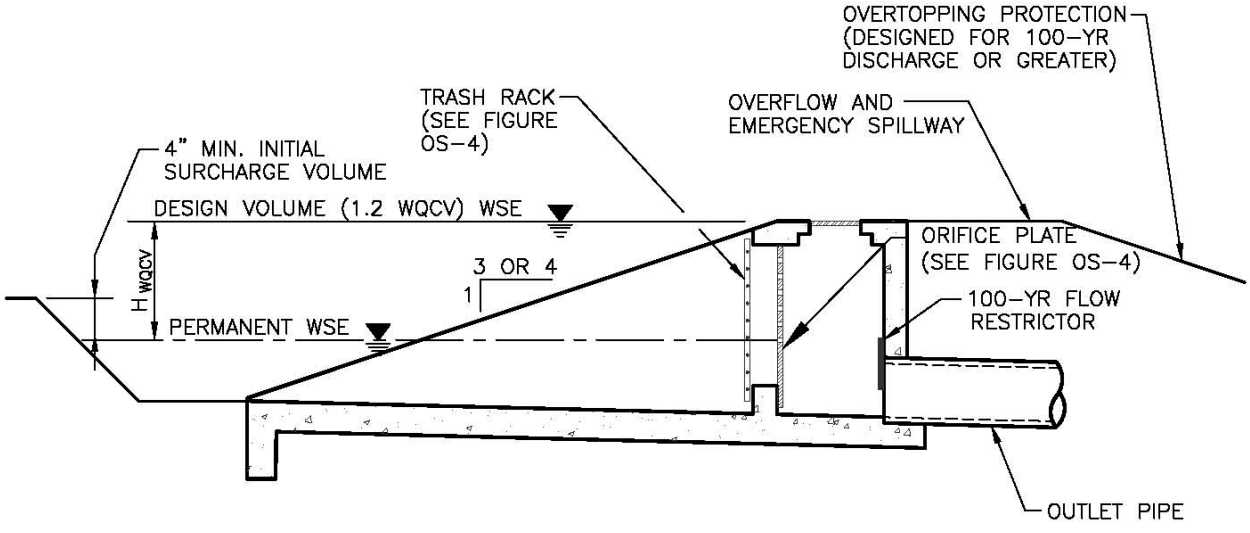
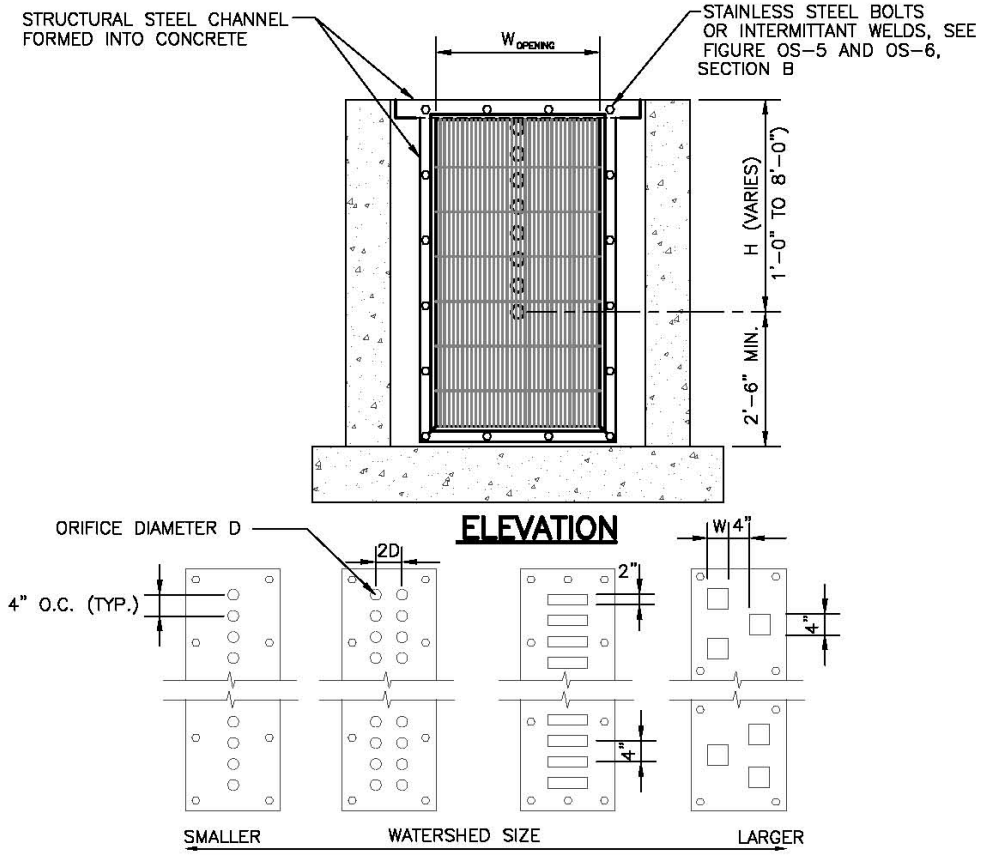


Figure OS-3. Typical Outlet Structure for WQCV Treatment and Attenuation



ORIFICE PLATE NOTES:

1. MINIMIZE THE NUMBER OF COLUMNS.
2. PROVIDE GASKET MATERIAL BETWEEN THE ORIFICE PLATE AND CONCRETE.
3. BOLT PLATE TO CONCRETE 12" MAX. ON CENTER.

EURV AND WQCV TRASH RACKS:

1. WELL-SCREEN TRASH RACKS (FOR CIRCULAR ORIFICES) SHALL BE STAINLESS STEEL AND SHALL BE ATTACHED BY INTERMITTENT WELDS ALONG THE EDGE OF THE MOUNTING FRAME.
2. BAR GRATE TRASH RACKS (FOR RECTANGULAR ORIFICES) SHALL BE ALUMINUM AND SHALL BE BOLTED USING STAINLESS STEEL HARDWARE.
3. TRASH RACK WIDTHS PROVIDED IN TABLE OS-2A AND OS-3A ARE FOR SPECIFIED TRASH RACK MATERIAL AND NEED TO BE ADJUSTED FOR MATERIALS HAVING A DIFFERENT OPEN AREA/GROSS AREA RATIO (R VALUE)
4. STRUCTURAL DESIGN OF TRASH RACKS SHALL BE BASED ON FULL HYDROSTATIC HEAD WITH ZERO HEAD DOWNSTREAM OF THE RACK.

OVERFLOW TRASH RACKS:

1. ALL TRASH RACKS SHALL BE MOUNTED USING STAINLESS STEEL HARDWARE AND PROVIDED WITH HINGED AND LOCKABLE OR BOLTABLE ACCESS PANELS.
2. TRASH RACKS SHALL BE STAINLESS STEEL, ALUMINUM, OR STEEL. STEEL TRASH RACKS SHALL BE HOT DIP GALVANIZED AND MAY BE HOT POWDER COATED AFTER GALVANIZING.
3. TRASH RACKS SHALL BE DESIGNED SUCH THAT THE DIAGONAL DIMENSION OF EACH OPENING IS SMALLER THAN THE DIAMETER OF THE OUTLET PIPE.
4. STRUCTURAL DESIGN OF TRASH RACKS SHALL BE BASED ON FULL HYDROSTATIC HEAD WITH ZERO HEAD DOWNSTREAM OF THE RACK.

Figure OS-4. Orifice Plate and Trash Rack

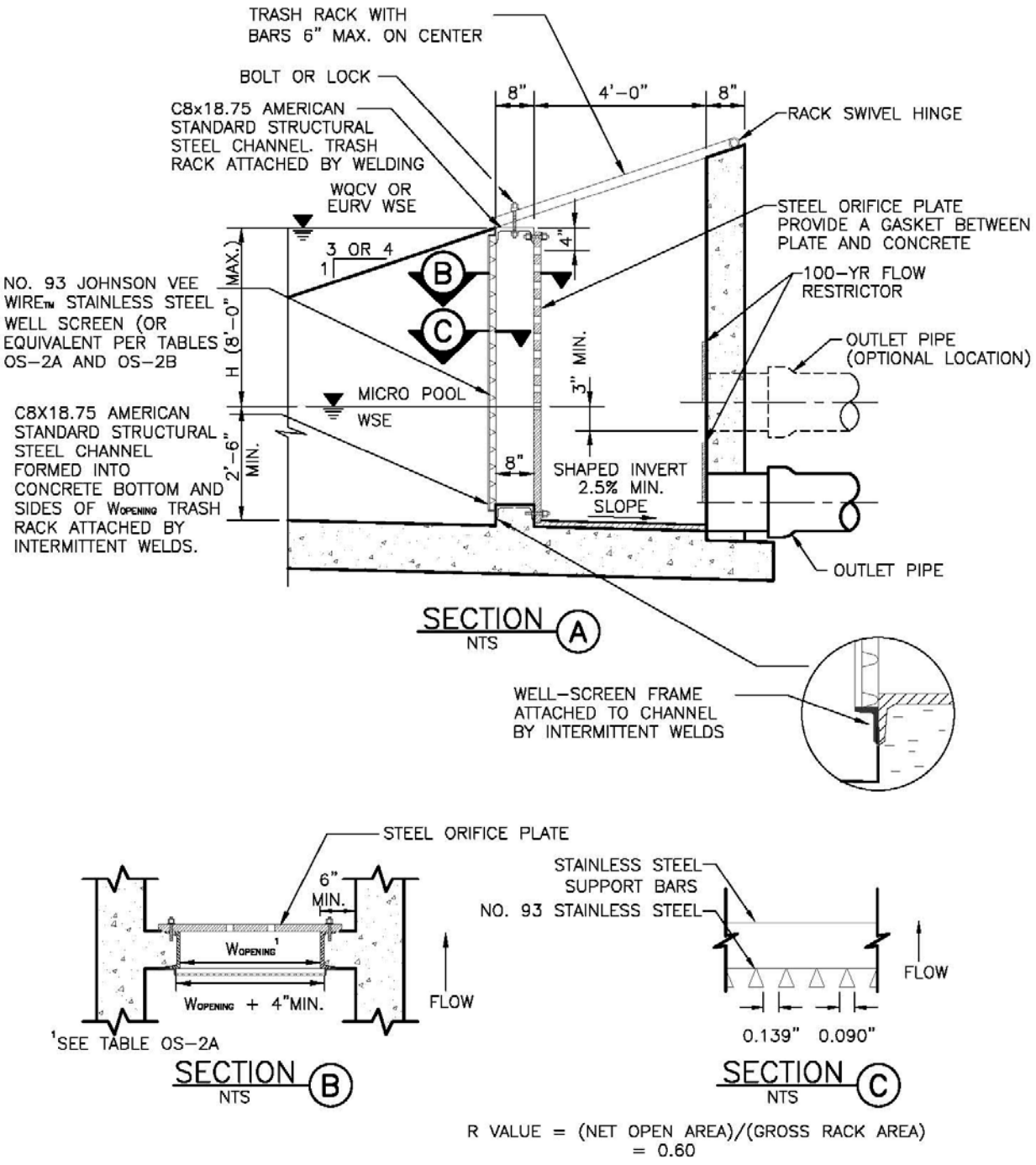


Figure OS-5. Typical Outlet Structure with Circular Orifice Plate

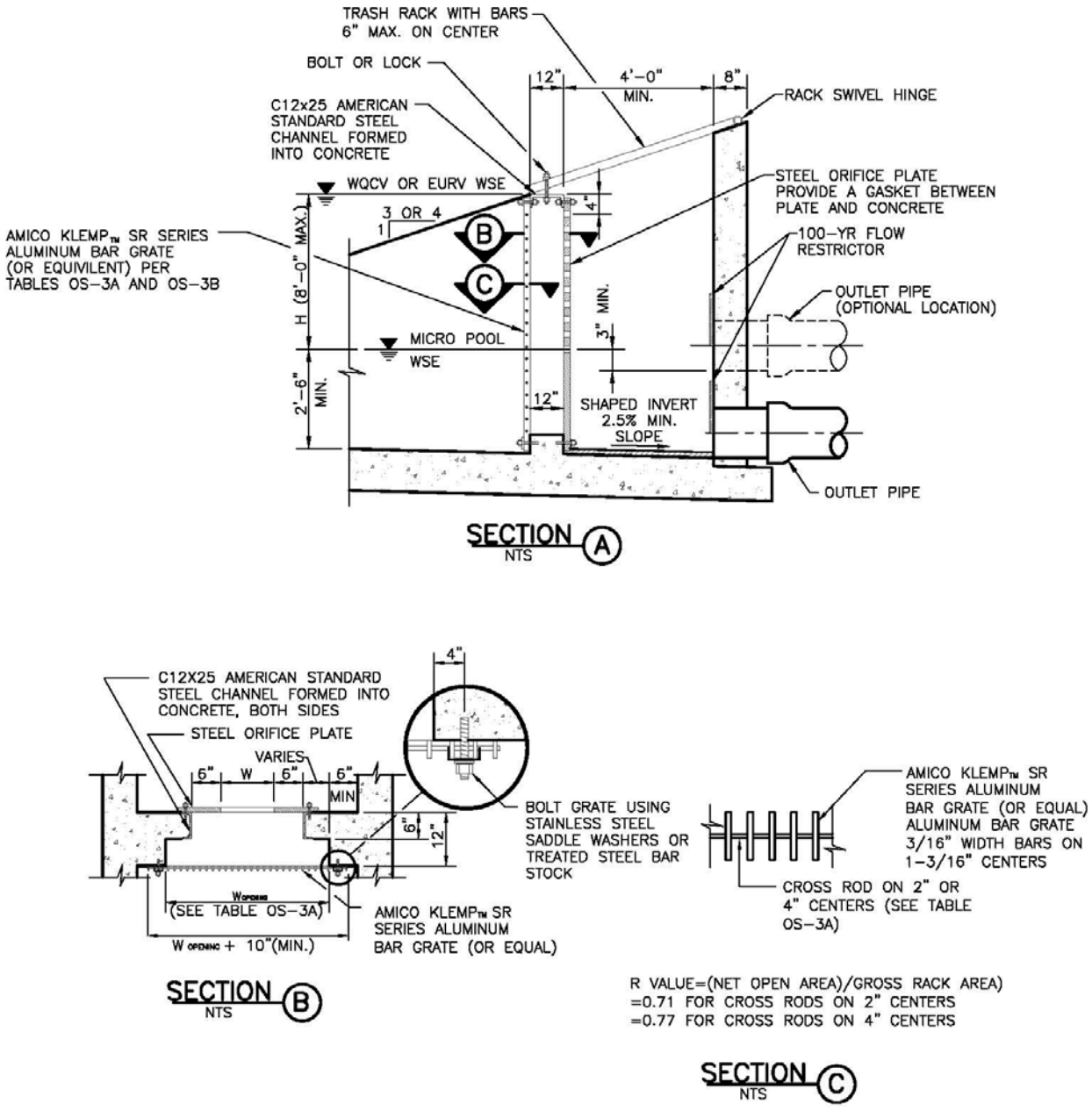


Figure OS-6. Typical Outlet Structure with Rectangular Orifice Plate

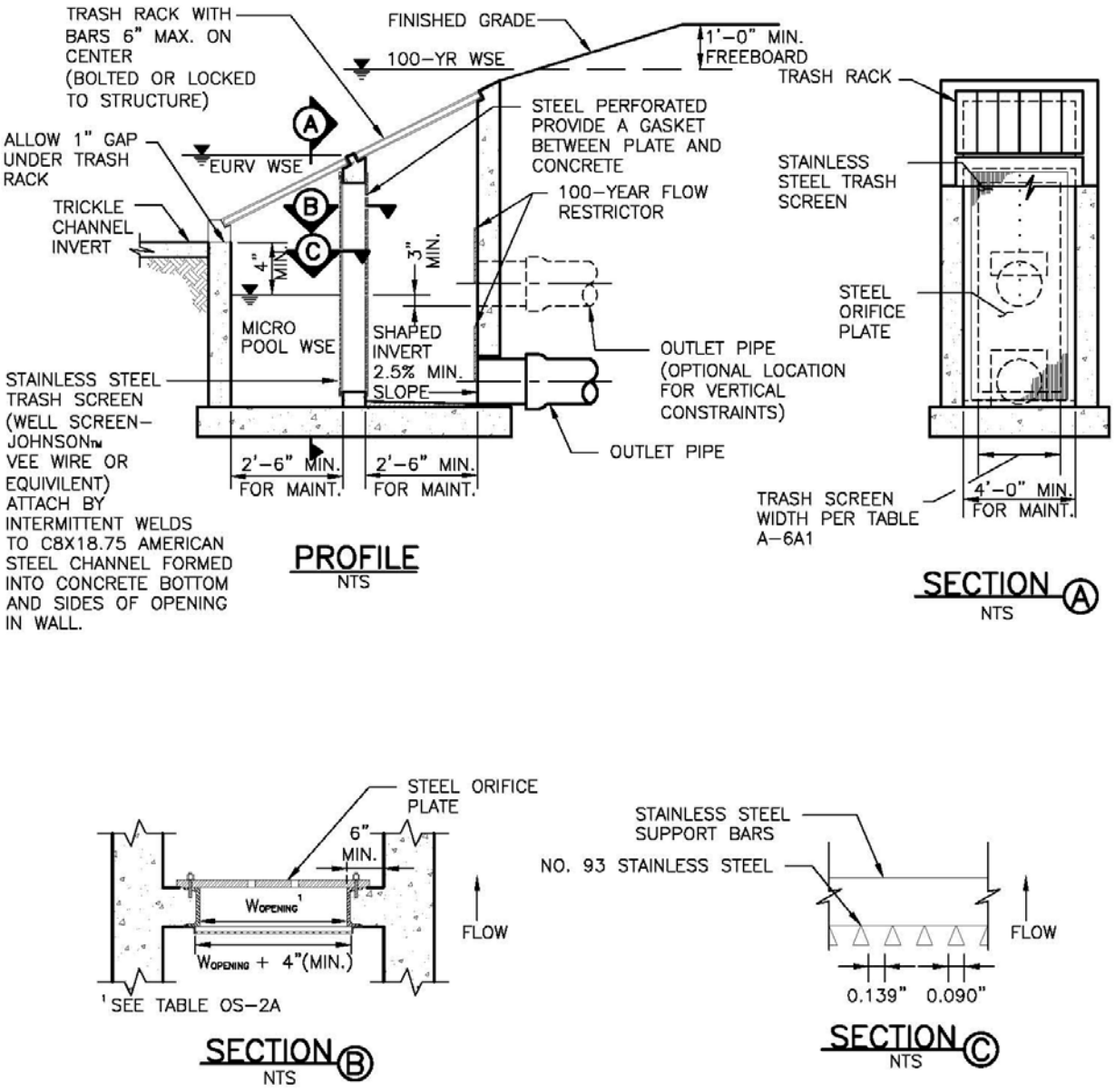


Figure OS-7. Full Spectrum Detention Outlet Structure for 5-acre Impervious Area or Less

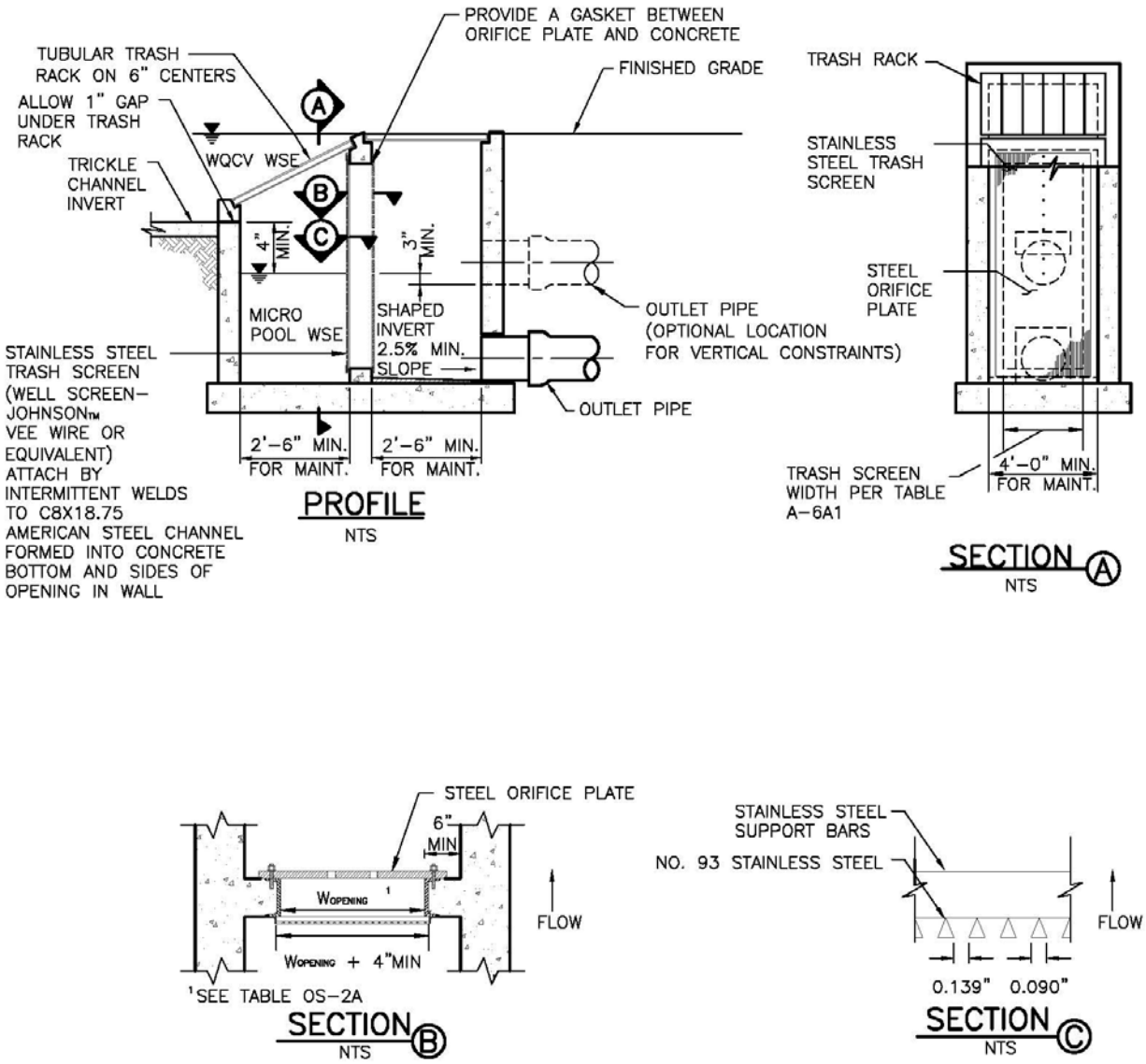


Figure OS-8. WQCV Outlet Structure for 5-acre Impervious Area or Less

6-1 Stormwater Quality Permit Documents

In order to attain an Adams County Stormwater Quality Permit it is necessary to submit the required application and forms. Prior to release of surety the permittee must follow the close-out process.

6-1.1 Template, Surety and State SW Permit Certification

The following documents must be submitted to the County for review prior to attaining an Adams County Stormwater Quality Permit:

a. Erosion and Sediment Control Plan – using the ESC Plan Template
b. Copy of the State CDPS Stormwater Construction Permit Certification
c. Opinion of Cost spreadsheet used to calculate the necessary surety to post
d. Provide surety in the form of an Irrevocable Letter of Credit

6-1.2 Certifications, Applications and ESC Plans

Prior to the release of surety, your construction site must be final stabilized and the permittee shall fill out and submit the following documents to the Stormwater Regulatory Compliance Unit:

a. Drainage Certification
b. Construction Site Stabilization Certification
c. Release of Financial Surety Request Form
d. CDPS Stormwater Construction Permit Inactivation Application
e. An electronic (.pdf), color copy of the final marked up ESC Plan. This includes documentation over the duration of the SWQ Permit

The ESC Plan Template, Opinion of Cost spreadsheet, Certifications, etc. can be found under the stormwater construction section of the County's website at: http://www.co.adams.co.us/index.aspx?NID=327.

For questions please contact:

Adams County Government Center
PW – SRC Unit
4430 S. Adams County Pkwy, 1st Fl., Ste. W2000B
Brighton, CO 80601
720-523-6875
swq@adcogov.org

Erosion and Sediment Control Plan Template

Erosion and Sediment Control Plan

for:

Insert Project Name
Insert Project Site Location/Address
Insert City, State, Zip Code

Operator(s):

Insert Company or Organization Name
Insert Owner Name
Insert Address
Insert City, State, Zip Code
Insert Telephone/Cell Number
Insert Fax/Email

ESC Plan Administrator:

Insert Company or Organization Name
Insert Name
Insert Address
Insert City, State, Zip Code
Insert Telephone/Cell Number
Insert Fax/Email

ESC Plan Preparation Date: Insert Date
Plan Revision: Insert Date
Docs. #3697430-v3

Table of Contents

General Instructions:
To fill out the Erosion and Sediment Control Template, select (double right click) the blue text and enter the applicable information.

When a blue box ☐ is present, check the applicable selection.

In general, if a section is not applicable to the project, select the blue text and enter not applicable "N/A".

In section 1.8 always answer "**Yes**" or "**No**"; no items shall be left blank!

Note that Appendix 13 – Subcontractor Certifications/Agreement is optional to the permittee.

SECTION 1: SITE EVALUATION, ASSESSMENT, AND PLANNING

1.1 Project/Site Information

Instructions:

- In this section, include basic site information identifying general project information, permit numbers and include a project vicinity map in Appendix 1 – Project Vicinity Map.

Project/Site Name: Insert Project/Site Name

Project Street/Location: Insert Project Street/Location

City: Insert City State: CO ZIP Code: Insert Zip Code

Subdivision: Insert Subdivision Name

County SWQ Permit Number: Insert ADCO SWQ Permit Number

Attach color project vicinity map in Appendix 1 – Project Vicinity Map.

1.2 Contact Information/Responsible Parties

Instructions:

- List the owners(s) operator(s), project managers, stormwater contact(s), and person or organization that prepared the ESC Plan. Indicate respective responsibilities, where appropriate. To do this, select the blue text by double right clicking then type in the applicable information.
- Place a copy of the State CDPS Stormwater Construction Permit Certification Page in Appendix 2 – State CDPS Stormwater Construction Permit Certification Page.

Owner(s):

Insert Owner(s) Company or Organization Name
Insert Owner(s) Name
Insert Owner(s) Address, City, State and Zip
Office #: (xxx)-xxx-xxxx Fax #: (xxx)-xxx-xxxx
Cell #: (xxx)-xxx-xxxx Email Address: xxx@xxx.com

Site Supervisor(s):

Insert Site Supervisor(s) Company or Organization Name
Insert Site Supervisor(s) Name
Insert Site Supervisor(s) Address
Insert Site Supervisor(s) City, State, Zip Code
Office #: (xxx)-xxx-xxxx Fax #: (xxx)-xxx-xxxx
Cell #: (xxx)-xxx-xxxx Email Address: xxx@xxx.com

ESC Plan Administrator(s):

Insert ESC Plan Administrator(s) Company or Organization Name
Insert ESC Plan Administrator(s) Name
Insert ESC Plan Administrator(s) Address
Insert ESC Plan Administrator(s) City, State, Zip Code
Office #: (xxx)-xxx-xxxx Fax #: (xxx)-xxx-xxxx
Cell #: (xxx)-xxx-xxxx Email Address: xxx@xxx.com
Insert ESC Plan Administrator's area of control (if more than one operator at site)
Insert area of control (if more than one operator at site)

This ESC Plan was Prepared by:

Insert Company or Organization Name
Insert Name
Insert Address

Insert City, State, Zip Code
Office #: (xxx)-xxx-xxxx Fax #: (xxx)-xxx-xxxx
Cell #: (xxx)-xxx-xxxx Email Address: xxx@xxx.com

Emergency 24-Hour Contact:
Insert Company or Organization Name
Insert Name
Office #: (xxx)-xxx-xxxx Cell #: (xxx)-xxx-xxxx

State CDPS Stormwater Construction Permit #: COR-03Xxxx

Attach a copy of the State CDPS Stormwater Construction Permit Certification Page in Appendix 2 – State CDPS Stormwater Construction Permit Certification.

1.3 Nature and Sequence of Construction Activity

Instructions:

- Describe the scope of the construction activity at the project site.
- Identify the purpose of the construction activity and include estimated dates construction will begin and commence.
- Describe the sequence for major construction activities at each phase of the construction project.

Describe the project scope of work:

INSERT TEXT HERE

What is the function of the construction activity (select check box)?

☐ Residential ☐ Commercial ☐ Industrial ☐ Road Construction ☐ Linear Utility

☐ Other (please specify): INSERT TEXT HERE

Estimated Project Start Date: Insert Estimated Project Start Date

Estimated Project Completion Date: Insert Estimated Project Start Date

Estimated Project Final Stabilization: Insert Estimated Project Start Date

Describe the major phases of Construction:

INSERT TEXT HERE

1.4 Soils, Slopes, Vegetation, and Current Drainage Patterns

Instructions:

- Describe the existing soil conditions at the construction site including soil type(s), drainage patterns, and other topographic features that might affect erosion and sediment control.
- Describe the pre-disturbance vegetation and include color pre-disturbance photos in Appendix 3 – Pre-Disturbance Photos.
- Note any soil or groundwater contamination evident from existing site features and known past usage of the site.

Soil type(s):

INSERT TEXT HERE

Slope(s) - describe current slope and its ratio i.e. 3:1, and note any changes to any of the slopes due to grading or fill activities:

INSERT TEXT HERE

Drainage Pattern(s) - describe current drainage patterns and note any changes due to the proposed grading or fill activities:

INSERT TEXT HERE

Vegetation - describe pre-disturbance vegetation and estimate of percent vegetative cover:

INSERT TEXT HERE

Attach color pre-disturbance photo in Appendix 3 – Pre-Disturbance Photos.

1.5 Construction Site Estimates

Instructions:

- Estimate the area to be disturbed by excavation, grading, or other construction activities, including dedicated off-site borrow and fill areas, equipment and material storage areas, and staging areas.
- Calculate the percentage of impervious surface area before construction.

The following are estimates of the construction site.

Total project area:	Insert Total project area	acres
Construction site area to be disturbed:	Insert Total Disturbed Area	acres

1.6 Receiving Waters

Instructions:

- List the waterbody(s) that would receive stormwater from your site, including streams, rivers, lakes and wetlands. Describe each as clearly as possible, such as: *Clear Creek, a tributary to the South Platte River*, and so on.
- List the jurisdictional storm sewer system or drainage system that stormwater from your site discharges to, such as *Storm sewer system at inlets, culverts and pipes* – Adams County MS4.

Description and name of receiving waters:
INSERT TEXT HERE

Description and owner's name of storm sewer system:
INSERT TEXT HERE

Other:
INSERT TEXT HERE

1.7 Protected Site Features and Sensitive Areas

Instructions:

- Describe unique site features including streams, stream buffers, wetlands, specimen trees, natural vegetation, steep slopes, or highly erodible soils that are to be preserved. Describe the measures that will be used to protect these features. Include unique features and sensitive areas on your ESC Plan site drawings.
- Identify and describe any historic structures and the methods to be used for demolition or protection.
- Describe any known soil or groundwater contamination; note that additional permitting will be required from the State Water Quality Control Division.

Historic Site Contamination (describe any known site contamination i.e. soil, ground water). Refer to http://www.cdphe.state.co.us/hm/HMSiteCover.htm and access the Hazardous Materials and Waste Management Division Site Locator Mapping Application:

INSERT TEXT HERE

1.8 Potential Sources of Pollution

Instructions:

- Below is a comprehensive source list of potential sediment and pollutants associated with construction, which may reasonably be expected to affect the quality of stormwater discharges from the construction site. Add rows if additional potential sources of pollution are not included.
- Identify and list all potential sources of pollution, other than sediment, which may reasonably be expected to affect the quality of stormwater discharges from the construction site.
- Below, identify if a potential pollutant source that is applicable to the construction site by selecting the blue Yes/No **then** type "**yes**" or "**no**" in the applicable information.

Potential Pollution Source	Potential on This Site?	Control Measures	BMP Implementation
All Disturbed and Stored Soils - grading - spoils - stockpiles	Yes/No	1. Sediment and Erosion Control Measures (IP1, IP2, SF, SSA, TRM, RECP, TOP, SCL, SBB, RS, SB, ST) 2. Preservation of Existing Vegetation (PV, VB, CF, CP) 3. Materials Management 4. Solid Waste Management (SP, GH) 5. Stockpile Management (SP) 6. Vehicle Tracking Controls (VTC)	1. Install BMPs prior to major construction. 2. Delineate protected areas prior to major construction. 3. Material management effective once material arrives on site. 4. Place trash receptacles on site prior to major construction. 5. Implement spill response procedures as needed. 6. Implement stockpile management controls as needed. 7. Delineate vehicle travel areas prior to major construction, adjust as needed.
Vehicle Tracking of Sediments - all permitted area vehicle traffic	Yes/No	1. Sediment and Erosion Control Measures (IP1, IP2, SF, SSA, TRM, RECP, TOP, SCL, SBB, RS, SB, ST) 2. Vehicle Traffic Controls 3. Vehicle Tracking Controls (VTC) 4. Street Sweeping (SS)	1. Install BMPs prior to major construction. 2. Delineate vehicle travel areas prior to major construction, adjust as needed. 3. Install VTC BMP prior to construction. 4. Implement street sweeping in conjunction with start of major construction and as needed.
Management of Contaminated Soils - fluid spills	Yes/No	1. Hazardous Materials Management (GH, CT) 2. Spill Response and Notification (GH) 3. Stockpile Management (SP)	1. Implement hazardous materials management as needed. 2. Implement spill response procedures as needed. 3. Implement stockpile management controls as needed.

* See the Stormwater Regulation Guide for acronyms used to identify BMP details.

Potential Pollution Source	Potential on This Site?	Control Measures	BMP Implementation
Loading and Unloading Activities - construction materials	Yes/No	1. Material Management (GH) 2. Vehicle Traffic Controls (VTC)	1. Materials management effective once materials arrive on site and effective throughout the project. 2. Delineate vehicle travel areas prior to major construction, adjust as needed.
Outdoor storage activities - building materials - fertilizers - chemicals	Yes/No	1. Material Storage Procedures (GH)	1. Designate materials storage areas prior to the delivery of materials. 2. Materials left outdoors must be covered if they can become a pollutant when mixed with water. 3. Secondary containment must be used for hazardous materials.
Vehicle equipment maintenance and fueling - gas - diesel - oil - lubricants - hydraulic fluids	Yes/No	1. Spill prevention controls (GH) 2. Designated Fuel Storage Area (GH) 3. Spill Response and Notification (GH)	1. Implement spill prevention controls as needed. 2. Designate fuel storage area as needed. 3. Implement spill response and notification procedures as needed.
Dust Control - Wind Transport - Saw Cutting Activities	Yes/No	1. Dust Control (DC) 2. Temporary Soil Stabilization (SF, SD, GB, SSA, TRM, RECP, TOP) 3. Street Sweeping (SS) 4. Preservation of Existing (PV, VB, CF) Vegetation (VB, CF)	1. Implement dust control in conjunction with soil disturbing activities and as needed. 2. Implement temporary soil stabilization measures as soon as practical. 3. Implement street sweeping at the start of major construction and maintain as needed. 4. Delineate protected areas prior to major construction.
Routine maintenance activities - fertilizers - pesticides - detergents - fuels - solvents - oils, etc.	Yes/No	1. Material Storage (GH) 2. Hazardous Waste Management (GH, CT) 3. Erosion and Sediment Controls (IP1, IP2, SF, SSA, TRM, RECP, TOP, SCL, SBB, RS, SB, ST)	1. Designate materials storage areas prior to their arrival on site. 2. Practice hazardous waste management procedures during the storage of such materials. 3. Install sediment and erosion control BMPs prior to conducting landscape activities.

* See the Stormwater Regulation Guide for acronyms used to identify BMP details.

Potential Pollution Source	Potential on This Site?	Control Measures	BMP Implementation
On-site waste management practices	Yes/No	1. Waste Management (GH) 2. Liquid Waste Management (GH) 3. Hazardous Waste Management (GH, CT)	1. Place trash receptacles on site prior to major construction. 2. Place designated watertight receptacles or washout area(s) prior to proceeding with an activity that is known to produce liquid waste. 3. Implement hazardous waste management procedures as needed.
Concrete truck/equipment washing	Yes/No	1. Concrete Washout area (CWA)	1. Install designated concrete washout(s) prior to commencement of concrete activities.
Dedicated asphalt and concrete batch plants	Yes/No	1. Secondary Containment 2. Concrete Washout Area (CWA) 3. Solid Waste Management (GH) 4. Materials Management (GH)	1. Install secondary containment BMPs prior to using dedicated batch plants. 2. Dedicated washout area must be established before construction begins. 3. Trash receptacles on site prior to major construction activities. 4. Material management effective once material arrives on site.
Non-industrial waste sources – worker trash and portable toilets	Yes/No	1. Sanitary Waste (GH) 2. Solid Waste Management (GH)	1. Place temporary sanitary facilities on site as needed and protect from off-site discharge. 2. Trash receptacles on site prior to major construction activities.
Waste from geo-technical testing, potholing, saw cutting, and utility borings for locates	Yes/No	1. Dust Control (DC) 2. Material Storage (GH) 3. Solid Waste Management (GH)	1. Implement dust control in conjunction with soil disturbing activities and as needed. 2. Designate materials storage areas prior to their arrival on site. 3. Trash receptacles on site prior to major construction activities.
Fly Ash - concrete - flow fill	Yes/No	1. Concrete Washout area (CWA) 2. Hazardous Waste Management (GH)	1. Install designated concrete washout(s) prior to commencement of concrete activities. 2. Implement hazardous waste management procedures as needed.

* See the Stormwater Regulation Guide for acronyms used to identify BMP details.

Potential Pollution Source	Potential on This Site?	Control Measures	BMP Implementation
Demolition of infrastructure, i.e. - concrete curb - asphalt road - steel/rebar	Yes/No	1. Dust Control (DC) 2. Solid Waste Management (GH)	1. Implement dust control in conjunction with soil disturbing activities and as needed. 2. Trash receptacles on site prior to major construction activities.
Drywall Mud and Paint	Yes/No	1. Liquid Waste Management (GH)	1. Place designated watertight receptacles or washout area(s) prior to proceeding with an activity that is known to produce liquid waste.
Electric Generator, i.e. pump	Yes/No	1. Secondary Containment 2. Spill Response and Notification (GH) 3. Hazardous Waste Management (GH, CT)	1. Install secondary containment BMPs prior to using generators. 2. Implement hazardous waste management procedures as needed.
Other areas or procedures where potential spills can occur	Yes/No	1. Hazardous Waste Management (GH) 2. Spill Response and Notification (GH)	1. Implement hazardous waste management as needed. 2. Implement spill response and notification procedures as necessary.
Flushing New Waterlines	Yes/No	1. Sediment and Erosion Control Measures 2. Low Risk Guidance for Potable Water**	1. Install sediment and erosion control measures prior to discharge. 2. Follow BMPs required by this low risk guidance.
Potential Source of Pollutant	Yes/No	Control Measures	BMP Implementation
Potential Source of Pollutant	Yes/No	Control Measures	BMP Implementation
Potential Source of Pollutant	Yes/No	Control Measures	BMP Implementation

* See the Stormwater Regulation Guide for acronyms used to identify BMP details.

Potential hazardous material/chemical pollutants, to stormwater runoff:

Potential On This Site	Material/ Chemical	Physical Description	Stormwater Pollutants	Location
Yes/No	Fertilizer	Liquid or solid grains	Nitrogen, phosphorous	Newly seeded areas
Yes/No	Cleaning solvents	Colorless, blue, or yellow-green liquid	Perchloroethylene, methylene chloride, trichloroethylene, petroleum distillates	Staging areas
Yes/No	Asphalt	Black solid	Oil, petroleum distillates	Streets
Yes/No	Concrete and Grout	White solid/grey liquid	Limestone, sand, pH, chromium	Curb and gutter, sidewalk, building construction
Yes/No	Curing compounds	Creamy white liquid	Naphtha	Curb and gutter, sidewalk, driveways, concrete slabs
Yes/No	Hydraulic oil/ fluids	Brown, oily petroleum hydrocarbon	Mineral oil	Leaks or broken hoses from equipment
Yes/No	Gasoline	Colorless, pale brown or pink petroleum hydrocarbon	Benzene, ethyl benzene, toluene, xylene, MTBE	Secondary containment/staging area
Yes/No	Antifreeze/ coolant	Clear green/yellow liquid	Ethylene glycol, propylene glycol, heavy metals (copper, lead, zinc)	Leaks or broken hoses from equipment or vehicles
Yes/No	Sanitary toilets	Various colored liquid	Bacteria, parasites, and viruses	Staging areas

Insert any additional hazardous material/chemical pollutants that are not listed above here.
INSERT TEXT HERE

***If "Flushing New Waterlines" is applicable to this construction project, the following information is applicable to this project.*

LOW RISK DISCHARGE GUIDANCE: DISCHARGES OF POTABLE WATER
Revised August 2009

This discharge guidance has been developed in accordance with WQP-27, Low Risk Discharges. The Division has previously had coverage for some discharges of potable water under the Treated Water Distribution Permit (COG380000), however, this permit is only available to entities that produce, store and distribute potable water supplies. The Division does not intend to renew the Treated Water Distribution Permit as all authorized discharges under this permit are potable water related. Other discharges of potable water have been covered under the Minimum Industrial Discharge Permit (COG600000); however, this permit is in process of being dismantled as it has evolved into covering numerous facility and discharge types.

When the provisions of this guidance are met, the Division will not actively pursue permitting or enforcement for the discharge of potable water, unless on a case-by-case basis the Division finds that a discharge has resulted in an adverse impact to the quality of any state waters receiving the discharge.
Discharges of potable water are a type of industrial activity with short term infrequent discharges that with proper management are not expected to contain pollutants in concentrations that are toxic or in concentrations that would cause or contribute to a violation of a water quality standard. The typical pollutant of concern is total residual chlorine, however, depending on how the discharge occurs, total suspended solids and oil and grease may become pollutants of concern. These pollutants can be handled using dechlorination techniques, filters, oil booms, and other best management practices (BMPs).
There are a large number of discharges of potable water, some of which are covered under the previously mentioned General Permits. Numerous discharges occur without permit coverage. These types of discharges may occur at all times of the year, and require a resource intensive effort to permit, without resulting in a clear general benefit to environmental quality.

The following conditions must be followed by anyone discharging potable water:
The discharge of cleaning materials or chemicals, including dyes, is strictly prohibited, and shall be sent to the sanitary sewer, with permission of the local wastewater treatment facility, or otherwise collected and disposed of.

The potable water shall **not** be used in any additional process. Processes include, but are not limited to, any type of washing, heat exchange, manufacturing, and hydrostatic testing of pipelines not associated with treated water distribution systems.

The discharge shall be from a potable water distribution system, tank or storage that has been maintained for potable water distribution use. Discharges from a distribution system, tank or storage that is used for conveyance or storage of materials other than potable water is not authorized under this policy.

The discharge shall not cause erosion of a land surface.

The discharge shall not contain solid materials in concentrations that can settle to form bottom deposits detrimental to the beneficial uses of the state waters or form floating debris, scum, or other surface materials sufficient to harm existing beneficial uses.

All discharges must comply with the lawful requirements of federal agencies, municipalities, counties, drainage districts, ditch owners, and other local agencies regarding any discharges to storm drain systems, conveyances, ditches or other water courses under their jurisdiction.

The guidance included in this document in no way reduces the existing authority of the owner of a storm sewer, ditch owner, or other local agency, from prohibiting or placing additional conditions on the discharge.

If the discharge is directly to a State surface water (any stream, creek, gully, whether dry or flowing), it must not contain any residual chlorine. The operator is responsible for determining what is necessary for removing chlorine from the discharge. If the discharge is to a ditch, chlorine content may be limited by the owner of the ditch. However, if the ditch returns flow to classified state waters, it must not contain any residual chlorine at the point where it discharges to the classified state water.

BMPs shall be implemented as necessary to meet the conditions above, by anyone discharging potable water. These BMPs have been developed by the Division to help ensure that the discharge will not negatively affect water quality.

For discharge to the ground, the water shall not cause any toxicity to vegetation. When discharging, allow the water to drain slowly so that it soaks into the ground as much as possible.

If discharge is to the sanitary sewer, contact the local wastewater treatment facility prior to discharge. System owners may grant blanket authorization to discharge to their systems. This must be done to ensure that the facility is able to accept the discharge. Not all facilities are able to accept such discharges. Note that additional restrictions or local guidelines may apply.

Removal of any residual chlorine must be done for any direct discharge to state surface waters or for any discharge to a storm sewer or conveyance where the chlorine will not dissipate prior to reaching state surface water. Dechlorination, if necessary, may be achieved by allowing water to stand uncovered until no chlorine is detected, or by dechlorination using a portable dechlorinator. Pay particular attention when handling super-chlorinated waters. A longer time is needed to dissipate chlorine from super-chlorinated waters.

The discharge shall be conducted to minimize the potential to pick up additional suspended solids. When possible, a best management practice, or combination of practices, for filtering or settling suspended solids and other debris, or a combination of practices, shall be used to remove suspended solids or other debris. Examples of suspended solid removal practices include, but are not limited to check dams, filter bags, and inlet protection. These devices shall be used and maintained in accordance with the manufacturers specifications.

The discharge shall be conducted to minimize the potential that it will not pick up any oil and grease. When possible, an absorbent oil pad, boom or similar device shall be used to eliminate oil from the discharge.

Contact Information:
Questions regarding this action shall be forwarded to Nicole Rolfe at: nicole.rolfe@state.co.us

1.9 Demolition

Instructions:

- Before demolition of a structure begins, a copy of the asbestos certification from the State certifying the structure is free of asbestos and other pollutants must be obtained. Attach a copy of the County Demolition Permit including the state issued asbestos abatement permit in Appendix 4 – Copy of Demolition Permit and State Asbestos Permit Certification.

Are there any structures to be demolished as part of construction related to this site?

☐ Yes ☐ No

If yes, describe or refer to documentation that determines the likelihood of an impact for erosion and the steps taken to address that impact. Place a copy of the state asbestos certification in Appendix 4, as applicable.

INSERT TEXT HERE

SECTION 2: EROSION AND SEDIMENT CONTROL BMPS

Instructions:

- Multiple structural and non-structural BMPs are used during each phase of construction to minimize erosion and the transport of sediment. Included is the *Expected Level of BMP Information* for structural and non-structural BMPs that are expected to minimize sediment transport and erosion control.
- Describe the BMPs that will be implemented to control pollutants in stormwater discharges. For each major activity identified below, complete the following:
  - ✓ Clearly select and describe appropriate control measures.
  - ✓ Describe the maintenance and inspection procedures that will be used for that specific BMP.
  - ✓ Include protocols, thresholds, and schedules for cleaning, repairing or replacing damaged or failing BMPs.
- If a construction project uses a BMP that is not included below, add BMPs in the place provided after each listed BMP and ensure that the *Expected Level of BMP Information* is included.
- Below are the listed BMP descriptions *Expected Level of BMP Information* items that address the following:
  - ✓ What BMPs will be installed?
  - ✓ When will the BMPs be implemented and removed?
  - ✓ Where will the BMPs be implemented?
  - ✓ How will the BMPs be maintained?
- Place all BMP details and associated procedures in Appendix 5 – Erosion and Sediment Control BMP Details.
- Categorize and describe each BMP under one of the following 8 activities:
  - *2.1 Minimize Disturbed Area and Protect Natural Features and Soil*
  - *2.2 Control Stormwater Flowing onto and through the Project*
  - *2.3 Stabilize Soils and Protect Slopes*
  - *2.4 Protect Storm Drain Inlets*
  - *2.5 Establish Perimeter Controls and Sediment Barriers*
  - *2.6 Retain Sediment On-Site and Control Dewatering Practices*
  - *2.7 Establish Stabilized Construction Exits*
  - *2.8 Any Additional BMPs*

Below are standard structural and non-structural practices that are often used for erosion and sediment control throughout a construction project. BMPs include but are not limited to the following list. Following each BMP is a placeholder for additional site specific comments or information the designer may want to include. If a BMP is not included, space has been provided at the end of each BMP table. Any additional BMPs shall include all four "Expected Level of BMP Information" (i.e. What, When, Where, How). All BMPs shall be installed as a phased operation when construction progresses.

Expected Level of BMP Information = What, When, Where and How

2.1 Minimize Disturbed Area and Protect Natural Features and Soil

Instructions:

- Describe the areas that will be disturbed with each phase of construction and the methods (e.g., signs, construction fence) that you will use to protect those areas that shall not be disturbed. Describe natural features identified earlier and how each will be protected during construction activity. Include these areas and associated BMPs on your site map(s) also. (Information can be found in the Stormwater Regulation Guide Detail SM-2 Protection of Existing Vegetation.)
- Below, identify BMPs that are applicable to the construction site by selecting the blue Yes/No then type "**yes**" or "**no**" AND identify the phase of construction the BMP is associated with, i.e. Phase1, 2, 3 or N/A.

Permitted Limits of Disturbance	Used: Yes	Phase(s): 1, 2, and 3
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	Used to designate the area of land that will be disturbed by construction activities.	
When – Installation	The permitted limits of disturbance shall be designated prior to land disturbing activities. If, at any time during construction, land is disturbed outside of the permitted area, the CDPS Stormwater Construction Permit and ESC Plan must be amended.	
Where – Location	The permitted limits of disturbance shall be identified on the ESC Plan.	
How – BMP Maintenance and Inspection	Typically, the permitted limits of disturbance are delineated by silt fence or construction fence. The Permittee shall continuously inspect and maintain the permitted limits of disturbance in an effort to not disturb land outside of the limits.	

Protection of Existing Vegetation (PV) SM-2	Used: Yes	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	A construction fence shall is installed around native areas that requires protection. It may also be necessary to install perimeter controls to prevent sediment loading to sensitive areas.	
When – Installation	BMPs installed for protection of existing vegetation shall be installed prior to land disturbing activities or as part of the phasing of the construction project.	
Where – Location	Protection of existing vegetation BMPs shall be installed at locations identified on the ESC Plan. These locations will be any	

	area that has been designated as a preservation area.
How – BMP Maintenance and Inspection	Protection of existing vegetation BMPs shall be installed per the protection of existing vegetation detail (Appendix 5 – Erosion and Sediment Control BMP Details and Procedural Plans). Clearly mark the area on the site plan to be preserved. No stockpiles, equipment, trailers or parking shall be allowed within the area. Repair or replace damaged or displaced protective barriers around the vegetated area. The Permittee shall continuously inspect and maintain all areas that are designated to be protected. If damage to the vegetation occurs in a protected area, reseed the area with the same or similar species. Construction equipment must not enter a wetland area, except as permitted by the U.S. Army Corps of Engineers (USACE). In advertent placement of fill in a wetland is a 404 permit violation and will require notification of the USACE.

BMP Name	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☐ ***Temporary***	
What – BMP Description	INSERT TEXT HERE	
When – Installation/Removal	INSERT TEXT HERE	
Where – Location	INSERT TEXT HERE	
How – BMP Maintenance and Inspection	INSERT TEXT HERE	

For additional BMPs, repeat as needed here

2.2 Control Stormwater Flowing onto and through the Project

Instructions:

- Describe structural practices (e.g., swales, diversions, berms, ditches, storage basins) used to divert flows from exposed soils, retain or detain flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. . (Information can be found in the Stormwater Regulation Guide Details EC-7 Temporary Slope Drains, EC-10 Earth Dikes and Drainage Swales & SC-8 Sediment Trap.)
- Below, identify BMPs that are applicable to the construction site by selecting the blue Yes/No then type "**yes**" or "**no**" AND identify the phase of construction the BMP is associated with, i.e. Phase1, 2, 3 or N/A.

Temporary Slope Drains (TSD) BMP Detail EC-7	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	A pipe or culvert used to convey water down a slope where there is high potential for erosion. A collection system at the top of the slope directs runoff to the conveyance. The pipe outlet must be equipped with outlet protection.	
When - Installation	Temporary slope drains shall be installed prior to up gradient land disturbing activities and are to remain in place until no longer needed, but shall be removed prior to the end of construction.	
Where – Location	Temporary slope drains shall be installed at the locations identified on the ESC Plan. They are for use on long, steep slopes where there is a high potential for flow concentration.	
How – BMP Maintenance and Inspection	Temporary slope drains shall be installed and maintained per the temporary slope drain detail EC-7 (Appendix 5 - Erosion and Sediment Control BMP Details). The Permittee shall continuously inspect and maintain all temporary slope drains throughout construction. Inspect the entrance for sediment accumulation and remove, as needed. Inspect the downstream outlet for signs of erosion and stabilize, as needed. Remove accumulated sediment at the entrance and outfall, and inspect pipe anchors to ensure they are secure.	

Earth Dikes/Drainage Swales (ED/DS) BMP Detail EC-10 Used: Yes/No Phase(s): 1, 2, 3, N/A	
☐ ***Permanent***	☒ ***Temporary***
What – BMP Description	Temporary storm conveyance channels used to divert runoff around slopes or to convey runoff to additional sediment control BMPs prior to discharge from the site.
When – Installation/Removal	Earth dikes and drainage swales will be installed immediately upon completion of channel grading and will remain in place until the end of construction.
Where – Location	Earth dikes and drainage swales shall be installed at the locations identified on the ESC Plan. They are typically installed around steep slopes or as a temporary conveyance feature leading to a sediment basin or trap.
How – BMP Maintenance and Inspection	Earth dikes and drainage swales shall be installed per the earth dikes and drainage swales detail EC-10 (Appendix 5 – Erosion and Sediment Control BMP Details and Procedural Plans). The Permittee shall continuously inspect and maintain all earth dikes and drainage swales for stability, compaction and signs of erosion and repair. Inspect side slopes for erosion and damage to erosion control fabric. Stabilize slopes and repair fabric as necessary. Accumulated sediment shall be removed when the sediment has accumulated to one-half of the depth of the earth dike or drainage swales.

Sediment Trap (ST) BMP Detail SC-8 Used: Yes/No Phase(s): 1, 2, 3, N/A	
☐ ***Permanent***	☒ ***Temporary***
What – BMP Description	An excavated or bermed area designed to capture drainage, allowing settling of sediment from a disturbed area less than one acre.
When – Installation/Removal	A sediment trap shall be installed prior to land disturbing activities; the sediment trap shall not be removed until the upstream area is sufficiently stabilized.
Where – Location	Sediment traps shall be installed at the locations identified on the ESC Plan. It shall be installed across a low area or drainage swale.
How – BMP Maintenance and Inspection	Sediment trap shall be installed per the sediment trap detail SC-8 (Appendix 5 – Erosion and Sediment Control BMP Details). The Permittee shall continuously inspect and maintain the sediment

	trap embankments for stability and seepage. Inspect the sediment trap embankments for stability and seepage, and the outlet for debris and damage. Repair damage to the outlet, and remove all obstructions. Accumulated sediment shall be removed when it reaches ½ the height of the outflow embankment.

Temporary Diversion Channel (TDC) *SM-8*	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	Diverts water from a stream to allow for construction activities to take place underneath or in the stream.	
When – Installation/Removal	All BMPs associated with a temporary diversion channel shall be installed prior to the start of any construction activities within a stream; removed when the work at the down gradient or natural channel is no longer required, the diversion channel shall be backfilled and stabilized.	
Where – Location	Temporary diversion channels shall be installed at the location identified on the ESC Plan. Temporary diversion channel BMPs can be used in the following locations: construction of detention ponds, dams, in-stream grade control structures, utility installations or any activity that requires work in a waterway.	
How – BMP Maintenance and Inspection	Temporary diversion channel shall be installed per the temporary diversion channel detail SM-8 (Appendix 5 - Erosion and Sediment Control BMP Details). The Permittee shall frequently and continuously inspect and maintain all temporary diversion channel BMPs throughout construction. Flow barriers shall be inspected at the start and end of each workday. The diversion channel shall be inspected for signs of erosion and the lining repaired or replaced if necessary.	

Dewatering Operations (DW) SM-9	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	Pumping water from an inundated area to a BMP, then	

	downstream to a receiving waterway, sediment basin or well-vegetated area. When pumping water outside of the permitted boundary a separate State Dewatering Permit is required.
When – Installation/Removal	Dewatering operations are used when an area of the construction site that is inundated with water which needs to be dewatered as a result of a large storm event, groundwater or existing ponding conditions; and be removed once the work in the down gradient area or natural channel is no longer required.
Where – Location	Dewatering BMPs shall be installed at the locations identified on the ESC Plan. Dewatering operations may occur in any area of the construction site where accumulated water needs to be removed.
How – BMP Maintenance and Inspection	Dewatering operations shall be conducted per dewatering operations detail SM-9 (Appendix 5 – Erosion and Sediment Control BMP Details). All dewatering discharges must be treated to remove sediment (and other pollutants as needed) before discharging from the construction site. The Permittee shall continuously inspect and maintain all dewatering operations throughout construction.

Temporary Stream Crossing (TSC) SM-10	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	A temporary crossing where an actively flowing watercourse must be crossed. Three methods are available: culvert crossing, stream ford and temporary bridge. A permit is required for placement of fill in a waterway under Section 404 of the Clean Water Act. Contact the local office of the U.S. Army Corps of Engineers regarding the requirements for obtaining a 404 permit.	
When – Installation/Removal	A temporary stream crossing shall be installed only when it is necessary to cross a stream; and removed when the crossing is no longer needed for construction.	
Where – Location	Temporary stream crossings shall be installed at the locations identified on the ESC Plan.	
How – BMP Maintenance and Inspection	Temporary stream crossings shall be installed per the temporary stream crossing detail SM-10 (Appendix 5 - Erosion and Sediment Control BMP Details).	

	The Permittee shall continuously inspect and maintain the temporary stream crossing throughout construction. Specifically, inspect for bank erosion and in-stream degradation.

BMP Name	Used: Yes/No	Phase(s):1, 2, 3, N/A
☐ ***Permanent***	☐ ***Temporary***	
What – BMP Description	INSERT TEXT HERE	
When – Installation/Removal	INSERT TEXT HERE	
Where – Location	INSERT TEXT HERE	
How – BMP Maintenance and Inspection	INSERT TEXT HERE	

For additional BMPs, repeat as needed here

2.3 Stabilize Soils and Protect Slopes

Instructions:

- Stabilize Soils - Describe controls (e.g., interim temporary mulching, seeding with native vegetation, hydro-seeding and soil binders) to stabilize exposed soils where construction activities have temporarily or permanently ceased. Also describe measures to control dust generation. (Information can be found in the Stormwater Regulation Guide Details EC-1 through EC-14 Erosion Control BMPs minus EC-5 & EC-9.)

- Protect Slopes - Describe controls (e.g., erosion control blankets, soil binders) including design specifications and details that will be implemented to protect all slopes from eroding. (Information can be found in the Stormwater Regulation Guide Details EC-1 through EC-14 Erosion Control BMPs minus EC-5 & EC-9.)

- Below, identify BMPs that are applicable to the construction site by selecting the blue Yes/No then type "**yes**" or "**no**" AND identify the phase of construction the BMP is associated with, i.e. Phase1, 2, 3 or N/A.

Surface Roughening (SR) BMP Detail EC-1	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	Tracking, scarifying, imprinting or tilling a disturbed area to provide temporary stabilization. Variations in the soil are created to help minimize wind and water erosion.	
When – Installation	Surface roughening shall be performed either after final grading or to temporarily stabilize an area during active construction.	
Where – Location	Surface roughening shall be used in the locations identified on the ESC Plan. It can be used on mild and steep slopes.	
How – BMP Maintenance and Inspection	Surface roughening shall be installed per the surface roughening detail EC-1 (Appendix 5 – Erosion and Sediment Control BMP Details). Surface roughening shall always be perpendicular to the slope. The Permittee shall continuously inspect and maintain all surfaces that are roughened throughout construction. Surface roughening shall be inspected for erosion as it is only a temporary control. Vehicles and equipment shall not be driven over areas that have been surface roughening. Additional activities may be needed to maintain the roughening on the soil surface.	

Temporary and Permanent Seeding (P) EC-2	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☒ ***Permanent***	☒ ***Temporary***	
What – BMP Description	*Amendment and Seed Specifications Must be Provided by ESC Plan Designer.* Seed is applied to disturbed areas in an effort to establish vegetation. Temporary seeding is used to stabilize disturbed areas that will be inactive for an extended period. Permanent seeding is used to stabilize areas at final grade that will not be otherwise stabilized. Effective seeding includes preparation of a seedbed, selection of an appropriate seed mixture, proper planting techniques, and protection of the seeded area with mulch, geotextile, or other appropriate measures. Mulching helps to protect the bare soil and must be secured by crimping, tackifiers, netting or other measures.	
When – Installation	Temporary and permanent seeding shall be performed on temporary inactive surfaces and following the completion of final grading.	
Where – Location	Temporary and permanent seeding shall be completed in the locations identified on the ESC Plan. They are used to stabilize areas at final grade that will not otherwise be stabilized.	
How – BMP Maintenance and Inspection	Permanent seeding and secured mulching shall be installed per the temporary and permanent seeding specifications and detail. The Permittee shall continuously inspect and maintain all temporary and permanent seeding and secured mulch throughout construction. Prepare the seedbed, select an appropriate seed mixture, use proper planting techniques and protect the seeded area with secured mulch.	

Soil Binders (SB) EC-3	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	A broad range of treatments that can be applied to exposed soils for temporary stabilization to reduce wind and water erosion.	
When – Installation	Use soil binders for short term temporary stabilization. Soil binders can break down fast due to natural weathering.	
Where – Location	Soil binders can be used on mild and steep slopes including	

	stockpiles. They are often used in areas where work has temporarily stopped, but is expected to resume before revegetation can is established.
How – BMP Maintenance and Inspection	Soil binders shall be used per the soil binder detail/specifications. The Permittee shall continuously inspect and maintain all areas where soil binders have been applied throughout construction. Soil binders can fail after heavy rainfall events and may require reapplication. In particular, soil binders will general experience spot failures during heavy rainfall events.

Mulching (MU) EC-4	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☒ ***Permanent***	☒ ***Temporary***	
What – BMP Description	Mulching consists of evenly applying straw, hay, shredded wood mulch, bark or compost to disturbed soils and securing the mulch be crimping, tackifiers or netting.	
When – Installation	Mulching is used in conjunction with seeding to help protect the seed bed and stabilize the soil. Mulch can also be used as a temporary cover on low to mild slopes to help temporarily stabilize disturbed area where there are growing season constraints. After mulching, the bare ground surface shall not be exposed. Reapply mulch, as needed, to cover bare areas.	
Where – Location	Temporary and permanent mulching shall be completed in the locations identified on the ESC Plan.	
How – BMP Maintenance and Inspection	Mulching shall be installed per the mulching detail EC-4 (Appendix 5 – Erosion and Sediment Control BMP Details). After mulching, the bare ground surface shall not be more than 10% exposed. Reapply mulch, as needed, to cover bare areas.	

Rolled Erosion Control Product (RECP) EC-6	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☒ ***Permanent***	☒ ***Temporary***	
What – BMP Description	A variety of temporary or permanently installed manufactured products designed to control erosion and enhance vegetation establishment and survivability, especially on slopes and in channels. There are four categories of products; mulch control netting, open weave textile, erosion control blanket and turf	

	reinforcement mat.
When – Installation	Rolled erosion control products shall be installed upon completion of slope grading and when revegetation measures are completed; rolled erosion control products are biodegradable typically and do not need to be removed after construction.
Where – Location	Rolled erosion control products shall be installed at the locations identified on the ESC Plan. They shall be installed according to manufacturer's specifications and guidelines.
How – BMP Maintenance and Inspection	Rolled erosion control products shall be installed per the rolled erosion control products detail EC-6 (Appendix 5 - Erosion and Sediment Control BMP Details). The Permittee shall continuously inspect and maintain all rolled erosion control products throughout construction. Check for signs of erosion, including voids under the mat. Also check for damaged or loose stakes and secure loose sections of the blanket.

Temporary Slope Drain (TSD) EC-7	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	A temporary slope drain is a pipe or culvert used to convey water down a slope where there is a high potential for erosion. A drainage channel or swale at the top of the slope typically directs up gradient runoff to the pipe entrance for conveyance down the slope. The pipe outlet must be equipped with outlet protection.	
When – Installation/Removal	A temporary slope drain shall be installed when it is necessary to convey water on long, steep slopes when there is a high potential of flow concentration or rill development. Temporary slope drains shall be removed when no longer needed or just prior to installation of permanent slope stabilization measures that cannot be installed with the slope drain in place.	
Where – Location	Temporary slope drain shall be installed at the locations indentified on the ESC Plan. It shall be installed where it is necessary to convey water down an erodible surface.	
How – BMP Maintenance and Inspection	Temporary slope drain shall be installed per the temporary slope drain detail EC-7 (Appendix 5 - Erosion and Sediment Control BMP Details). The Permittee shall continuously inspect and maintain all temporary slope drains as the conveyance system may be dislodged or displaced. Accumulated sediment shall be	

	removed before the outlet protection becomes buried and ineffective.

Temporary Outlet Protection (TOP) EC-8	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	Riprap rock placed at the outlet to help reduce erosion immediately downstream of a pipe, culvert, slope drain rundown or other conveyance with concentrated flow. Temporary outlet protection is intended to be used for less than two years.	
When – Installation/Removal	Temporary outlet protection shall be installed immediately upon the completion of grading; temporary outlet protection shall be removed once the pipe is no longer draining and upstream area or once the downstream area has been sufficiently stabilized.	
Where – Location	Temporary outlet protection shall be installed at the locations identified on the ESC Plan. It shall be installed where a conveyance discharges onto a disturbed area where there is a potential for accelerated erosion due to concentrated flow.	
How – BMP Maintenance and Inspection	Temporary outlet protection shall be installed per the temporary outlet protection detail with topside protection[1] EC-8 (Appendix 5 - Erosion and Sediment Control BMP Details). The Permittee shall continuously inspect and maintain all temporary outlet protection as the rocks may be damaged or displaced. Accumulated sediment shall be removed before the outlet protection becomes buried and ineffective. [1] 8/5/11 LR Comment	

Earth Dikes/Drainage Swales (ED/DS) BMP Detail EC-10	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	Temporary storm conveyance channels are used to divert runoff around slopes or to convey runoff to additional sediment control BMPs prior to discharge from the site.	
When – Installation/Removal	Earth dikes and drainage swales will be installed immediately upon completion of channel grading and will remain in place until the end of construction.	
Where – Location	Earth dikes and drainage swales shall be installed at the locations identified on the ESC Plan. They are typically installed around steep slopes or as a temporary conveyance feature leading to a	

	sediment basin or trap.
How – BMP Maintenance and Inspection	Earth dikes and drainage swales shall be installed per the earth dikes and drainage swales detail EC-10 (Appendix 5 - Erosion and Sediment Control BMP Details). The Permittee shall continuously inspect and maintain all earth dikes and drainage swales for stability, compaction and signs of erosion and repair. Inspect side slopes for erosion and damage to erosion control fabric. Stabilize slopes and repair fabric as necessary. Accumulated sediment shall be removed when the sediment has accumulated to one-half of the depth of the earth dike or drainage swales.

Terracing (TER) EC-11	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	Grading steep slopes into a series of relatively flat sections separated at intervals by steep slope segments. They shorten the uninterrupted flow lengths on steep slopes, reducing the development of rills and gullies.	
When – Installation/Removal	Terracing shall be completed during grading activities; when slope is at final grade vegetation shall be established as soon as possible.	
Where – Location	Terracing shall be installed at the locations identified on the ESC Plan. It is usually used to control erosion on slopes that are steeper than 4:1.	
How – BMP Maintenance and Inspection	Terracing shall be installed per the terracing detail EC-11 (Appendix 5 - Erosion and Sediment Control BMP Details). Terracing shall be used in combination with other stabilization measures that provide cover for exposed soils. The Permittee shall continuously inspect and maintain all terracing throughout construction. Remove accumulated sediment and repair rill erosion as necessary.	

Check Dams (CD) EC-12	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☒ ***Permanent***	☒ ***Temporary***	
What – BMP Description	Temporary grade control structures are used in drainage channels to reduce the velocity of runoff and concentrated flows. They can be constructed from rock, gravel bags, sand bags or proprietary devices.	
When – Installation/Removal	Check dams shall be installed prior to earth disturbing activities or immediately upon completion of channel grading. Temporary check dams shall be removed and stabilized. Permanent check dams shall be cleaned and remain in place.	
Where – Location	Check dams shall be installed at the locations identified on the ESC Plan. Typically they are placed in drainage channels, swales or on mild to moderately steep slopes.	
How – BMP Maintenance and Inspection	Check dams shall be installed per the check dam detail EC-12 (Appendix 5 - Erosion and Sediment Control BMP Details). They shall be placed at regularly spaced intervals along the drainage swale or ditch. The height of the dams shall allow for pooling of the runoff. The Permittee shall continuously inspect and maintain check dams as rocks can be displaced and gravel bags or sandbags can be torn. Accumulated sediment shall be removed before it reaches one-half the height of the check dam.	

Streambank Stabilization (SS) ***EC-13***	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☒ ***Permanent***	☒ ***Temporary***	
What – BMP Description	A combination of erosion and sediment control BMPs are used to protect streams, banks, and in-stream habitat from accelerated erosion. Some of the BMPs that may be used include protection of existing vegetation, check dams, temporary and permanent seeding and rolled erosion control products.	
When – Installation/Removal	BMPs used for streambank stabilization shall be installed prior to earth disturbing activities to protect existing vegetation or to preserve an exposed streambank to mitigate erosion rates from the disturbed area; for BMPs that are not to remain in place as a part of final stabilization, such as silt fence and other temporary measures, BMPs shall be removed when all land disturbing activities have ceased and area have been permanently	

	stabilized.
Where – Location	BMPs used for stream bank stabilization shall be installed at the locations identified on the ESC Plan. They shall be installed along the banks of streams or waterways.
How – BMP Maintenance and Inspection	See individual details and notes for the various BMPs used in streambank stabilization EC-13 (Appendix 5 - Erosion and Sediment Control BMP Details). The Permittee shall continuously inspect and maintain BMPs used in streambank stabilization.

Wind Erosion/Dust Control (DC) EC-14	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	Wind erosion and dust control BMPs help sediment from disturbed soils and soil stockpiles from entering the air as a result of land disturbing construction activities. A variety of practices that focus on either graded disturbed areas or construction roadways may be used.	
When – Installation	During conditions which result in the formation of dust from either construction activities or from naturally occurring winds. Do not overwater.	
Where – Location	Dust abatement shall be completed throughout the project area where any material exists that has the potential to become airborne.	
How – BMP Maintenance and Inspection	Wind erosion/dust control measures shall be performed per the wind erosion/dust control detail EC-14 (Appendix 5 - Erosion and Sediment Control BMP Details). The Permittee may apply water or magnesium chloride, seed and mulch or use spray-on soil binders on disturbed areas. Water and magnesium chloride shall be applied such that concentrated flows do not form.	

BMP Name	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☐ ***Temporary***	
What – BMP Description	INSERT TEXT HERE	
When – Installation/Removal	INSERT TEXT HERE	

Where – Location	INSERT TEXT HERE
How – BMP Maintenance and Inspection	INSERT TEXT HERE

For additional BMPs, repeat as needed here

2.4 Protect Storm Drain Inlets

Instructions:

- Describe controls (e.g., inserts, rock-filled bags, or block and gravel) including design specifications and details that will be implemented to protect all inlets receiving stormwater from the project during the entire project. (Information can be found in the Stormwater Regulation Guide Details SC-5 Rock Sock and SC-6 Inlet Protection.)
- Below, identify BMPs that are applicable to the construction site by selecting the blue Yes/No then type "**yes**" or "**no**" AND identify the phase of construction the BMP is associated with, i.e. Phase1, 2, 3 or N/A.

Rock Sock (RS) SC-5	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	An elongated cylindrical filter constructed of gravel wrapped by wire mesh or woven geotextile. Also called curb socks when placed at angles in the curb line.	
When – Installation/Removal	Rock socks shall be installed prior to land disturbing activities; once upstream stabilization is complete, rock socks and accumulated sediment shall be removed and properly disposed.	
Where – Location	Rock socks shall be installed at the locations identified on the ECS Plan. They are typically used for perimeter control of a disturbed area, part of inlet protection.	
How – BMP Maintenance and Inspection	Rock socks shall be installed per the rock sock detail SC-5 (Appendix 5 - Erosion and Sediment Control BMP Details). The Permittee shall continuously inspect and maintain all rock socks as they are susceptible to displacement and breakage due to vehicle traffic. Accumulated sediment shall be removed by sweeping, as needed, to maintain functionality.	

Inlet Protection (IP) SC-6	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	A permeable barrier that is installed around an inlet to filter runoff and remove sediment before it enters the storm drain inlet. Inlet protection can be constructed of the following: rocks socks, sediment control logs, silt fence, blocks and rock socks, or other materials.	
When – Installation/Removal	Inlet protection for existing inlets shall be installed prior to land disturbing activities upslope from the inlet. Inlet protection for	

	proposed inlets shall be installed immediately after the inlet is completed and backfilled; inlet protection and any associated sediment must be removed and properly disposed of when the drainage area for the inlet is stabilized.
Where – Location	Inlet protection shall be installed at the locations identified on the ESC Plan. Inlet protection shall not be a stand-alone BMP. It shall be used in conjunction with other up gradient BMPs.
How – BMP Maintenance and Inspection	Inlet protection shall be installed per the inlet protection detail SC-6 (Appendix 5 - Erosion and Sediment Control BMP Details). Inlet protection shall enable the inlet to function without completely blocking the flow. The Permittee shall continuously inspect and maintain all inlet protection BMPs throughout construction as it is the final BMP before runoff enters the storm drain. Accumulated sediment shall be removed when it has reached one-half the height of the inlet protection or looses functionality, whichever comes first. Inlet protection shall not be used as standalone BMP and shall be part of redundant BMPs.[1] [1](8/5/11 LR Comment)

BMP Name	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☐ ***Temporary***	
What – BMP Description	INSERT TEXT HERE	
When – Installation/Removal	INSERT TEXT HERE	
Where – Location	INSERT TEXT HERE	
How – BMP Maintenance and Inspection	INSERT TEXT HERE	

For additional BMPs, repeat as needed here

2.5 Establish Perimeter Controls and Sediment Barriers

Instructions:

- Describe structural practices (e.g., silt fences or fiber rolls) including design specifications and details to filter and trap sediment before it leaves the construction site. (Information can be found in the Stormwater Regulation Guide Details SM-3 Construction Fence, SM-4 Vehicle Tracking Control and SC-9 Vegetated Buffer.)
- Below, identify BMPs that are applicable to the construction site by selecting the blue Yes/No then type "**yes**" or "**no**" AND identify the phase of construction the BMP is associated with, i.e. Phase1, 2, 3 or N/A.

Construction Fence (CF) BMP Detail SM-3	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	Restricts site access to designated entrances and exits, delineates construction site boundaries, and keeps construction out of sensitive locations such as natural areas to be preserved as open space, wetlands and riparian areas.	
When – Installation/Removal	Construction fence shall be installed prior to earth disturbing activities; and removed once construction is complete.	
Where – Location	Along the site perimeter or any area within the site where access shall be restricted.	
How – BMP Maintenance and Inspection	Construction fencing shall be installed, maintained and removed per the construction fence detail SM-3 (Appendix 5 – Erosion and Sediment Control BMP Details). The Permittee shall continuously inspect fences for damages and slumping. The fence shall be tight and any areas with slumping or fallen posts shall be reinstalled and/or replace the fencing.	

Vehicle Tracking Control (VTC) SM-4	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☐ ***Temporary***	
What – BMP Description	A stabilized site access point that helps remove sediment from vehicle tires and reduces tracking of the sediment onto paved surfaces.	
When – Installation/Removal	Vehicle tracking control shall be installed prior to any land disturbing activities; and removed when there is no longer the potential for vehicle tracking to occur.	

Where – Location	Vehicle tracking control shall be installed at the location identified on the ESC Plan. Locate your vehicle tracking control where frequent vehicle traffic will exit the construction site onto a paved roadway.
How – BMP Maintenance and Inspection	Vehicle tracking control shall be installed per the vehicle tracking control detail SM-4 (Appendix 5 - Erosion and Sediment Control BMP Details). All vehicle tracking control BMPs must have non-woven geotextile fabric between soil and rock. Recycled concrete aggregate is not allowed. The Permittee shall continuously inspect and maintain all vehicles tracking control BMPs throughout construction. If the area becomes clogged with sediment, remove and dispose of excess sediment or replace material with a fresh layer of aggregate. Any sediment that is tracked onto adjacent roadways shall be cleaned with brooms, shovels (no water washing), or mechanically cleaned with a pick-up broom.

Vegetated Buffer (VB) SC-9	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☐ ***Temporary***	
What – BMP Description	Preserved natural vegetation used to protect waterways and wetlands. A vegetated buffer may be required as a type of setback from a natural waterway. It shall be used in conjunction with other perimeter BMPs.	
When – Installation	Vegetated buffers shall be pre-existing of land disturbing activities.	
Where – Location	Vegetated buffers shall be installed at the locations identified on the ESC Plan. Vegetated buffers shall be use for separating land disturbing activities with additional BMPs.	
How – BMP Maintenance and Inspection	Vegetated buffer shall be installed per the vegetated buffer detail SC-9 (Appendix 5 - Erosion and Sediment Control BMP Details). The Permittee shall continuously inspect and maintain the vegetated buffer for signs of erosion. Inlet protection shall not be used as standalone BMP and shall be part of redundant BMPs.[1] [1](8/5/11 LR Comment)	

BMP Name	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☐ ***Temporary***	
What – BMP Description	INSERT TEXT HERE	
When – Installation/Removal	INSERT TEXT HERE	
Where – Location	INSERT TEXT HERE	
How – BMP Maintenance and Inspection	INSERT TEXT HERE	

For additional BMPs, repeat as needed here

2.6 Retain Sediment On-Site

Instructions:

- Describe sediment control practices (e.g., sediment trap or sediment basin), including design specifications and details (volume, dimensions, outlet structure) that will be implemented at the construction site to retain sediments on-site. (Information can be found in the Stormwater Regulation Guide Details SC-1 through SC-3 Straw Bale Barrier and SC-7 Sediment Basin and SC-8 Sediment Trap.)
- Below, identify BMPs that are applicable to the construction site by selecting the blue Yes/No then type "**yes**" or "**no**" AND identify the phase of construction the BMP is associated with, i.e. Phase1, 2, 3 or N/A.

Silt Fence (SF) SC-1	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	A woven geotextile fabric attached to wooden posts and trenched into the ground. It is used to intercept sheet flow runoff from disturbed areas.	
When – Installation/Removal	Silt fence shall be installed prior to all land disturbing activities. Silt fence shall be removed when the upstream area is stabilized.	
Where – Location	Silt fence shall be installed at the locations identified on the ESC Plan. It is typically installed along the contour of slopes, which is down slope of a disturbed area to accept sheet flow, and placed along the perimeter of a construction site. ***Silt fence is not designed to receive concentrated flow or to be used a filter fabric.***	
How – BMP Maintenance and Inspection	Silt fence shall be installed per the silt fence detail SC-1 (Appendix 5 - Erosion and Sediment Control BMP Details). The Permittee shall continuously inspect and maintain all silt fence throughout construction. Any section of silt fence that has a tear, hole, slumping, undercutting or has been bypassed shall be replaced with a new section. Accumulated sediment shall be removed before it reaches a depth of 6 inches.	

Sediment Control Log (SCL) SC-2	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	Aka "Straw Wattle" - a linear roll made of natural materials such	

	as straw, coconut fiber or other fibrous material that is trenched into the ground and held with wooden stakes. It is used to intercept sheet flow runoff from disturbed areas.
When - Installation/Removal	Sediment control logs shall be installed during land disturbing activities and after formation of a stockpile; once the upstream area is stabilized, remove and properly dispose of the logs. If disturbed areas exist after removal, the area shall be covered with top soil, seeded and mulched.
Where – Location	Sediment control logs shall be installed at the locations identified on the ECS Plan. They are typically used for stockpile control, inlet protection, and check dams in small drainage ditches, on disturbed slopes to shorten flow lengths and/or as part of multi-layered perimeter control along receiving water such as a stream, pond or wetland. Sediment control logs work well in combination with other layers of erosion and sediment controls. Stockpiles stored on impervious surfaces shall not be placed in a flowline and shall have weighted sediment control logs; stockpiles stored on pervious surfaces may be protected by pervious sediment control logs, silt fence or adequate vegetative cover as allowed.
How – BMP Maintenance and Inspection	Sediment control log shall be installed per the sediment control log detail SC-2 (Appendix 5 - Erosion and Sediment Control BMP Details). Sediment control logs shall be installed along (parallel) the slope contour to avoid concentrating flows. The Permittee shall continuously inspect and maintain all sediment control logs throughout construction as they will eventually degrade. Accumulated sediment shall be removed before the depth is one-half the height of the sediment control log.

Straw Bale Barrier (SBB) SC-3	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	A linear barrier of straw bales used to intercept and capture sheet flow and to trap sediment before runoff exits a disturbed area. It is typically used for perimeter control of a site or stockpile management, at the toe of a slope, along the edge of a drainage pathway, or as part of inlet protection.	
When –	Straw bale barriers shall be installed prior to land disturbing	

Installation/Removal	activities and after formation of a stockpile; remove and properly dispose of the straw bale once the upstream area has been stabilized. Areas of disturbance beneath the ball shall be seeded and mulched when the bale is removed.
Where – Location	Straw bale barriers shall be installed at the locations identified on the ECS Plan.
How – BMP Maintenance and Inspection	Straw bale barrier shall be installed per the straw bale barrier detail SC-3 (Appendix 5 - Erosion and Sediment Control BMP Details). The Permittee shall continuously inspect and maintain all straw bale barriers as they may be bypassed or undercut by flows and will degrade and rot. Accumulated sediment shall be removed when the depth reaches one-quarter the height of the bale.

Sediment Basin (SB) SC-7	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	A temporary basin built on a construction site to capture sediment transported in runoff prior to discharge from the site. A sediment basin is designed to capture runoff and slowly release it to allow time for settling of the sediment prior to discharge.	
When – Installation/Removal	A sediment basin shall be installed prior to land disturbing activities; for a basin being converted to permanent detention basins. For basins to be converted to a detention facility, remove accumulated sediment and reconfigure the basin and outlet to meet the requirements of the final design for the detention facility. For basins that are temporary and not to be used as a permanent detention facility, fill the excavated area with soil and stabilize accordingly.	
Where – Location	Sediment basins shall be installed at the locations identified on the ESC Plan. Where feasible, the sediment basin shall be installed in the same location where a permanent post-construction detention pond will be located.	
How – BMP Maintenance and Inspection	The sediment basin shall be installed per the sediment basin detail SC-7 (Appendix 5 - Erosion and Sediment Control BMP Details). The Permittee shall continuously inspect and maintain the sediment basin to ensure its effectiveness.	

	Accumulated sediment shall be dredged from the basin when it reaches no more than one-third of the design storage volume.

Sediment Trap (ST) BMP Detail SC-8	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	An excavated or bermed area designed to capture drainage, allowing settling of sediment from a disturbed area less than one acre.	
When – Installation/Removal	A sediment trap shall be installed prior to land disturbing activities; the sediment trap shall not be removed until the upstream area is sufficiently stabilized.	
Where – Location	Sediment traps shall be installed at the locations identified on the ESC Plan. It shall be installed across a low area or drainage swale.	
How – BMP Maintenance and Inspection	Sediment traps shall be installed per the sediment trap detail SC-8 (Appendix 5 - Erosion and Sediment Control BMP Details). The Permittee shall continuously inspect and maintain the sediment trap embankments for stability and seepage. Inspect the sediment trap embankments for stability and seepage, and the outlet for sediment, debris and damage. Repair damage to the outlet, and remove all obstructions. Accumulated sediment shall be removed when it reaches ½ the height of the outflow embankment.	

BMP Name	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☐ ***Temporary***	
What – BMP Description	INSERT TEXT HERE	
When – Installation/Removal	INSERT TEXT HERE	
Where – Location	INSERT TEXT HERE	
How – BMP Maintenance and Inspection	INSERT TEXT HERE	

For additional BMPs, repeat as needed here

2.7 Establish Stabilized Construction Exits

Instructions:

- Describe location(s) of vehicle entrance(s) and exit(s), procedures to remove accumulated sediment off-site (e.g., vehicle tracking), and stabilization practices (e.g., stone pads or wash racks or both) to minimize off-site vehicle tracking of sediments and discharges to stormwater. (Information can be found in the Stormwater Regulation Guide Detail SM-4 Vehicle Tracking Control and SM-6 Stabilized Staging Area.)
- Below, identify BMPs that are applicable to the construction site by selecting the blue Yes/No **then** type "**yes**" or "**no**" in the applicable information AND identify the phase of construction the BMP is associated with, i.e. Phase1, 2, 3 or N/A.

Vehicle Tracking Control (VTC) SM-4	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	A stabilized site access point that helps remove sediment from vehicle tires and reduces tracking of the sediment onto paved surfaces.	
When – Installation/Removal	Vehicle tracking control shall be installed prior to any land disturbing activities; and removed when there is no longer the potential for vehicle tracking to occur. This is typically after the site has been stabilized.	
Where – Location	Vehicle tracking control shall be installed at the location identified on the ESC Plan. Locate your vehicle tracking control where frequent vehicle traffic will exit the construction site onto a paved roadway.	
How – BMP Maintenance and Inspection	Vehicle tracking control shall be installed per the vehicle tracking control detail SM-4 (Appendix 5 - Erosion and Sediment Control BMP Details). All vehicle tracking control BMPs must have non-woven geotextile fabric between soil and rock. Recycled concrete aggregate is not allowed. The Permittee shall continuously inspect and maintain all vehicles tracking control BMPs throughout construction. If the area becomes clogged with sediment, remove and dispose of excess sediment or replace material with a fresh layer of aggregate. Any sediment that is tracked onto adjacent roadways shall be cleaned with brooms, shovels (no water washing), or mechanically cleaned with a pick-up broom.	

Stabilized Construction Roadway (SCR) SM-5	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	A temporary method to control sediment runoff, vehicle tracking, and dust from roads during construction activities consisting of aggregate base course of 3-inch diameter granular material (no recycled concrete allowed).	
When – Installation/Removal	Use on high traffic construction roads to minimize dust and erosion, and use in place of rough cut street controls on roadways with frequent construction and vehicle traffic; gravel shall be removed once the road is ready to be paved. Prior to paving, the road should be inspected for grade changes and damage. Regrade and repair as necessary.	
Where – Location	Stabilized construction roadways shall be installed at the locations identified on the ESC Plan. Apply gravel to disturbed areas that are used as a route for vehicles.	
How – BMP Maintenance and Inspection	A stable surface cover of rigid gravel shall be maintained as well as repairing any perimeter controls. Inspect drainage ditches along the roadway for erosion and stabilize, as needed, through the use of check dams or rolled erosion control products.	

Stabilized Staging Area (SSA) SM-6	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	A stabilized staging area is a clearly designated area where construction equipment and vehicles, stockpiles, waste bins and other construction-related materials are stored. If the construction site is big, more than one staging area may be necessary.	
When – Installation/Removal	Stabilized staging areas shall be installed prior to any land disturbing activities.	
Where – Location	Stabilized staging areas shall be installed at the location identified on the ESC Plan.	
How – BMP Maintenance and Inspection	Stabilized staging areas shall be installed per the stabilized staging area detail SM-6 (Appendix 5 - Erosion and Sediment Control BMP Details). The Permittee shall continuously inspect and maintain all stabilized staging areas throughout construction.	

	A stable surface cover of rigid gravel shall be maintained as well as repairing any perimeter controls and following good housekeeping practices.

Street Sweeping and Vacuuming (SS) SM-7	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	Used where vehicles track sediment onto paved roadways to reduce the transport of it into storm drain systems or surface waterways.	
When – Applicable	Street sweeping or vacuuming shall be conducted when there is noticeable sediment accumulation on roadways adjacent to the construction site. Street sweeping and vacuuming shall be completed prior to any precipitation events, at the end of the workday as needed, and at the end of construction.	
Where – Location	Street sweeping and vacuuming shall be utilized throughout and adjacent to construction.	
How – BMP Maintenance and Inspection	Street sweeping and vacuuming shall be performed per the street seeping and vacuuming detail SM-7 (Appendix 5 - Erosion and Sediment Control BMP Details). Use standard street sweeping and vacuuming equipment to adequately remove sediment from roadways adjacent to the construction site.	

BMP Name	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☐ ***Temporary***	
What – BMP Description	INSERT TEXT HERE	
When – Installation/Removal	INSERT TEXT HERE	
Where – Location	INSERT TEXT HERE	
How – BMP Maintenance and Inspection	INSERT TEXT HERE	

For additional BMPs, repeat as needed here

2.8 Additional BMPs

Instructions:

- Describe additional BMPs that are not listed in Sections 2.1 – 2.7.
- Below, identify BMPs that are applicable to the construction site by selecting the blue Yes/No then type "**yes**" or "**no**" AND identify the phase of construction the BMP is associated with, i.e. Phase1, 2, 3 or N/A.

Concrete Washout Areas (CWA) *MM-1*	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	A specific area of the construction site must be designated and managed as a concrete washout area. Three basic options are available: excavation of a pit in the ground, use of an above ground storage area or use of prefabricated haul-away concrete washout containers.	
When – Installation/Removal	Concrete washout areas shall be installed prior to any concrete delivery to the construction site; upon termination of use of the washout, accumulated solid waste, including concrete waste and any contamination soils, must be removed from the site to a designated disposal location.	
Where – Location	Concrete washout areas shall be installed at the locations identified on the ESC Plan. Washout areas within 400 feet of any natural drainage pathway or waterbody or within 1,000 feet of any wells or drinking water sources must be lined.	
How – BMP Maintenance and Inspection	Concrete washout areas shall be installed per the concrete washout area detail MM-1 (Appendix 5 - Erosion and Sediment Control BMP Details). The Permittee shall continuously inspect and maintain all concrete washout area BMPs throughout construction. Ensure adequate signage is in place identifying the location of the washout area. Remove concrete waste in the washout area when filled to about two-thirds of its capacity to maintain functionality.	

Stockpile Management (SP) *MM-2*	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	Includes measures to minimize erosion and sediment transport from stockpiles. Stockpile management shall be used when soils	

	or other erodible materials are stored at a construction site.
When – Installation/Removal	Stockpile locations shall be determined during construction; and when temporary removal of a BMP is necessary to access the stockpile, ensure BMPs area reinstalled in accordance with their respective design detail section. When the stockpile is no longer needed, properly dispose of excess materials and re-vegetate or otherwise stabilize the ground surface where the stockpile was located.
Where – Location	Stockpile locations shall be placed away from areas where concentrated stormwater flow is anticipated, major drainageways, gutters, and storm sewer inlets. Stockpile locations shall be noted on the ESC Plan.
How – BMP Maintenance and Inspection	Stockpile management shall be performed per the stockpile management detail MM-2 (Appendix 5 – Erosion and Sediment Control BMP Details). The Permittee shall continuously inspect and maintain all stockpiles throughout construction. *Pervious Surface* - It is recommended that stockpiles are stored on a pervious surface and are protected from any sediment transport. BMPs that can be used on pervious surfaces include, but are not limited to sediment control logs, vegetated buffer and silt fence. *Impervious Surface* - Stockpile locations are only allowed on impervious surfaces if no other practical alternative exists. Temporary sediment control shall be placed around the perimeter of the stockpile, such as but not limited to rock socks, straw bales and sand bags.

Paving and Grinding Operations (PGO) SM-12	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☐ ***Temporary***	
What – BMP Description	Runoff management practices shall be used during all paving and grinding operations. A variety of management practices can be used including, but not limited to: inlet protection, perimeter controls, store materials away from the storm sewer system, drainages and waterways and keep a spill kit onsite.	

When – Installation/Removal	Paving and grinding operations shall be scheduled when dry weather is forecasted; recycle asphalt and pavement material when feasible. Material that cannot be recycled must be disposed of in accordance with applicable regulations.
Where – Location	Use runoff management practices during all paving and grinding operations such as surfacing, resurfacing, and saw cuts.
How – BMP Maintenance and Inspection	The Permittee shall continuously inspect and maintain BMPs associated with paving and grinding operations throughout construction. Perform maintenance on associated BMPs in accordance with their applicable detail maintenance notes.

BMP Name	Used: Yes/No	Phase(s): 1, 2, 3, N/A
☐ ***Permanent***	☐ ***Temporary***	
What – BMP Description	INSERT TEXT HERE	
When – Installation/Removal	INSERT TEXT HERE	
Where – Location	INSERT TEXT HERE	
How – BMP Maintenance and Inspection	INSERT TEXT HERE	

For additional BMPs, repeat as needed here

SECTION 3: CONSTRUCTION SITE PHASING AND SITE MAPS

Instructions:

- **Phased BMP Implementation** – The ESC Plan Site Maps shall clearly delineate the construction sequencing between the separate phases of construction, and the BMP implementation and maintenance of both structural and non-structural BMPs with each phase of construction.

- The ESC Plan **must** identify the BMPs to be implemented during the following three project phases. ***Develop a separate phased detailed site maps (i.e. one page representing one phase; not combined) by delineating each BMP for each phase of construction AND provide BMP details with Installation and Maintenance Notes.***

- **Phases of Construction** – Using Section 1.3 Nature and Sequence of Construction Activity section, delineate which BMPs will be used for each of the following phases of construction:

  Initial Construction
  - **Phase I – Locations of all initial BMPs**
    Examples of activities include: protect specified vegetation, construction staging/parking/storage, clearing, grubbing, tree and scrub removal, top soil stripping and stock piling temporary roads, and site access points.

  Interim Construction
  - **Phase II – Locations of all interim BMP**s
    Examples of activities include: removal of existing pipe, earthwork (excavation/embankment), dewatering, construction of utilities & structures, rip rap, and placement of top soil.

  Final Construction
  - **Phase III – Locations of all final BMPs**
    Examples of activities include: final topsoil placement, sod, seeding, mulching, permanent landscaping, pavement, sod, seed and mulching.

  - Place the site map pages for each phase in Appendix 6 – Erosion and Sediment Control Plan – Site Map.

  Note the location of each BMP on your site map(s). All BMP details (with installation, maintenance and removal notes) shall be placed in Appendix 5 – Erosion and Sediment Control BMP Details.

3.1 Phase BMP Construction Activity

Instructions:

- Using the information provided in Section 1.3 Nature and Sequence of Construction Activity, specifically the major phases of construction describe the construction phase.
- Describe the BMPs associated with each phase, and the temporary & permanent stabilization methods to be used for each phase.

- **Initial Construction - Phase I**
  - Describe construction phase
  - List BMPs associated with this phase
  - Describe stabiliztion methods for this phase

- **Interim Construction - Phase II**
  - Describe construction phase
  - List BMPs associated with this phase
  - Describe stabiliztion methods for this phase

- **Final Construction - Phase III**
  - Describe construction phase
  - List BMPs associated with this phase
  - Describe stabiliztion methods for this phase

3.2 General Notes

Instructions:
Below are the required general notes applicable to this Erosion and Sediment Control Plan.

1. Owner/Contractor is responsible for obtaining a State of Colorado, Colorado Department of Public Health and Environment (CDPHE) General Permit for Stormwater Discharges Associated with Construction Activity COR-030000 prior to construction (CDPS Stormwater Construction Permit).

2. The Owner/Contractor shall provide Adams County with a copy of the CDPS Stormwater Construction Permit Inactivation Notice Application. There will be no fee charged to Adams County for the Inactivation Notice or if the Contractor neglects to file this Notice.

3. It is anticipated that the BMPs implemented at the site will have to be maintained and modified to adapt to changing conditions or to ensure that potential pollutants are being properly managed at the site. Responsive ESC Plan changes addressing BMP installation, maintenance and/or implementation or when BMPs are determined to be ineffective; shall be made prior to changes in site conditions. Prior to BMP modification, a notation shall be made in the ESC Plan that includes date and time of changes in the field, an identification of the BMPs removed or added, and the locations of those BMPs.

4. Construction Safety Barrier Fencing (orange construction fence) shall be used to protect wetlands and other sensitive areas, to prevent access, and to delineate the Limits of Construction. The Construction Safety Barrier Fencing shall be installed prior to any work or earth disturbing activities. It shall be specified in the ESC Plan and the locations shown on the site map.

5. The Owner/Contractor is responsible for implementing and maintaining erosion and sediment control measures at all times during construction. The ESC Plan shall be modified in compliance to the Adams County Stormwater Regulations.

6. Stormwater Inspections – always use the Stormwater construction Inspection Report form provided in Appendix 7 - Inspection Report Instructions and Form.

7. Minimum Stormwater Inspection Schedule - A thorough inspection of the Best Management Practices (BMPs) shall be performed every fourteen (14) calendar days and within twenty-four (24) hours after any precipitation or snowmelt event that causes surface erosion.

    a. Post-Storm Event Stormwater Inspections at Temporarily Idle Sites – If no construction activities will occur following a storm event, post-storm event inspections shall be

conducted prior to re-commencing construction activities, but no later than seventy two (72) hours following the storm event. The occurrence of any such delayed inspections must be documented in the inspection record. Routine inspections still must be conducted at least every fourteen (14) calendar days.

b. Stormwater Inspections at Completed Sites/Areas – For sites or portions of sites that meeting the following criteria, the permittee shall make a thorough inspection of their construction site BMPs at least once every month, and post-storm event stormwater inspection are not required.
    i. all construction activities that will result in surface ground disturbed are completed;
    ii. all activities required for final stabilization, in accordance with the ESC Plan, have been completed;
    iii. the ESC Plan has been amended to indicate those areas that will be inspected in accordance with the reduced schedule allowed.

8. Always use biodegradable erosion control blankets on slopes 3:1 or steeper and in swales, long channels and roadside ditches.

9. All soil imported to or exported from the site shall be properly covered to prevent the loss of material during transport. Haul routes must be permitted by the County. No material shall be transported to another site without first obtaining a Hauling Permit from Adams County Planning.

10. Sediment caused by accelerated soil erosion shall be removed from runoff water before it leaves the site of the earth disturbance.
11. Any construction areas, not graded to final grade, require temporary BMPs for site stabilization.

12. Construction debris shall be stockpiled within the designated staging area and properly disposed of.

13. Excavated material shall not be stockpiled within the roadway section unless it is temporary and has appropriate sediment control measures in place.

14. Permanent erosion and sediment control measures for all slopes, channels, ditches, or any disturbed land area shall be stabilized immediately after final grading.

15. All spills shall be cleaned up immediately after discovery, or contained until appropriate cleanup methods can be employed. Section 4.2 Spill Prevention, Containment and Control shall be followed along with proper disposal methods.

SECTION 4: WASTE MANAGEMENT PLAN

Instructions:

- The construction site wastes identified in Section 1.8 Potential Sources of Pollutants include the following categories of waste:
  - Solid Waste (e.g. sediment, gravel, compost, building materials, vehicle tracking, construction spoils, trash, etc.)
  - Liquid Waste (e.g. oil, gas, tar, hydraulic fluid, etc.)
  - Concrete and Paint Washout (e.g. truck chute and associated fixtures and equipment, paint, etc.)
  - Sanitary Waste (e.g. worker trash, portable toilets, waste piles and dumpsters, etc.)
  - Chemical Waste (e.g. fertilizers, pesticides, detergents, fuels, solvents, oils, etc.)
  - Contaminated Groundwater Management, if applicable
  - Permitted Construction Dewatering, if applicable

- Use the Stormwater Regulation Guide to write a waste management plan by describing structural and non-structural pollution prevention BMPs that will be implemented to control pollutants in stormwater from construction site waste from leaving the construction site permitted area.

- The following BMP categories shall be addressed to control construction site waste, as applicable. Use the Stormwater Regulation Guide for information on the following BMPs:
  - Covering Outdoor Storage and Handling Areas
  - Spill Prevention, Containment and Control
  - Good Housekeeping
  - Vehicle Maintenance, Fueling and Storage
  - Street Sweeping and Cleaning
  - Storm Sewer System Cleaning

4.1 Covering Outdoor Storage and Handling Areas

Instructions:

- Below, identify BMP procedures that are applicable to the construction site by selecting the blue Yes/No **then** type "**yes**" or "**no**".
- The following procedures shall be implemented for covering outdoor storage and handling areas.

Covering Outdoor Storage and Handling Areas	Used: Yes/No	Phase(s): 1, 2, 3
☐ ***Permanent***	☒ ***Temporary Procedure***	

Description

When raw materials, byproducts, finished products, storage tanks, and other materials are stored or handled outdoors, stormwater runoff that comes in contact with the materials can become contaminated. Proactively covering storage and handling areas can be an effective source control for such areas. Coverings can be permanent or temporary and consist of tarp, plastic sheeting, roofing, enclosed structures, or other approaches that reduce exposure of materials to precipitation and wind.

Appropriate Uses

Covering is appropriate for areas where solids (e.g., gravel, compost, building materials) or liquids (e.g., oil, gas, tar) are stored, prepared, or transferred. Cover the follow areas that are applicable to this construction site:

- **Loading and Unloading:** Loading and unloading operations usually take place at outside storage or staging area on the construction site. Materials may be spilled during transfer between storage facilities and trucks during pumping of liquids, pneumatic transfer of dry chemicals, and mechanical transfer of bags, boxes, drums, or other containers by material handling equipment.
- **Aboveground Tanks/Liquid Storage:** Accidental releases of chemicals from above-ground liquid storage can contaminate stormwater with a variety of pollutants. Several common causes of accidental releases from above-ground storage include: external corrosion and structural failure, problems due to improper installation, spills and overfills due to operator error, failure of piping systems, and leads or spills during pumping of liquids or gases between trucks to a storage facility.
- **Outside Manufacturing:** Common outside manufacturing activities may include parts assembly, rock grinding or crushing, metals paining or coating, grinding or sanding, degreasing, concrete manufacturing, parts cleaning or operations that use hazardous materials. These activities can result in dry deposition of dust, metal and wood shavings and liquid discharges of dripping or leaking fluids from equipment or process and other

residuals being washed away in storm runoff. In addition to the manufacturing process, outside storage of materials and waste products may occur in conjunction with outside manufacturing.

- **Waste Management:** Wastes spilled, leached, or lost from outdoor waste management areas or outside manufacturing activities may accumulate in soils or on other surfaces and be carried away by storm runoff. There is also the potential for liquid wastes from surface impoundments to overflow to surface waters or soak the soil where they can be picked up by runoff. Possible stormwater contaminants include toxic compounds, oil and grease, oxygen-demanding organics, paints and solvents, heavy metals and high levels of suspended solids. Lack of coverage of waste receptacles can result in precipitation seeping through the material and collecting contaminants or the material being blown around the site and into the storm sewer system. Typical containment sources include waste piles, wastewater and solid waste treatment and disposal, land application sites, dumpsters, or unlabeled drums.
- **Outside Storage of Materials:** Raw materials, intermediate products, byproducts, process residuals, finished products, containers, and materials storage areas can be sources of pollutants such as metals, oils and grease, sediment and other contaminants. Pollutant transport can occur when solid materials wash off or dissolve into water, or when spills or leaks occur.

Practice Procedures

- Where practical, conduct operations indoors. Where impractical, select an appropriate temporary of permanent covering to reduce exposure of materials to precipitation and runoff.
- The type of covering selected depends on a variety of factors such as the type and size of activity being conducted and materials involved. Types of cover range from relatively inexpensive tarps and plastic sheeting to overhead structures or fully enclosed buildings equipped with ventilation, lighting, etc.
- Covering practices should be combined with Good Housekeeping BMPs to be most effective.
- Measures such as tarps and plastic sheets typical require more frequent inspection and maintenance than construction facilitates.

*During construction Adams County Inspects for Construction Site Waste.

Place additional information here:

INSERT TEXT HERE

4.2 Spill Prevention, Containment and Control

Instructions:

- Below, identify BMP procedures that are applicable to the construction site by selecting the blue Yes/No **then** type "**yes**" or "**no**".
- The following procedures shall be implemented for spill prevention, containment and control.

Spill Prevention, Containment and Control	Used: Yes/No	Phase(s): 1, 2, 3
☐ ***Permanent***	☒ ***Temporary Procedure***	

Description

Spills and leaks of solid and liquid materials processed, handled or stored outdoors can be significant source of stormwater pollutants. Spilled substances can reach receiving waters when runoff washes these materials from impervious surfaces or when spills directly enter the storm sewer system during dry weather conditions.

Effective spill control includes both spill prevent and spill response measures and depends on proper training for spill response measures and may also include structural spill containment. Structural spill containment measures typically include temporary or permanent curbs or berms that surround a potential spill site. Berms may be construction of concrete, earthen material, metal, synthetic liners, or other material that will safely contain the spill. Spill control devises may also include valves, slide gates, or other devices that can control and contain spilled material before it reaches the storm sewer system or receiving waters.

Appropriate Uses

Implement spill prevention, containment and control measures at construction sites in areas where materials may be spilled in quantities that can adversely impact receiving waters when discharged directly or through the storm sewer system.

Practice Procedures – Spill Prevention Measures

- Train employees on potential sources of pollution on-site and provide clear, common-sense spill prevention practices be strictly followed.
- Identify equipment that is exposed to precipitation, pollutants that may be generated and possible sources of leaks or discharges.
- Perform regular inspection and preventative maintenance of equipment to ensure proper operation and to check for leaks or evidence of discharge (stains). Provide clear procedures to ensure that needed repairs are completed and provide temporary leak

containment until such repairs can be made.

- Drain or replace motor oil and other automotive fluids in a designated area away from storm sewer inlets. Collect spent fluids and recycle or dispose of properly. Never dispose of these fluids in the storm sewer or sanitary sewer.
- In fueling areas, clean up spills with dry methods (absorbents) and use damp cloths on gas pumps and damp mops on paved surfaces. Never use a hose to "wash down" a fuel spill.
- Where practical, reduce stormwater contact with equipment and materials by implementing covered storage, reduce stormwater run-on and follow good housekeeping practices.

Identification of Spill Areas

Identify potential spill areas, potential spill volumes, material types, frequency of material used, and drainage paths from spill areas with relation to storm sewer inlets, adjacent water bodies, structural BMPs, and containment structures. Use this information to determine the types of spill prevention and control measures needed specific to the site conditions. Examples of potential spill locations include:

- Loading and unloading areas
- Outdoor storage areas
- Outdoor manufacturing or processing activities
- Waste disposal
- Areas that generate significant dust or particulates (that may be subsequently deposited on the ground)
- Areas prone to spills based on past experience at the site
- Locations where other routine maintenance activities occur such as equipment maintenance and cleaning, pesticide/fertilizer application, etc.

Additionally, areas where smaller leaks may occur such as parking should also have basic spill cleanup procedures.

Material Handling Procedures

From a water quality perspective, the primary principle behind effective material handling practices is to minimize exposure to precipitation. This can be accomplished by storing the material indoors under weather-resistant covering, elevating the material off the ground by using pallets, and diverting stormwater around materials storage areas. Representative outdoor materials handling procedures include:

- Keep bulk solid materials such as raw materials, sand, gravel, topsoil, compost, concrete, packing materials, metal products and other materials covered and protected from stormwater.
- When practical, store materials on impermeable surfaces.
- Store hazardous materials according to federal, state, and local hazardous materials requirements.
- Adopt procedures that reduce the chance of spills or leaks during filling or transfer of materials.
- Substitute less toxic or nontoxic materials for toxic materials.
- Store containers that are easily punctured or damaged away from high traffic areas.
- Add waste-capture containers such as collection pans for lubricating fluids.
- Store drums and containers with liquid materials on impermeable surfaces and provide secondary containment where appropriate. Drums stored outdoors should be located on pallets to minimize contact with runoff.

Spill Response Procedures and Equipment

Spill response procedures should be tailored to site-specific conditions and industry-specific regulatory requirements. General spill response procedures include:

- Containment and cleanup of spills should begin promptly after the spill is observed.
- Sweep up small quantities of dry chemical or solids to reduce exposure to runoff. Shoveling may be used for larger quantities of materials.
- Absorbents should be readily accessible in fueling areas or other areas susceptible to spills.
- Wipe up small spills with a shop rag, store shop rags in appropriate containers, dispose of rags properly or use a professional industrial cleaning service.
- Contain medium-sized spills with absorbents (e.g., kitty litter, sawdust) and use inflatable berms or absorbent "snakes" as temporary booms for the spill. Store and dispose of absorbents properly. Wet/dry vacuums may also be used, but not for volatile fluids.
- Develop procedures and locations for containing and storing leaking containers.
- Install drip pans below minor equipment leaks and properly dispose of collected material until a repair can be made.
- For large spills, first contain the spill and plug storm sewer inlets where the liquid may migrate off-site, then clean up the spill.
- Excavation of spill areas to removed contaminated material may be required where large liquid spills occur on unpaved surfaces.

- An inventory of cleanup materials should be maintained onsite and strategically located based on the types and quantities of chemicals present.

Structural Spill Containment Measures

Two general approaches are often used when implementing spill containment measures. The first approach is designed to contain the entire spill. The second approach uses curbing to route spilled material to a collection basin. Both containment berming and curbing should be sized to safely contain or convey to a collection basin a spill from the largest storage tank, tanker truck, or other containment device in the possible spill area. The spill containment area must have an impermeable surface (e.g., impermeable liner, asphalt or concrete) to prevent groundwater contamination. The containment system must be designed to enable collection and removal of spilled material through a pump or vacuum trucks, use of sorbent or gelling material, or other measures. Material removed from the spill area must be disposed of or recycled according to local, state, and federal standards.

If the capacity of the containment berming or the collection basin is exceeded, supplemental spill control measures should be available such as a portable containment device, sorbent materials, or gelling agents that eventually solidify the material. Water that collects within containment areas due to rainfall or snowmelt must be appropriately treated before release from the spill area.

Spill Plan Development

Many industries are required by federal law to have a Spill Prevention, Control and countermeasures Plan (SPCC) that meets specific regulatory criteria when certain types and quantities of materials are used or processed at a site. These plans can be instrumental in developing a spill control plan for stormwater management purposes. Even if an SPCC plan is not legally required at a site, a spill control plan for stormwater management purposes may be necessary. Representative information appropriate for a spill control plan, building on concepts previously introduced in this Fact Sheet, includes:

- Site plan showing where materials are stored and handled, and where associated activities occur.
- Notification procedures to be used in the event of an accident.
- Instructions for clean-up procedures.
- A designated person with spill response and clean-up authority.
- Training of key personnel in plan and clean-up procedures.
- Signs posted at critical locations providing a summary of SPCC plan information, phone numbers, contacts, equipment locations, etc.
- Provisions requiring spills to be cleaned up, corrective actions taken, or

countermeasures implemented immediately.

- Provisions for absorbents to be made available for use in fuel areas, and for containers to be available for used absorbents.
- Prohibition on washing absorbents into the storm sewer system or into the sanitary sewer system via floor drains.
- Provision for emergency spill containment and clean-up kits in accessible and convenient locations. Kits should contain the appropriate clean-up materials applicable to the materials stored at the site.

*During construction Adams County Inspects for Construction Site Waste.

Place additional information here:

INSERT TEXT HERE

4.3 Good Housekeeping

Instructions:

- Below, identify BMP procedures that are applicable to the construction site by selecting the blue Yes/No **then** type "**yes**" or "**no**".
- The following procedures shall be implemented for good housekeeping.

Good Housekeeping Practices	Used: Yes/No	Phase(s): 1, 2, 3
☐ ***Permanent***	☒ ***Temporary***	

Description

Good housekeeping practices are designed to maintain a clean and orderly work environment. The most effective first steps towards preventing pollution in stormwater from construction sites simply involve using common sense to improve the facility's basic housekeeping methods. Poor housekeeping practices result in increased waste and potential for stormwater contamination.

A clean and orderly work site reduces the possibility of accidental spills caused by mishandling of chemicals and equipment and should reduce safety hazards to personnel. A well-maintained material and chemical storage area will reduce the possibility of stormwater mixing with pollutants.

Some simple procedures a facility can use to promote good housekeeping include improved operation and maintenance of machinery and processes, material storage practices, material inventory controls, routine and regular clean-up schedules, maintaining well organized work areas, signage, and educational programs for employees and the general public about all of these practices.

Practice Procedures

Good housekeeping practices include these general areas:

- Operation and Maintenance
- Material Storage
- Material Inventory
- Training and Participation.

Operation and Maintenance

Consider implementing the following practices:

- Maintain dry and clean floors and ground surfaces by using brooms, shovels, vacuums or cleaning machines, rather than wet clean-up methods.
- Regularly collect and dispose of garbage and waste material.

- Routinely inspect equipment to ensure that it is functioning properly without leaking and conduct preventative maintenance and needed repairs.
- Train employees on proper clean up and spill response procedures.
- Designate separate areas of the site for auto parking, vehicle refueling and routine maintenance.
- Promptly clean up leaks, drips and other spills.
- Cover and maintain dumpsters and waste receptacles. Add additional dumpsters or increase frequency of waste collection if overflowing conditions reoccur.
- Where outdoor painting and sanding occur, implement these practices:
    - Conduct these activities in designated areas that provide adequate protection to prevent overspray and uncontrolled emissions. All operations should be conducted on paved surfaces to facilitate cleanup.
    - Use portable containment as necessary for outside operations.
    - Clean up and properly dispose of excess paint, paint chips, protective coatings, grit waste, etc.
- Maintain vegetation on facility grounds in a manner that minimizes erosion. Follow the Landscape Maintenance and Pesticide, Herbicide and Fertilizer Usage BMPs to ensure that minimum amounts of chemicals needed for healthy vegetation are applied in a manner that minimizes transport of these materials in runoff.

Material Storage Practices

Proper storage techniques include the following:

- Provide adequate aisle space to facilitate material transfer and ease of access for inspection.
- Store containers, drums, and bags away from direct traffic routes to reduce container damage resulting in accidental spills.
- Stack containers according to manufacturer's instructions to avoid damaging the containers from improper weight distribution. Also store materials in accordance with directions in Material Safety Data Sheets (MSDSs).
- Store containers on pallets or similar devices to prevent corrosion of containers that results from containers coming in contact with moisture on the ground.
- Store toxic or hazardous liquids within curbed areas or secondary containers.

Material Inventory Practices

An up-to-date materials inventory can keep material costs down by preventing overstocking, track how materials are stored and handled onsite, and identify which materials and activities pose the most risk to the environment. Assign responsibility of hazardous material inventory to individuals trained to handle such materials. A material inventory should include these steps:

- Identify all chemical substances present at work site. Perform a walk-through of the site, review purchase orders, list all chemical substances used and obtain Material Safety Data Sheets (MSDS) for all chemicals.
- Label all containers. Labels should provide name and type of substance, stock number, expiration date, health hazards, handling suggestions, and first aid information. Much of, this information can be found on an MSDS.
- Clearly identify special handling, storage, use and disposal considerations for hazardous materials on the material inventory.
- Institute a shelf-life program to improve material tracking and inventory that can reduce the amount of materials that are overstocked and ensure proper disposal of expired materials. Careful tracking of materials ordered can result in more efficient materials use. Decisions on the amounts of hazardous materials that are stored on site should include an evaluation-of any emergency control systems that are in place. All storage areas for hazardous materials should be designed to contain spills.

Training and Participation

It is recommended that frequent and proper training in good housekeeping techniques reduces the likelihood that chemicals or equipment will be mishandled. To promote good housekeeping, consider implementing these practices:

- Discuss good housekeeping practices in training programs and meetings.
- Publicize pollution prevention concepts through posters or signs.
- Post bulletin boards with updated good housekeeping procedures, tips and reminders.

*During construction Adams County Inspects for Construction Site Waste.

Place additional information here:

INSERT TEXT HERE

4.4 Vehicle Maintenance, Fueling and Storage

Instructions:

- Below, identify BMP procedures that are applicable to the construction site by selecting the blue Yes/No **then** type "**yes**" or "**no**".
- The following procedures shall be implemented for vehicle maintenance, fueling and storage.

Vehicle Maintenance, Fueling and Storage	Used: Yes/No	Phase(s): 1, 2, 3
☐ ***Permanent***	☒ ***Temporary***	

Description

Areas where vehicles are fueled, maintained, and stored/parked can be pollutant "hot spots" that can result in hydrocarbons, trace metals, and other pollutants being transported in precipitation runoff. Proper fueling operations, storage of automotive fluids and effective spill cleanup procedures can help reduce contamination of stormwater runoff from vehicle maintenance and fueling facilities.

Fuel-related spills can occur due to inattention during fueling or "topping off" fuel tanks. Common activities at construction sites include vehicle fluid replacement and equipment replacement and repair. Some of the wastes generated maintaining automobiles include solvents (degreasers, paint thinners, etc.), antifreeze, brake fluid and brake pad dust, battery acid, motor oil, fuel, and lubricating grease.

Appropriate Uses

These BMP procedures are applicable to vehicle maintenance and fueling. Be aware that vehicle wash water is considered process wastewater that will not be discharged to the storm sewer system.

Practice Procedures

Vehicle Maintenance

The most effective way to minimize wastes generated by automotive maintenance activities is to prevent their production in the first place. Consider adopting these practices:

- Perform maintenance activities inside or under cover. When repairs cannot be performed indoors, be sure to use drip pans or absorbents.
- Keep equipment clean and free of excessive oil and grease buildup.
- Promptly cleanup spills using dry methods and properly dispose of waste. When water

is required, use as little as possible to clean spills, leaks, and drips.

- Use a solvent collection service to collect spent solvent used for parts cleaning.
- When using liquids for cleaning, use a centralized station to ensure that solvents and residues stay in one area. Locate drip pans and draining boards to direct solvents back into a solvent sink or holding tank for reuse.
- Store used oil for recycling in labeled tanks. Locate used oil tanks and drums away from storm sewer, flowing streams, and preferably indoors.
- Use non-hazardous or less hazardous alternatives when practical. For example, replace chlorinated organic solvents with non-chlorinated ones like kerosene or mineral spirits.
- Properly recycle or dispose of grease, oil, antifreeze, brake fluid, cleaning solutions, hydraulic fluid, batteries, transmission fluid, worn parts, filters, and rags.
- Drain and crush oil filters before recycling or disposal.
- Drain all fluids and remove batteries from salvage vehicles and equipment.
- Closely monitor parked vehicles for leaks and place pans under any leaks to collect the fluids for proper disposal or recycling.
- Install berms or other measures to contain spills and prevent work surface runoff from entering storm sewer system.
- Develop and follow a spill prevention plan. This includes a variety of measures such as spill kits and knowing where storm sewers are located and how to protect them (e.g., drain mat, berm) when larger spills occur. (See the Spill Prevention, Containment and Control BMP Procedure for more information.)
- Conduct periodic employee training to reinforce proper disposal practices.
- Promptly transfer used fluids to recycling drums or hazardous waste containers.
- Store cracked batteries in leak-proof secondary containers.
- Inspect outdoor storage areas regularly for drips, spills and improperly stored materials (unlabeled containers, auto parts that might contain grease or fluids, etc.). This is particularly important for parking areas for vehicles awaiting repair.
- Structural stormwater BMPs in vehicle hotspot areas require routine cleanout of oil and grease, sometimes monthly or more frequently. During periods of heavy rainfall, cleanout is required more often to ensure that pollutants are not washed through the trap. Sediment removal is also required on a regular basis to keep the BMP working efficiently.

Vehicle Fueling

- Designated fueling areas should be designed to prevent stormwater runoff and spills. For example, fuel-dispensing areas should be paved with concrete or an equivalent impervious surface, with an adequate slope to prevent ponding, and separated from the

rest of the site by a grade break or berm that prevents run-on of precipitation.

- For facilities where equipment is being fueled with a mobile fuel truck, establish a designated fueling area. Place temporary "caps" over nearby catch basins or manhole covers so that if a spill occurs, it is prevented from entering the storm sewer system. A form of secondary containment should be used when transferring fuel from the tank truck to the fuel tank. Storm drains in the vicinity should also be covered. Install vapor recovery nozzles to help control drips, as well as reduce air pollution.
- Keep spill response information and spill cleanup materials onsite and readily available.
- Dry cleanup methods should be employed when cleaning up fuel spills. Such methods include sweeping to remove litter and debris and using rags and absorbents for leaks and spills.
- Water should not be used to wash these areas. During routine cleaning, use a damp cloth on the pumps and a damp mop on the pavement, rather than spraying with a hose. Fuel dispensing nozzles should be fitted with "hold-open latches" (automatic shutoff) except where prohibited by local fire departments. Signs can be posted at the fuel dispenser or island warning vehicle owners/operators against "topping off' vehicle fuel tanks.
- Written procedures that describe these BMPs should be provided to employees who will be using fueling systems.

*During construction Adams County Inspects for Construction Site Waste.

Place additional information here:

INSERT TEXT HERE

4.5 Street Sweeping and Cleaning

Instructions:

- Below, identify BMPs that are applicable to the construction site by selecting the blue Yes/No **then** type "**yes**" or "**no**".
- The following procedures shall be implemented for street sweeping and cleaning.

Street Sweeping and Cleaning	Used: Yes/No	Phase(s): 1, 2, 3
☐ ***Permanent***	☒ ***Temporary***	

Description

Street sweeping uses mechanical pavement cleaning practices to reduce sediment, litter and other debris washed into storm sewers by runoff. This can reduce pollutant loading to receiving waters and in some cases reduce clogging of storm sewers and prolong the life of infiltration oriented BMPs and reduce clogging of outlet structures in detention BMPs. Different designs are available with typical sweepers categorized as a broom and conveyor belt sweeper, wet or dry vacuum-assisted sweepers, and regenerative-air sweepers. The effectiveness of street sweeping is dependent upon particle loadings in the area being swept, street texture, moisture conditions, parked car management, equipment operating conditions and frequency of cleaning (Pitt et al. 2004).

Appropriate Uses

Street sweeping is an appropriate technique in urban areas where sediment and litter accumulation on streets is of concern for aesthetic, sanitary, water quality, and air quality reasons. From a pollutant loading perspective, street cleaning equipment can be most effective in areas where the surface to be cleaned is the major source of contaminants. In areas where construction activity is occurring, street sweeping shall occur as part of construction site erosion and sediment control plans.

Practice Procedures

1. Street sweeping shall be completed when there is sediment or tracking from the construction site exits present that has come from the construction site into the public right-of-way.
2. The frequency of street sweeping is dependent on presence of sediment or tracking that has occurred. If tracking is occurring, either a VTC shall be installed, the VTC needs maintenance or the VTC present is inadequate; all require that the Erosion and Sediment Control Plan be updated.

3. All instances of off-site (outside permitted area) sediment or tracking from the construction site shall be swept immediately.
4. Conduct street sweeping prior to precipitation events.
5. Operate sweepers at manufacturer recommended optimal speed levels to increase effectiveness.
6. Regularly inspect vehicles and equipment for leaks and repair promptly.
7. Keep accurate logs of the number of curb-miles swept and the amount of waste collected.
8. Dispose of street sweeping debris and dirt at a landfill.
9. Do not store swept material along the side of the street or near a storm drain inlet.

Place additional information here:

INSERT TEXT HERE

4.6 Storm Sewer System Cleaning

Instructions:

- Describe structural and non-structural BMPs that are used to remove accumulated sediment, trash, and other pollutants of the storm sewer system including inlets, pipes and stormwater BMPs for the applicable construction site wastes identified in Section 1.8 Potential Sources of Pollution to maintain a clean and orderly construction site.
- Below, identify BMPs that are applicable to the construction site by selecting the blue Yes/No **then** type "**yes**" or "**no**".

Storm Sewer System Cleaning	Used: Yes/No	Phase(s): 1, 2,3
☐ ***Permanent***	☒ ***Temporary***	

Description

Periodic storm sewer system cleaning can help to remove accumulated sediment, trash, and other substances from various components of the storm sewer system including inlets, pipes and stormwater BMPs.

Routine cleaning reduces the amount of pollutants, trash, and debris both in the storm drain system and in receiving waters. Clogged drains and storm drain inlets can cause the drains to overflow, leading to increased erosion (Livingston et al. 1997). Cleaning increases dissolved oxygen, reduces levels of bacteria, and supports in-stream habitat. Areas with relatively flat grades or low flows should be given special attention because they rarely achieve high enough flows to flush themselves (Ferguson et al. 1997).

Water used in storm drain cleaning must be collected and properly disposed of, typically at a sanitary wastewater treatment facility. Simpler methods in localized areas can also include manual trash collection and shoveling sediment and debris from inlets and outlets.

Frequency and prioritization of storm sewer cleaning is affected by multiple factors such as the activity and intensity of construction and the proper installation and maintenance for construction BMPs.

Appropriate Uses

The contractor is responsible for properly cleaning out the storm sewer system. It is recommended that prior to construction, the contractor inspect existing storm sewer inlets to document if they are clean or need maintenance.

The storm sewer system shall be cleaned, at minimum, following completion of construction but prior to stabilization.

Practice Guidelines

To be most effective, the storm sewer system shall be inspected as part of the mandated 14 day stormwater quality inspections.

- **Technology**: A variety of methods of cleaning catch basins are available, including manual cleaning (shovel), vacuum cleaning and vacuum combination jet cleaning. Choose the approach that is most effective for site conditions.
- **Staff training**: Operators should be properly trained in catch basin maintenance including waste collection and disposal methods.
- **Material disposal**: Most catch basin waste is of acceptable quality for landfills. If it is suspected that catch basin waste contains hazardous material, it should be tested and disposed of accordingly.

Place additional information here:

INSERT TEXT HERE

SECTION 5: STORMWATER INSPECTIONS

5.1 Inspections

Instructions:

- Identify the individual(s) responsible for conducting 14 day and stormwater quality inspections and describe their qualifications. It is recommended that the individual responsible for conducting stormwater quality inspection is Certified Inspector of Sediment and Erosion Control (CISEC) certification is preferred.
- Describe the frequency of inspections and procedures to inspect BMPs that will occur at your site.
- Identify procedures that will be taken to document the repairs and maintenance of BMPs that you undertake as a result of your inspections.
- For standard required stormwater quality inspections, use the Standard Stormwater Quality Inspection Form in Appendix 7 – Standard Stormwater Quality Inspection Form. Place completed stormwater quality inspections in Appendix 9 – Completed Stormwater Quality Inspections.

1. Inspection Personnel:

Identify the person(s) who will be responsible for conducting inspections and describe their qualifications:

INSERT TEXT HERE

2. Inspection Frequency:

Stormwater Quality Regulations Section 9-05-05-02

"…shall perform and document complete inspections, at minimum, once every fourteen (14) days during active construction in addition to post-precipitation events that may cause surface erosion." And "The Permittee shall make a thorough inspection of their construction site at least once every month once all construction activities have been completed."

Stormwater Inspections – always use the Stormwater construction Inspection Report form provided in Appendix 7 - Inspection Report Instructions and Form.

a. Minimum Stormwater Inspection Schedule - A thorough inspection of the Best Management Practices (BMPs) shall be performed every fourteen (14) calendar days and within twenty-four (24) hours after any precipitation or snowmelt event that causes surface erosion.

b. Post-Storm Event Stormwater Inspections at Temporarily Idle Sites – If no construction activities will occur following a storm event, post-storm event inspections shall be conducted prior to re-commencing construction activities, but no later than seventy two (72) hours following the storm event. The occurrence of

any such delayed inspections must be documented in the inspection record. Routine inspections still must be conducted at least every fourteen (14) calendar days.

c. Stormwater Inspections at Completed Sites/Areas – For sites or portions of sites that meeting the following criteria, the permittee shall make a thorough inspection of their construction site BMPs at least once every month, and post-storm event stormwater inspection are not required.

   i. all construction activities that will result in surface ground disturbed are completed;

   ii. all activities required for final stabilization, in accordance with the ESC Plan, have been completed;

   iii. the ESC Plan has been amended to indicate those areas that will be inspected in accordance with the reduced schedule allowed.

Minimum Stormwater Quality Inspection Schedule

The permittee will inspect at least once every 14 calendar days. Also, post-storm event inspections must be conducted within 24 hours after the end of any precipitation event that causes surface erosion.

Stormwater Quality Inspections at Completed Sites

The permittee is allowed to make a thorough stormwater quality inspection of their project site at least once every month contingent upon:

a. All construction activities that will result in surface ground disturbance are completed but final stabilization has not been achieved due to the vegetative cover that has not become established;

b. All activities required for final stabilization, in accordance with the ESC Plan, have been completed;

c. The ESC Plan has been amended to indicate those areas that will be inspected in accordance with the reduced inspection schedule.

INSERT ANY ADDITIONAL INFORMATION HERE

3. Inspection Procedures:

At minimum, inspect the construction site perimeter, all disturbed area, material and/or waste storage areas that are exposed to precipitation, discharge location, and locations where vehicles access the site shall be inspected for evidence of, or the potential for, pollutants leaving the Permitted boundaries, entering the storm sewer system, or

discharging to the County's MS4 Permitted Area. Refer to Section 5.5 Recommended inspection sequence.

INSERT ANY ADDITIONAL INFORMATION HERE

4. Correcting Problems:

Describe the general procedures for correcting problems when they are identified and the responsible staff that is responsible for making corrections.

INSERT TEXT HERE

5. Inspection Form:

Always use the inspection form provided under Appendix 7 – Standard Stormwater Inspection Form and place all completed inspections under Appendix 9 – Completed Stormwater Quality Inspections.

5.2 Delegation of Authority

Instructions:

- Delegation of Authority is optional.
- Identify the individual(s) or specifically describe the position where the construction site operator has delegated authority for the purposes of signing inspection reports, certifications, or other information.

Duly Authorized Representative(s) or Position(s):

Insert Company or Organization Name
Insert Name
Insert Title
Insert Address
Insert City, State, Zip Code
Insert Telephone Number
Insert Fax/Email

Optional - Attach a copy of the signed delegation of authority form in Appendix 8.

5.3 Recommended Inspection Sequence

Instructions:

- When conducting stormwater inspections of your construction site it is recommended that one always follows this recommended inspection sequence to ensure that all procedures and measures are being followed. Place all completed inspections in Appendix 9 – Completed Stormwater Quality Inspections.

1. **Plan your stormwater inspection**
   - Always use the inspection form provided in Appendix 7 – Stormwater Quality Inspection Form.
   - Obtain a copy of the site drawings with BMP locations marked.
   - Plan to walk the entire site, including discharge points from the site and any off-site support activities.
   - Follow a consistent pattern each time to ensure you inspect all areas.
2. **Inspection frequency**
   - Site inspections must be conducted at least once every 14 calendar day.
   - Post-storm inspections must be conducted within 24 hours after the end of any precipitation or snowmelt event that causes surface erosion.
   - Stabilization inspections are inspections conducted at upon completion of construction, but final stabilization has not been achieved due to a vegetative cover that has not become established. Stabilization inspections are conducted at least once every month.
3. **Inspect discharge points and downstream, off-site areas**
   - Inspect discharge locations to determine whether erosion and sediment control measures are effective.
   - Inspect nearby downstream locations, if feasible.
   - Walk down the street to inspect off-site areas for signs of discharges. This is important in areas with existing curbs and gutters.
   - Inspect down slope existing catch basin inlets to ensure they are free of sediment and other pollutants and to ensure that they are adequately protected.
4. **Inspect perimeter controls and slopes**
   - Inspect perimeter controls such as silt fences to determine if sediment shall be removed.
   - Check the structural integrity of the BMP to determine if portions of the BMP need to be replaced.

- Inspect slopes and temporary stockpiles to determine if erosion controls are effective.

5. **Compare BMPs in the site plan with the construction site conditions.**
   - Determine whether BMPs are in place as required by the site plan.
   - Evaluate whether BMPs have been adequately installed and maintained.
   - Look for areas where BMPs are needed but are missing and are not in the Erosion and Sediment Control Plan.
6. **Inspect construction site entrances**
   - Inspect the construction exits to determine if there is tracking of sediment from the site onto the street.
   - Refresh or replace the rock in designated entrances and concrete washout areas.
   - Look for evidence of additional construction exits being used that are not in the ESC Plan or are not stabilized.
   - Sweep or vacuum the street if there is evidence of sediment accumulation.
7. **Inspect sediment controls**
   - Inspect any sediment basins for sediment accumulation.
   - Remove sediment when it reduces the capacity of the basin by the specified amount for maintenance.
8. **Inspect pollution prevention and good housekeeping practices**
   - Inspect trash areas to ensure that waste is properly contained.
   - Inspect material storage and staging areas to verify that potential pollutant sources are not exposed to stormwater runoff.
   - Verify that concrete, paint, and stucco washouts are being used properly and are correctly sized for the volume of wash water.
   - Inspect vehicle/equipment fueling and maintenance areas for signs of stormwater pollutant exposure.
9. **Inspect for final stabilization**
   - Inspect all temporary and permanent BMPs for correct application and installation with the BMP details.
   - Remove sediment that is in the private storm sewer system pipes – do not jet pollutants into the County's storm sewer system.

5.4 Common Compliance Problems During Construction

The following reasons are problems commonly found at construction sites.

Problem #1 – Not using phased grading or providing temporary or permanent soil stabilization

Problem #2 – No sediment controls on-site

Problem #3 – No sediment control for temporary stockpiles

Problem #4 – No inlet protection

Problem #5 – No BMPs or inadequate BMPs to minimize vehicle tracking onto the road

Problem #6 – Inadequate or improper solid waste or hazardous waste management

Problem #7 – Unpermitted dewatering and other pollutant discharge at the construction site

Problem #8 – Poorly managed washouts (concrete, paint, stucco)

Problem #9 – Inadequate BMP maintenance

Problem #10 – Inadequate documentation

SECTION 6: RECORDKEEPING

6.1 Recordkeeping

Instructions:

- The following is a list of records you shall keep available at your construction site for County Stormwater Program Inspectors to review:
  - ✓ An updated ESC Plan showing all changes to site conditions and BMPs on site.
  - ✓ Inspection reports, these shall be placed in Appendix 9 – Completed Stormwater Quality Inspections.

Records will be retained for a minimum period of at least 3 years after the permit is terminated.

LIST ANY ADDITIONAL COMMENTS HERE

SECTION 7: FINAL STABILIZATION

7.1 Final Construction Site Stabilization

Instructions:

- The final stabilization of construction sites occurs when there is 70% uniform vegetated cover. The vegetation MUST be uniform so that there are no open patches of soil. Vegetated cover for final stabilization is not what the vegetation was just prior to construction; it is from a fully vegetated site.

In accordance with Adams County Stormwater Quality Regulations 9-07-04:

"Final Construction Site Stabilization means that all ground disturbing activities are complete, and all disturbed areas have either been built on, paved over or are awaiting uniform vegetative cover per County accepted plans.

Prior to closing out the Adams County Stormwater Quality Permit, all the items listed below must be completed in order for the construction site to be considered to have final stabilization.

1. The site has a uniform vegetative cover with a density of at least seventy percent (70%) compared to the original undisturbed site. Such cover is capable of adequately controlling soil erosion, as determined by the Stormwater Regulatory Compliance Unit.

2. Proper installation of all approved, permanent, post-construction stormwater quality BMPs.

3. Removal of all stockpiles of soil, construction material/debris, construction equipment, etc. from the construction site.

4. Streets, parking lots and other surrounding paved surfaces are clean and free of any sediment or debris.

5. Removal of sediment and debris within the County's MS4 and surrounding property, caused by the construction activity; this includes all pollutants. The Permittee shall restore any damaged public infrastructure caused by the Permittee's construction activities.

6. Provide documentation as required by Section 9-05-08 Permit Closeout and Section 9-05-09 Permit Closeout Notification."

7.2 Stormwater Quality Permit Close-out

In accordance with Adams County Stormwater Quality Regulations 9-05-08:

"In order to close out an Adams County Stormwater Quality permit, all of the following measures must be met:

a. Notify the Stormwater Regulatory Compliance Unit as required in Section 9-05-09 Permit Closeout Notification.

b. When a construction site is considered to be final stabilized, but prior to BMP removal; submit an electronic (.pdf) color copy of the ESC Plan final marked up copy to Adams County Public Works – SRC Unit with all revisions and markups that update the plan during construction for stabilization.

c. Provide Construction Site Stabilization Certification and color photo documentation in compliance with Section 9-05-10-02 Construction Site Stabilization Certification.

d. BMPs will be removed only after a Release of Financial Surety Request has been approved by the SRC Unit."

7.3 Permit Closeout Notification

In accordance with Adams County Stormwater Quality Regulations 9-05-09:

"Permittee must contact Adams County Public Works - SRC Unit to set up a Closeout Stormwater Quality Inspection. This notification shall be sent to the Public Works - SRC Unit via e-mail as indicated on the County SWQ Permit. The Public Works – SRC Unit must be contacted by the Permittee at least three (3) business days prior to scheduling the final inspection.

The purpose of the Closeout Inspection is to verify the site is adequately stabilized and/or covered with pavement or structures, per the County accepted plans.

If the Adams County Public Works - SRC Unit needs to conduct more than one Closeout Inspection, an inspection fee will be assessed for each additional closeout inspection, as approved by resolution, by the Board of County Commissioners."

7.4 Removal of Temporary BMPs

In accordance with Adams County Stormwater Quality Regulations 9-05-09-01:

Once the site has met the final stabilization conditions, as specified in Section 9-07-04 Final Construction Site Stabilization, the remaining temporary BMPs such as perimeter controls, inlet protection, silt fence, etc. shall be removed and disposed of properly.

7.5 Construction Site Stabilization Certification

In accordance with Adams County Stormwater Quality Regulations 09-05-10-02:

"The responsible Adams County Stormwater Quality Permit holder (permittee) shall provide formal notarized certification in accordance with the stabilization certification page found in the supplemental stormwater guide.

The signed, sealed and notarized Stabilization Certification shall be submitted, in electronic form, to Adams County Public Works - SRC Unit along with documented proof in the form of electronic color photographs, depicting the stabilized site. The photographs must show the materials used for stabilization and that growth of the vegetation is adequate. It must be proved that the vegetation is 70% of pre-disturbance levels and no sediment will erode outside the permitted area. Refer to the supplemental stormwater guide for a copy of the Stabilization Certification Form.

Remove all temporary BMPs in compliance with Section 9-05-09-01 Removal of Temporary BMPs."

7.6 Stabilization

Instructions:

Describe procedures for final stabilization. Following construction remember to update your site plans to indicate areas that have achieved final stabilization.

INSERT TEXT HERE	Used: Yes/No	Phase(s): 3
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	INSERT TEXT HERE	
When - Installation	INSERT TEXT HERE	
Where - Location	INSERT TEXT HERE	
How – BMP Maintenance and Inspection		

INSERT TEXT HERE	Used: Yes/No	Phase(s): 3
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	INSERT TEXT HERE	
When - Installation	INSERT TEXT HERE	
Where - Location	INSERT TEXT HERE	
How – BMP Maintenance and Inspection		

INSERT TEXT HERE	Used: Yes/No	Phase(s): 3
☐ ***Permanent***	☒ ***Temporary***	
What – BMP Description	INSERT TEXT HERE	
When - Installation	INSERT TEXT HERE	
Where - Location	INSERT TEXT HERE	
How – BMP Maintenance and Inspection		

For additional BMPs, repeat as needed here

SECTION 8: STORMWATER QUALITY PERMIT VIOLATIONS

8.1 Stormwater Quality Violations

In accordance with Adams County Stormwater Quality Regulations:

"Adams County complies with Colorado Revised Statute, Title 30 Government – County to enforce the Stormwater Quality Regulations specifically, 30-15-401.11, CRS et. seq. These regulations allow the County to enforce upon a Permittee or violator of these regulations to compel the abatement of any condition that caused or contributes to a violation of the Adams County Stormwater Quality Regulations.

ALL VIOLATIONS ARE SUBJECT TO ENFORCMENT FROM THE TIME EVIDENCE IS DOCUMENTED OF VIOLATIONS.

The following items are considered a violation of the Adams County Regulations or Adams County Ordinance No. 11 Concerning Illicit Discharges to the Waters of the State within Unincorporated Adams County.

A. Conducting Permit Covered Activity without a County SWQ Permit.

B. Failure to prepare an Erosion and Sediment Control Plan.

C. Deficient Erosion and Sediment Control Plan.

D. Failure to install, maintain or properly select Best Management Practices.

E. Failure to perform required inspections of the permitted construction site.

F. Failure to submit requested documentation.

G. Failure to adequately respond to the SRC Unit's findings as designated by a Compliance Inspection Notification.

H. Failure to maintain the Erosion and Sediment Control Plan to reflect current site conditions.

I. Pollution, contamination or degradation of stormwater quality caused by work outside of the Adams County Stormwater Quality Permit boundary.

J. An illicit discharge into the County's Municipal Separate Storm Sewer System."

SECTION 9: CERTIFICATION AND NOTIFICATION

9.1 Stormwater Quality Regulation Certification

Instructions:

The Permittee shall certify the ESC Plan by signing the ESC Plan Certification and Notification statement below. It is recommended that all subcontractors sign the Subcontractor Certifications/Agreements in Appendix 10 – Subcontractor Certifications/Agreements.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name: INSERT TEXT HERE Title: INSERT TEXT HERE

Signature: _____ Date: _____

ESC PLAN APPENDICES

Attach the following documentation to the ESC PLAN:

Appendix 1 – Project Vicinity Map (Section 1.1)

Appendix 2 – State CDPS Stormwater Construction Permit Certification Page (Section 1.2)

Appendix 3 – Pre-disturbance Photos (Section 1.4)

Appendix 4 – Copy of Demolition Permit and State Asbestos Permit (Section 1.9)

Appendix 5 – Erosion and Sediment Control BMP Details (Section 1.10)

Appendix 6 – Erosion and Sediment Control Plan - Site Map (Section 2.10)

Appendix 7 – Standard Stormwater Quality Inspection Form (Section 5.1)

Appendix 8 – Delegation of Authority (optional) (Section 5.2)

Appendix 9 – Completed Stormwater Quality Inspections (Sections 5.3 & 5.5)

Appendix 10 – Subcontractor Certifications/Agreements (optional) (Section 9.1)

*The format is "Appendices #– Name (Section Number)".

Appendix 1 – Project Vicinity Map

Appendix 2 – State CDPS Stormwater Construction Permit Certification Page

Appendix 3 – Pre-Disturbance Photos

Appendix 4 – Copy of Demolition Permit and State Asbestos Permit

Appendix 5 – Erosion and Sediment Control BMP Details

Appendix 6 – Erosion and Sediment Control Plan - Site Map

Appendix 7 – Inspection Report Instructions and Form

Instructions
This inspection report has been developed for you use in completing your 14 day and storm event site inspections and inspections at completed sites. This inspection report was created consistent with County's Stormwater Quality Regulations.

For an electronic copy of just the ESC Plan Contractor Stormwater Quality Inspection Form please go to http://co-adamscounty.civicplus.com/index.aspx?nid=327.

Using the Inspection Report
You can complete the items in the upper section that will remain constant, such as the date, project name, contractor, and inspector (if you only use one inspector). You will either need to print out multiple copies of this inspection report or save an electronic version as a master form to use during your inspections.

Ensure that all items in the "Weather/Off-Site Discharge Assessment" AND the "Overall Site Assessment" are completed by checking "Yes" or "No" and document any "Corrective Action Needed/Notes". Under "Site Specific BMP Assessment", document the BMPs that are required and/or used, if maintenance is needed and document any "Corrective Action Needed/Notes" as necessary.

When "findings" are present at a construction site due to a 14 day inspection, storm event site inspections and inspections at completed sites, ensure that when the "finding" has been addressed, on the same inspection form. Always document when the "finding" was addressed by filling in the "Date Action Complete".

ADAMS COUNTY COLORADO **Erosion and Sediment Control Plan** **Contractor Stormwater Quality Inspection Form**	Date of Inspection: Project Name: Project Location:
ADCO SWQ Permit #:	Inspected By:
Contractor Name: Contractor Address: Contractor Phone Number(s):	Type of Inspection: ☐ 14-Day Inspection ☐ Storm Event Inspection ☐ Completed Site Inspection
ESC Plan Administrator:	Present Phase of Construction (circle): 1 2 3

Weather/Off-Site Discharge Assessment		
Has a storm event occurred since last inspection?	☐Yes ☐No	If yes, estimate storm Start Date/Time: _____ Duration:_____hours Amount:_____inches
Have any off-site discharges occurred since the last inspection?	☐Yes ☐No	If yes, describe:
Are there any off-site discharges at the time of this inspection?	☐Yes ☐No	If yes, describe:

Overall Site Assessment			
BMP/Activity	**Implemented**	**Maintenance Req'd**	**Corrective Action Needed/Notes**
Are disturbed areas not actively being worked or stabilized?	☐Yes ☐No	☐Yes ☐No	
Are natural resource areas (i.e. streams, wetlands and trees) protected with BMPs?	☐Yes ☐No	☐Yes ☐No	
Is the construction perimeter contained?	☐Yes ☐No	☐Yes ☐No	
Are all discharge points free of any pollutants (i.e. sediment, trash)	☐Yes ☐No	☐Yes ☐No	
Are storm inlets properly protected?	☐Yes ☐No	☐Yes ☐No	
Is the VTC preventing sediment from being tracked into the street?	☐Yes ☐No	☐Yes ☐No	
Is all trash/construction site waste collected and in a covered dumpster?	☐Yes ☐No	☐Yes ☐No	
Are washout facilities clearly identified and maintained?	☐Yes ☐No	☐Yes ☐No	
Are potential stormwater contaminants stored properly?	☐Yes ☐No	☐Yes ☐No	
Are equipment maintenance areas free of spills or leaks?	☐Yes ☐No	☐Yes ☐No	
Are non-stormwater discharges properly controlled?	☐Yes ☐No	☐Yes ☐No	
Other:	☐Yes ☐No	☐Yes ☐No	
Other:	☐Yes ☐No	☐Yes ☐No	

Site Specific BMP Assessment							
BMP Description	Code	Practice		Maintenance		Corrective Action Needed/Notes	Date Action Complete
		Req	Used	Yes	No		
Sediment Control BMPs							
Silt Fence	SF						
Sediment Control Log	SCL						
Straw Bale Barrier	SBB						
Rock Sock	RS						
Inlet Protection	IP						
Sediment Basin	SB						
Sediment Trap	ST						
Vegetated Buffer	VB						
Erosion Control BMPs							
Surface Roughening	SR						
Temporary & Permanent Seeding	TS/ PS						
Soil Binders	SB						
Mulching	MU						
Rolled Erosion Control Product	RECP						
Temporary Slope Drain	TSD						
Temporary Outlet Protection	TOP						
Earth Dikes/Drainage Swales	ED/DS						
Terracing	TER						
Check Dams	CD						
Streambank Stabilization	SS						
Wind Erosion/Dust Control	DC						
Materials Management							
Concrete Washout Area	CWA						
Stockpile Management	SP						
Good Housekeeping	GH						
Site Management Controls							
Protection of Existing Vegetation	PV						
Construction Fence	CF						
Vehicle Tracking Control	VTC						
Stabilized Construction Roadway	SCR						
Stabilized Staging Area	SSA						
Dewatering Operations	DW						
Temporary Stream Crossing	TSC						
Paving and Grinding Operations	PGO						

CERTIFICATION STATEMENT

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Signature: _____ **Date:** _____

Appendix 8 – Delegation of Authority Form

Delegation of Authority

I, _____ (name), hereby designate the person or specifically described position below to be a duly authorized representative for the purpose of overseeing compliance with environmental requirements, including the Construction General Permit, at the _____ construction site. The designee is authorized to sign any reports, stormwater pollution prevention plans and all other documents required by the permit.

_____ (name of person or position)
_____ (company)
_____ (address)
_____ (city, state, zip)
_____ (phone)

By signing this authorization, I confirm that I meet the requirements to make such a designation as set forth in _____ (Reference State Permit), and that the designee above meets the definition of a "duly authorized representative" as set forth in _____ (Reference State Permit).

Appendix 9 – Completed Stormwater Inspections

Insert completed 14-day, storm event and stabilization inspections here.

Appendix 10 – Subcontractor Certifications/Agreements

SUBCONTRACTOR CERTIFICATION
STORMWATER POLLUTION PREVENTION PLAN

Project Number: _____

Project Title: _____

Operator(s): _____

As a subcontractor, you are required to comply with the Erosion and Sediment Control Plan (ESC Plan) for any work that you perform on-site. Any person or group who violates any condition of the ESC Plan may be subject to substantial penalties or loss of contract. You are encouraged to advise each of your employees working on this project of the requirements of the ESC Plan. A copy of the ESC Plan is available for your review at the office trailer.

Each subcontractor engaged in activities at the construction site that could impact stormwater must be identified and sign the following certification statement:

I certify under the penalty of law that I have read and understand the terms and conditions of the ESC PLAN for the above designated project and agree to follow the BMPs and practices described in the ESC Plan.

This certification is hereby signed in reference to the above named project:

Company: _____

Address: _____

Telephone Number: _____

Type of construction service to be provided: _____

_____

_____

Signature: _____

Title: _____

Date: _____