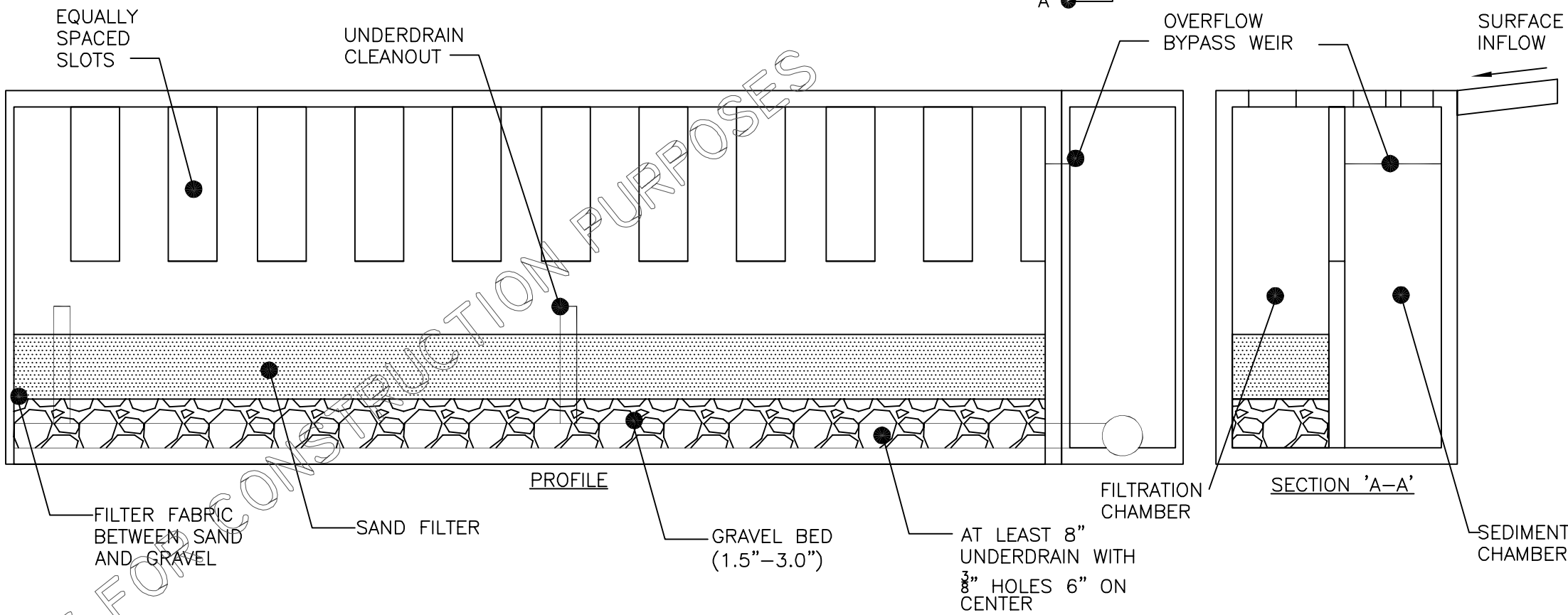


PLAN



PERIMETER SAND FILTER DETAILS

NOT TO SCALE

- CONSTRUCTION SEQUENCING:**
1. PERFORM CONTINUOUS INSPECTIONS OF EROSION CONTROL PRACTICES.
 2. INSTALL SILT FENCE ALONG THE PERIMETER OF THE SITE TO PREVENT SEDIMENT FROM LEAVING THE SITE DURING THE CONSTRUCTION PROCESS.
 3. ALL DOWNGRADIENT PERIMETER SEDIMENT-CONTROL BMPs MUST BE IN PLACE BEFORE ANY UP GRADIENT LAND-DISTURBING ACTIVITY BEGINS.
 4. REMOVE TOPSOIL FROM THE SITE AND PLACE IN TEMPORARY STOCKPILE LOCATION. TEMPORARY SEED THE STOCKPILE.
 5. INSTALL UNDERGROUND UTILITIES (WATER, SANITARY SEWER, ELECTRIC AND PHONES) TAKING THE LOCATION AND FUNCTION OF STORM WATER BMPs INTO CONSIDERATION.
 7. SEED AND MULCH DISTURBED AREAS ON SITE.
 8. CONSTRUCT THE ROADS TAKING THE LOCATION AND FUNCTION OF STORM WATER BMPs INTO CONSIDERATION.
 9. PERFORM ALL OTHER SITE IMPROVEMENTS TAKING THE LOCATION AND FUNCTION OF THE STORM WATER BMPs INTO CONSIDERATION.
 10. FINAL GRADE THE SITE.
 11. STABILIZE THE SITE BY IMPLEMENTING THE NATIVE SEEDING AND PLANTING PORTION OF THE LANDSCAPING PLAN.
 12. INSTALL THE EROSION CONTROL BLANKET
 13. REMOVE THE SILT FENCE AFTER THE SITE IS STABILIZED PER PROJECT ENGINEER APPROVAL.
- GENERAL NOTES:**
1. INSTALL ALL TEMPORARY EROSION CONTROL MEASURES (IN ACCORDANCE WITH MnDOT GENERAL CONDITIONS 2573) PRIOR TO THE START OF ANY CONSTRUCTION OPERATION THAT MAY CAUSE ANY SEDIMENTATION OR SILTATION AT THE SITE.
 2. INSTALL STORM DRAIN INLET PROTECTION TO PREVENT CLOGGING OF THE STORM SEWER AND SEDIMENT LOADS TO DOWNSTREAM STORM WATER FACILITIES OR WATERBODIES.
 5. EXCAVATE THE FILTER TO THE SPECIFIED DEPTH (ELEVATION).
 6. GRADE TO THE DEPTH (ELEVATION) SPECIFIED IN THE CONSTRUCTION DOCUMENTS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
 7. IN THE EVENT THAT SEDIMENT IS INTRODUCED INTO THE BMP DURING OR IMMEDIATELY FOLLOWING EXCAVATION, THIS MATERIAL WILL NEED TO BE REMOVED FROM THE BASIN PRIOR TO INITIATING THE NEXT STEP IN THE CONSTRUCTION PROCESS. SEDIMENT THAT HAS BEEN WASHED INTO THE BASIN DURING THE EXCAVATION PROCESS CAN SEAL THE PERMEABLE MATERIAL, SIGNIFICANTLY REDUCING THE INFILTRATION CAPACITY OF THE SOILS.
 14. SEEDING AND INSTALLATION OF EROSION CONTROL BLANKET SHALL BE COMPLETED WITHIN 48 HOURS OF FINAL GRADING.

NO.	REVISION DESCRIPTION	DATE	BY

I hereby certify that this plan was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota

Print Name: _____ Sign Name: _____ Date: _____ License No. _____

Date	Designed By	Drawn By

Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155-4194
Phone: (651)-296-6300
TTY: (651)-282-5332
WEBSITE: www.pcas.state.mn.us/

2005 MINNESOTA STORMWATER MANUAL

PERIMETER SAND FILTER DETAILS

Sheet No. _____ of _____ Sheets

**SURFACE SAND FILTER
COST ESTIMATE WORKSHEET
2005 Prices**

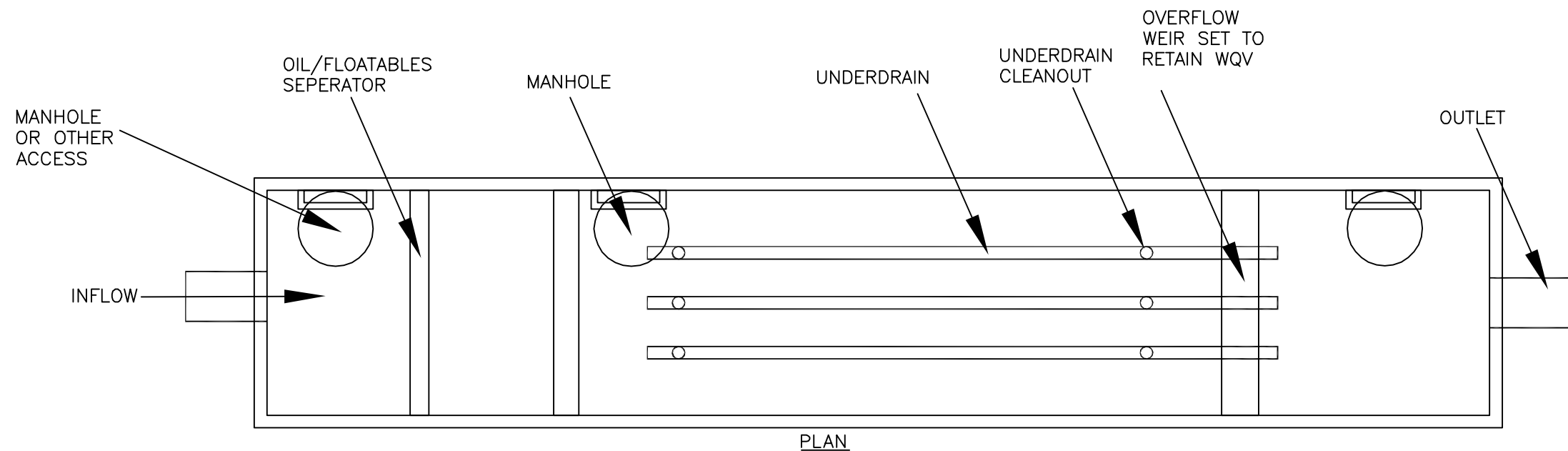
Project Title _____
Owner _____
Location _____
Project Number _____
Date _____

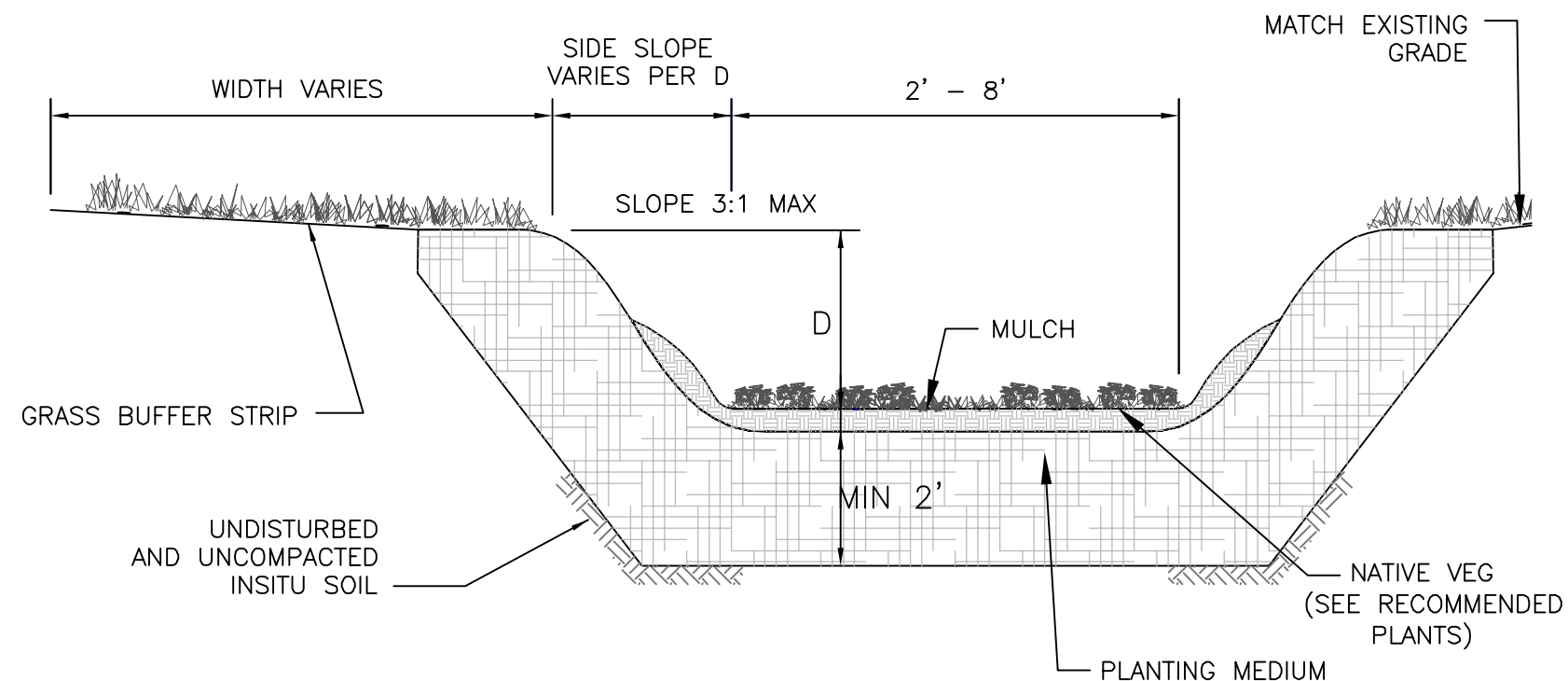
Description	Units	Quantity	Unit Cost	Total Estimated Price
Site Preparation				
Tree removal - up to 12" diameter	each	-----	\$350.00	\$0.00
Clear and grub brush	square yard	-----	\$1.50	\$0.00
Tree protection - temp. fence	lineal foot	-----	\$3.00	\$0.00
Topsoil - 6" depth, salvage on site	square yard	-----	\$4.50	\$0.00
Site Formation				
Excavation - 6' depth	square yard	-----	\$8.00	\$0.00
Grading	square yard	-----	\$1.50	\$0.00
Hauling off-site - 6' depth	square yard	-----	\$10.00	\$0.00
Structural Components				
Underdrain - with pea gravel and geotextile	square yard	-----	\$400.00	\$0.00
Inlet structure	each	-----	\$1,500.00	\$0.00
Sand filter media - 18" depth	square yard	-----	\$15.00	\$0.00
Outlet structure	each	-----	\$3,000.00	\$0.00
Site Restoration				
Sod filter strip	lineal foot	-----	\$1.50	\$0.00
Soil preparation	square yard	-----	\$5.00	\$0.00
Seeding	square yard	-----	\$0.50	\$0.00
Subtotal				\$0.00
10% Contingencies				\$0.00
Subtotal				\$0.00
Apply MN Location Factor				
TOTAL CONSTRUCTION COST				\$0.00

Annual Operation and Maintenance				
Debris removal	per visit	-----	\$50.00	\$0.00
Mowing	per visit	-----	\$150.00	\$0.00
Sediment removal	per year	-----	\$500.00	\$0.00
Gate / valve operation	per visit	-----	\$125.00	\$0.00
Erosion repair	square yard	-----	\$75.00	\$0.00
Inspection	per visit	-----	\$125.00	\$0.00
Subtotal				\$0.00
Apply MN Location Factor				
TOTAL ANNUAL O&M COST				\$0.00

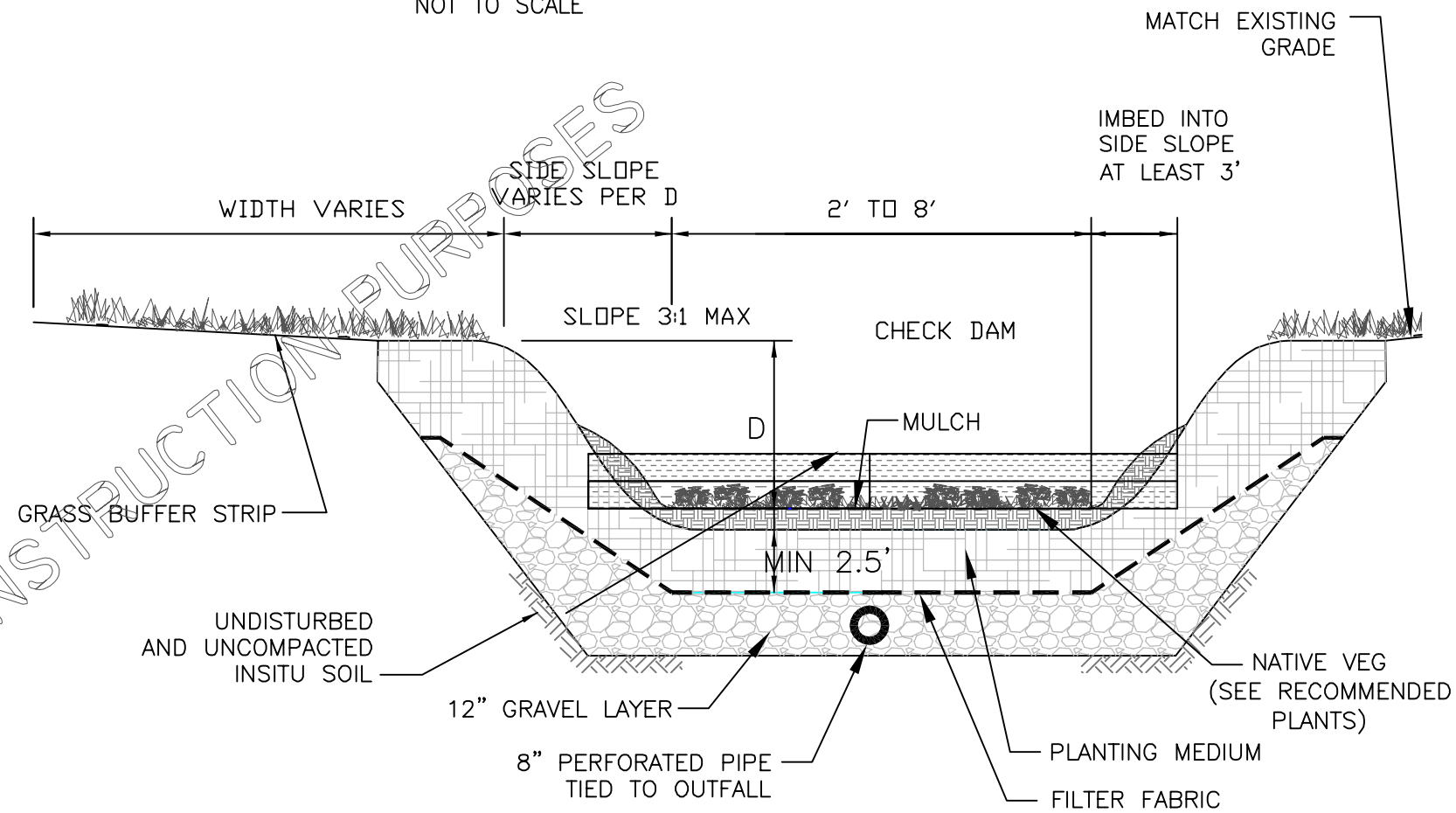
Minnesota Location Factors	
Bemidji	0.963
Brainerd	1.003
Detroit Lakes	0.962
Duluth	0.991
Mankato	0.990
Minneapolis	1.035
Rochester	0.983
St. Paul	1.000
St. Cloud	1.002
Thief River Falls	1.042
Willmar	0.961
Windom	0.935

Note: Suggested unit costs are based on RSMeans prices for Spring, 2005, then factored into an area basis based on typical design features for Media Filtration BMPs. To be used for preliminary cost estimation.





TYPICAL WET SWALE CROSS-SECTION
NOT TO SCALE



TYPICAL DRY SWALE CROSS-SECTION (WITH CHECKDAM)
NOT TO SCALE

- CONSTRUCTION SEQUENCING:**
1. PERFORM CONTINUOUS INSPECTIONS OF EROSION CONTROL PRACTICES.
 2. INSTALL SILT FENCE ALONG THE PERIMETER OF THE SITE TO PREVENT SEDIMENT FROM LEAVING THE SITE DURING THE CONSTRUCTION PROCESS.
 3. ALL DOWNGRAIDENT PERIMETER SEDIMENT-CONTROL BMPs MUST BE IN PLACE BEFORE ANY UP GRADIENT LAND-DISTURBING ACTIVITY BEGINS.
 4. REMOVE TOPSOIL FROM THE SITE AND PLACE IN TEMPORARY STOCKPILE LOCATION. TEMPORARY SEED THE STOCKPILE.
 5. INSTALL UNDERGROUND UTILITIES (WATER, SANITARY SEWER, ELECTRIC AND PHONES) TAKING THE LOCATION AND FUNCTION OF STORM WATER BMPs INTO CONSIDERATION.
 7. SEED AND MULCH DISTURBED AREAS ON SITE.
 8. CONSTRUCT THE ROADS TAKING THE LOCATION AND FUNCTION OF STORM WATER BMPs INTO CONSIDERATION.
 9. PERFORM ALL OTHER SITE IMPROVEMENTS TAKING THE LOCATION AND FUNCTION OF THE STORM WATER BMPs INTO CONSIDERATION.
 10. FINAL GRADE THE SITE.
 11. STABILIZE THE SITE BY IMPLEMENTING THE NATIVE SEEDING AND PLANTING PORTION OF THE LANDSCAPING PLAN.
 12. INSTALL THE EROSION CONTROL BLANKET AND COIR ROLL/CHECK DAMS.
 13. REMOVE THE SILT FENCE AFTER THE SITE IS STABILIZED PER PROJECT ENGINEER APPROVAL.

- GENERAL NOTES:**
1. INSTALL ALL TEMPORARY EROSION CONTROL MEASURES (IN ACCORDANCE WITH MnDOT GENERAL CONDITIONS 2573) PRIOR TO THE START OF ANY CONSTRUCTION OPERATION THAT MAY CAUSE ANY SEDIMENTATION OR SILTATION AT THE SITE.
 2. INSTALL STORM DRAIN INLET PROTECTION TO PREVENT CLOGGING OF THE STORM SEWER AND SEDIMENT LOADS TO DOWNSTREAM STORM WATER FACILITIES OR WATERBODIES.
 4. GRADING OF THE SWALE SHALL BE ACCOMPLISHED USING LOW-IMPACT EARTH-MOVING EQUIPMENT TO PREVENT COMPACTION OF THE UNDERLYING SOILS. SMALL TRACKED DOZERS AND BOBCATS WITH RUNNER TRACKS ARE RECOMMENDED.
 5. EXCAVATE THE SWALE TO THE SPECIFIED DEPTH (ELEVATION). IT IS RECOMMENDED THAT ALL SUB MATERIAL BELOW THE SPECIFIED ELEVATION SHALL BE LEFT UNDISTURBED, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
 6. GRADE TO THE DEPTH (ELEVATION) SPECIFIED IN THE CONSTRUCTION DOCUMENTS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
 7. IN THE EVENT THAT SEDIMENT IS INTRODUCED INTO THE BMP DURING OR IMMEDIATELY FOLLOWING EXCAVATION, THIS MATERIAL WILL NEED TO BE REMOVED FROM THE SWALE PRIOR TO INITIATING THE NEXT STEP IN THE CONSTRUCTION PROCESS. THIS IS ESPECIALLY IMPORTANT IF THE SWALE HAS BEEN DESIGNED TO INFILTRATE STORM WATER: SEDIMENT THAT HAS BEEN WASHED INTO THE SWALE DURING THE EXCAVATION PROCESS CAN SEAL THE PERMEABLE MATERIAL, SIGNIFICANTLY REDUCING THE INFILTRATION CAPACITY OF THE SOILS.
 8. MATERIAL EXCAVATED FROM THE SWALE(S) SHALL BE DISPOSED OF ON-SITE AT LOCATIONS (STOCKPILE AREAS) DESIGNATED BY ENGINEER.
 9. **NON-STANDARD COMPONENT:** CLEAN, WASHED 1.5 TO 3.5-INCH GRAVEL SHALL BE PLACED IN THE BOTTOM OF THE SWALE TO THE DEPTH SPECIFIED IN THE CONSTRUCTION DOCUMENTS. GRAVEL SHOULD BE PLACED IN LIFTS AND LIGHTLY COMPACTED WITH PLATE COMPACTORS.
 10. **NON-STANDARD COMPONENT:** THE PERFORATED PIPE (UNDERDRAIN) SHALL BE LAID DIRECTLY ON THE GRAVEL BED. GRADE AND ALIGNMENT SHALL NOT VARY FROM THE PRESCRIBED GRADE BY MORE THAN 0.03 FEET (9 MM) AT ANY POINT. THE JOINTS BETWEEN SECTIONS OF PIPE SHALL BE CONNECTED IN A FASHION ACCEPTABLE TO ENGINEER. ONCE THE PIPE IS IN PLACE, IT SHALL BE COVERED IMMEDIATELY WITH GRANULAR MATERIAL AS SPECIFIED IN THE CONSTRUCTION DOCUMENTS. THE GRANULAR MATERIAL SHALL BE OF UNIFORM DEPTH ON BOTH SIDES OF THE PIPE. SPECIAL INLETS AND SPECIAL DEVICES AT THE OUTLET END OF THE PIPE SHALL BE CONSTRUCTED AS SHOWN IN THE PLANS.
 12. PORTIONS OF SWALE TO BE PLANTED SHALL RECEIVE 3" OF WOODCHIP MULCH (MnDOT TYPE 6).
 13. PORTIONS OF SWALE TO BE SEEDED SHALL BE MULCHED WITH CLEAN GRAIN STRAW (MnDOT TYPE 3) AT A RATE OF 2 TONS PER ACRE.
 14. SEEDING AND INSTALLATION OF EROSION CONTROL BLANKET SHALL BE COMPLETED WITHIN 48 HOURS OF FINAL GRADING.

I hereby certify that this plan was prepared by me or under my direct supervision and that it complies with the laws of the State of Minnesota.		
Print Name:	Sign Name:	
Date:	License No.:	
Date	Designed By	Drawn By
Minnesota Pollution Control Agency 520 Lafayette Road St. Paul, MN 55155-4194 Phone: (651) 296-6300 TTY: (651) 282-5332 WEBSITE: www.pcas.state.mn.us		
		
2005 MINNESOTA STORMWATER MANUAL		
WET AND DRY SWALES		
Sheet No. _____ of _____		Sheets

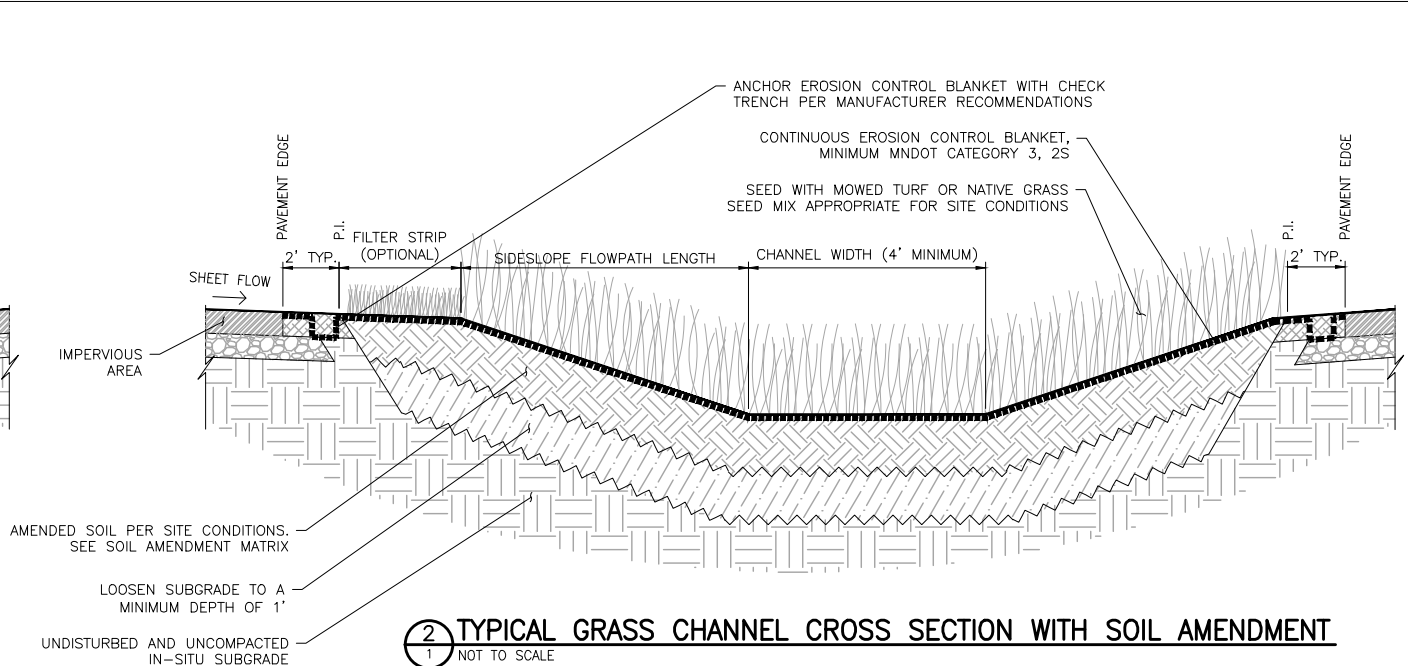
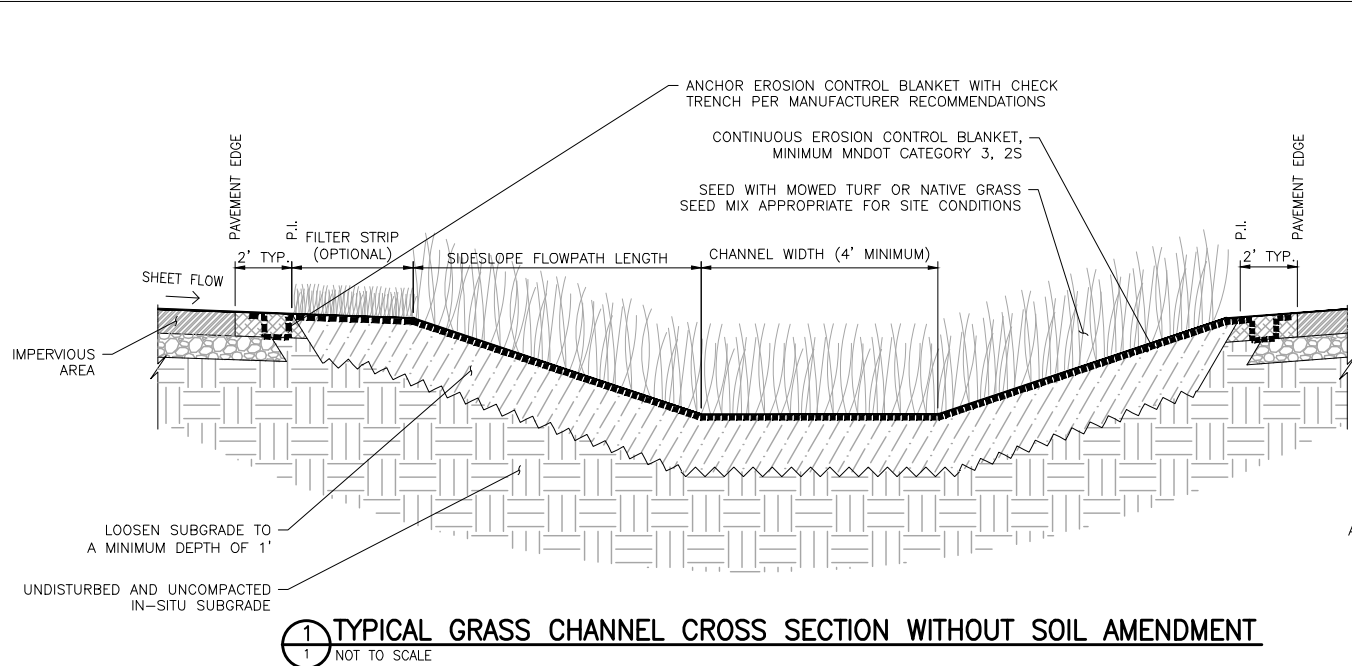


TABLE 1: MIDS GRASS CHANNEL SOIL AMENDMENT MATRIX

<i>Vegetation Type</i>	In-Situ Soil Type			
	A	B	C	D
MOWED TURF SWALE OR NATIVE GRASS SWALE	Place 6" Imported topsoil**. Mix topsoil into subsoil by loosening subsoil to a minimum depth of 12"	Loosen subsoil to a minimum depth of 12"	Place 6" imported filtration soil* on top of subgrade and mix into subsoil by loosening subsoil to a minimum depth of 12"	Place 6" imported filtration soil* on top of subgrade and mix into subsoil by loosening subsoil to a minimum depth of 12"

* Filtration soil is defined as 80% clean sand mixed with 20% organic compost by volume

** Topsoil shall be sandy loam, loamy sand, or loam texture per USDA textural triangle with less than 5% clay content

GENERAL NOTES - GRASS CHANNELS AND DRY SWALES:

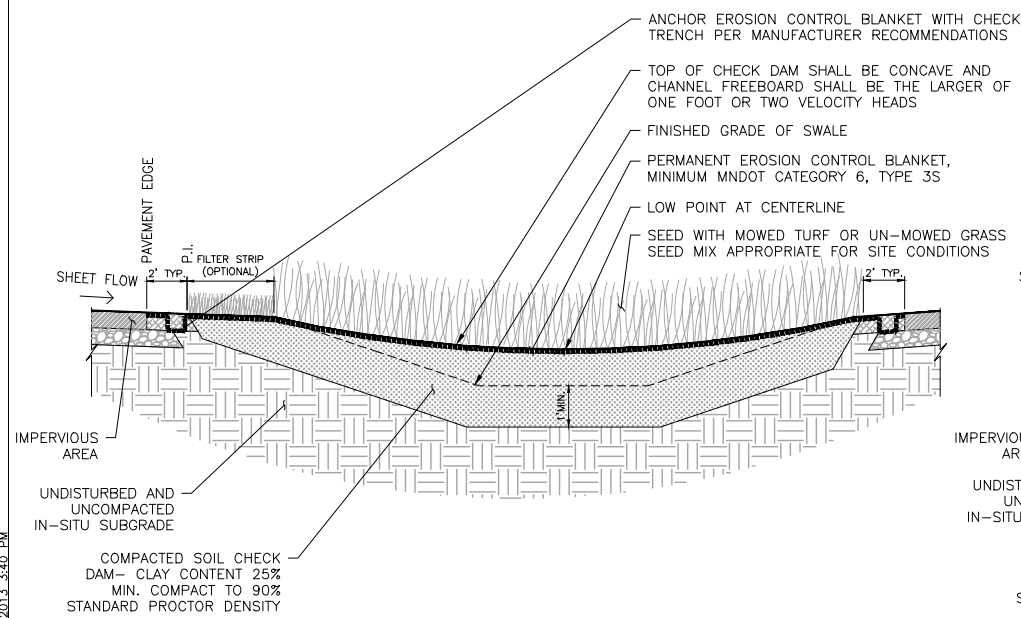
1. INSTALL ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES IN ACCORDANCE WITH THE SWPPP, PROJECT PLANS, AND SPECIFICATIONS IN ORDER TO EFFECTIVELY REDUCE THE VOLUME AND VELOCITY OF RUNOFF AND REDUCE EROSION OF SURFACE SOILS AND TO CONTROL SEDIMENT TRANSPORT OFF SITE DURING THE CONSTRUCTION PERIOD.
2. INSPECT AND MAINTAIN ALL EROSION AND SEDIMENT CONTROL MEASURES DURING THE DURATION OF THE PROJECT.
3. SEED MIX SHALL BE SELECTED BASED ON SITE CONDITIONS INCLUDING SOIL TYPE, MOISTURE CONDITIONS, FLOW CONDITIONS, SUN VS. SHADE CONDITIONS, AESTHETICS, AND MAINTENANCE REQUIREMENTS. MNDOT SPECIFICATION 3876 PROVIDES USEFUL CRITERIA FOR SELECTING APPROPRIATE SEED MIXTURES.
4. EROSION CONTROL BLANKET SHALL BE SELECTED IN ACCORDANCE WITH MNDOT SPECIFICATION 3885 FOR THE SPECIFIC SITE CONDITIONS. THE MINIMUM RECOMMENDED EROSION CONTROL BLANKET IS CATEGORY 3, 2S. MORE PERMANENT EROSION CONTROL BLANKET MAY BE REQUIRED BASED ON SWALE GRADIENT, FLOW VELOCITY, AND FLOW DEPTH.
5. EROSION CONTROL BLANKETS INSTALLATION SHALL BE IN ACCORDANCE WITH MNDOT SPECIFICATION 3885 AND MANUFACTURERS RECOMMENDATIONS FOR ANCHORING, CHECK TRENCHES, AND EDGE AND END OVERLAPS.
6. AVOID COMPACTION OF ALL IN-SITU SOILS AND IMPORTED SOILS UNLESS DIRECTED OTHERWISE. DO NOT LOOSEN SUBSOIL UNDER CHECK DAMS.
7. IF POSSIBLE, RESTRICT FLOW OR DIVERT FLOW FROM SWALE UNTIL VEGETATION IS ESTABLISHED.

TYPICAL CONSTRUCTION SEQUENCING-GRASS CHANNEL:

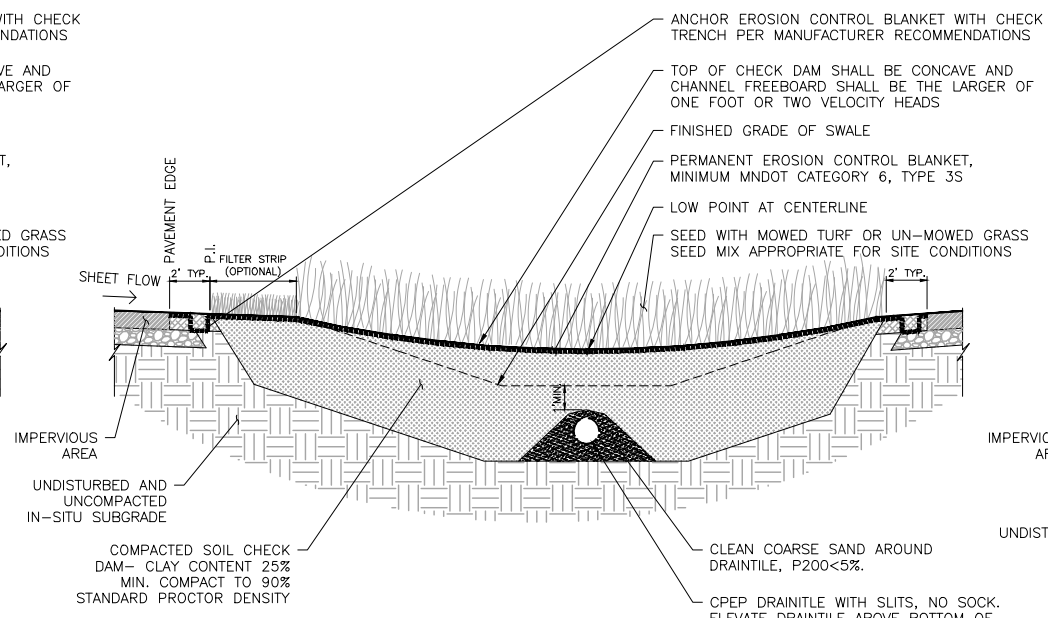
1. EXCAVATE CHANNEL TO SUBGRADE ELEVATIONS PER THE PLAN.
2. CONSTRUCTION SEQUENCE VARIES DEPENDING ON IN-SITU SOIL TYPE. SEE TABLE 1 FOR PROPER SEQUENCE FOR LOOSENING SUBSOILS AND ADDING SOIL AMENDMENTS.
3. LOOSEN SOIL IN A MANNER THAT AVOIDS RECOMPACTION OF THE SOIL BY CONSTRUCTION TRAFFIC.
4. AFTER SOIL LOOSENING AND ADDITION OF SOIL AMENDMENTS THE SURFACE OF THE SWALE WILL BE ROUGH.
5. IF POSSIBLE, STABILIZE ALL UPSTREAM TRIBUTARY AREAS BEFORE COMPLETING FINISH GRADING OF SWALES. THIS WILL MINIMIZE THE DEPOSITION OF SEDIMENT IN THE FINISHED SWALE.
6. IN THE EVENT THAT SEDIMENT IS INTRODUCED INTO THE BMP DURING OR IMMEDIATELY FOLLOWING EXCAVATION, THIS MATERIAL WILL NEED TO BE REMOVED FROM THE SWALE PRIOR TO INITIATING THE NEXT STEP IN THE CONSTRUCTION PROCESS. THIS IS ESPECIALLY IMPORTANT IF THE SWALE HAS BEEN DESIGNED TO INFILTRATE STORMWATER: SEDIMENT THAT HAS BEEN WASHED INTO THE SWALE DURING THE EXCAVATION PROCESS CAN SEAL THE PERMEABLE MATERIAL, SIGNIFICANTLY REDUCING THE INFILTRATION CAPACITY OF THE SOILS.
7. FINISH GRADE THE SWALE USING METHODS THAT AVOID RECOMPACTION OF LOOSENEED SOIL. ACCEPTABLE METHODS INCLUDE HAND RAKING, SMOOTHING WITH A BACKHOE BUCKET FROM OUTSIDE THE LIMITS OF THE SWALE, AND/OR PULLING A DRAG BEHIND LOW GROUND PRESSURE EQUIPMENT LIKE AN ATV.
8. SOW SEED AND PLACE EROSION CONTROL BLANKET AFTER FINISH GRADING AND BEFORE THE FIRST RAINFALL EVENT (WITHIN 24 HOURS IS PREFERRED). DEPOSITION OF SEDIMENT ON TOP OF THE EROSION CONTROL BLANKET MAY KILL SEED AND BECOME A SOURCE OF SEDIMENT WASHING OFF SITE. SEDIMENT ON TOP OF THE EROSION CONTROL BLANKET SHALL BE REMOVED TO A DEPTH LESS THAN ONE INCH.
9. IF STEP 6 IS NOT COMPLETED BEFORE THE FIRST RAINFALL EVENT, REPAIR RESULTING EROSION AND REMOVE ALL ACCUMULATED SEDIMENT FROM THE SWALE BEFORE SOWING SEED AND PLACING EROSION CONTROL BLANKET. EROSION REPAIR AND SEDIMENT REMOVAL SHALL BE COMPLETED WITHOUT COMPACTING THE SOIL (SEE STEP 5).

TYPICAL CONSTRUCTION SEQUENCING-DRY SWALES (SEE SHEET 2):

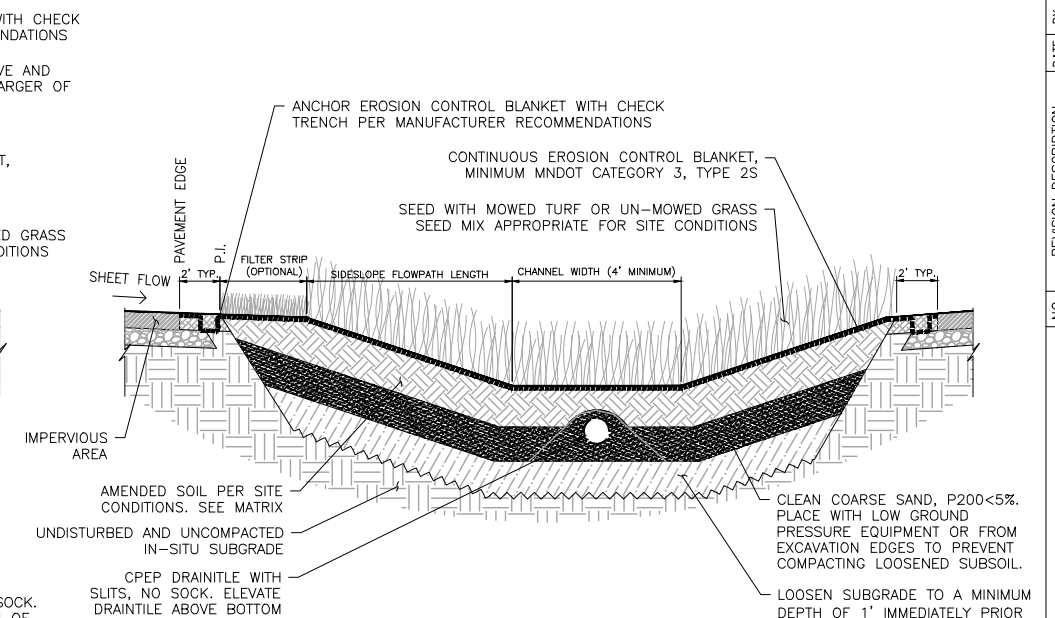
1. EXCAVATE CHANNEL TO SUBGRADE ELEVATIONS PER THE PLAN.
2. CONSTRUCTION CHECK DAMS AT THE LOCATIONS AND TO THE ELEVATIONS SHOWN ON THE PLANS.
3. CONSTRUCTION SEQUENCE VARIES DEPENDING ON IN-SITU SOIL TYPE. SEE TABLE 1 FOR PROPER SEQUENCE FOR LOOSENING SUBSOILS AND ADDING SOIL AMENDMENTS.
4. LOOSEN SOIL IN A MANNER THAT AVOIDS RECOMPACTION OF THE SOIL BY CONSTRUCTION TRAFFIC. DO NOT LOOSEN SOILS UNDER CHECK DAMS.
5. INSTALL UNDERDRAIN (IF SPECIFIED) AFTER LOOSENING SUBGRADE SOILS. CAREFULLY COVER UNDERDRAIN WITH SAND TO AVOID COMPACTION AND DAMAGE TO THE PIPE. MARK THE LOCATION OF UNDERDRAIN AS NECESSARY TO AVOID DAMAGING THE PIPE DURING SUBSEQUENT CONSTRUCTION ACTIVITIES.
6. STABILIZE ALL UPSTREAM TRIBUTARY AREAS BEFORE COMPLETING FINISH GRADING OF SWALES. THIS WILL MINIMIZE THE DEPOSITION OF SEDIMENT IN THE FINISHED SWALE.
7. FINISH GRADE THE SWALE USING METHODS THAT AVOID RECOMPACTION OF LOOSENEED SOIL. ACCEPTABLE METHODS INCLUDE HAND RAKING, SMOOTHING WITH A BACKHOE BUCKET FROM OUTSIDE THE LIMITS OF THE SWALE, AND/OR PULLING A DRAG BEHIND LOW GROUND PRESSURE EQUIPMENT LIKE AN ATV.
8. SOW SEED AND PLACE EROSION CONTROL BLANKET AFTER FINISH GRADING AND BEFORE THE FIRST RAINFALL EVENT (WITHIN 24 HOURS IS PREFERRED). DEPOSITION OF SEDIMENT ON TOP OF THE EROSION CONTROL BLANKET MAY KILL SEED AND BECOME A SOURCE OF SEDIMENT WASHING OFF SITE. SEDIMENT ON TOP OF THE EROSION CONTROL BLANKET SHALL BE REMOVED TO A DEPTH LESS THAN ONE INCH.
9. IF STEP 6 IS NOT COMPLETED BEFORE THE FIRST RAINFALL EVENT, REPAIR RESULTING EROSION AND REMOVE ALL ACCUMULATED SEDIMENT FROM THE SWALE BEFORE SOWING SEED AND PLACING EROSION CONTROL BLANKET. EROSION REPAIR AND SEDIMENT REMOVAL SHALL BE COMPLETED WITHOUT COMPACTING THE SOIL (SEE STEP 5).



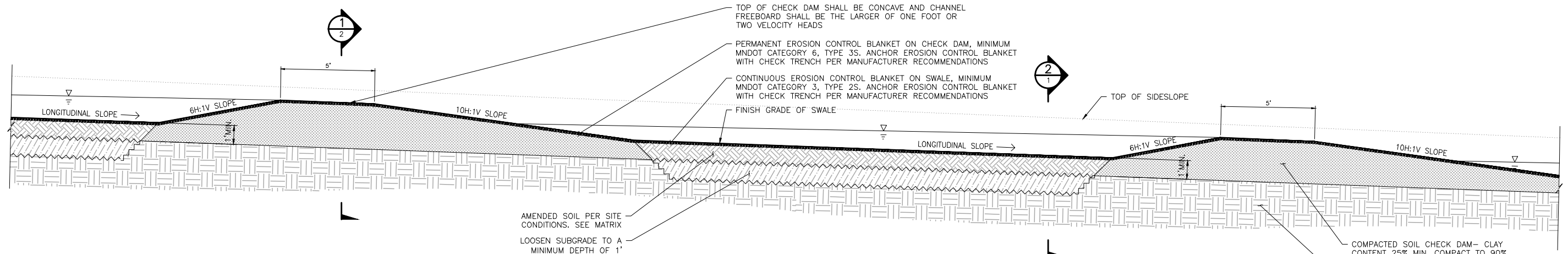
1 TYPICAL DRY SWALE CHECK DAM CROSS SECTION
2 NOT TO SCALE



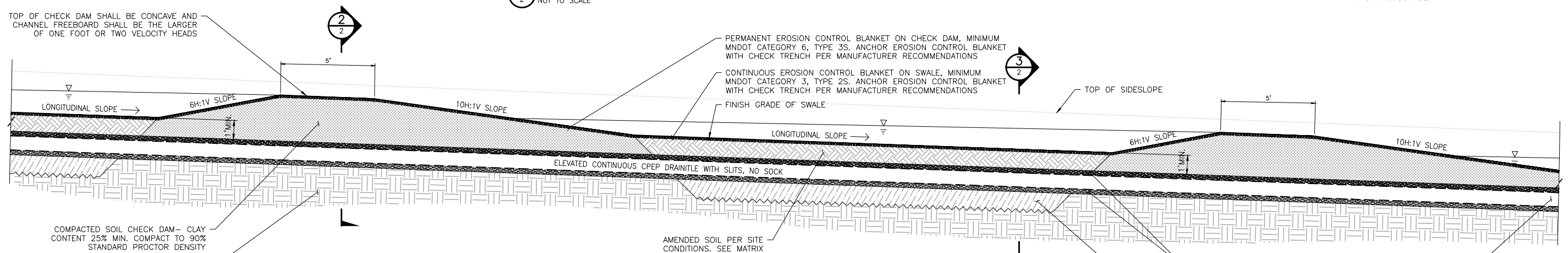
2 TYPICAL DRY SWALE CHECK DAM CROSS SECTION WITH DRAINTILE
2 NOT TO SCALE



3 TYPICAL DRY SWALE CROSS SECTION WITH DRAINTILE
2 NOT TO SCALE



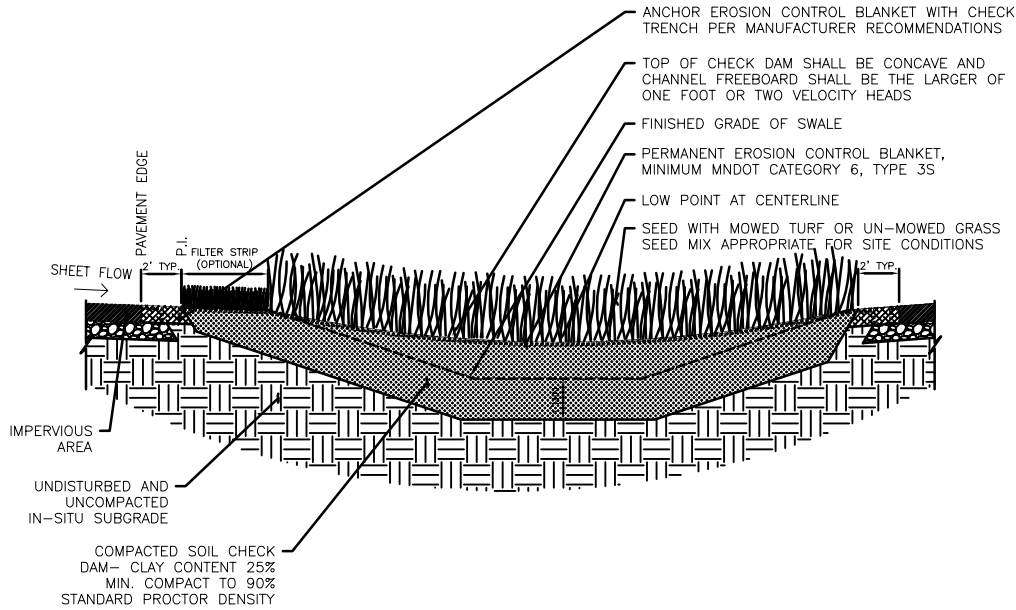
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2 TYPICAL DRY SWALE PROFILE SECTION WITH CHECK DAMS
NOT TO SCALE



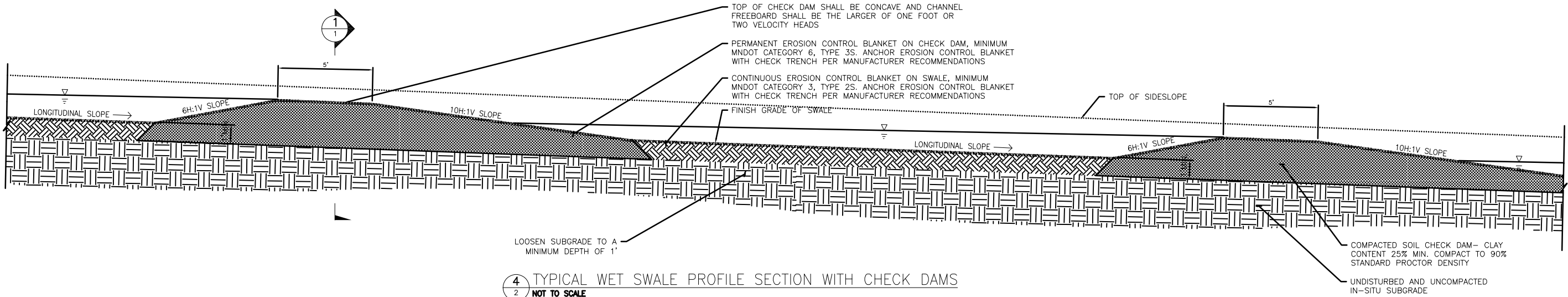
5 TYPICAL DRY SWALE PROFILE SECTION WITH CHECK DAMS AND DRAINTILE
2 NOT TO SCALE

<div style="text-align: center;"> <p>TYPICAL DRY SWALE WITH CHECKDAM AND DRAINTILE</p> </div>			Date _____	by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota
			Designed By _____	
			Drawn By _____	
			Print Name: _____	
			Sign Name: _____	
			Date _____ License No.: _____	
Sheet No. 2 of 2 Sheets				

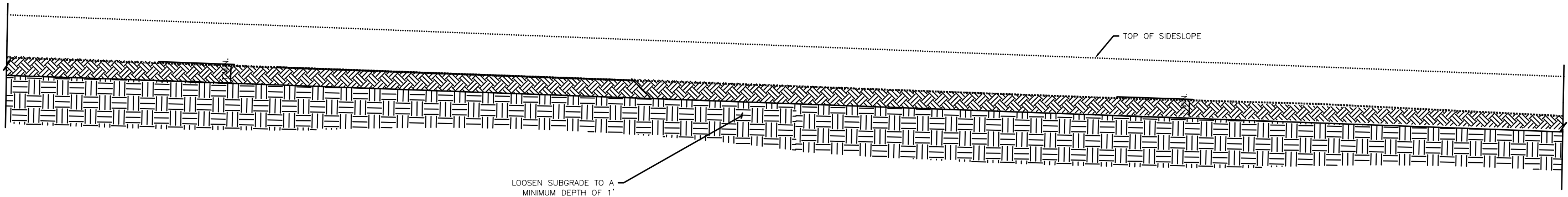
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1
1 TYPICAL WET SWALE CHECK DAM CROSS SECTION
NOT TO SCALE



4
2 TYPICAL WET SWALE PROFILE SECTION WITH CHECK DAMS
NOT TO SCALE



5
2 TYPICAL WET SWALE PROFILE SECTION
NOT TO SCALE

NOT FOR CONSTRUCTION PURPOSES

NO.	REVISION DESCRIPTION	DATE	BY

I hereby certify that this plan was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota

Print Name: _____ Sign Name: _____ Date: _____ License No. _____

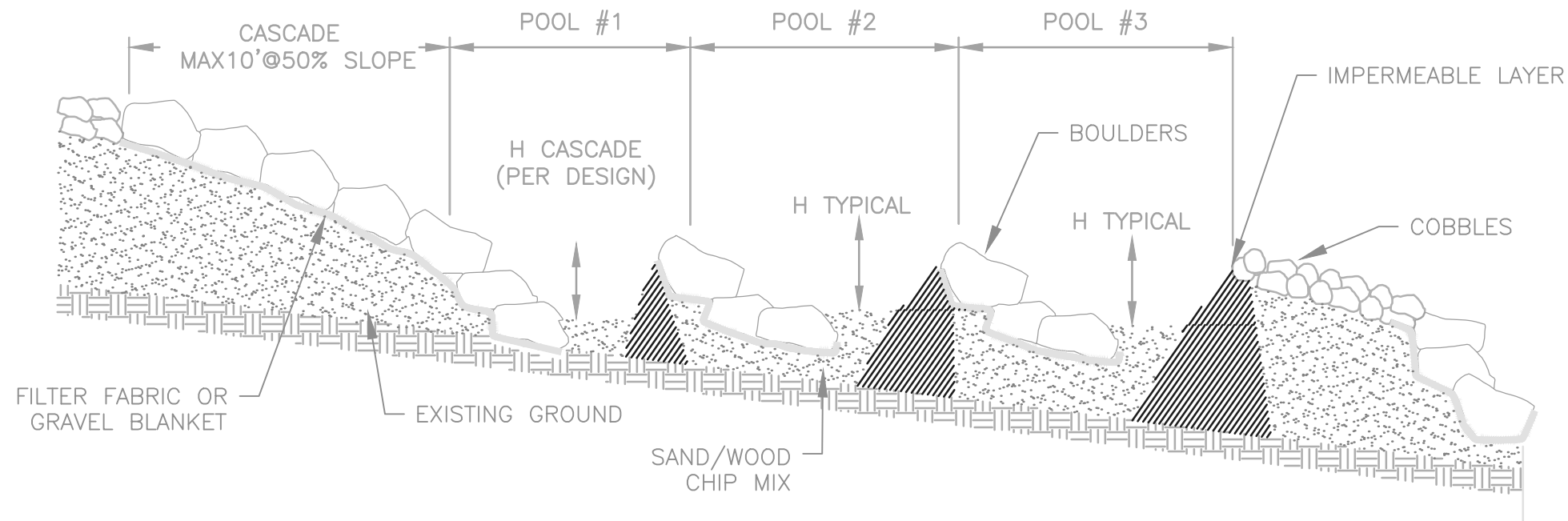
Date	Designed By	Drawn By

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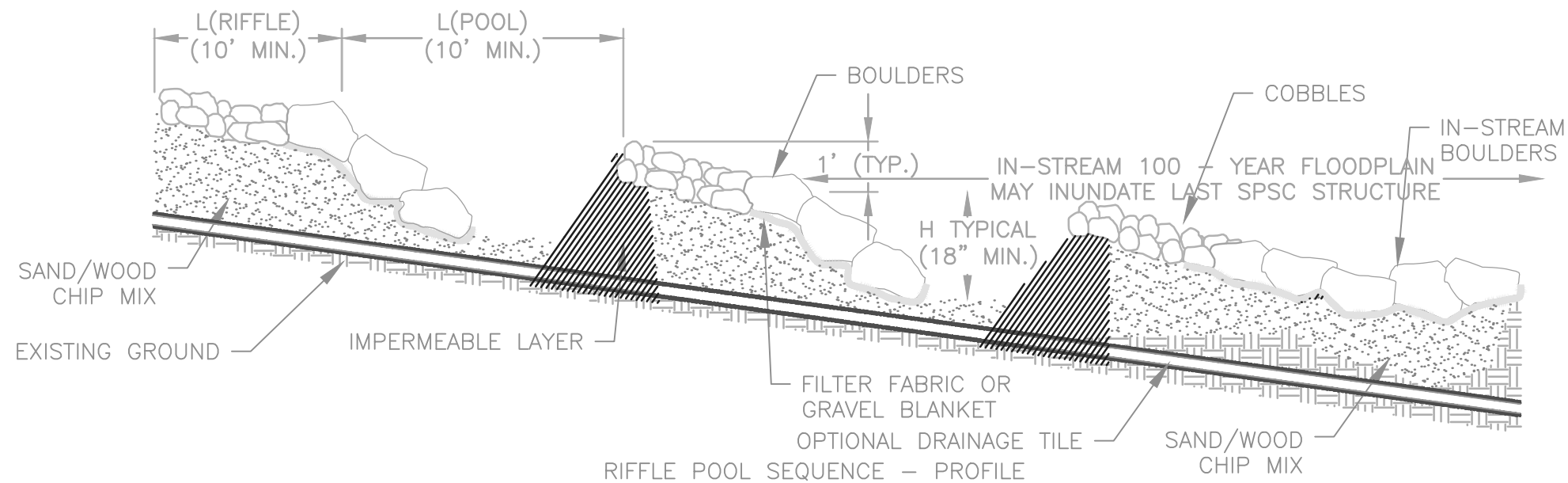
TYPICAL WET SWALE

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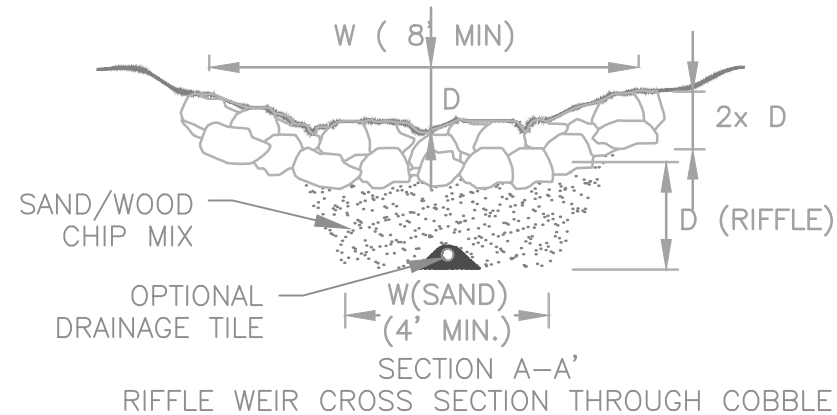
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2	2
Sheets	



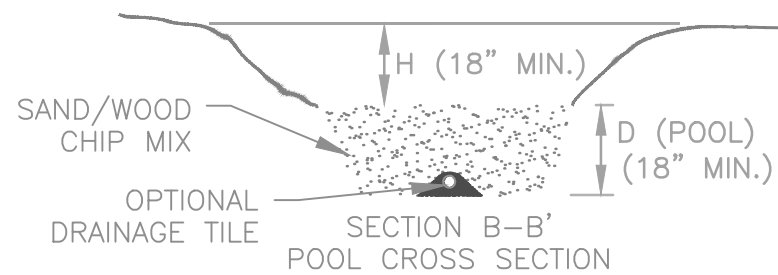
CASCADe PROFILE - THREE POOLS FOLLOWING CASCADe



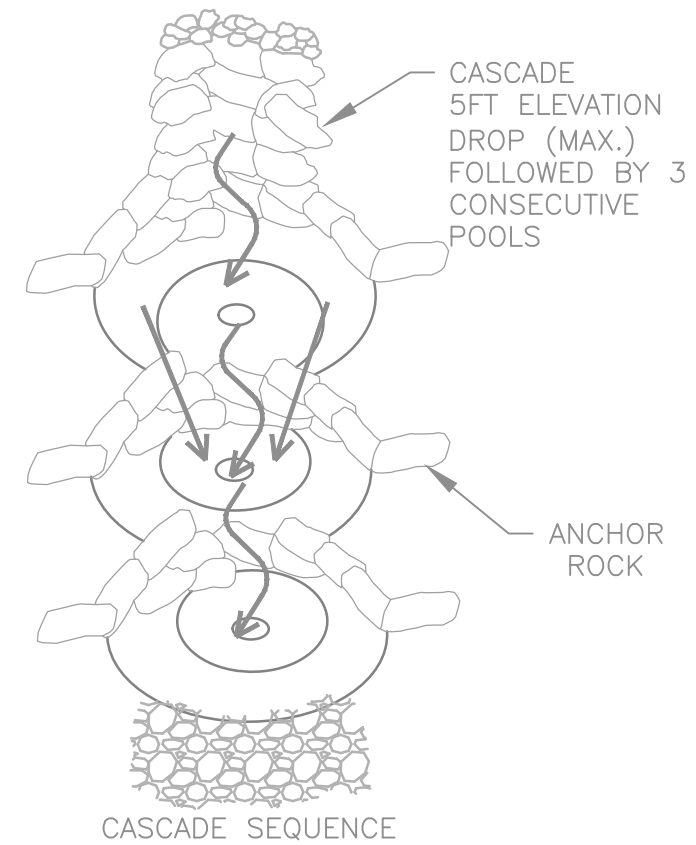
RIFFLe POOL SEQUENCE - PROFILE



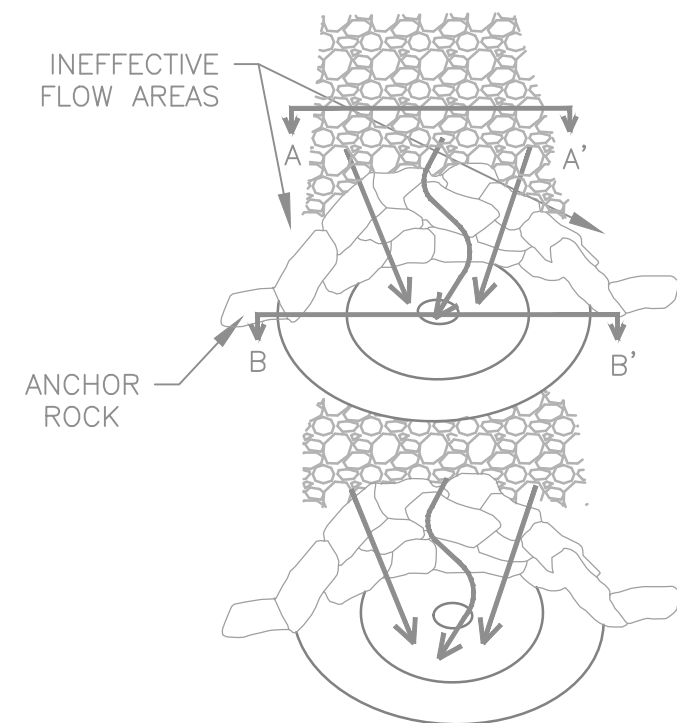
RIFFLe WEIR CROSS SECTION THROUGH COBBLE



SECTION B-B' POOL CROSS SECTION



CASCADe SEQUENCE



RIFFLe - POOL SEQUENCE (TYPICAL)

NOT FOR CONSTRUCTION PURPOSES

Minnesota Pollution Control Agency
520 Lafayette Road
St. Paul, MN 55155-4194
Phone: (651) 296-6300
TTY: (651) 282-5332
WEBSITE: www.pca.state.mn.us/



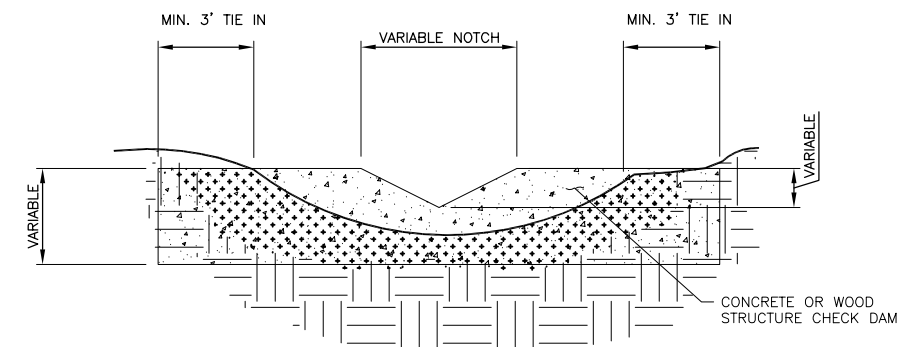
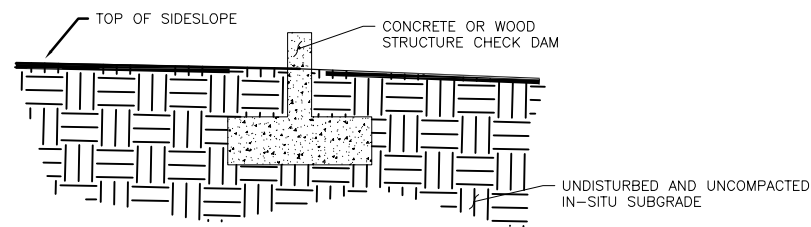
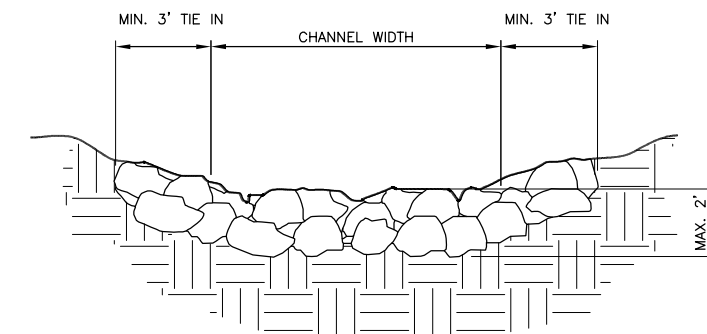
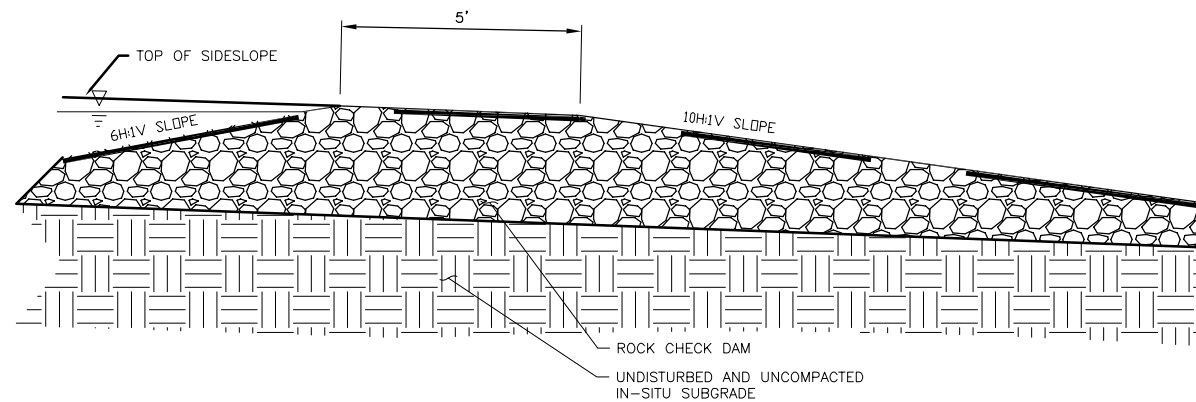
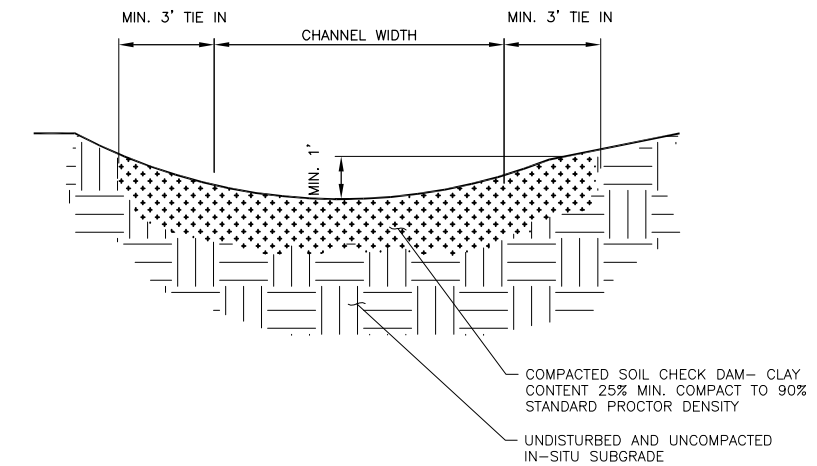
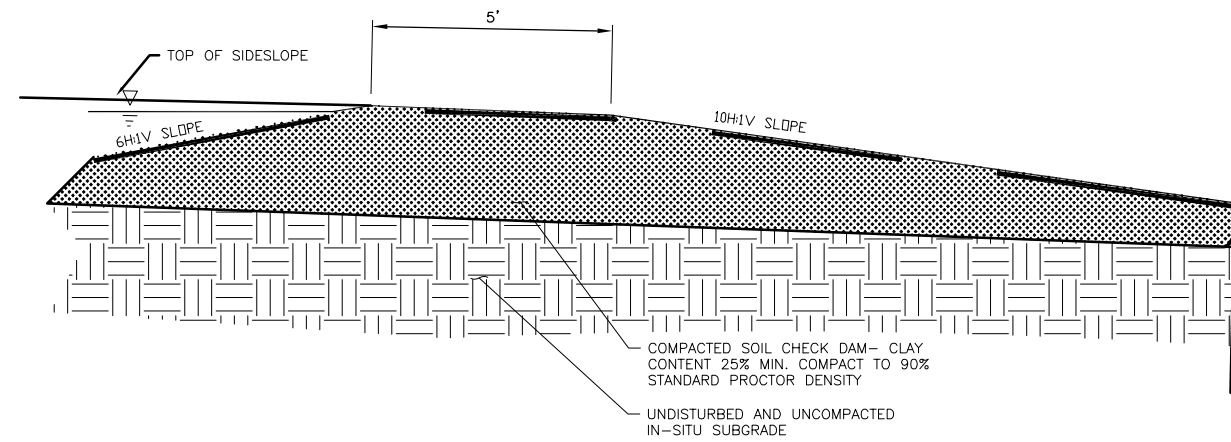
2018 MINNESOTA
STORMWATER
MANUAL

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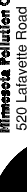
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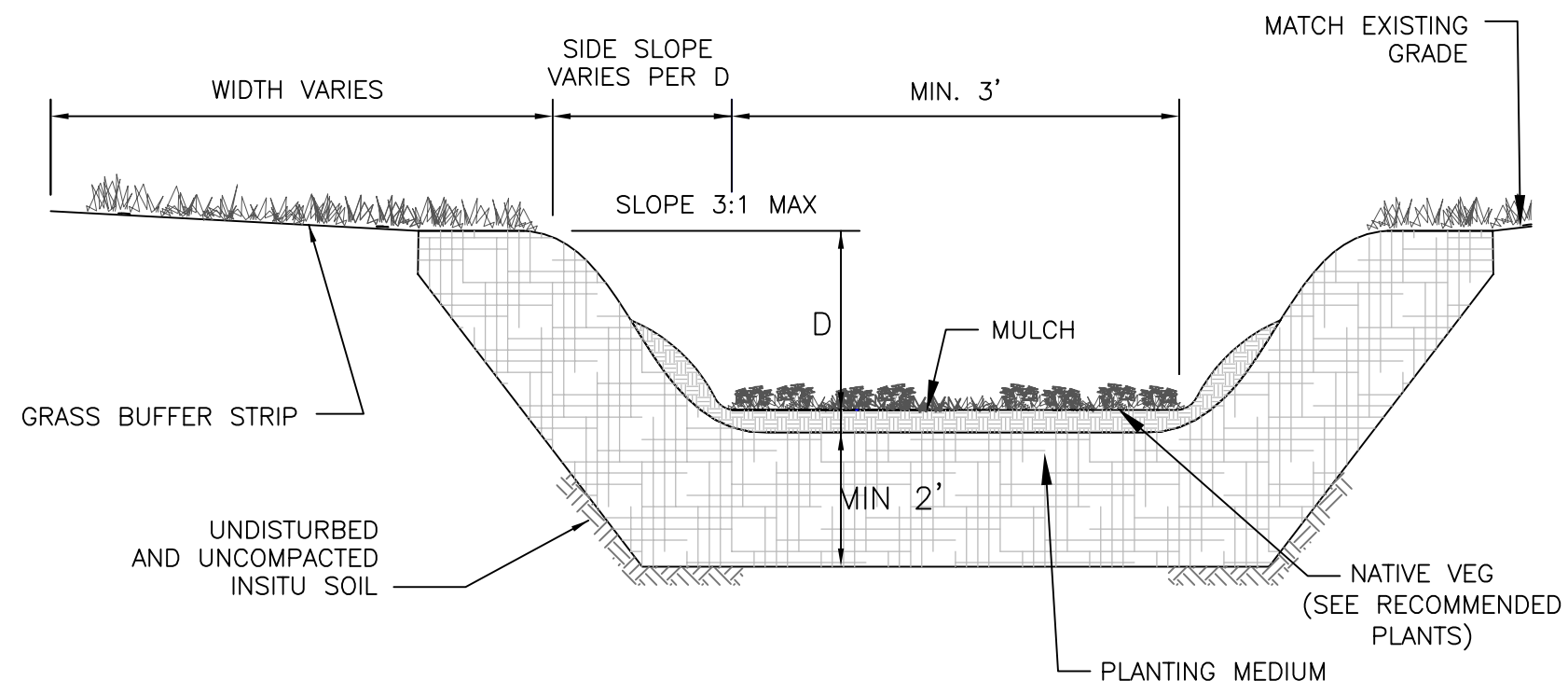
I hereby certify that this plan was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.
Print Name: _____
Sign Name: _____
Date: _____ License No. _____

Date _____
Designed By _____
Drawn By _____

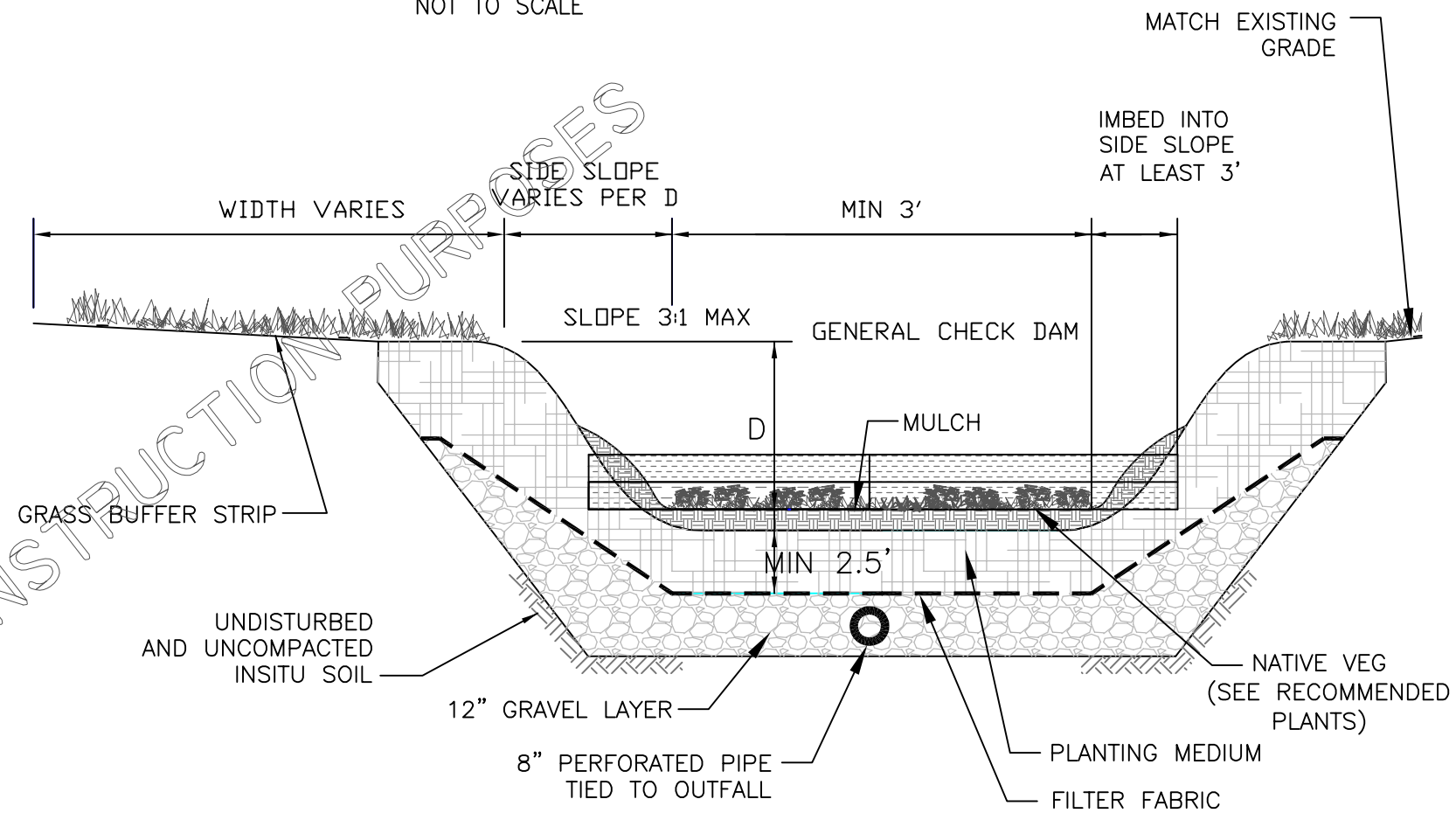


NOT FOR CONSTRUCTION PURPOSES

2018 MINNESOTA STORMWATER MANUAL	 <p>Minnesota Pollution Control Agency 520 Lafayette Road St. Paul, MN 55155-4194 Phone: (651)-296-6300 TTY: (651)-292-5332 WEBSITE: www.pca.state.mn.us/</p>	Designed By	Date	I hereby certify that this plan was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota	NO.	REVISION	DESCRIPTION	DATE	BY
		Print Name:	Sign Name:		Drawn By	Date	_____ License No.	_____ License No.	



TYPICAL WET SWALE CROSS-SECTION
NOT TO SCALE



TYPICAL DRY SWALE CROSS-SECTION (WITH GENERAL CHECKDAM)
NOT TO SCALE

- CONSTRUCTION SEQUENCING:**
1. PERFORM CONTINUOUS INSPECTIONS OF EROSION CONTROL PRACTICES.
 2. INSTALL SILT FENCE ALONG THE PERIMETER OF THE SITE TO PREVENT SEDIMENT FROM LEAVING THE SITE DURING THE CONSTRUCTION PROCESS.
 3. ALL DOWNGRAIDENT PERIMETER SEDIMENT-CONTROL BMPs MUST BE IN PLACE BEFORE ANY UP GRADIENT LAND-DISTURBING ACTIVITY BEGINS.
 4. REMOVE TOPSOIL FROM THE SITE AND PLACE IN TEMPORARY STOCKPILE LOCATION. TEMPORARY SEED THE STOCKPILE.
 5. INSTALL UNDERGROUND UTILITIES (WATER, SANITARY SEWER, ELECTRIC AND PHONES) TAKING THE LOCATION AND FUNCTION OF STORM WATER BMPs INTO CONSIDERATION.
 6. SEED AND MULCH DISTURBED AREAS ON SITE.
 7. CONSTRUCT THE ROADS TAKING THE LOCATION AND FUNCTION OF STORM WATER BMPs INTO CONSIDERATION.
 8. PERFORM ALL OTHER SITE IMPROVEMENTS TAKING THE LOCATION AND FUNCTION OF THE STORM WATER BMPs INTO CONSIDERATION.
 9. FINAL GRADE THE SITE.
 10. STABILIZE THE SITE BY IMPLEMENTING THE NATIVE SEEDING AND PLANTING PORTION OF THE LANDSCAPING PLAN.
 11. INSTALL THE EROSION CONTROL BLANKET AND COIR ROLL/CHECK DAMS.
 12. REMOVE THE SILT FENCE AFTER THE SITE IS STABILIZED PER PROJECT ENGINEER APPROVAL.

- GENERAL NOTES:**
1. INSTALL ALL TEMPORARY EROSION CONTROL MEASURES (IN ACCORDANCE WITH MnDOT GENERAL CONDITIONS 2573) PRIOR TO THE START OF ANY CONSTRUCTION OPERATION THAT MAY CAUSE ANY SEDIMENTATION OR SILTATION AT THE SITE.
 2. INSTALL STORM DRAIN INLET PROTECTION TO PREVENT CLOGGING OF THE STORM SEWER AND SEDIMENT LOADS TO DOWNSTREAM STORM WATER FACILITIES OR WATERBODIES.
 3. GRADING OF THE SWALE SHALL BE ACCOMPLISHED USING LOW-IMPACT EARTH-MOVING EQUIPMENT TO PREVENT COMPACTION OF THE UNDERLYING SOILS. SMALL TRACKED DOZERS AND BOBCATS WITH RUNNER TRACKS ARE RECOMMENDED.
 4. EXCAVATE THE SWALE TO THE SPECIFIED DEPTH (ELEVATION). IT IS RECOMMENDED THAT ALL SUB MATERIAL BELOW THE SPECIFIED ELEVATION SHALL BE LEFT UNDISTURBED, UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
 5. GRADE TO THE DEPTH (ELEVATION) SPECIFIED IN THE CONSTRUCTION DOCUMENTS UNLESS OTHERWISE DIRECTED BY THE ENGINEER.
 6. IN THE EVENT THAT SEDIMENT IS INTRODUCED INTO THE BMP DURING OR IMMEDIATELY FOLLOWING EXCAVATION, THIS MATERIAL WILL NEED TO BE REMOVED FROM THE SWALE PRIOR TO INITIATING THE NEXT STEP IN THE CONSTRUCTION PROCESS. THIS IS ESPECIALLY IMPORTANT IF THE SWALE HAS BEEN DESIGNED TO INFILTRATE STORM WATER: SEDIMENT THAT HAS BEEN WASHED INTO THE SWALE DURING THE EXCAVATION PROCESS CAN SEAL THE PERMEABLE MATERIAL, SIGNIFICANTLY REDUCING THE INFILTRATION CAPACITY OF THE SOILS.
 7. MATERIAL EXCAVATED FROM THE SWALE(S) SHALL BE DISPOSED OF ON-SITE AT LOCATIONS (STOCKPILE AREAS) DESIGNATED BY ENGINEER.
 8. **NON-STANDARD COMPONENT:** CLEAN, WASHED 1.5 TO 3.5-INCH GRAVEL SHALL BE PLACED IN THE BOTTOM OF THE SWALE TO THE DEPTH SPECIFIED IN THE CONSTRUCTION DOCUMENTS. GRAVEL SHOULD BE PLACED IN LIFTS AND LIGHTLY COMPACTED WITH PLATE COMPACTORS.
 9. **NON-STANDARD COMPONENT:** THE PERFORATED PIPE (UNDERDRAIN) SHALL BE LAID DIRECTLY ON THE GRAVEL BED. GRADE AND ALIGNMENT SHALL NOT VARY FROM THE PRESCRIBED GRADE BY MORE THAN 0.03 FEET (9 MM) AT ANY POINT. THE JOINTS BETWEEN SECTIONS OF PIPE SHALL BE CONNECTED IN A FASHION ACCEPTABLE TO ENGINEER. ONCE THE PIPE IS IN PLACE, IT SHALL BE COVERED IMMEDIATELY WITH GRANULAR MATERIAL AS SPECIFIED IN THE CONSTRUCTION DOCUMENTS. THE GRANULAR MATERIAL SHALL BE OF UNIFORM DEPTH ON BOTH SIDES OF THE PIPE. SPECIAL INLETS AND SPECIAL DEVICES AT THE OUTLET END OF THE PIPE SHALL BE CONSTRUCTED AS SHOWN IN THE PLANS.
 10. PORTIONS OF SWALE TO BE PLANTED SHALL RECEIVE 3" OF WOODCHIP MULCH (MnDOT TYPE 6).
 11. PORTIONS OF SWALE TO BE SEEDDED SHALL BE MULCHED WITH CLEAN GRAIN STRAW (MnDOT TYPE 3) AT A RATE OF 2 TONS PER ACRE.
 12. SEEDING AND INSTALLATION OF EROSION CONTROL BLANKET SHALL BE COMPLETED WITHIN 48 HOURS OF FINAL GRADING.

DATE		BY	
REVISION DESCRIPTION			
NO.			
I hereby certify that this plan was prepared by me or under my direct supervision and that it complies with the laws of the State of Minnesota.			
Print Name:		License No.	
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WET AND DRY SWALES			
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