Project Name:

Sky Valley Subdivision (Outfall Cascade), Subwatershed ID 141.

Location:

Valley View Drive and Piney Point Drive.

Drainage Area:

The drainage area tributary to the 27-inch CMP outfall is approximately 12.4 acres. The peak flow under a 10-yr storm event is approximately 14 cfs, with approximately 7.6 cfs running down Valley View Drive and 6.5 cfs being routed along Piney Point Drive. The hydrologic soil type within the drainage area are Type B soils, representing soils with moderate to high infiltration rates.

Existing Condition:

Stormwater runoff is routed through roadside ditches to a 27-inch CMP outfall culvert at the corner of Valley View Drive and Piney Point Drive. There is an additional 24-inch HDPE culvert that collects excess runoff that overtops Piney Point Drive. Runoff from the culvert outfalls flows down to Sky Valley Drive in an eroded channel on the steep hill, which shows significant signs of active incising and tree failure along the channel. Erosion is evident in the receiving ditch along Sky Valley Drive and in the channel receiving flows from the culvert under Sky Valley Drive. The subdivision has three other small drainage outfalls along Valley View Drive that act to divert flow prior to reaching the corner outfall. These have had their capacity limited as the upstream ends of the CMP culverts have been deformed and in some instances shut mostly closed.

Proposed Design:

The proposed concept design aims to contain and divert as much flow as possible to attenuate peak flows reaching the storm drain outfall at the low point of Piney Point Drive. Additionally, the concept design remediates and stabilizes the receiving channel below the culvert outfall. The concept design involves replacing/restoring flow capacity to the three culverts under Valley View Drive, providing end of pipe protection, and increasing capacity in existing ditches to avoid runoff from overtopping roads and damming flow at driveway culverts, storing and infiltrating stormwater runoff through the use of a vegetated swale with check dams and infiltration trenches, and finally conveying runoff down the steep hill in a controlled and stable manner to prevent bank erosion and channel incising. Two alternatives were evaluated to rehabilitate the steep culvert outfall channel. One alternative is to place a 30-inch flexible HDPE corrugated perforated pipe filled with clean aggregate inside the channel and backfill the channel to natural grade simulating a French drain condition. The pipe would be tied into manholes at

both ends. A second alternative is to construct a series of cascading step-pools in the channel to dissipate the energy and stabilize the banks.

Possible Alternative Concepts:

Any additional stormwater runoff that can be recharged into the ground represents a benefit to the water quality of Deep Creek Lake and the subdivision. As an alternative, all roadside ditches could be converted into infiltration trenches to limit the volume of runoff routed through the several outfalls.

Ease of Implementation:

Design implementation will require private property buy-in as most of the recommended improvements occur within private property. Tree impacts are not anticipated along the residential areas, tree impacts are anticipated in order to remediate and stabilize the cascading channel. Construction access for the swale, infiltration trenches and ditches will be from the local roads. Access to the steep channel rehabilitation is difficult as access is from the top or bottom of the channel through a heavy wooded area and may require a bucket crane.

Project Name:

Sky Valley Subdivision (Pond Outfall), Subwatershed ID 141.

Location:

Sky Valley Drive and Bench Road.

Drainage Area:

The drainage area tributary to the pond outfall is approximately 108 acres. The peak flow to the pond under a 10-yr storm event is approximately 54 cfs. The hydrologic soil type within the drainage area are mainly Type B soils, representing soils with moderate to high infiltration rates. Soil Type D exists at and around the pond structure.

Existing Condition:

Stormwater runoff from the pond is discharged through a CMP outfall culvert in the vicinity of the corner between Sky Valley Drive and Bench Road. As shown in the picture above, the outfall discharge freefalls from an approximate height of 3 feet to the receiving stream channel. The existing outfall configuration is constantly scouring the channel's bottom which will continue to degrade. The scoured channel and eroding vertical right bank provide sediment loads to Deep Creek Lake.

Proposed Design:

The proposed concept design aims to stabilize the pond outfall by constructing a step-pool system to transition from the existing pipe elevation down the stream channel elevation. The steep banks will be graded back from the outfall for approximately half the channel length to Bench Road to mimic the slopes of the stable second half of the channel. In order to open up the banks at the outfall without weakening the pond embankment, a precast concrete culvert head wall with apron and wing walls is recommended.

Possible Alternative Concepts:

Instead of the step-pool system the channel bed can be filled in and stabilize with rip-rap to provide a more uniform overall channel slope for the reach.

Ease of Implementation:

Design implementation will require approval from the property owner as the recommended improvements occur within private property. Significant tree impacts are not anticipated, but the immediate area adjacent to the outfall will need to be cleared for construction. Construction access will be from Sky Valley Drive.

Sky Valley

Stabilize Outfall and Channel:
Widen channel at a 2:1 slope and place rip-rap at outfall to dissipate energy and construct step-pools to tie-in outfall to the natural channel. Construct end-wall at pipe outlet.

Stabilize channel with rip-rap and vegetate were applicable.

Stabilize outfall:
1. Backfill channel with mixture of rip-rap, sandy soil and gravel. Construct step-pools.
2. Install HDPE corrugated perforated pipe filled with clean aggregate material and backfill, tie into manholes at both ends.

Repair/Replace Culverts (3 locations):
Culvert ends are deformed, some are almost shut. Provide endwall protection. Provide rip-rap apron at outfall.

Vegetated Swale:
12-in overflow relief culvert.

Infiltration Trench:
Replace ditch with Infiltration Trench.

Deepen and Widen Ditches (multiple):
Approx. 2-ft deep with 2:1 slope on road side and 1:1 slope on property side. Ditch inverts should be set at least 6 inches below culvert inverts. Grass lined ditches with appropriate seed for climate region and sun exposure.

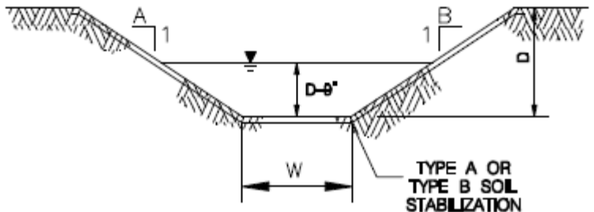
New Culverts:
Install 12-in culverts under road to provide relief to proposed vegetated swale.

Vegetated Swale:
Construct 1.5-ft deep by 15-ft wide (6-ft flat base) vegetated swale with two check dams.

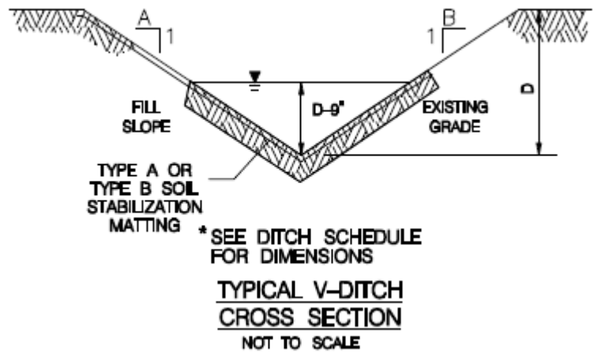
BENCH ROAD
SKY VALLEY DR
TRACI LN
VALLEY VIEW DR
PINEY POINT DR
BREEZY TERRACE
HILLTOP TER
HIGH POINT DR
RIDGE RD

0 50 100 200 Feet

Legend
- Existing Ditch
- Culvert (Repair)
- Culvert (New)
- Ditch (Deepen and Widen)
- Infiltration Trench
- Outfall Stabilization
- Vegetated Swale w/ Check Dams

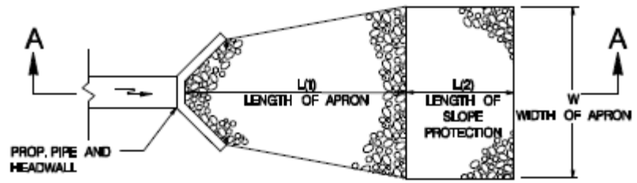


TYPICAL TRAPEZOIDAL
DITCH CROSS SECTION
NOT TO SCALE

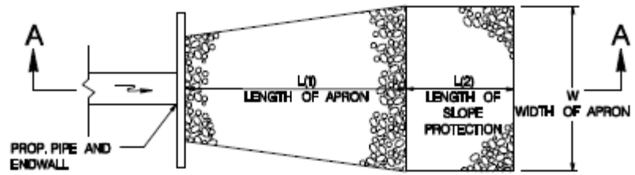


TYPICAL V-DITCH
CROSS SECTION
NOT TO SCALE

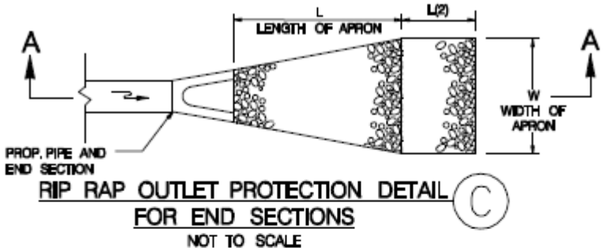
Drainage Ditch Detail



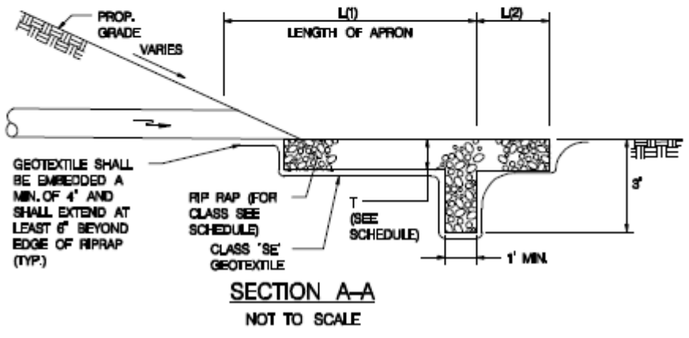
RIP RAP OUTLET PROTECTION DETAIL
FOR HEADWALLS (A)
NOT TO SCALE



RIP RAP OUTLET
PROTECTION DETAIL FOR ENDWALLS (B)
NOT TO SCALE

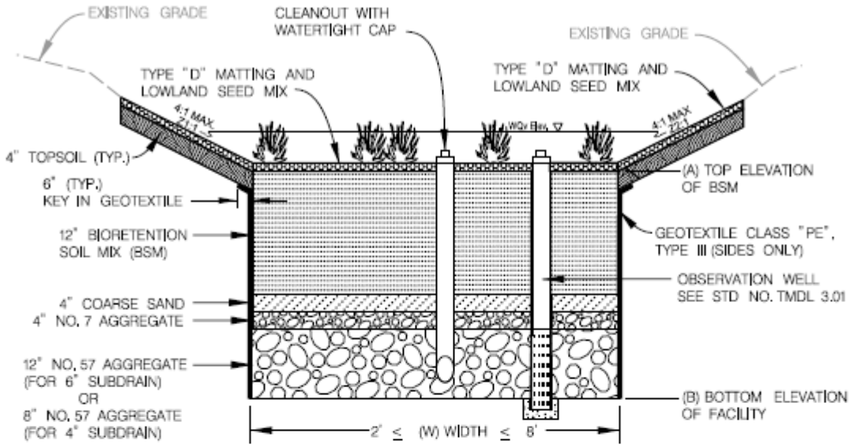


RIP RAP OUTLET PROTECTION DETAIL
FOR END SECTIONS (C)
NOT TO SCALE

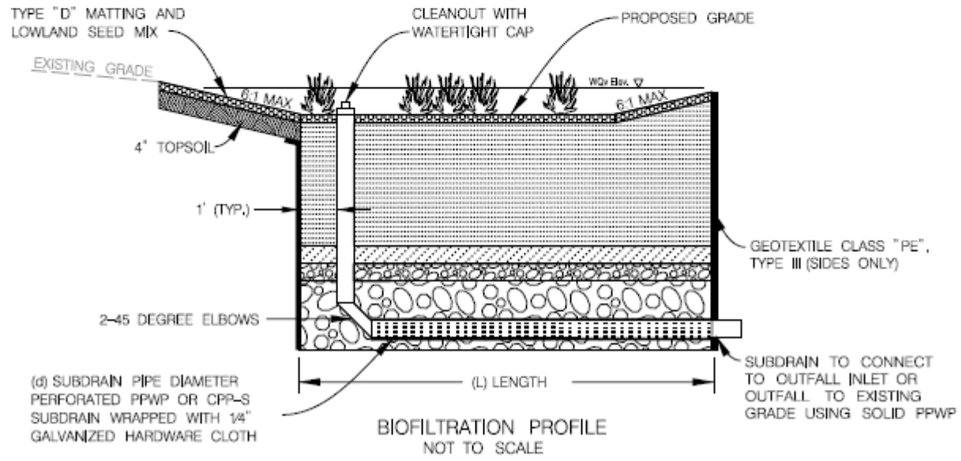


SECTION A-A
NOT TO SCALE

Outfall Protection Detail



BIOFILTRATION SECTION
NOT TO SCALE

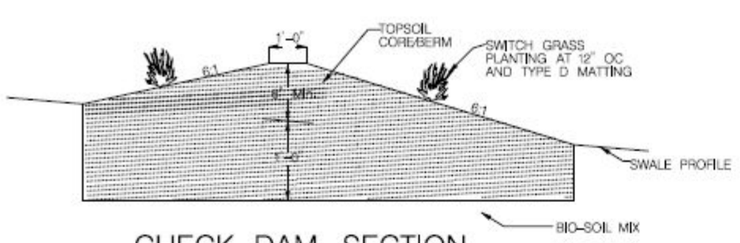


BIOFILTRATION PROFILE
NOT TO SCALE

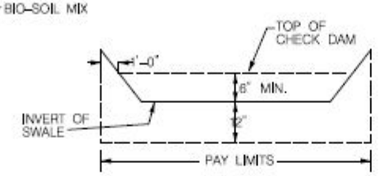
NOTE:
1. ONE CLEAN-OUT AND OBSERVATION WELL TO BE PROVIDED EVERY 1000 SQUARE FEET OF SURFACE AREA.
2. ALL PERFORATED PPWP OR CPP-S SHALL BE WRAPPED WITH 1/4" GALVANIZED HARDWARE CLOTH. SEE SECTION 316-STORMWATER FILTERATION FACILITIES OF THE IFB BOOK FOR MATERIAL AND INSTALLATION PROCEDURE. THE COST OF THE 1/4" GALVANIZED HARDWARE CLOTH WILL BE INCIDENTAL TO THE COST OF THE PPWP OR CPP-S ITEM.
3. RODENT SCREEN TO BE PROVIDED WHERE SUBDRAIN OUTFALLS TO EXISTING GRADE. COST OF THE RODENT SCREEN IS INCIDENTAL TO THE COST OF THE NON-PERFORATED PPWP OR CPP-S ITEM AS USED FOR THE BMP FACILITY OUTLET.
4. SEE SECTION 316 OF SPECIFICATIONS FOR MATERIALS AND INSTALLATION.
5. REVISED 31912 REDUCED BIO-SOIL TO 12".

Infiltration Trench
Biofiltration Trench Detail

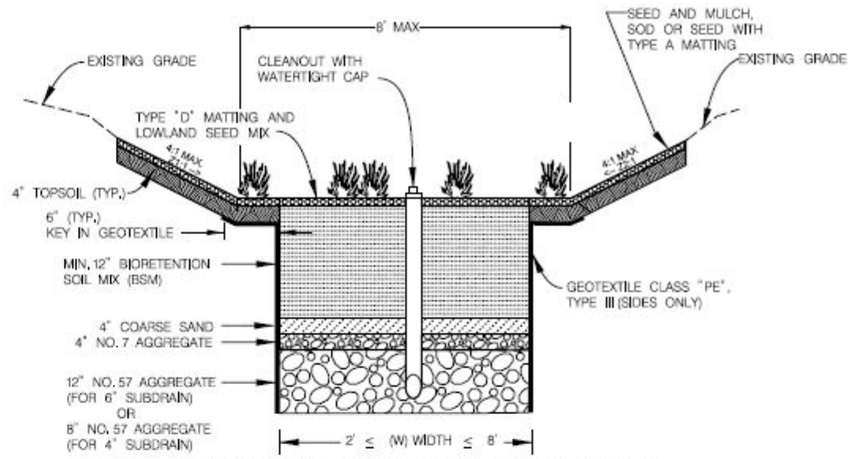
Sky Valley Site Details



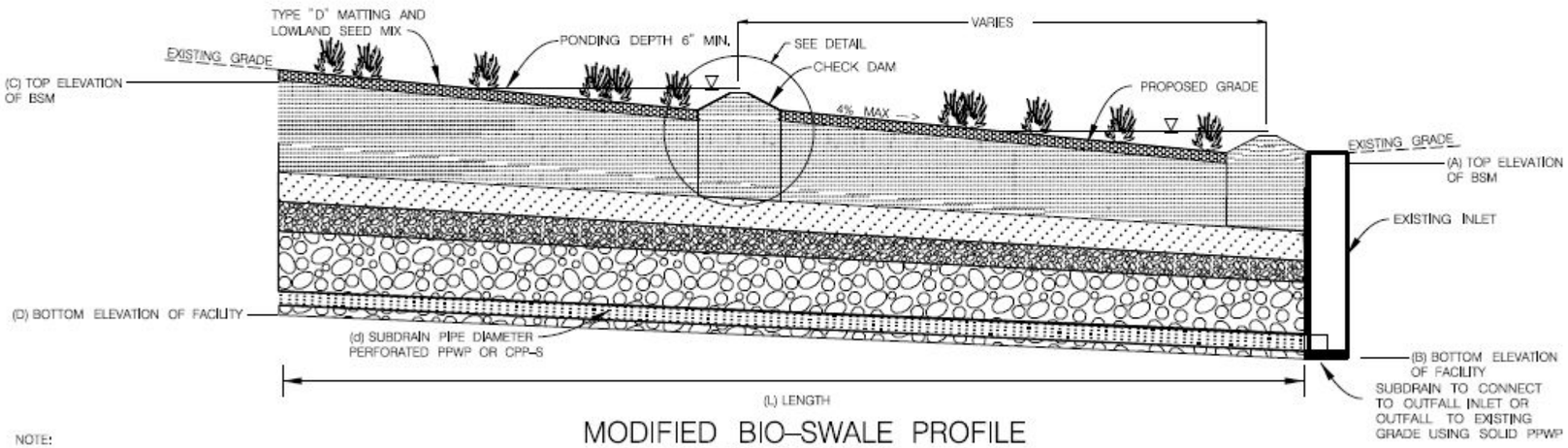
CHECK DAM SECTION
NOT TO SCALE



SWALE W/CHECK DAM DETAIL
NOT TO SCALE



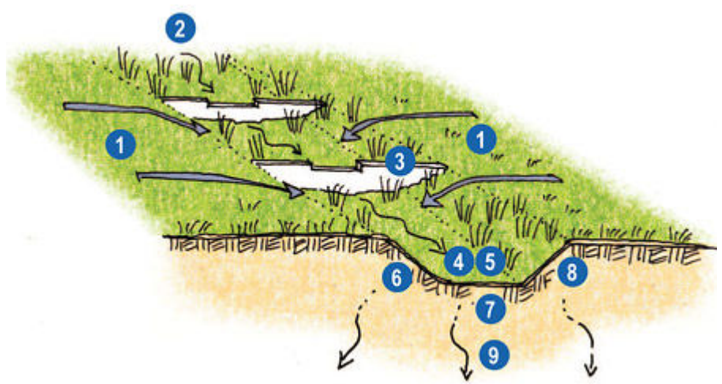
MODIFIED BIO-SWALE SECTION
NOT TO SCALE



MODIFIED BIO-SWALE PROFILE
NOT TO SCALE

NOTE:

1. ONE CLEAN-OUT TO BE PROVIDED EVERY 1000 SQUARE FEET OF SURFACE AREA.
2. RODENT SCREEN TO BE PROVIDED WHERE SUBDRAIN OUTFALLS TO EXISTING GRADE. COST OF THE RODENT SCREEN IS INCIDENTAL TO THE COST OF THE NON-PERFORATED PPWP OR CPP-S ITEM AS USED FOR THE BMP FACILITY OUTLET.
3. SEE SECTION 316 OF SPECIFICATIONS FOR MATERIALS AND INSTALLATION.
4. CHECK DAM SPACING PER CHART ON PLAN.
5. ALL PERFORATED PPWP OR CPP-S SHALL BE WRAPPED WITH 1/4" GALVANIZED HARDWARE CLOTH. SEE SECTION 316-STORMWATER FILTRATION FACILITIES OF THE IFB BOOK FOR MATERIAL AND INSTALLATION PROCEDURE. THE COST OF THE 1/4" GALVANIZED HARDWARE CLOTH WILL BE INCIDENTAL TO THE COST OF THE PPWP OR CPP-S ITEM.

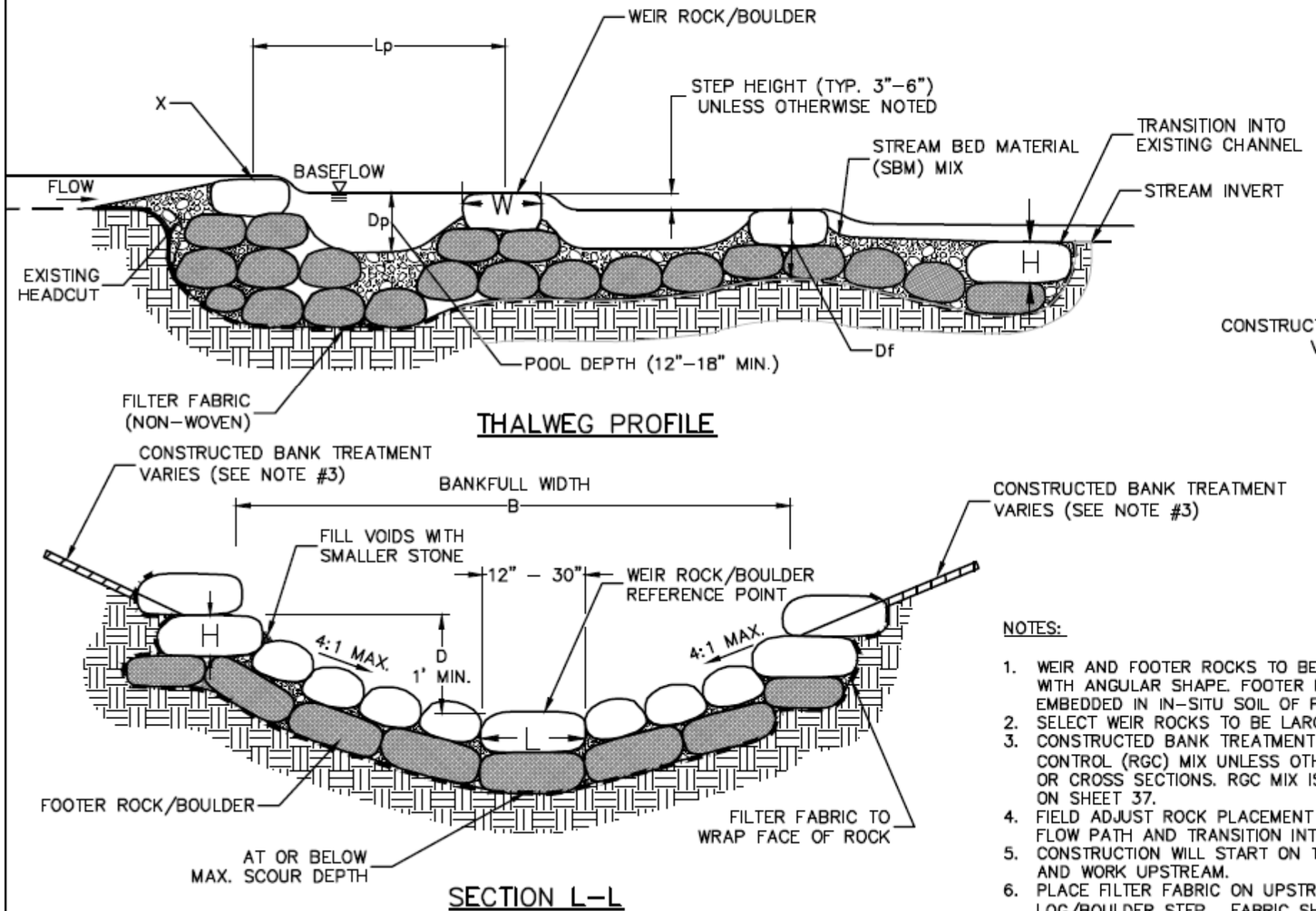


1. Inflow; 2. Max. slope 5%; 3. Check dams for slopes over 5%; 4. 6-inch grass recommended; 5. Max. treatment depth; 6. Trapezoidal shape; 7. 10-foot max. channel bottom width; 8. 3:1 max. channel bank sloope; 9. Infiltration if feasible.

Sky Valley Site Details

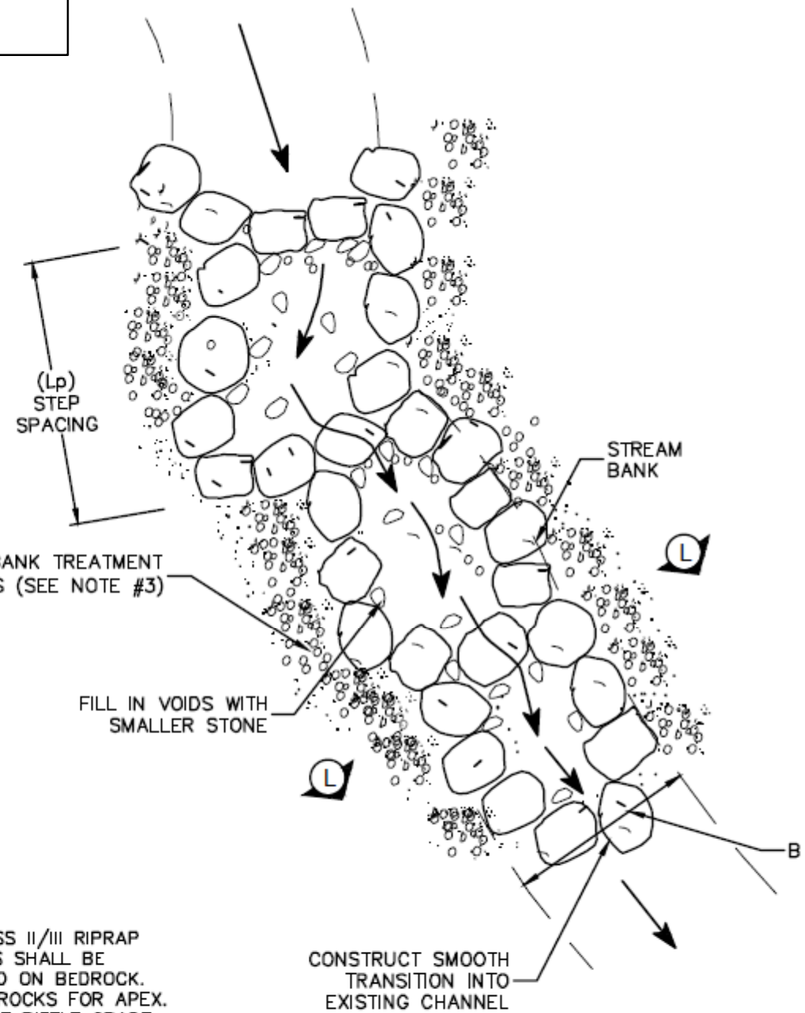
Vegetated Swale with Check Dam Detail

Pond Outfall Step Pool Detail



THALWEG PROFILE

SECTION L–L



PLAN VIEW – STEP POOL

CONSTRUCTED BANK TREATMENT
VARIES (SEE NOTE #3)

NOTES:

1. WEIR AND FOOTER ROCKS TO BE CLASS II/III RIPRAP WITH ANGULAR SHAPE. FOOTER ROCKS SHALL BE EMBEDDED IN IN–SITU SOIL OF PLACED ON BEDROCK.
2. SELECT WEIR ROCKS TO BE LARGEST ROCKS FOR APEX.
3. CONSTRUCTED BANK TREATMENT TO BE RIFFLE GRADE CONTROL (RGC) MIX UNLESS OTHERWISE SHOWN ON PLAN OR CROSS SECTIONS. RGC MIX IS SHOWN ON DETAIL 2.2 ON SHEET 37.
4. FIELD ADJUST ROCK PLACEMENT TO ENSURE STABLE FLOW PATH AND TRANSITION INTO ADJACENT BANKS.
5. CONSTRUCTION WILL START ON THE DOWNSTREAM END AND WORK UPSTREAM.
6. PLACE FILTER FABRIC ON UPSTREAM SIDE OF LOG/BOULDER STEP. FABRIC SHOULD COVER THE UPSTREAM FACE OF THE ENTIRE BOULDER AND SHALL EXTEND A MINIMUM OF 2 FEET UPSTREAM OF STRUCTURE.

Sky Valley Site Details

Project Name:

South Shore Road (Drainage Conveyance), Subwatershed ID 160.

Location:

In Harvey Peninsula, along South Shore Road.

Drainage Area:

The drainage area tributary to the outfall is approximately 9.8 acres. The peak flow to the outfall channel under a 10-yr storm event is approximately 8 cfs. The hydrologic soil type within the drainage area are mainly Type A soils, representing soils with high infiltration rates. Soil Type B exists on the western end of the drainage area, representing soils with moderate to high infiltration rates.

Existing Condition:

Stormwater runoff from Oak Way Road and South Shore Road is mainly routed by existing ditches to an outfall channel located between the private properties at 190 and 214 South Shore Road. A pipe under the road discharges the ditch-conveyed runoff from the north edge of South Shore Road to the lake side of the road. The outfall channel has been lined with flagstone into a V-shaped channel by the property owners, who are mainly responsible for the channel maintenance as it runs through their property down to the lake. Along South Shore Road, several of the culverts installed under driveways have become deformed and/or partially blocked causing the ditches to overflow across the road and private properties. Harvey Peninsula was developed before stormwater management regulations, therefore, no stormwater management facilities exist. AMT's desktop analysis and field assessments showed the need for improved conveyance in this area as concentrated flows are being routed through private properties with limited runoff controls.

Proposed Design:

The proposed concept design for this area aims to collect and convey stormwater runoff in a more controlled and stable manner. By combining infiltration techniques with better maintained and deeper ditches along South Shore Road, the concept design objective is to lower peak flow discharges for the more frequent storm events and route them to a storage vault that would release flow at a slower rate to the outfall channel. Storing runoff and reducing the peak discharge allows for more ground infiltration, more groundwater recharge and less erosion and sediment transport to the lake. The storage vault could be constructed under the off-road parking space on 214 South Shore Road.

Ease of Implementation:

Design implementation will require approval of the property owners as the recommended improvements occur mainly within private property. Significant tree impacts are not anticipated and the ditch and infiltration trench width can be adjusted as required to avoid existing trees. Construction access will be from South Shore Road.

South Shore

HARVEY PENINSULA ROAD

OAK WAY RD

S SHORE RD

2550

2540

2530

2510

2500

2490

2480

2470

2460

Repair/Replace Culverts (multiple):
Culvert ends are deformed and have lost flow capacity. Provide end-wall protection.

Infiltration Trench (multiple):
Replace ditch with Infiltration Trench.

Deepen and Widen Ditches:
Approximate size 2-ft deep by 4-ft wide as space permits, Grass lined ditches with appropriate seed for climate region and sun exposure.

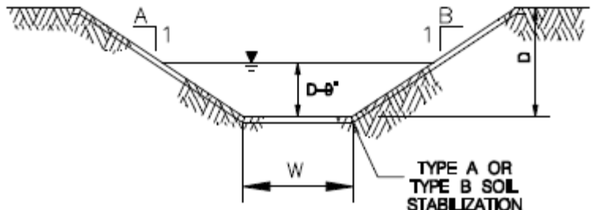
Storage Vault:
Construct concrete vault with low and high flow discharge orifices. Approximate size: 10-ft depth by 15-ft and 20-ft sides.

1 in = 100 ft

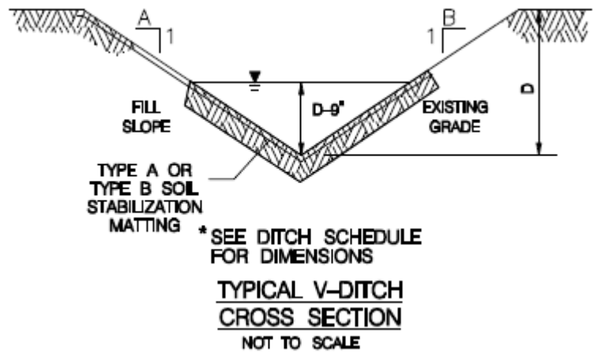
N

Legend

- Existing Ditch
- Culvert (Repair)
- Ditch (Deepen and Widen)
- Infiltration Trench
- Underground Vault

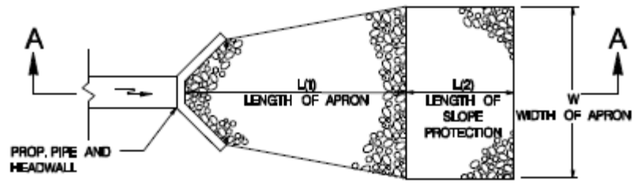


TYPICAL TRAPEZOIDAL
DITCH CROSS SECTION
NOT TO SCALE

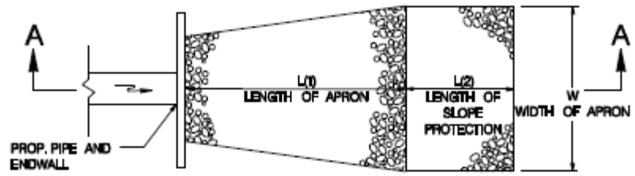


TYPICAL V-DITCH
CROSS SECTION
NOT TO SCALE

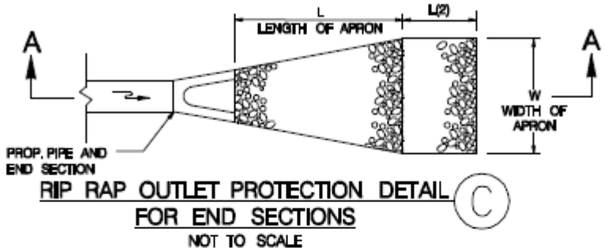
Drainage Ditch Detail



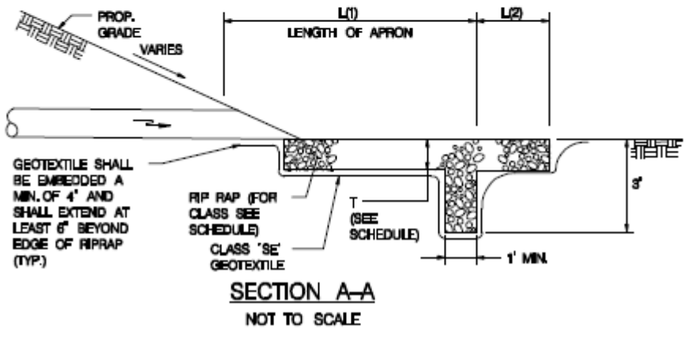
RIP RAP OUTLET PROTECTION DETAIL
FOR HEADWALLS (A)
NOT TO SCALE



RIP RAP OUTLET
PROTECTION DETAIL FOR ENDWALLS (B)
NOT TO SCALE

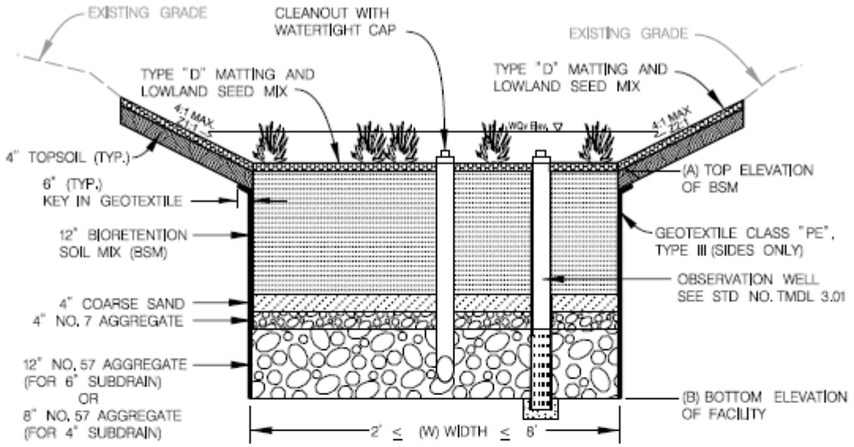


RIP RAP OUTLET PROTECTION DETAIL
FOR END SECTIONS (C)
NOT TO SCALE

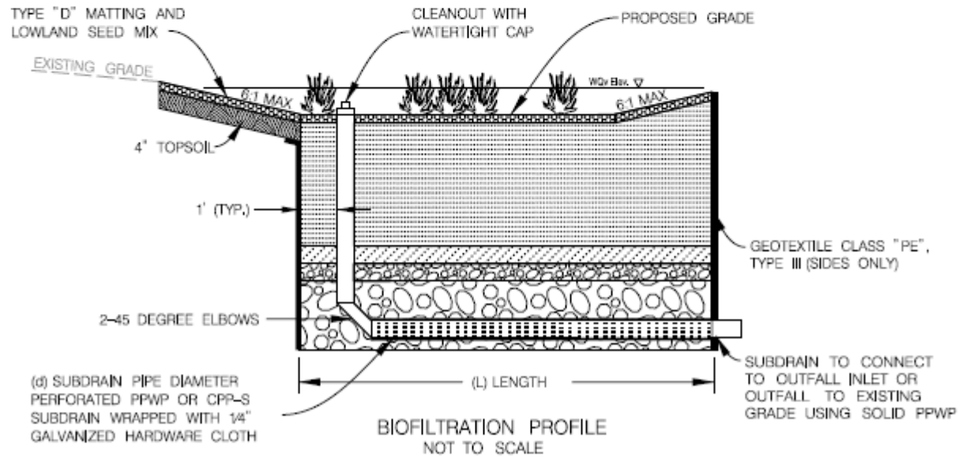


SECTION A-A
NOT TO SCALE

Outfall Protection Detail



BIOFILTRATION SECTION
NOT TO SCALE



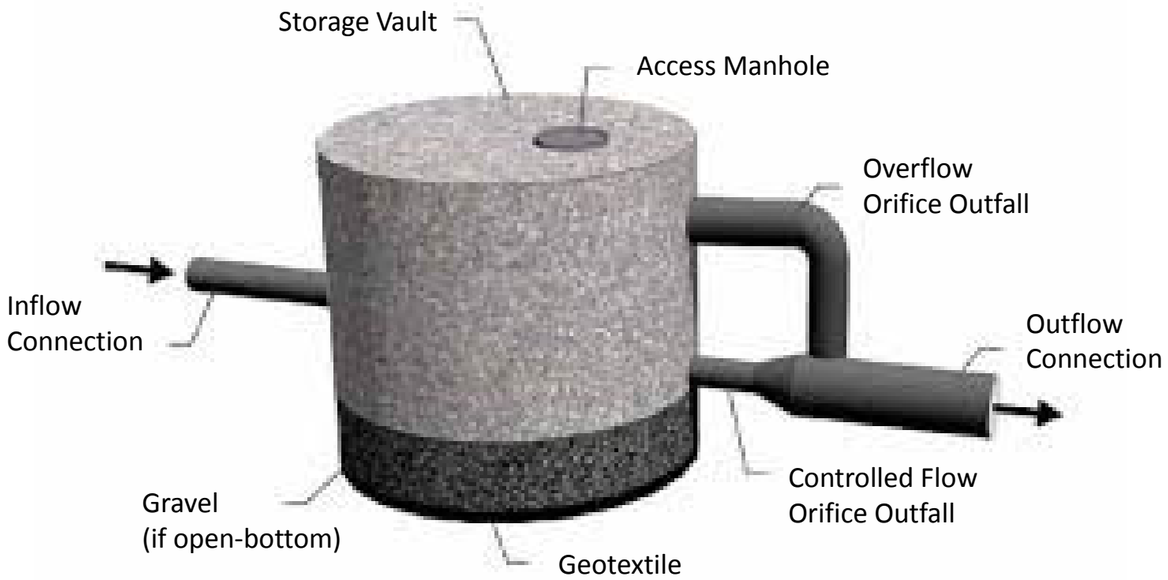
BIOFILTRATION PROFILE
NOT TO SCALE

NOTE:
1. ONE CLEAN-OUT AND OBSERVATION WELL TO BE PROVIDED EVERY 1000 SQUARE FEET OF SURFACE AREA.
2. ALL PERFORATED PPWP OR CPP-S SHALL BE WRAPPED WITH 1/4" GALVANIZED HARDWARE CLOTH. SEE SECTION 316-STORMWATER FILTERATION FACILITIES OF THE IFB BOOK FOR MATERIAL AND INSTALLATION PROCEDURE. THE COST OF THE 1/4" GALVANIZED HARDWARE CLOTH WILL BE INCIDENTAL TO THE COST OF THE PPWP OR CPP-S ITEM.
3. RODENT SCREEN TO BE PROVIDED WHERE SUBDRAIN OUTFALLS TO EXISTING GRADE. COST OF THE RODENT SCREEN IS INCIDENTAL TO THE COST OF THE NON-PERFORATED PPWP OR CPP-S ITEM AS USED FOR THE BMP FACILITY OUTLET.
4. SEE SECTION 316 OF SPECIFICATIONS FOR MATERIALS AND INSTALLATION.
5. REVISED 31912 REDUCED BIO-SOIL TO 12".

Infiltration Trench
Biofiltration Trench Detail

South Shore Site Details

Storage Vault Detail



South Shore Site Details

Project Name:

White Oak Drive North Side (Drainage Conveyance), Subwatershed ID 123.

Location:

In Beckham Peninsula, along White Oak Drive.

Drainage Area:

The drainage area tributary to the culvert under White Oak Drive in the northern end is approximately 5.6 acres. The peak flow to the outfall channel under a 10-yr storm event is approximately 5.7 cfs. The hydrologic soil type within the drainage area are mainly Type B soils, representing soils with moderate to high infiltration rates. Some soil Type A exists on the northern end of the drainage area, close to the culvert under White Oak Drive, representing soils with high infiltration rates.

Existing Condition:

Stormwater runoff from Wooded Ridge Road and White Oak Drive is mainly routed by existing ditches along the western side of White Oak Drive to a culvert crossing the road at approximately 597 White Oak Drive. The outfall discharges onto private property at 606 White Oak Drive where a natural drainage channel has formed conveying the stormwater runoff to Deep Creek Lake. During heavy rainfall events, the property receives highly concentrated flows eroding and depositing sediment onto the front and back yard of the property. Beckham Peninsula was developed before stormwater management regulations, therefore, no stormwater management facilities exist. AMT's desktop analysis and field assessments showed the need for peak flow attenuation in this area as concentrated flows are being routed through private property with limited runoff controls.

Proposed Design:

The proposed concept design for this area aims to collect and convey stormwater runoff in a more controlled and stable manner. By employing infiltration techniques along White Oak Drive, the concept design will lower peak flow discharges for the more frequent storm events. Capturing some of the runoff allows for groundwater recharge and less erosion and sediment transport to the lake.

Ease of Implementation:

Design implementation will require approval of property owners as the recommended improvements occur mainly within private property. Significant tree impacts are not anticipated and the infiltration trench width can be adjusted as required to avoid existing trees. Construction access will be off of White Oak Drive.

White Oak North

GLEN MEADOW ROAD

WOODED RIDGE RD

WHITE OAK DR

Infiltration Trench:
Construct 5-ft deep by 3-ft wide infiltration trench.

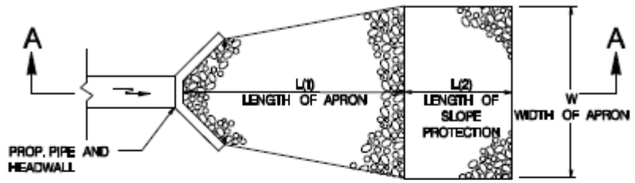
Repair Culvert:
Culvert outfall is deformed and is restricting flow through the culvert.

361
283
223
272
310
755
750
734
727
716
697
183
246
625
659
700
232
2570
597
680
194
2540
634
656
672
606
2500
2470
2460
178
527
2520
588
515
570
495
2530
548
437
536
2480
518
2490
490
472
452
462

1 in = 100 ft

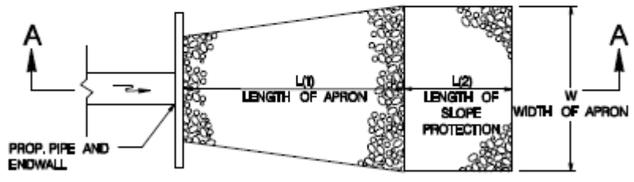
Legend

- Existing Ditch
- Culvert (Repair)
- Infiltration Trench



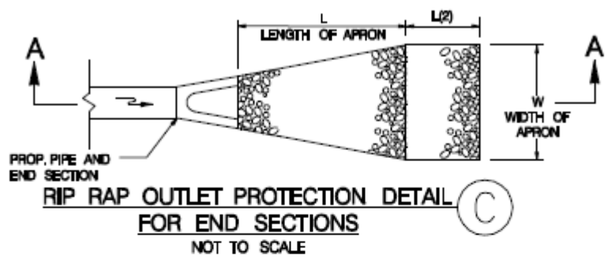
RIP RAP OUTLET PROTECTION DETAIL FOR HEADWALLS (A)

NOT TO SCALE



RIP RAP OUTLET PROTECTION DETAIL FOR ENDWALLS (B)

NOT TO SCALE



RIP RAP OUTLET PROTECTION DETAIL FOR END SECTIONS (C)

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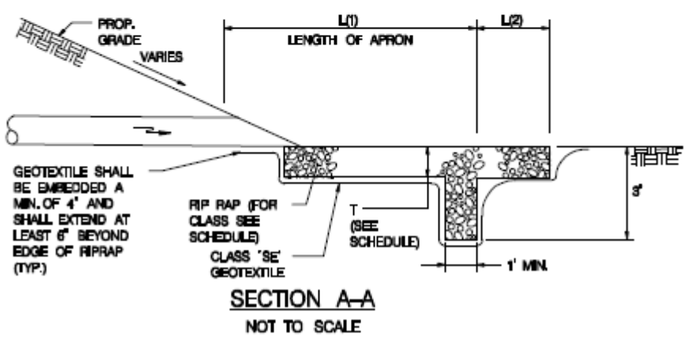
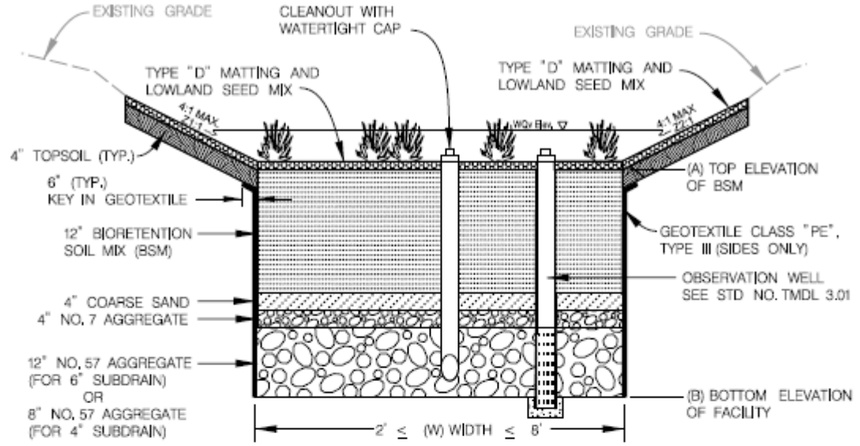


SECTION A–A

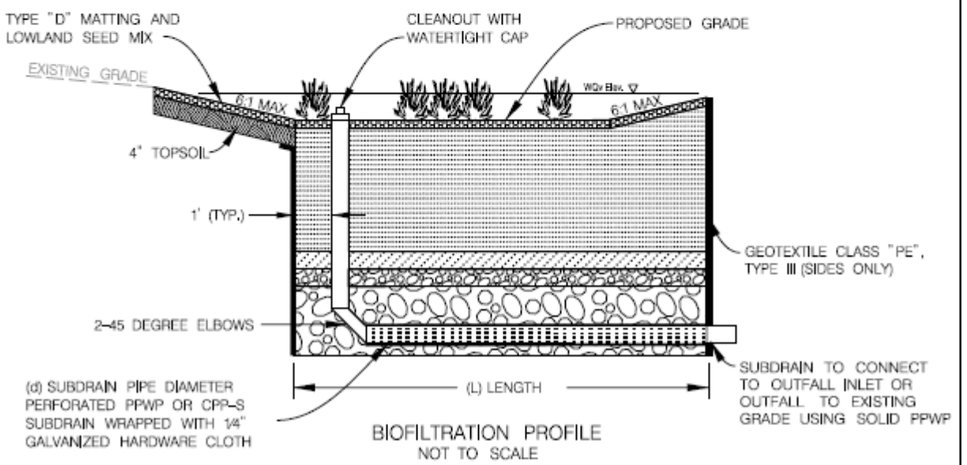
NOT TO SCALE

Outfall Protection Detail



BIOFILTRATION SECTION

NOT TO SCALE



BIOFILTRATION PROFILE

NOT TO SCALE

NOTE:

1. ONE CLEAN–OUT AND OBSERVATION WELL TO BE PROVIDED EVERY 1000 SQUARE FEET OF SURFACE AREA.
2. ALL PERFORATED PPWP OR CPP–S SHALL BE WRAPPED WITH 1/4" GALVANIZED HARDWARE CLOTH. SEE SECTION 316–STORMWATER FILTERATION FACILITIES OF THE IFB BOOK FOR MATERIAL AND INSTALLATION PROCEDURE. THE COST OF THE 1/4" GALVANIZED HARDWARE CLOTH WILL BE INCIDENTAL TO THE COST OF THE PPWP OR CPP–S ITEM.
3. RODENT SCREEN TO BE PROVIDED WHERE SUBDRAIN OUTFALLS TO EXISTING GRADE. COST OF THE RODENT SCREEN IS INCIDENTAL TO THE COST OF THE NON–PERFORATED PPWP OR CPP–S ITEM AS USED FOR THE BMP FACILITY OUTLET.
4. SEE SECTION 316 OF SPECIFICATIONS FOR MATERIALS AND INSTALLATION.
5. REVISED 31912 REDUCED BIO–SOIL TO 12".

Infiltration Trench
Biofiltration Trench Detail

White Oak North Site Details

Project Name:

White Oak Drive (Drainage Conveyance), Subwatershed ID 193.

Location:

In Beckham Peninsula, along White Oak Drive.

Drainage Area:

The drainage area tributary to the culvert under White Oak Drive in the northern end is approximately 9 acres. The peak flow to the outfall channel under a 10-yr storm event is approximately 9.5 cfs. The hydrologic soil type within the drainage area are Type B soils, representing soils with moderate to high infiltration rates.

Existing Condition:

Stormwater runoff from Wooded Ridge Road and White Oak Drive is mainly routed by existing ditches along the northern side of the road to a couple of culverts crossing White Oak Drive. The outfall discharges onto private properties on the lake side of White Oak Drive where natural and/or manmade drainage channels convey the stormwater runoff to Deep Creek Lake. Several of the culverts connecting the ditches under private driveways have become deformed and/or partially blocked causing the ditches to overflow across the road and onto private properties. During heavy rainfall events, some of these properties receive concentrated flows with high flow velocities eroding and depositing sediment onto the front and back yard of private properties. Beckham Peninsula was developed before stormwater management regulations, therefore, no stormwater management facilities exist. AMT's desktop analysis and field assessments showed the need for improved conveyance and peak flow attenuation in the area as concentrated flows are routed through private properties with limited runoff controls.

Proposed Design:

The proposed concept design for this area aims to collect and convey stormwater runoff in a more controlled manner and disperse concentrated flows through multiple culverts. By combining infiltration techniques and increasing capacity of ditches along White Oak Drive, the concept design will lower peak flow discharges in each channel for the more frequent storm events by installing multiple outfalls.

Ease of Implementation:

Design implementation will require property owner approval as the recommended improvements occur mainly within private property. Significant tree impacts are not anticipated and the ditch and infiltration trenches width can be adjusted as required to avoid existing trees. Construction access will be from White Oak Drive.

White Oak

WOODED RIDGE RD

WHITE OAK DR

Deepen and Widen Ditches (multiple):
Approximate size 2-ft deep by 4-ft wide.
Grass lined ditches with appropriate seed for climate region and sun exposure.

Repair/Replace Culverts (multiple):
Culvert ends are deformed and have lost flow capacity. Provide end-wall protection.

Infiltration Trench:
Replace ditch with Infiltration Trench.

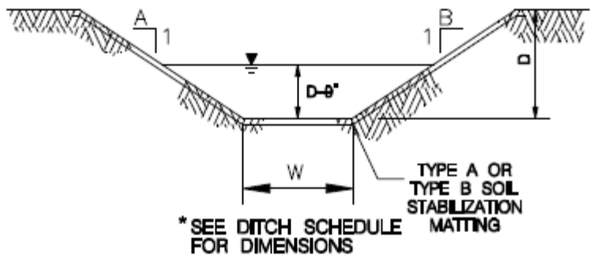
Outfall Channel (multiplel):
Disperse concentrated flows through multiple culverts. Provide and stabilize outfall channels along driveways and grass swales for stable conveyance to buffer area.

1 in = 100 ft

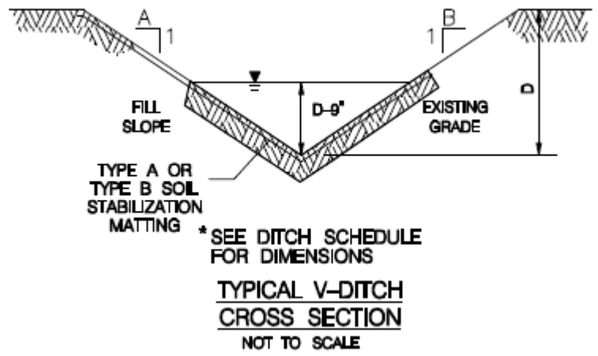
N

Legend

- Existing Ditch
- Culvert (Repair)
- Culvert (New)
- Ditch (Deepen and Widen)
- Infiltration Trench
- Outfall Stabilization

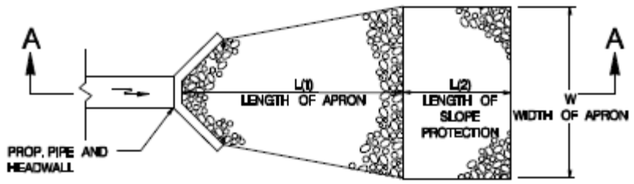


TYPICAL TRAPEZOIDAL
DITCH CROSS SECTION
NOT TO SCALE

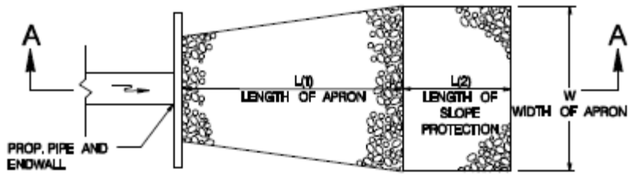


TYPICAL V-DITCH
CROSS SECTION
NOT TO SCALE

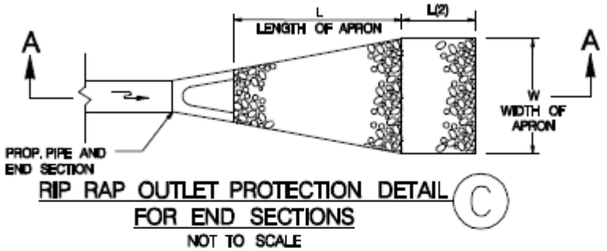
Drainage Ditch Detail



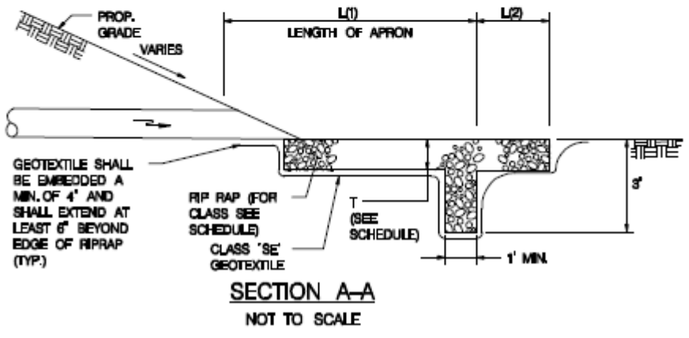
RIP RAP OUTLET PROTECTION DETAIL
FOR HEADWALLS (A)
NOT TO SCALE



RIP RAP OUTLET
PROTECTION DETAIL FOR ENDWALLS (B)
NOT TO SCALE

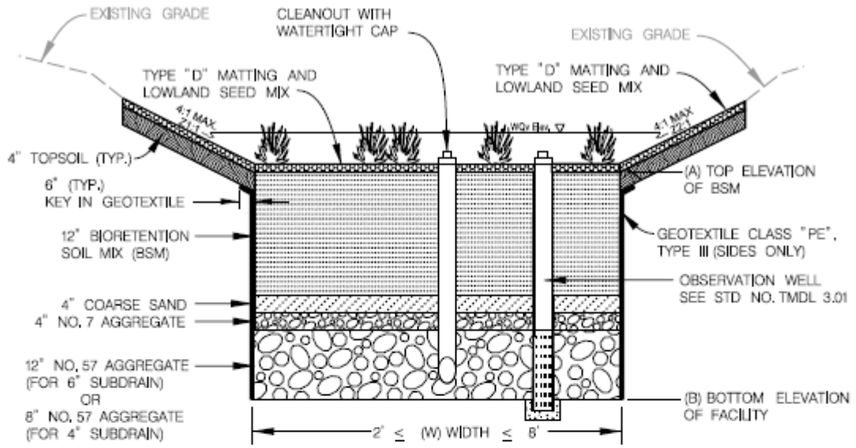


RIP RAP OUTLET PROTECTION DETAIL
FOR END SECTIONS (C)
NOT TO SCALE

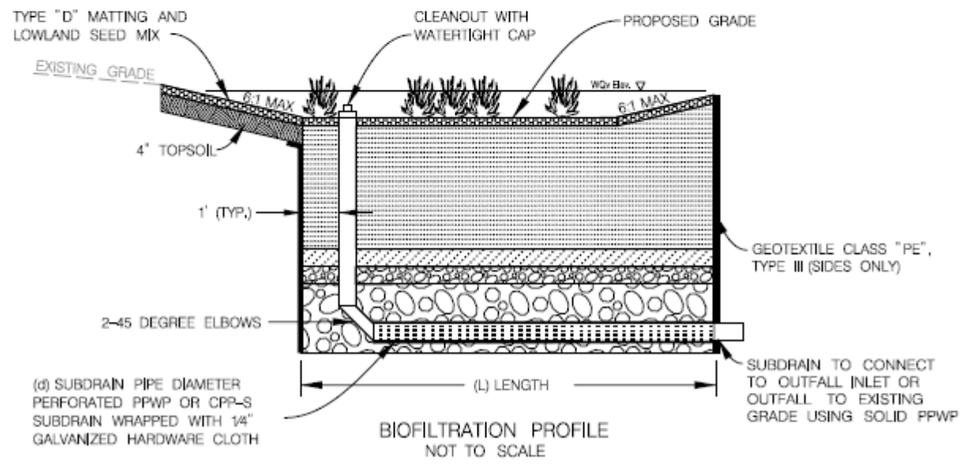


SECTION A-A
NOT TO SCALE

Outfall Protection Detail



BIOFILTRATION SECTION
NOT TO SCALE



BIOFILTRATION PROFILE
NOT TO SCALE

NOTE:
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2. ALL PERFORATED PPWP OR CPP-S SHALL BE WRAPPED WITH 1/4" GALVANIZED HARDWARE CLOTH. SEE SECTION 316-STORMWATER FILTERATION FACILITIES OF THE IFB BOOK FOR MATERIAL AND INSTALLATION PROCEDURE. THE COST OF THE 1/4" GALVANIZED HARDWARE CLOTH WILL BE INCIDENTAL TO THE COST OF THE PPWP OR CPP-S ITEM.
3. RODENT SCREEN TO BE PROVIDED WHERE SUBDRAIN OUTFALLS TO EXISTING GRADE. COST OF THE RODENT SCREEN IS INCIDENTAL TO THE COST OF THE NON-PERFORATED PPWP OR CPP-S ITEM AS USED FOR THE BMP FACILITY OUTLET.
4. SEE SECTION 316 OF SPECIFICATIONS FOR MATERIALS AND INSTALLATION.
5. REVISED 31912 REDUCED BIO-SOIL TO 12".

Infiltration Trench
Biofiltration Trench Detail

White Oak Site Details

Project Name:

North Glade Road (Culvert Replacement), Subwatershed ID 89.

Location:

Crossing under North Glade Road, near intersection with Beckman Lohr Road.

Drainage Area:

The drainage area tributary to the culvert is approximately 1,050 acres. The peak flow to the culvert under a 10-yr storm event is approximately 168 cfs. The hydrologic soil type within the drainage area is mainly Type B soils, representing soils with moderate to high infiltration rates. Some pockets of hydrologic soil Type A are also present, while the stream channels and immediate floodplains are mostly of Type C and D hydrologic soils.

Existing Condition:

The tributary to North Glade Run that runs through the CMP culvert under North Glade Road represents the second biggest tributary to Deep Creek Lake within the North Glade Run watershed. The stream collects and routes stormwater runoff from the northeastern agricultural and residential areas of the watershed. Field assessments, hydrologic and hydraulic analyses showed that the CMP culvert under North Glade Road is undersized and that the road overtops under the 10-yr storm event. The upstream and downstream culvert headwalls and embankment show clear signs of overtopping and structural failure.

Proposed Design:

The proposed concept design for the culvert recommends replacing the existing CMP culvert with a double barrel 36-inch RCP culvert with concrete headwalls. Upsizing the road culvert will not only increase road safety, but will eliminate road overtopping under frequent storm events and the corresponding embankment and streambank erosion currently occurring.

Ease of Implementation:

Design implementation does not require private owner approval as the recommended improvements occur within public right-of-way. No tree impacts are anticipated and construction access will be from North Glade Road.

Project Name:

North Glade Run (Stream Restoration), Subwatershed ID 89.

Location:

Tributary to Deep Creek Lake, downstream of North Glade Road.

Drainage Area:

The drainage area tributary North Glade Run downstream of North Glade Road is approximately 2,200 acres. The peak flow to this reach of the stream under a 10-yr storm event is approximately 309 cfs. The hydrologic soil type within the drainage area are mainly Type B soils, representing soils with moderate to high infiltration rates. The stream channels and immediate floodplains are mostly of Type C and D hydrologic soils. Soils east of the intersection of Bittinger Road and Mellinger Road are of Type C.

Existing Condition:

North Glade Run represents the greatest source of stormwater runoff within the North Glade Run watershed tributary to Deep Creek Lake. The stream collects and routes stormwater runoff from the eastern part of the watershed, which lands are mainly used for agricultural purposes. Field assessment of the reach downstream of North Glade Road showed signs indicative of a degrading stream reach. Active channel widening and incising signs were observed along with multiple fallen and undercut trees. This stream reach, being the main lake influent in the watershed, presents the greatest opportunity to reduce sediment and nutrient loadings into Deep Creek Lake.

Proposed Design:

A proposed stream restoration design for this reach of North Glade Run would have as objectives to stabilize the eroding streambanks and to provide sediment and nutrient removal measures. By use of stream restoration techniques including in-stream structures, bank stabilization and floodplain reconnection, water quality will be increased and sediment loads into Deep Creek Lake will be reduced.

Ease of Implementation:

Design implementation would require private property right-of-entry to provide the necessary access to the stream reach. It is anticipated that access would be secured through 1646 North Glade Road, but a thorough assessment of the area is needed to determine the necessary limits of disturbance and the best access point. Tree impacts are anticipated to provide access for the necessary machinery and material required to restore the stream reach, these could be minimized with adequate field assessments and planning.

North Glade Run

Culvert Headwall/Capacity:
Culvert capacity is inadequate, peak flow for 10-year storm is approximately 168 cfs. Based on estimated culvert size and slope the road begins overtopping at 113 cfs. Recommend installing 36-inch RCP double barrel culvert with headwalls.

Stream Restoration:
North Glade Run is the main tributary to the Lake in the Study Area. Heavy sedimentation and nutrient loading travel through the tributary. Signs of bank erosion and falling trees are evidence of this. Applicable restoration techniques need to be evaluated but likely include: step-pools, cross vanes, J-hooks, sills, rock toe and soil lift bank stabilization.

N GLADE RD

BECKMAN LOHR ROAD

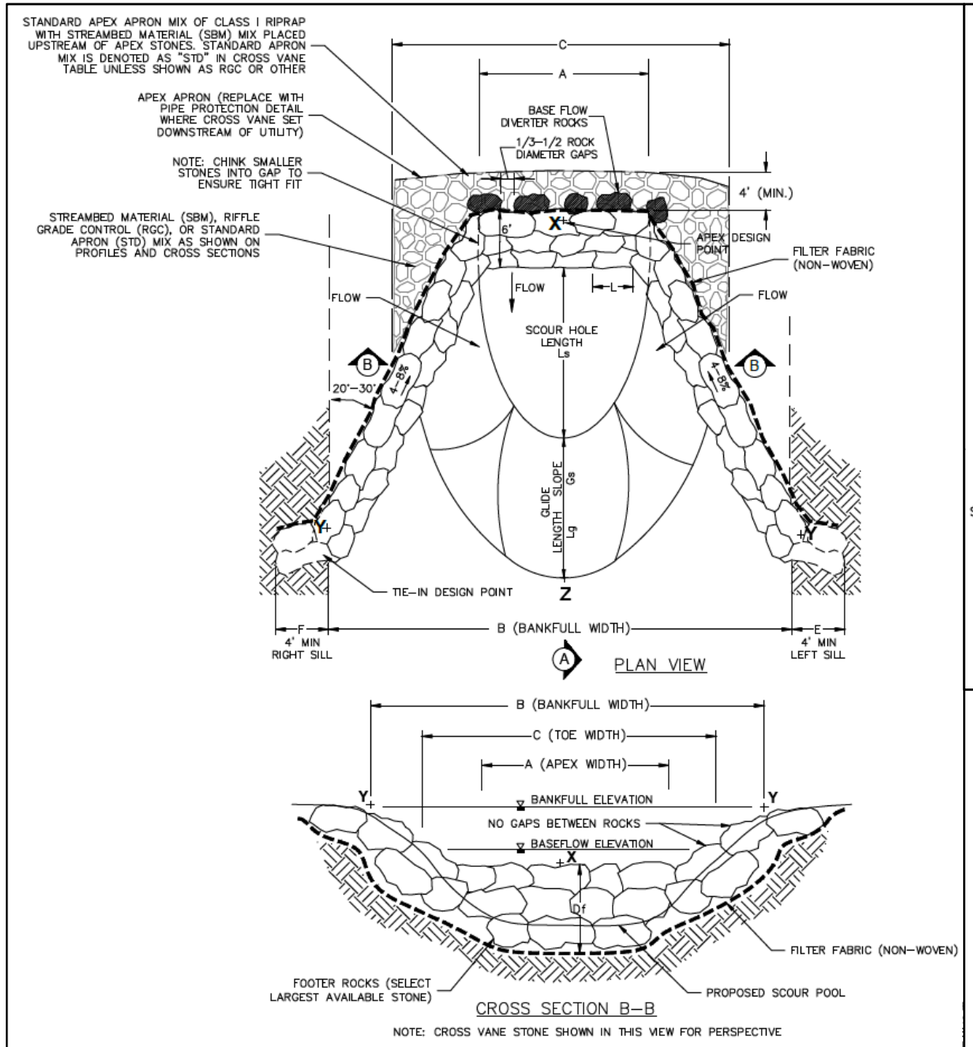
WOODLAND AVE

1 in = 103 ft

N

Legend

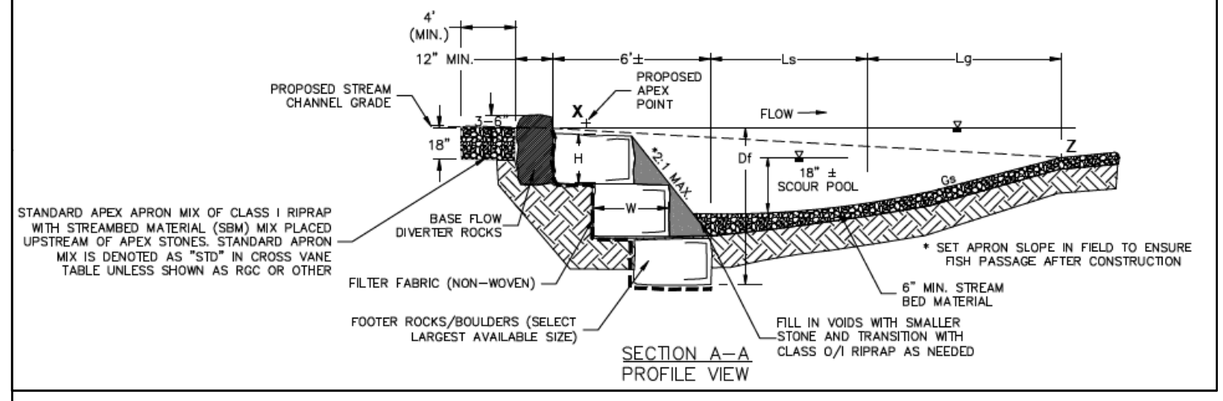
- Existing Ditch
- Culvert (Repair)
- Stream Restoration

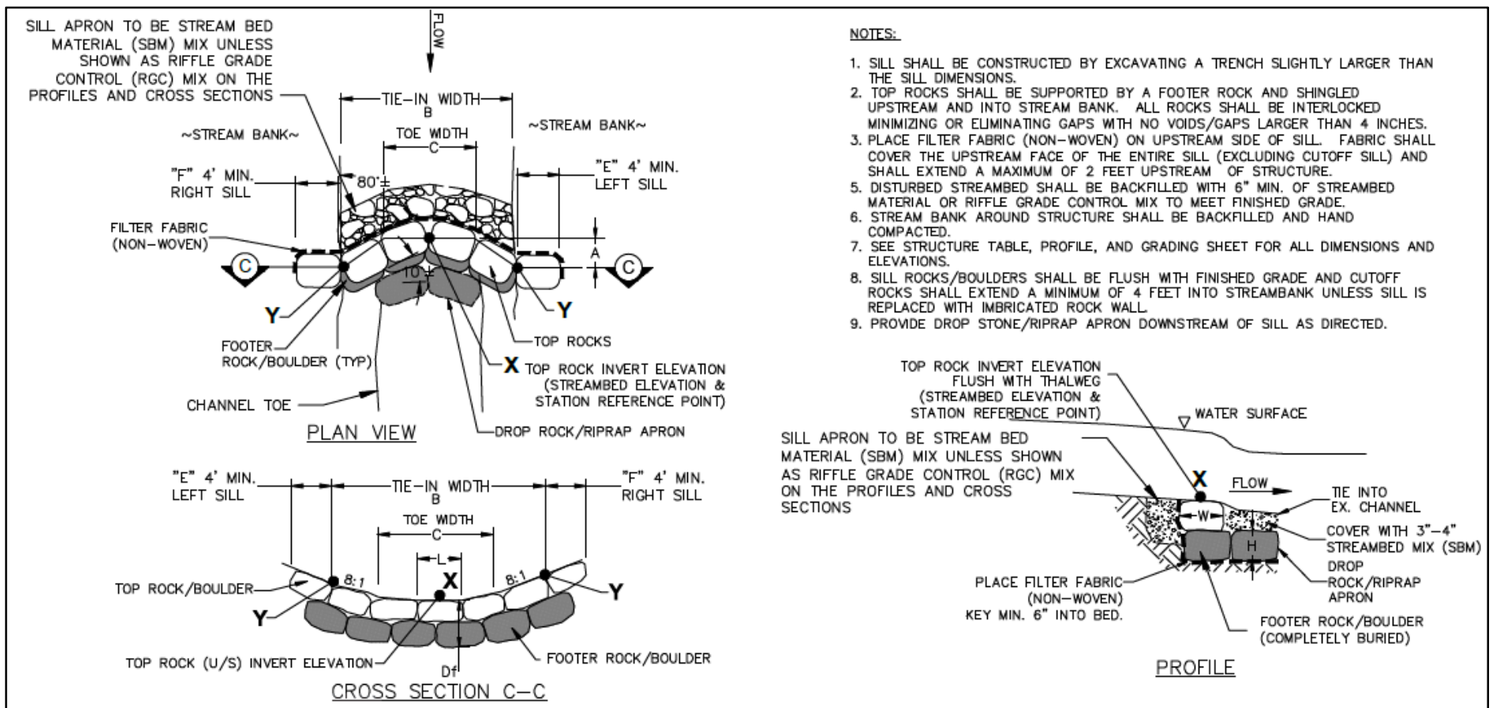


Cross Vane Detail

NOTES:

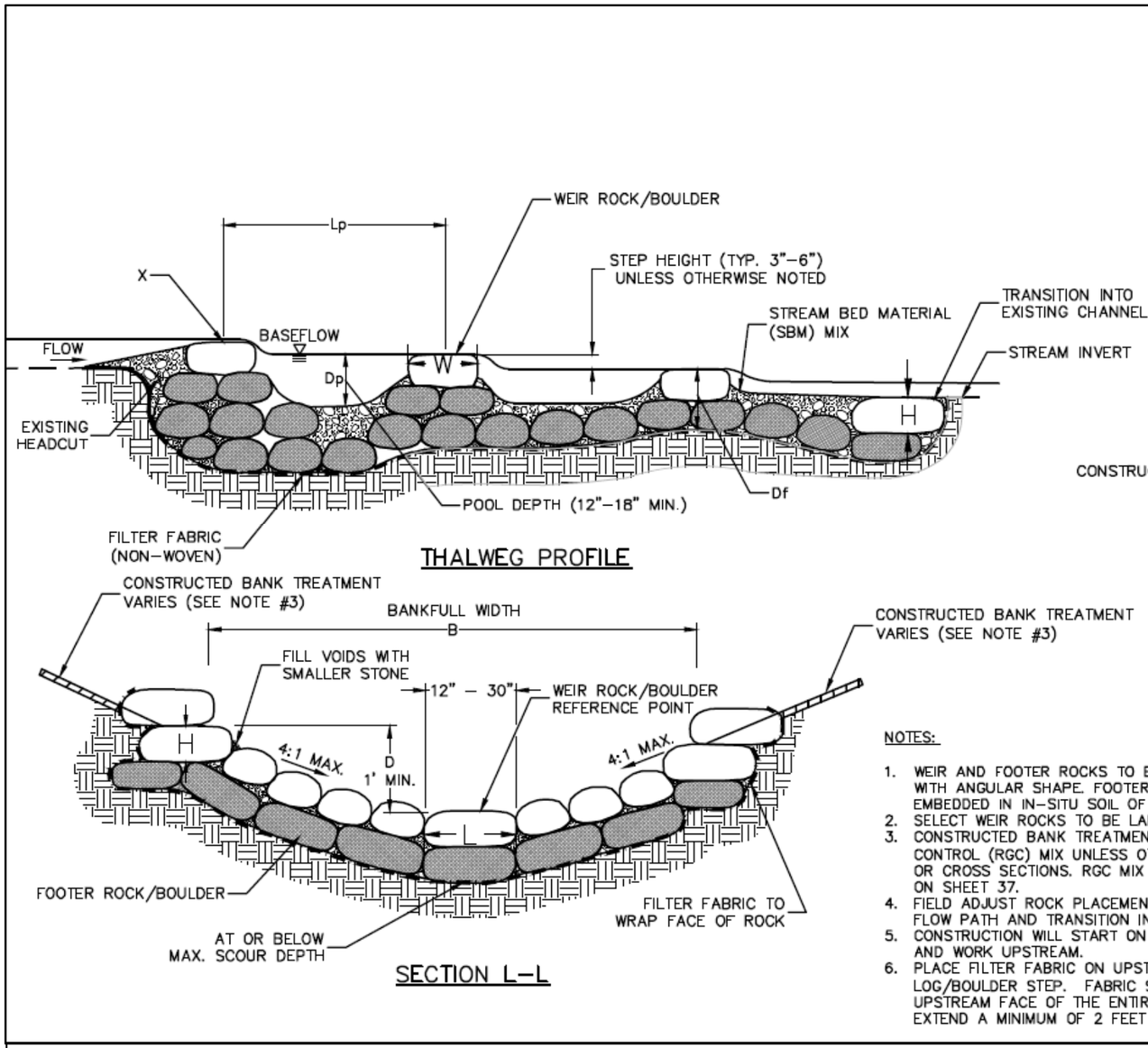
1. ALL DIMENSION/ELEVATIONS TO BE FIELD ADJUSTED TO ENSURE STABLE INSTALLATION, FISH PASSAGE, AND TIE–IN TO BANKS.
2. ROCK/BOULDER SHALL BE RECTANGULAR BLOCK SHAPE.
3. THE MINIMUM ELEVATION DIFFERENCE BETWEEN ELEVATION "X" AND ELEVATION "Y" IS 4–INCHES.
4. ACTUAL APEX ROCKS/BOULDERS SHALL BE FIELD SELECTED BY THE ENGINEER.
5. STONE PLACEMENT SHALL BE FIELD ADJUSTED TO CREATE BOWL SHAPE AND ENSURE STONE WILL REMAIN IN PLACE OVER FULL RANGE OF FLOW CONDITIONS.
6. REPLACEMENT OF ROCKS/BOULDERS MANY BE REQUIRED BASED UPON INSPECTION OF COMPLETED INSTALLATION TO MEET DESIGN INTENT AND PERMIT REQUIREMENTS.
7. TIE IN SILLS SHALL EXTEND 4' MINIMUM INTO STABLE CHANNEL BANK.
8. ROCKS/BOULDERS SHALL BE TIGHT FITTING WITH NO VOIDS/GAPS LARGER THAN 4 INCHES. VOIDS ALONG APEX AND VANE ARMS SHALL BE CHINKED IN WITH SMALLER NON–WEATHERING STONE TO ESTABLISH SURFACE FLOW AND INTERCONNECTION OF ROCKS.
9. WHERE CROSS VANE SETS DOWNSTREAM OF UTILITY CROSSING, REPLACE APEX APRON WITH PIPE PROTECTION DETAIL. LOCATE CROSS VANE APEX DOWNSTREAM OF UTILITY AND SET ORIENTATION TO MATCH CHANNEL.
10. STREAMBED MATERIAL SHALL COME FROM SALVAGED SOURCE FIRST AND THEN FURNISHED AS NECESSARY. OFFSITE STREAMBED MATERIAL SHALL BE USED TO CHOKE BOTTOM LAYERS OF ROCK WITH SALVAGED MATERIAL SAVED FOR TOP.
11. STATION REFERENCE POINT "X" IS LOCATED AT CENTER OF CHANNEL UNLESS SPECIFIED OTHERWISE.





Rock Sill Detail

North Glade Run Site Details

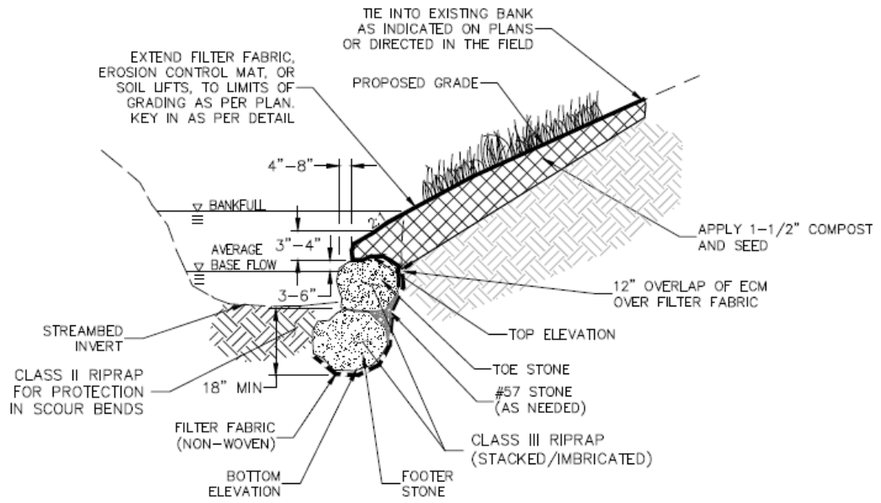


NOTES:

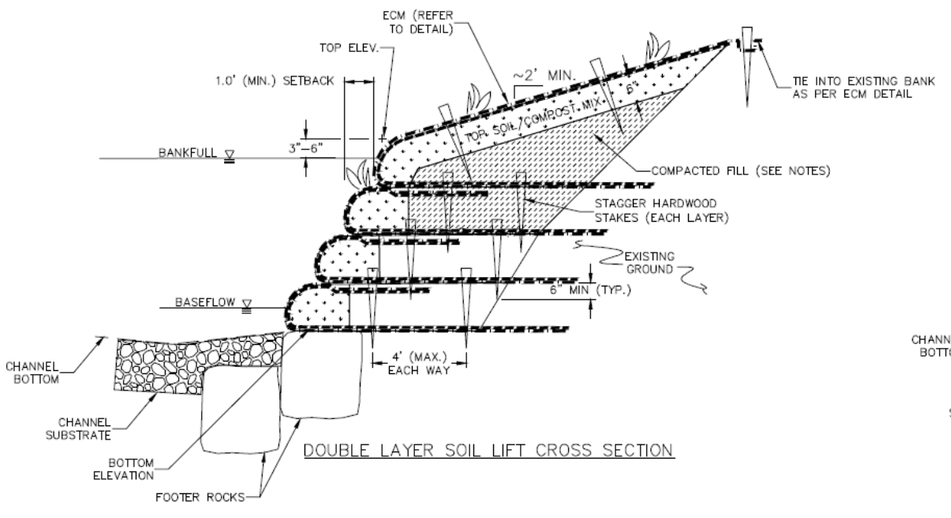
1. WEIR AND FOOTER ROCKS TO BE CLASS II/III RIPRAP WITH ANGULAR SHAPE. FOOTER ROCKS SHALL BE EMBEDDED IN IN–SITU SOIL OF PLACED ON BEDROCK.
2. SELECT WEIR ROCKS TO BE LARGEST ROCKS FOR APEX.
3. CONSTRUCTED BANK TREATMENT TO BE RIFFLE GRADE CONTROL (RGC) MIX UNLESS OTHERWISE SHOWN ON PLAN OR CROSS SECTIONS. RGC MIX IS SHOWN ON DETAIL 2.2 ON SHEET 37.
4. FIELD ADJUST ROCK PLACEMENT TO ENSURE STABLE FLOW PATH AND TRANSITION INTO ADJACENT BANKS.
5. CONSTRUCTION WILL START ON THE DOWNSTREAM END AND WORK UPSTREAM.
6. PLACE FILTER FABRIC ON UPSTREAM SIDE OF LOG/BOULDER STEP. FABRIC SHOULD COVER THE UPSTREAM FACE OF THE ENTIRE BOULDER AND SHALL EXTEND A MINIMUM OF 2 FEET UPSTREAM OF STRUCTURE.

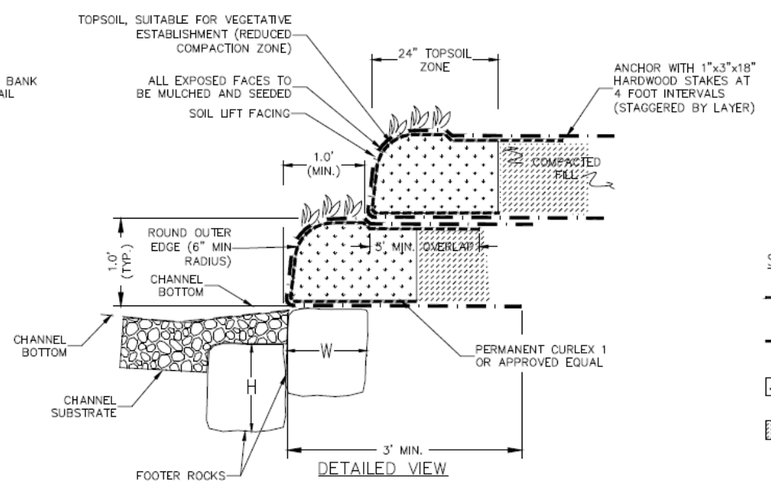
Step Pool Detail

North Glade Run Site Details



Rock Toe Detail





SOIL LIFT LEGEND

- INNER LAYER COIR FIBER MAT
- OUTER LAYER COIR FIBER MAT
- TOP SOIL/COMPOST MIX
- COMPACTED FILL
- PLANTS

SOIL LIFT NOTES:

1. COIR FIBER WRAP SHALL CONSIST OF ORGANIC GEOTEXTILE MATTING (COIR FIBER MAT) WITH TWO LAYERS OF MAT. THE INNER MAT LAYER IS TO CONSIST OF A NON–WOVEN MAT OF COCONUT FIBERS HELD TOGETHER WITH BIODEGRADABLE COTTON THREADS. THE OUTER MAT LAYER IS TO CONSIST OF TWISTED COCONUT FIBERS WOVEN INTO A MESH WITH MAXIMUM OPEN AREA OF 50–PERCENT.
2. THE COIR FIBER WRAPS ARE TO BE FILLED WITH TOPSOIL AND SEED MIX.
3. THE COIR FIBER WRAPPED TOPSOIL LIFTS ARE TO BE 12–INCHES HIGH, PER LIFT.
4. MATTING TO BE STRETCHED TIGHT AND WRINKLE FREE AROUND LIFT.
5. 6" TOPSOIL/COMPOST MIX SURFACE TO BE FREE OF STICKS, DEBRIS, AND TWIGS TO PREVENT CAVITATION.
6. SATISFACTORY SOIL TYPES INCLUDE ASTM D 2487 SOIL CLASSIFICATION GROUPS GW, GP, GM, SW, SP AND SM OR A COMBINATION OF THESE SOIL GROUPS. SOIL SHALL BE FREE OF ROCK OR GRAVEL LARGER THAN 2 INCHES IN ANY DIMENSION DEBRIS, WASTE, FROZEN MATERIALS, VEGETATION AND OTHER DELETERIOUS MATTER.
7. SOIL LIFTS TO BE SEEDED AND PLANTED AS DESCRIBED ON PLANTING DETAIL PLANS.
8. PLAIN WOODEN STAKES SHALL CONSIST OF ROUGH SAWN HARDWOOD, TRIANGULAR IN SHAPE, 1–INCH BY 3–INCHES IN CROSS SECTION AND 18–INCHES IN LENGTH. THE WOOD STAKES SHALL HAVE A GALVANIZED STEEL NAIL PARTIALLY DRIVEN IN THE TOP–SIDE FOR THE PURPOSE OF SNAGGING AND HOLDING THE WOVEN COIR MAT.
9. ONCE PLACED, SOIL LIFTS SHALL NOT BE DRIVEN OVER WITH HEAVY EQUIPMENT.

Double Layer Soil Lift Detail

North Glade Run Site Details

Bill's Marina

Stormwater Hotspot:

Possible Permit and Documentation Required:
- General/Individual NPDES Permit
- Storm Water Pollution Prevention Plan (SWPPP)

MISTY MEADOWS DR

HARVEY PENINSULA ROAD

Detention Pond

Could not identified existing BMP onsite.

Water Quality Basin

Oil/Grit Separator:
Stormwater runoff and runoff from boat maintenance and washing must be pretreated before discharged to Deep Creek Lake.

Existing Infiltration Trench requires maintenance. Water ponding and discharging overland during light rainfall event observed.

Infiltration Trench

Could not identified existing BMP onsite.

Infiltration Basin:
Stormwater runoff pretreatment may be necessary before runoff enters basin. See NPDES permit requirements.

156
200
683
589
575
595
601
605
609
615
663
699
713
721
727
747
767

2510
2500
2490
2480
2470
2460

1 in = 100 ft

N

Legend
- Existing BMP
- Existing Ditch
- Infiltration Basin
- Oil-Grit Separator

Patterson Boat

Stormwater Hotspot:

Possible Permit and Documentation Required:
- General/Individual NPDES Permit
- Storm Water Pollution Prevention Plan (SWPPP)

HARVEY PENINSULA ROAD

N SHORE DR

ROUND BEACH CIRCLE DR

Existing vegetated swales require maintenance. Boats and other equipment placed over BMP. Defined swale channel would improve runoff conditions.

Vegetated Swale A1

Vegetated Swale B1

Oil/Grit Separator:
Stormwater runoff and discharge from boat maintenance and washing must be pretreated before discharged to Deep Creek Lake.

Fuel Pump:
Fuel pump must be kept well maintained and adequate containment measures must be in place for spill-prevention.

1 in = 100 ft

N

Legend

- Existing BMP
- Existing Ditch
- Infiltration Basin
- Oil-Grit Separator