



May 27, 2019

Summerlyn Homeowners Association, Inc.
c/o Shana Gripper, William Douglas

Re: Limited Drainage and Erosion Inspection
Private Asphalt Greenways
Clayton, NC

Dear Sirs:

At your request, a limited erosion inspection of the above property was performed on May 22, 2019. The inspection was performed and report written by Christopher A. Flythe, PE.

The scope of this project was limited to a visual-only inspection and evaluation of the erosion and potential drainage concerns along the private sections of greenway in the Summerlyn community. The report is intended to cover only those premises that may be examined visually without excavation, removing surface materials and disassembling components.

No tests, measurements or calculations have been made except as described in this report. We have not investigated for toxic materials or wastes, or examined public records regarding this property. No site/civil engineering plans or topographic surveys of the greenways were available for review.

The discussion and recommendations provided in this report are intended to address concerns that were noted during the inspection. Conditions may change which would result in additional repair recommendations. Our recommendations are intended to provide reasonable solutions based on our experience with other similar communities within a limited budget. Permitting and/or easements may be required and should be investigated prior to construction. During the permitting process, it may be determined that some repairs may not be allowed, particularly those involving impacts to streams and/or stream buffers. Some of the concerns are related to poor maintenance of lawn areas on homeowner property, which may be difficult to address by the Association, depending on the HOA Covenants.

SUMMARY OF FINDINGS

A 10-foot wide, asphalt greenway generally runs along the southern portion of the Summerlyn residential community, between the rear of several homes and the adjacent stream. The greenway extends from a sanitary sewer pump station adjacent to 168 Cherry Bark Loop, across Glen Laurel Road, along the southern boundary of the community, and connects to a concrete sidewalk (assumed to be public) just south of the Town of Clayton park. Based on review of historical aerial imagery, the greenways were originally constructed around 2011.

The asphalt greenway appears to be in generally good condition for paving of approximately eight years old, with some exceptions noted below. Portions of the asphalt appear to have had an asphalt overlay recently installed, including south of Fern Meadow Circle and from 63 Sugarcane Court to 65 Mulberry Banks Drive.

We noted many areas of overgrown, weedy vegetative growth, some of which prevented a visual inspection of ditches and swales. In some areas, vegetation is sparse, with bare soils and erosion noted. Runoff from the single family homes generally drains toward the greenway as sheet flow or shallow concentrated flows, running across the asphalt and into the adjacent stream. Pipe culverts have been installed to carry concentrated flows from the roadside swales below the asphalt and outlet into the streams.

We noted several instances of a high shoulder on the low side of the asphalt greenway, and a low shoulder on the high side of the greenway. A “high shoulder” is a case where the grassed slope is at a higher elevation than the greenway. When this occurs on the low side of the asphalt, it creates a situation where ponding can occur since the water cannot flow freely across the pavement and into the stream. Similarly, a “low shoulder” is a case where the elevation of the grass slope is lower than the pavement. Ponding is likely when a low shoulder occurs on the uphill side of the greenway. While this was noted in many areas, we have specifically referenced locations where we noted actual concerns.

SPECIFIC AREAS OF CONCERN

Area #1

In this area, we noted a condition described above as a high shoulder. It is possible that the asphalt may not be properly sloped toward the stream in sections of the greenway. The high shoulder is preventing water from naturally flowing across the pavement. The temporary ponding is allowing sedimentation to occur on the greenway. A contributing factor is the bare soils and lack of vegetation on the slopes uphill from the greenway which is causing minor erosion.

We recommend the shoulder be fine graded to allow water to naturally sheet flow across the greenway, and ensure the asphalt is properly sloped in this direction. We recommend a 2% cross slope in all sections of the greenway (or as specified in the construction details). In addition, all bare soils should be properly vegetated.

Area #2

A high shoulder in this area forces runoff to concentrate at the localized low point in the greenway. This shallow concentrated flow is causing minor erosion on the shoulder, which will continue to worsen over time.

We recommend the shoulder be fine graded to allow water to naturally sheet flow across the greenway, and ensure the asphalt is properly sloped in this direction. We recommend a 2% cross slope in all sections of the greenway (or as specified in the construction details). In addition, all bare soils should be properly vegetated.

Area #3

At this pipe crossing, we noted erosion at the upstream and downstream ends of the pipe. Typically, the slopes on the upstream side of open-ended culverts are protected with some type of armoring (a headwall, endwall, flared end section, or rip rap), and the outlet end of a pipe is protected with a rip rap dissipater pad due to the erosive flows. We recommend installing a flared end section on the upstream and downstream ends of the pipe and installing a rip rap dissipater at the downstream end of the pipe. Vegetation should be installed and maintained.

We also noted cracking and localized settlement of the asphalt, which is likely caused by either natural consolidation of the soil above the pipe due to poor initial compaction, or subsidence of the soil due to the erosion noted above. We recommend removal and replacement of this section of asphalt. The subgrade should be properly filled and carefully compacted.

Area #4

A rip rap swale carries flow toward and across the asphalt greenway in the natural area behind 114 Sugarbush Court. In our opinion, if a swale requires rip rap armoring due to excessive velocity or flowrates, it should pass through a pipe culvert below the greenway rather than flow across the top. We recommend installing a properly sized culvert below the greenway to carry the associated flows to the adjacent stream.

Area #5

We noted several concerns at the greenway in the vicinity of the retaining wall behind 110-114 Sugarbush Court:

- The slope above the wall is poorly vegetated, with moderate erosion noted.
- Runoff appears to overtop the wall
- Moderate erosion was noted at both ends of the wall
- Bare soils and inadequate vegetation in all areas
- The greenway appears to be inadequately sloped toward the stream, with localized depressions noted
- A high shoulder was noted on the downstream side of the greenway

We recommend the shoulders be fine graded to allow water to naturally sheet flow across the greenway, and ensure the asphalt is properly sloped in this direction. We recommend a 2% cross slope in all sections of the greenway (or as specified in the construction details). In addition, all bare soils should be properly vegetated. If fine grading alone cannot prevent ponding, a properly sized storm drainage system should be installed.

Most wall manufacturer's standard details include recommendations for a swale to be installed at the top of the wall to divert water toward the ends of the walls to prevent overtopping. We recommend consulting with the wall engineer to determine if this is acceptable. If not, the engineer should provide recommendations to re-direct flows away from the wall. At a minimum, the ends of the wall should be stabilized with an appropriately sized rip rap.

Area #6

Two shallow grassed swales are located between the homes at 15-47 Sugarcane Drive, which flow into two rip rap swales along the steep portions of the slope at the rear of the properties. The swales discharge into a landscape swale/ditch, which is intended to flow along the side of the greenway. Though most of the area is overgrown with vegetation preventing adequate inspection, we did note sedimentation at the bottom of the rip rap which is creating a dam in the greenway swale. Evidence of water overtopping the greenway was noticed. We recommend the following improvements:

- Mow the overgrown vegetation and install an appropriate groundcover (grass)
- Repair any erosion after mowing of vegetation
- Remove accumulated sediment
- Re-grade swale and rip rap transition to better allow flow in the greenway swale (currently, swale narrows at rip rap, which contributes to runoff overtopping the greenway)
- Stabilize all disturbed areas with rip rap/vegetation

Area #7

A high density polyethylene (HDPE) culvert flows below the greenway behind 63 Sugarcane Drive. The upstream side of the pipe is overgrown with vegetation, preventing adequate inspection. Inadequate protection at the downstream end of the pipe and erosion with a small sinkhole was noted at the downstream end of the pipe.

We recommend removing the small washed stone at the downstream end of the pipe, carefully backfilling and compacting soil around the pipe outlet, and installing a rip rap dissipater pad. Additional repairs may be required based upon conditions visible after vegetation removal.

Area #8

Near the rear of 73 Standing Oaks Lane, we noted a low/depressed area of pavement as well as a high shoulder which is causing sedimentation to occur on the greenway.

We recommend the shoulder be fine graded to allow water to naturally sheet flow across the greenway, and ensure the asphalt is properly sloped in this direction. We recommend a 2% cross slope in all sections of the greenway (or as specified in the construction details). In addition, all bare soils should be properly vegetated.

Area #9

A small section of missing asphalt is located at the greenway. The asphalt should be patched.

Area #10

This pipe crossing is in generally good condition with no significant signs of erosion.

Area #11

Fatigue and edge cracking was noted in several areas. The asphalt can be patched or left in place until full resurfacing is completed.

Area #12

An area of open space creates a large amount of runoff that sheet flows across the greenway. The bare soils are beginning to erode, causing sedimentation at the high shoulder on the low side of the greenway.

Option #1: maintain adequate vegetation on grassed areas, and fine grade shoulder to allow positive flow across and away from greenway to prevent ponding.

Option #2: Install catch basin in open space area upstream of the greenway and direct runoff into the catch basin. The runoff can then be piped under the greenway in lieu of sheet flow across the greenway.

Area #13 & #14

At the two pipe crossings, we noted erosion due to inadequate slope protection. On the downstream side of the pipe, the rip rap is inadequately sized for the flowrate and velocity as evidenced by the displacement of the rip rap and exposed geotextile fabric.

Ideally, the downstream end of the pipe would be extended to allow for a wider shoulder with a slope that is less steep. However, it is assumed the pipe ends due to the inability to extend into the stream buffer. Therefore, we recommend armoring the steep slope with additional, appropriately sized rip rap. We also recommend removal and replacement of the small rip rap with appropriately sized rip rap.

Area #15

A landscape swale is located between the asphalt greenway and the gravel parking lot for the Town's dog park. A portion of the swale has eroded, with the erosion now extending to the greenway and is undermining the stone base.

We recommend filling the swale to a uniform contour. Typically, fill materials are easily erodible. Therefore, care should be taken to properly compact the backfill to approximately 85% standard proctor density. The area should then be sodded with a warm season grass to prevent erosion during any rain event. The sod may need to be stapled to prevent movement, and watered to ensure establishment.

If the sod does not become established, or erosion continues, the area will likely require armoring with rip rap over a non-woven filter fabric. The rip rap should extend to the edge of the asphalt greenway. The rip rap will need to be keyed into the existing grade, such that the top of the rip rap will be flush with the grass surface (not sit above the rip rap). While this will cause ponding of water in the rip rap, this is standard practice in order to mitigate erosion in the swale.

General Concerns and Discussion

As noted previously, overgrown, weedy vegetation was noted in many sections of the community on the upstream and/or downstream side of the greenway. A grass or other hearty groundcover should be established and maintained in order to prevent erosion and protect the slopes.

Silt fence, silt fence outlets, rip rap check dams, and various forms of temporary erosion and sedimentation control measures were noted to be installed along the greenway. At the end of a development project, these temporary measures should be removed after all upstream areas have been stabilized as required. As construction appears to be ongoing, it is assumed that the remaining measures will be removed at the completion of the project.

The Association should also contract with a qualified landscaping company to maintain the vegetation along the greenways. At this time, the Contractor should address minor erosion and drainage concerns before they develop into more significant repairs. As with any community, repairs will be required over time. While more established vegetation may help to prevent minor erosion issues, maturing trees are likely to cause increased maintenance costs due to tree root invasion into the asphalt. The repairs and associated expenses can sometimes be difficult to predict, and should be adjusted as needed.

Recommendations discussed above (installing rip rap, catch basins and piping, etc.) should be properly designed by the original site/civil engineer based upon the actual field conditions. In addition, the recommendations are intended to be an attempt to mitigate drainage and erosion concerns based on a visual-only inspection. Additional, more aggressive repairs are available and may be warranted if the required maintenance is not performed to the existing measures.

We have included standard details of some of the recommendations discussed above.

CONCLUSION

We trust that this report provides the information you require. Please contact us (919) 465-3801 if you have any questions

Thank you for the opportunity to be of assistance to you.

Sincerely,



Christopher A. Flythe, PE
Principal Engineer
Criterium-Giles Engineers Inc.
Firm NC License No. C-2871

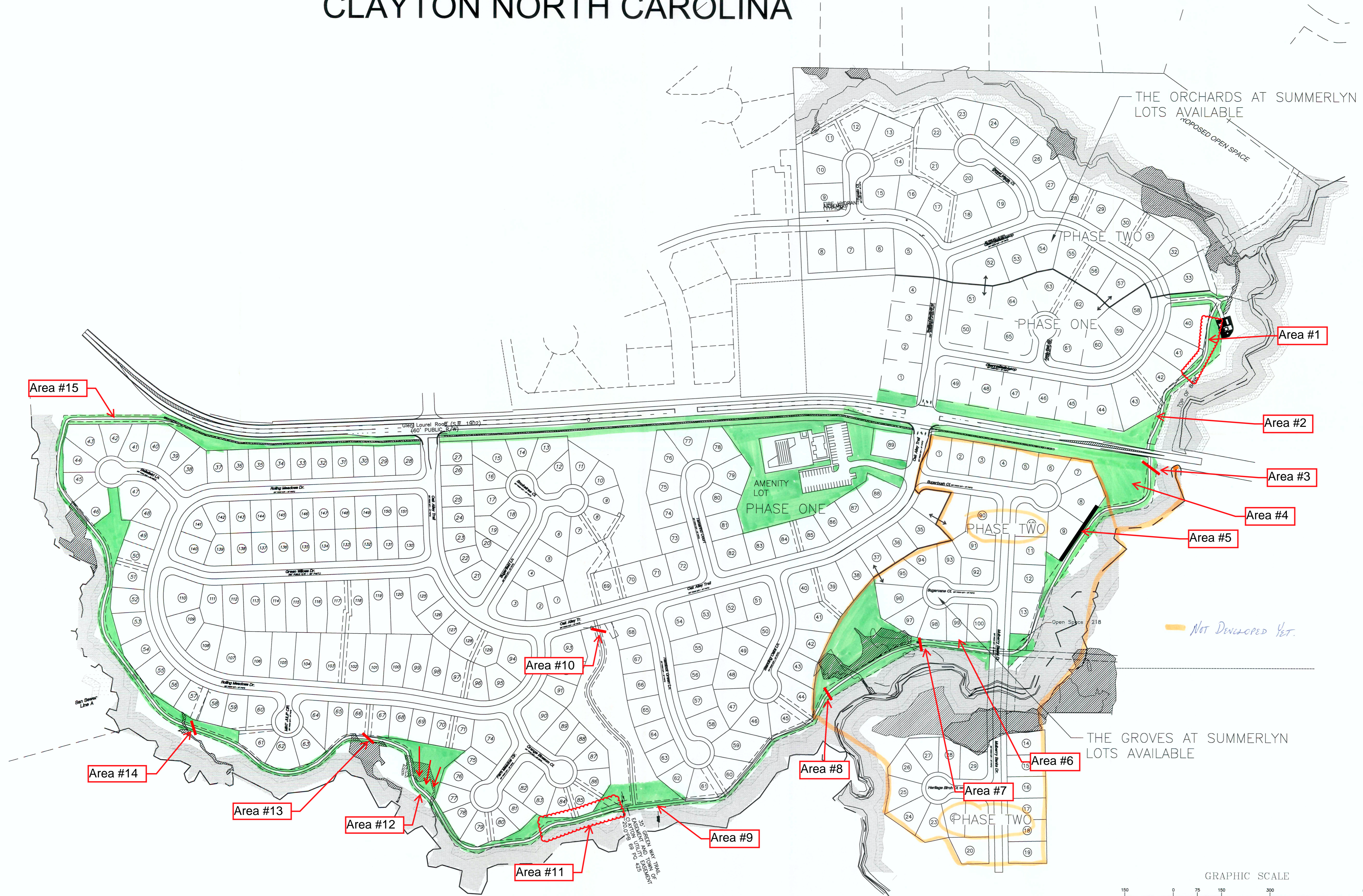


5/30/2019

Enclosures



GRANITE LAND AND TIMBER, LLC SUMMERLYN SUBDIVISION CLAYTON NORTH CAROLINA



DEVELOPER / OWNER
GRANITE LAND AND TIMBER, LLC
314 W. MILLBROOK ROAD
RALEIGH, NC 27609

PRELIMINARY
NOT FOR
CONSTRUCTION

SUMMERLYN SUBDIVISION
Granite Land and Timber, LLC
CLAYTON, NORTH CAROLINA
MASTER PLAN

REVISIONS	
NO.	

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Phone: 919-803-8704
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DATE: 5-13-13
DRAWN BY: KWR
JOB NO.: 10077

SHEET NO.
C-0

Description

Area #1: High shoulder
and sedimentation



Photo No.
1

Description

Area #1



Photo No.
2

Description

Bare soils uphill from greenway allow erosion, which leads to sedimentation



Photo No.

3

Description

Area #2: high shoulder forces water to concentrate and runoff the greenway



Photo No.

4

Description
Area #2: minor erosion
at shoulder



Photo No.
5

Description
Area #3



Photo No.
6

<p>Description Area #3: Minor erosion at pipe</p>	
<p>Photo No. 7</p>	

<p>Description Area #3: settlement of greenway</p>	
<p>Photo No. 8</p>	

Description

Area #4: rip rap swale
flowing through silt
fence outlet



Photo No.
9

Description

Area #4: flow from rip
rap swale discharges
across greenway



Photo No.
10

Description

Area #5: erosion along retaining wall



Photo No.
11

Description

Area #5: sedimentation at base of wall



Photo No.
12

Description
Area #5: erosion at wall



Photo No.
13

Description
Area #5: Erosion of poorly vegetated slope above wall



Photo No.
14

Description

Area #6: rip rap swale transition to greenway swale; sedimentation in swale



Photo No.
15

Description

Area #6: evidence of overtopping of greenway



Photo No.
16

Description

Area #7: overgrown
vegetation at upstream
side of culvert



Photo No.
17

Description

Area #7: erosion and
sinkhole at downstream
end of culvert



Photo No.
18

Description

Area #8: Low/depressed area with a high shoulder on downstream side of greenway



Photo No.
19

Description

Area #8: Low/depressed area with a high shoulder on downstream side of greenway



Photo No.
20

<p>Description Area #9: missing asphalt in greenway</p>	
<p>Photo No. 21</p>	

<p>Description Area #11: Typical fatigue/edge cracking noted in various areas</p>	
<p>Photo No. 22</p>	

Description

Area #12: Large area of sheet flow crosses greenway, bare soils noted above with high shoulder on low side of greenway



Photo No.
23

Description

Area #13: erosion at downstream end of pipe



Photo No.
24

Description

Area #14: Displacement of small rip rap at downstream end of pipe



Photo No.
25

Description

Area #14: erosion at slope of greenway



Photo No.
26

Description

Area #15: Area of erosion



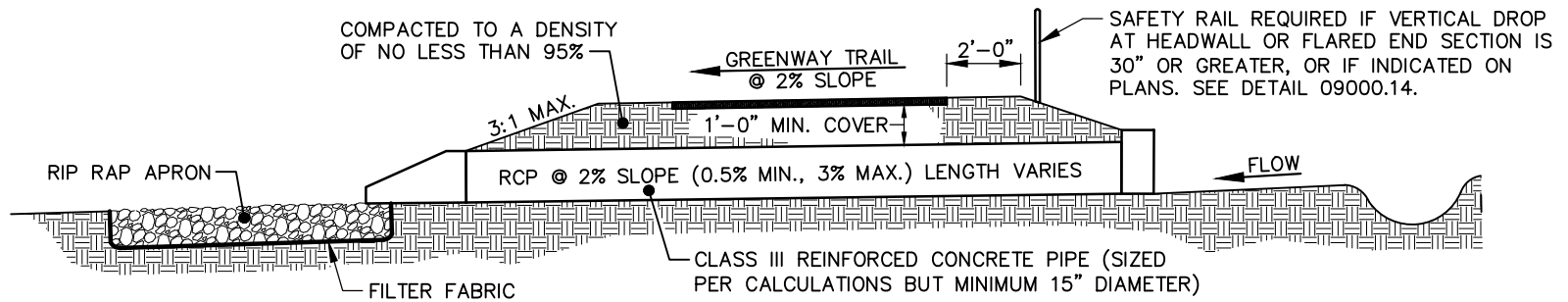
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27

Description

Area #15: erosion is beginning to undermine greenway

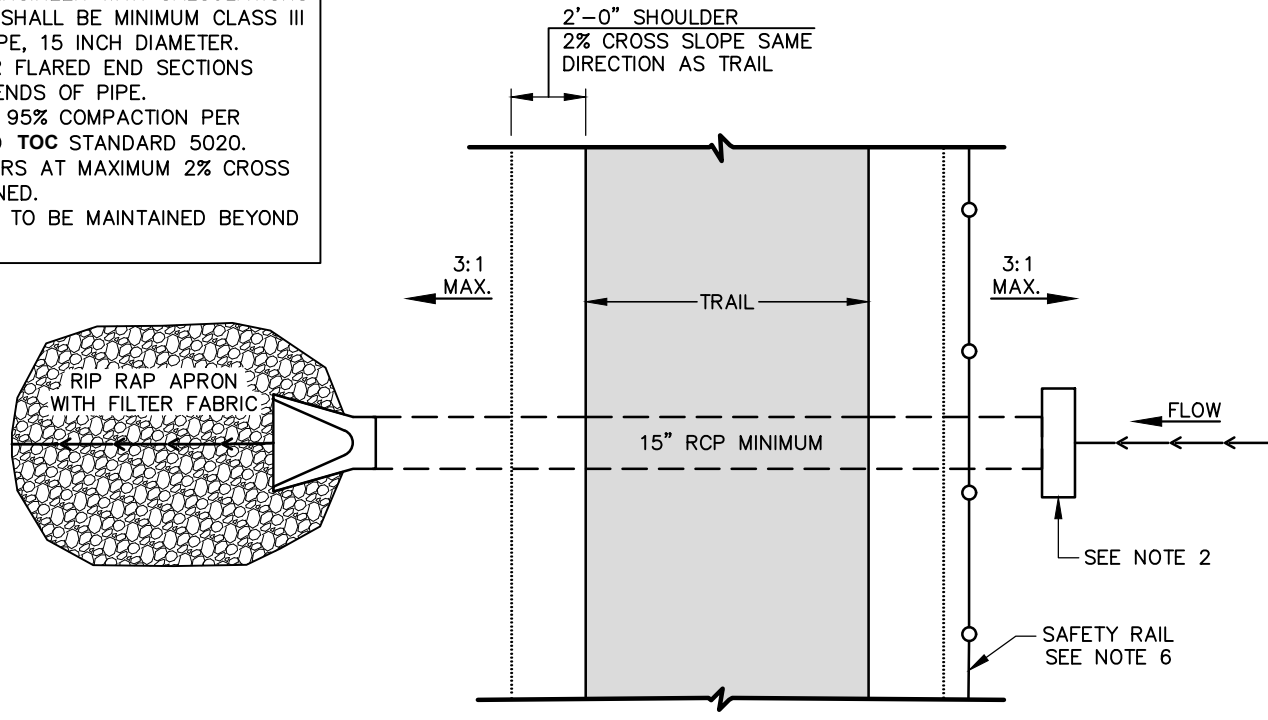


Photo No.
28



PROFILE VIEW

- NOTES:**
1. PIPE SHALL BE SIZED BY ENGINEER WITH CALCULATIONS INCLUDED IN PLANS, BUT SHALL BE MINIMUM CLASS III REINFORCED CONCRETE PIPE, 15 INCH DIAMETER.
 2. HEADWALLS, ENDWALLS, OR FLARED END SECTIONS SHALL BE INSTALLED AT ENDS OF PIPE.
 3. BACKFILL PIPE TRENCH TO 95% COMPACTION PER AASHTO METHOD T99 AND TOC STANDARD 5020.
 4. 2 FOOT GRASSED SHOULDERS AT MAXIMUM 2% CROSS SLOPE SHALL BE MAINTAINED.
 5. MAXIMUM 3:1 SIDE SLOPES TO BE MAINTAINED BEYOND SHOULDERS.



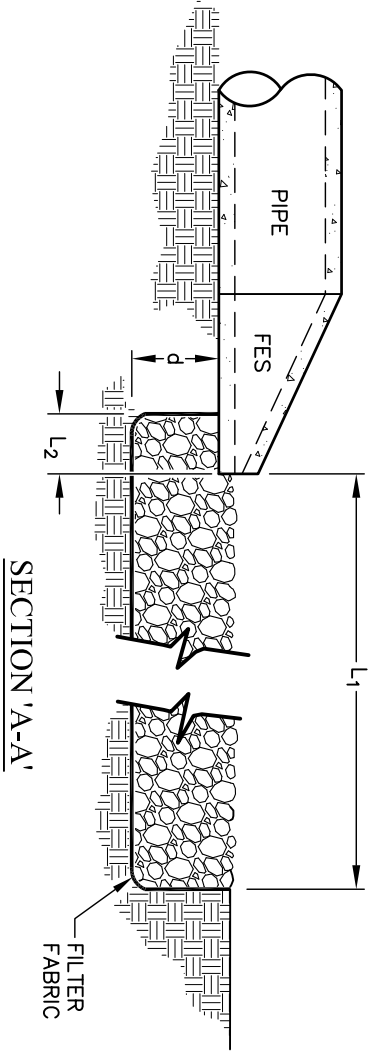
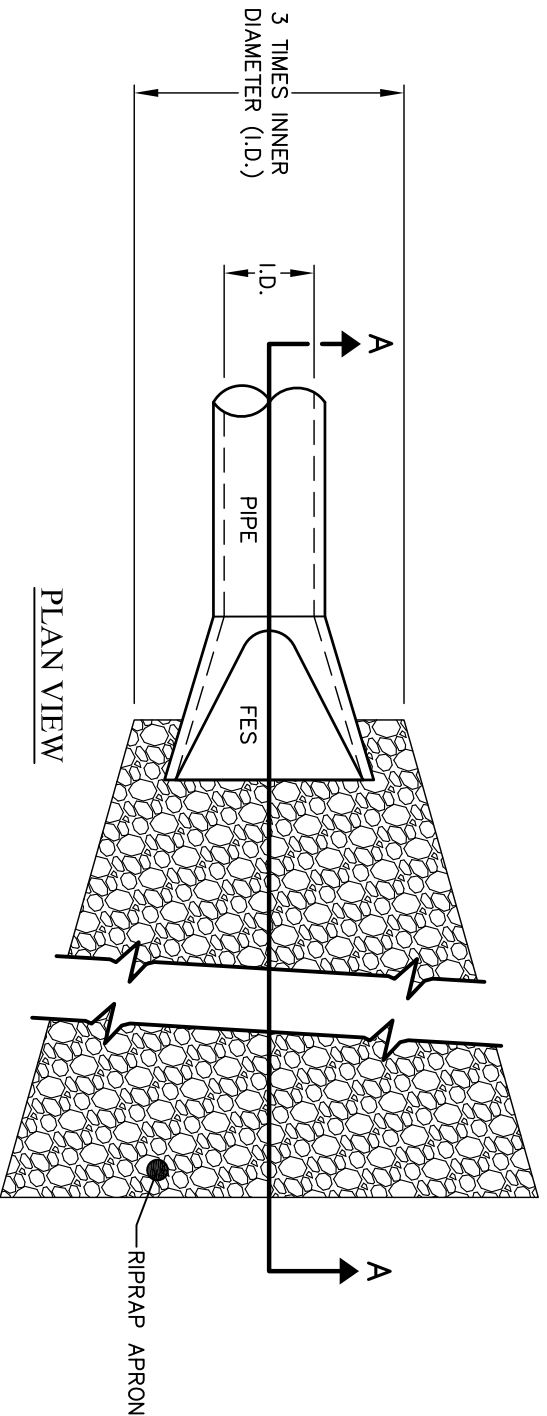
PLAN VIEW

GREENWAY CULVERT



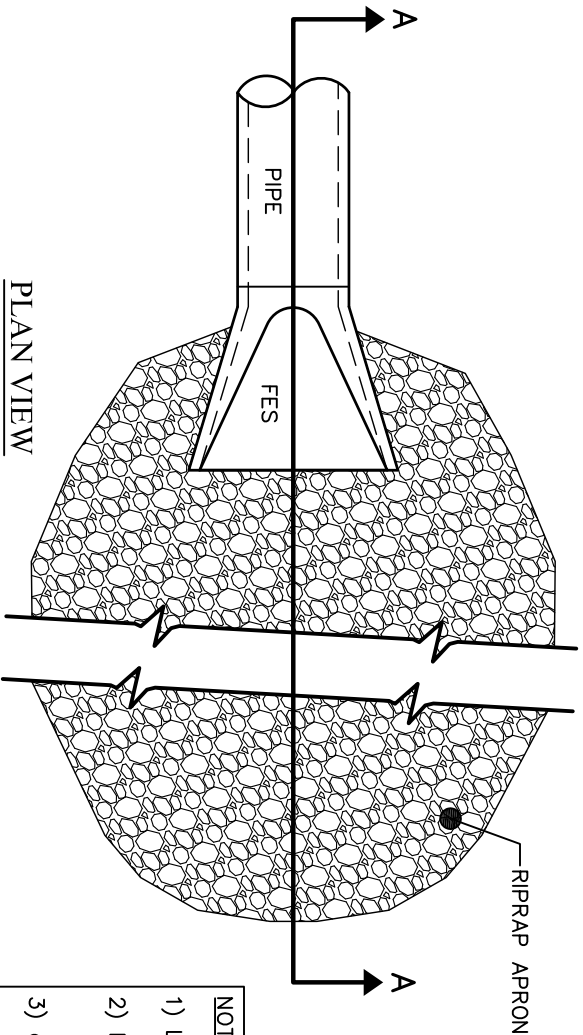
EFFECTIVE: 01/05/17

DETAIL No.
09000.26
SHEET 1 OF 1

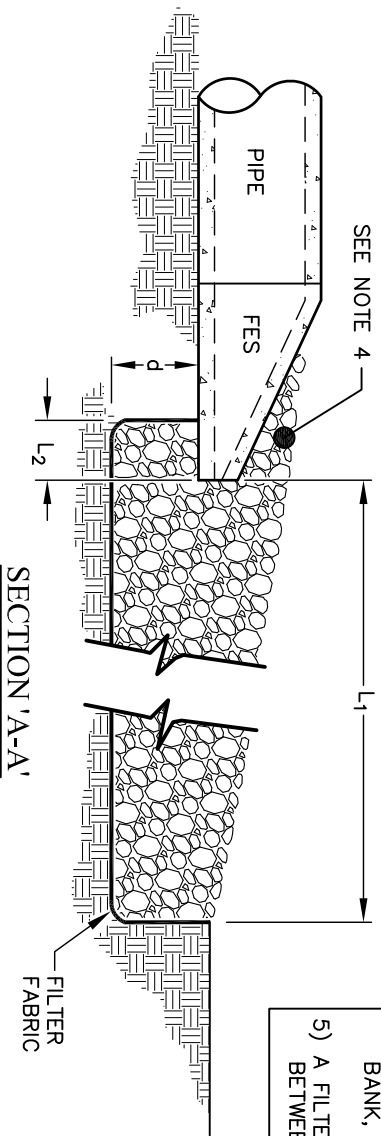


- NOTES:
- 1) L = LENGTH OF THE RIPRAP APRON.
 - 2) L₂ = RIPRAP TO BE INSTALLED UNDERNEATH 1/3 THE LENGTH OF FLARED END SECTION (FES).
 - 3) d = 1.5 TIMES THE MAXIMUM STONE DIAMETER BUT NOT LESS THAN 6 INCHES.
 - 4) A FILTER BLANKET OR FILTER FABRIC SHOULD BE INSTALLED BETWEEN THE RIPRAP AND SOIL FOUNDATION.

PIPE OUTLET TO FLAT AREA
NO WELL-DEFINED CHANNEL



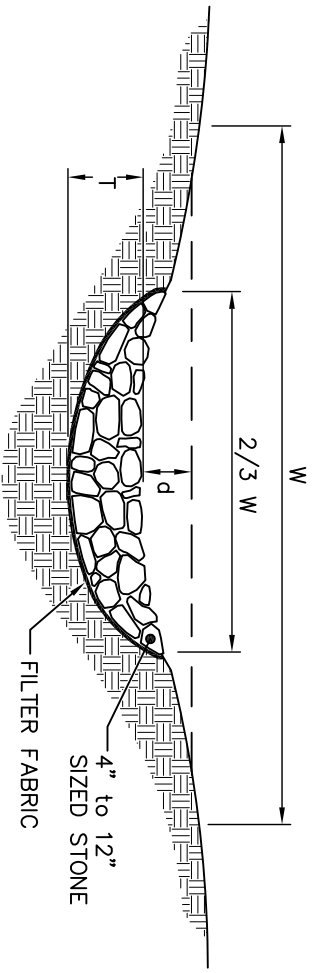
PLAN VIEW



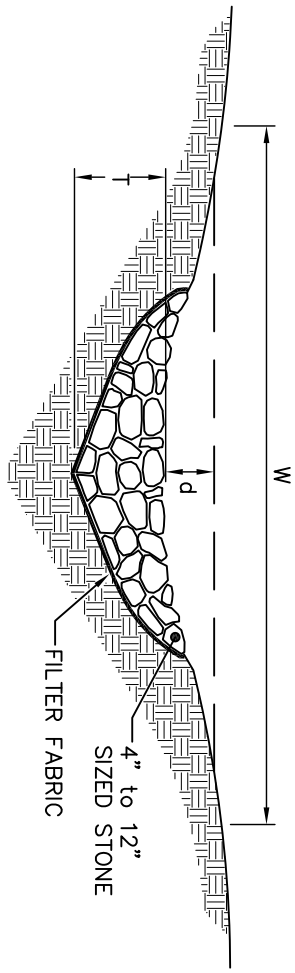
SECTION 'A-A'

- NOTES:
- 1) L_1 = LENGTH OF THE RIPRAP APRON.
 - 2) L_2 = RIPRAP TO BE INSTALLED UNDERNEATH 1/3 THE LENGTH OF FLARED END SECTION (FES).
 - 3) d = 1.5 TIMES THE MAXIMUM STONE DIAMETER BUT NOT LESS THAN 6 INCHES.
 - 4) IN A WELL-DEFINED CHANNEL EXTEND THE APRON UP THE CHANNEL BANKS TO AN ELEVATION OF 6 INCHES ABOVE THE MAXIMUM TAILWATER DEPTH OR TO THE TOP OF THE BANK, WHICHEVER IS LESS.
 - 5) A FILTER BLANKET OR FILTER FABRIC SHOULD BE INSTALLED BETWEEN THE RIPRAP AND SOIL FOUNDATION.

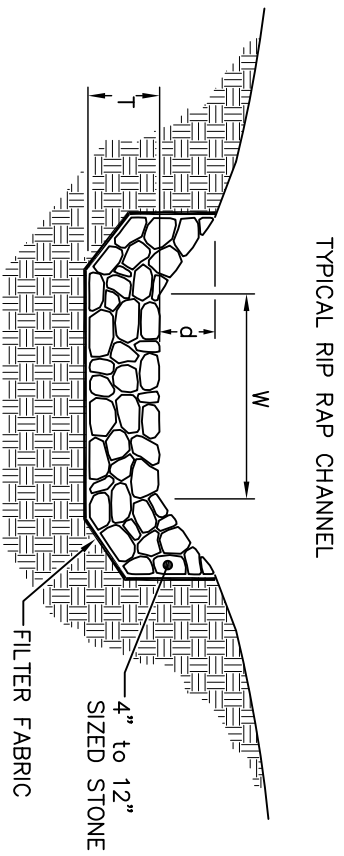
PIPE OUTLET TO WELL-DEFINED CHANNEL



PARABOLIC-SHAPED WATERWAY WITH STONE CENTER DRAIN
(SHAPED BY BULLDOZER)



V-SHAPED WATERWAY WITH STONE CENTER DRAIN
(SHAPED BY MOTOR GRADER)

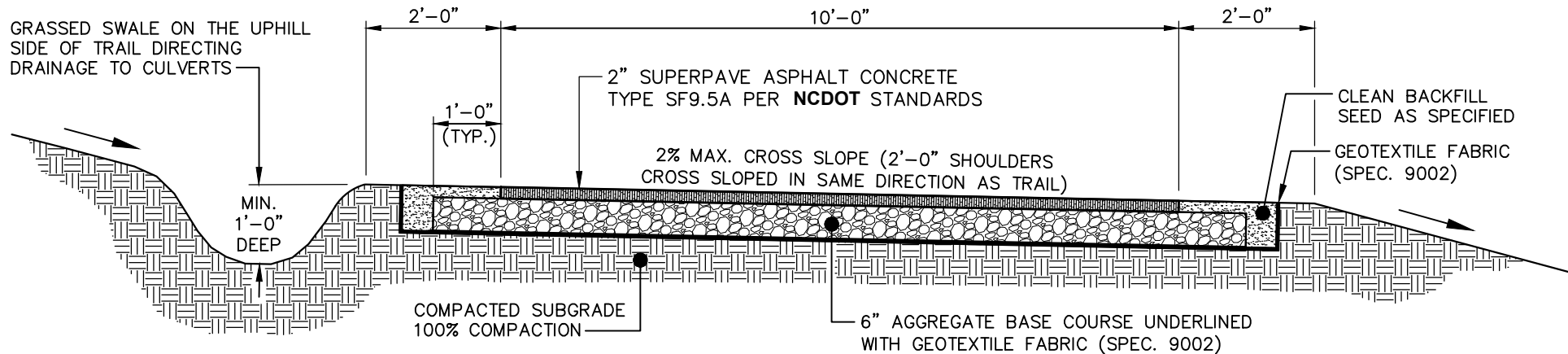


TYPICAL RIP RAP CHANNEL

TRAPEZOIDAL

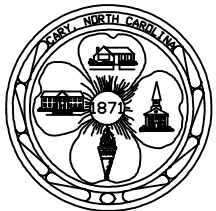
- NOTES:**
1. TO BE USED WHERE EXCESSIVE STORMWATER VELOCITIES PROHIBIT VEGETATIVE LININGS.
 2. SIZE OF STONE MUST BE DETERMINED BY APPROPRIATE DESIGN PROCEDURE.
 3. MAXIMUM SIDE SLOPE TO BE 3H : 1V.
 4. FILTER FABRIC TO BE MIRAFL 140N OR EQUAL.

STANDARD RIP-RAP LINED CHANNELS



NOTES:

1. CONTRACTOR IS RESPONSIBLE FOR RE-ESTABLISHING ALL SLOPES DISTURBED BY CONSTRUCTION.
2. NO ABOVE GROUND UTILITIES OR UTILITY SURFACE COVERS/PLATES/MANHOLES SHALL BE LOCATED WITHIN TRAIL AND SHALL BE MINIMUM 2 FEET FROM THE EDGE OF TRAIL. RAISED MANHOLES SHALL BE MINIMUM 4 FEET FROM TRAIL EDGE.
3. ALL TRAILS SHALL BE LOCATED MINIMUM 5 FEET FROM THE BACK OF CURB.
4. SIDE SLOPES SHALL NOT EXCEED 3:1. CUT & FILL SLOPES SHALL TIE INTO EXISTING SLOPES TO CREATE AN EVEN TRANSITION.
5. CROSS SLOPE TYPICALLY TO LOW SIDE BUT CROSS SLOPE TO INSIDE OF DOWNHILL CURVES, WITH GRADUAL TRANSITIONS BETWEEN ANY CROSS SLOPE DIRECTION CHANGES.



EFFECTIVE: 01/05/17

STANDARD 10-FT ASPHALT GREENWAY TRAIL

DETAIL No.

09000.01

SHEET 1 OF 1