

CHARLOTTE LAND DEVELOPMENT STANDARDS MANUAL

SPECIFICATIONS AND SPECIAL PROVISION NOTES

Includes ETJ

The following specifications and special provisions are intended to be used in conjunction with Charlotte Land Development Standard Drawings, NCDOT Roadway Standard Drawings, and NCDOT Standard Specifications for Roads and Structures for all development within the City of Charlotte and the City of Charlotte ETJ unless otherwise directed by the City.

I. STREETS

A. GENERAL NOTES

1. All work and materials shall conform to the latest edition of the North Carolina Department of Transportation Standard Specifications for Roads and Structures *unless otherwise specified in this manual*.
2. All asphalt cuts shall be made with a saw when preparing street surfaces for patching or widening strips.
3. Paper joints shall be used to seal the ends of an asphalt pour so that future extensions can be made without causing rough joints.
4. When placing asphalt against existing surfaces, a straight edge shall be used to prevent “humping” at that location.
5. Stone shall be primed if paving is not complete within seven days following stone base approval.
6. Surfaces shall be tacked when asphalt is being placed over existing asphalt streets or adjoining concrete, storm drain and sanitary sewer structures.

This document is the proposed revised version with all changes accepted. See following document for a "redlined" comparison version.

7. In rolling and hilly terrains, sweeping of the stone base and/or application of a tack coat may be required near intersections. These requirements will be established by the City Inspector based on field conditions.
8. ALL concrete used for streets, curb and gutter, sidewalks and drainage structures, etc. shall have a minimum compressive strength of 3600 PSI at 28 days. This requirement shall be met regardless of any lesser compressive strength specified in the North Carolina Department of Transportation Standard Specifications for Roads and Structures. The contractor shall prepare concrete test cylinders in accordance with Section 1000 of the North Carolina Department of Transportation Standard Specifications for Roads and Structures at the direction of the project inspector. All equipment and cylinder molds shall be furnished by the contractor. It shall be the responsibility of the contractor to protect the cylinders until such time as they are transported for testing. Testing for projects shall be performed by an independent testing lab, at no cost to the City. The contractor shall provide equipment and perform tests on concrete for a maximum slump and air content as defined in Section 1000 of the North Carolina Department of Transportation Standard Specifications for Roads and Structures. These tests shall be performed at a frequency established by the inspector. Materials failing to meet specifications shall be removed by the contractor.
9. All concrete shall be cured with 100% Resin Base, white pigmented curing compound which meets ASTM Specifications C-309, Type 1, applied at a uniform rate at one (1) gallon to 400 square feet within 24 hours of placement of the concrete.
10. All curb and gutter shall be backfilled with soil approved by the Inspector within 48 hours after construction to prevent erosion.
11. All backfill shall be non-plastic in nature, free from roots, vegetative matter, waste, construction material or other objectionable material. Said material shall be capable of being compacted by mechanical means and the material shall have no tendency to flow or behave in a plastic manner under the tamping blows or proof rolling.
12. Materials deemed by the Inspector as unsuitable for backfill purposes shall be removed and replaced with select backfill material.

13. All trenches in the street right-of-way shall be backfilled with suitable material immediately after the pipe is laid. The fill around all pipe shall be placed in layers not to exceed six (6) inches and each layer shall be compacted thoroughly. For Storm Drainage see Backfill under Storm Drainage section.
14. Under no circumstances shall water be permitted to rise in un-backfilled trenches after the pipe has been placed.
15. Compaction requirements shall be attained using mechanical compaction methods. Each six (6) inch layer of backfill shall be placed loose and thoroughly compacted into place.
16. Straight forms shall not be used for forming curb and gutter in curves.
17. All excess concrete on the front edge (lip) of gutter shall be removed when curb and gutter is poured with a machine.
18. All subgrade shall be compacted to 100% of the maximum density obtainable with the Standard Proctor Test to a depth of eight (8) inches, and a density of 95% Standard Proctor for depths greater than eight (8) inches. All tests shall be performed by developer at no cost to the City.
19. A canvas cover or other suitable cover shall be required for transporting plant mix asphalt during cool weather when the following conditions are present:
 - a. Air temperature is below 60 degrees F.
 - b. Length of haul from plant to job is greater than five (5) miles.
 - c. Other occasions at the Inspector's discretion when a combination of factors indicates that material should be covered in order to assure proper placement temperature.
20. Concrete or asphalt shall not be placed until the air temperature measured at the location of the paving operation is at 35 degrees F and rising by 10:00 a.m. Concrete or paving operations should be suspended when the air temperature is 40 degrees F and descending. The contractor shall protect freshly placed concrete or asphalt in accordance with Sections 420 (Concrete Structures), 600 (Asphalt Bases and Pavements), and 700 (Concrete Pavements and Shoulders) of the North Carolina Department of Transportation Standard Specifications when the air temperature is at or below 35 degrees F and the concrete has not obtained an age of 72 hours.

21. The contractor shall always maintain two-way traffic when working within existing streets. The contractor shall place and maintain signs, danger lights, and barricades and furnish watchmen or flagmen to direct traffic in accordance with the latest edition Work Area Traffic Control Handbook (WATCH). Work in the right-of-way of State System Streets may require additional traffic control provisions.
22. The contractor shall do that which is necessary to control erosion and to prevent sedimentation damage to all adjacent properties and streams in accordance with the appropriate City of Charlotte Erosion and Sedimentation Control Ordinance.

B. STANDARDS OF STREET DESIGN

Note: Use of Hilly Terrain criteria is NOT permitted without PRIOR approval of the Director of Transportation.

Note: Design standards that apply for the ETJ are taken from the July 2020 edition of the NCDOT Subdivision Manual. Any revisions to Subdivision Manual will supersede the design standards given in the Charlotte Land Development Standards for ETJ streets. However, under no circumstances shall an NCDOT/ETJ standard be less restrictive than what is required by the City of Charlotte.

1. STREETS (PUBLIC and PRIVATE):

	ALL LOCAL STREETS (Except Industrial & Collector)		LOCAL INDUSTRIAL AND COLLECTOR ONLY	
	<u>Level/Rolling</u>	<u>Hilly</u>	<u>Level/Rolling</u>	<u>Hilly</u>
a. Terrain Classification	0%-15%	15%+	0%-15%	15%+
b. Maximum Grade	10%	12%	8%	10%+
c. Design Speed (mph)	25	20	30	25
d. Minimum Radius (ft.)				
Public Street	150	90	250	175
Private Street	50	50	150	150

	ALL LOCAL STREETS (Except Industrial & Collector)		LOCAL INDUSTRIAL AND COLLECTOR ONLY	
	<u>Level/Rolling</u>	<u>Hilly</u>	<u>Level/Rolling</u>	<u>Hilly</u>
e. Min. Tangent between Horizontal Reverse Curves (ft.)	50	50	100	100
f. K Value (CREST/SAG)	20/20	15/20	28/35	20/20
K Value (STOP Condition)	9	5	14	9

Note: K=Rate of Vertical Curvature for Minimum Sight Distance. Provisions of adequate stopping sight distance may require use of larger K values than the minimums listed above. The Charlotte Department of Transportation, under Section 19-245 of City Code, reserves the right to prescribe more stringent sight distance standards and/or means to achieve adequate sight distance than these listed above.

2. INTERSECTIONS:

a. Maximum Street Grade at Intersections ^{a,b}

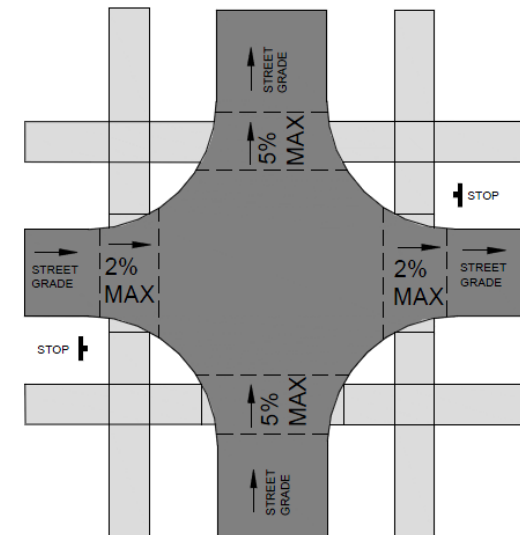
STOP or YIELD Condition: Vertical alignment is 2% maximum through the crosswalk areas (marked or unmarked). Outside of the crosswalk areas the vertical alignment is 5% maximum within 100 feet of an intersection ^c

THROUGH MOVEMENT Condition: Vertical alignment is 5% maximum through the crosswalk areas. Where feasible, it is recommended that the vertical alignment for a through-movement street also be set at 2% maximum through the crosswalk areas (marked or unmarked). Outside of the crosswalk areas, see B.1.b for maximum grade.

b. Midblock Pedestrian Street Crossings: At midblock crossings, the cross slope of the pedestrian street crossing is allowed to equal the street grade

c. Minimum Angle of Intersection is 75 degrees

d. See Charlotte Unified Development Ordinance Section 31.3.D for intersection sight distance requirements.



- a Preferred option: Design intersections with a max. 2% street grade through the crosswalk area of all legs of the intersection. This will provide a level intersection where the required sidewalks, curb ramps, and street crossings can be constructed with the use of CLDSM standard details included in the plans. Special attention to drainage design is warranted to ensure that these intersections drain properly. For intersections with street grades greater than 2% in any direction it is strongly recommended that the sidewalks, curb ramps, and street crossings be included as part of the design process and site-specific details of the designs and any alternate layouts shall be included in plans as appropriate.
- b Refer to Charlotte Unified Development Ordinance Section 31.1.D regarding potential modification of required street spacing and stub street requirements in areas of steep slopes.
- c 100' is the standard for Level/Rolling Terrain. In areas classified as Hilly Terrain, 100' is preferred length, but 40' minimum may be approved by the Director of Transportation. This only applies within the City of Charlotte limits and not in the ETJ, where NCDOT vertical alignment criteria would govern.

(Please note: Modifications to standards as noted in ^b and ^c or the use of "Hilly Terrain" street alignment criteria are typically requested via a subdivision sketch plan submittal. The sketch plan submittal must contain sufficient information to support the request for modified standards. For example, modification requests based upon topographical constraints should include existing and proposed street profiles.)

- e. Minimum Curb & R/W Radius = Taken from Appendix C (Curb Return Radii Guidelines) of USDG

Table 4 - Curb Radii for Local Street Intersections

From/To	R/Medium	R/Wide	C/Narrow	C/Wide	Industrial
R/Medium	15				
R/Wide	15	10			
C/Narrow	15	25	35		
C/Wide	15	15	30	10	
Industrial	25	15	40	25	50
R=Residential					
C=Commercial					

- f. Minimum Intersection Separation.

Along local streets	125 feet
Along collector streets	200 feet
Along arterials/Uptown Streets	To be determined by CDOT

Intersection offsets/separation from a thoroughfare, at signalized intersections, or at intersections that may become signalized in the future may need to be greater than these minimums and will be determined by CDOT on a case by case basis.

- Design criteria for arterial streets shall be established by the Director of the Department of Transportation on a case by case basis using the latest edition of the American Association of State Highway and Transportation Officials (AASHTO) A Policy on Geometric Design of Highway and Streets and/or NCDOT Roadway Design Manual.
- Intersection corner – A minimum 50' x 50' sight triangle (measured along back of curb or edge of pavement) shall be provided at each intersection corner. An additional 10' x 70' sight triangle shall be provided at intersections connecting to NCDOT maintained roadways. Other sight distance requirements may be required by the NCDOT or CDOT per the Charlotte Unified Development Ordinance (UDO) Section 31.3.D.
- Refer to the NCDOT Subdivision Roads Minimum Construction Manual for development criteria for sites located within the City of Charlotte Extraterritorial Jurisdiction (ETJ) within these areas governed by Charlotte Land Development Standards Manual and the NCDOT Subdivision Roads Minimum Construction Standards Manual. The more restrictive standard shall apply.

C. GRADING

1. Proposed street rights-of-way shall be graded to their full width for ditch type streets and a minimum of eight (8) feet behind the curb for curb and gutter sections.
2. Fill embankments shall be formed of suitable material placed in successive layers not to exceed more than six (6) inches in depth for the full width of the cross-section, including the width of the slope area. No stumps, trees, brush, rubbish or other unsuitable materials or substances shall be placed in the embankment. Each successive six (6) inch layer shall be thoroughly compacted by the sheepfoot tamping roller, 10-ton power roller, pneumatic-tired roller, or other methods approved by the City. Embankments over and around all pipe culverts shall be of select material, placed, and thoroughly tamped and compacted as directed by the City.

D. ROADWAY BASE

1. All roadways shall be constructed with a base course as described on the appropriate Charlotte Land Development Standard Detail Drawing.
2. The material for stone base course shall conform to the requirements of Section 1010, Aggregate for Non-Asphalt Flexible Type Base, and Section 520, Aggregate Base course of the North Carolina Department of Transportation Standard Specifications for Roads and Structures.
3. The stone base shall be compacted to 100% of the maximum density obtainable with the Modified Proctor Test (AASHTO-T180) by rolling with ring or tamping roller or with a pneumatic tired roller with a minimum weight of ten tons. When completed, the base course shall be smooth, hard, dense, unyielding and well bonded.
4. A bituminous concrete base course, as specified on the Standard Detail Drawing may be substituted in lieu of a stone base course.
5. Asphalt base course will only be allowed within widening strips less than five (5) feet in width.

E. ROADWAY INTERMEDIATE AND SURFACE COURSE

1. All public roadways shall be constructed with an intermediate and surface course as described on the appropriate City of Charlotte Land Development Standard Detail Drawing.
2. Plant mixed asphalt shall conform in all respects to Section 610 of the North Carolina Department of Transportation Standard Specifications for Roads and Structures.
3. The final (1) one inch lift of asphalt surface course for Residential Subdivision Streets shall be withheld until a minimum of (75%) Seventy-Five Percent of the Development is occupied (occupied means a certificate of occupancy has been issued) or at least (1) one year has lapsed from the application of the intermediate course layer (All documentation to be provided by the developer and approved by the City Inspector). All known base failures shall be repaired prior to application of the final one inch lift of asphalt surface course.
4. The City inspector shall be given a (24) twenty-four-hour notification to inspect the intermediate course deficiencies. All deficiency repairs are to be monitored by a City Inspector and accepted prior to application of final layer.
5. City inspectors shall be notified prior to using recycled plant mixes.
6. Failure to meet the above requirements may result in the delay or prevention of street acceptance by the City of Charlotte or NCDOT.

F. SIDEWALKS, RAMPS, AND DRIVEWAYS

1. Where sidewalks and pedestrian routes within street crossings (including marked and unmarked crosswalks) are provided, they must be constructed so they are accessible to all potential users, including those with disabilities.

The July 26, 2011 “Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way” was written by the US Access Board and is also known as the Public Right-of-Way Accessibility Guidelines or PROWAG. PROWAG provides more specific information than the existing Americans with disabilities Act Accessibilities Guidelines (ADAAG) for transportation facilities within the right-of-way including pedestrian access routes, signals, and parking facilities. The PROWAG requirements are currently in the development and adoption process and have not been officially adopted by the Department of Justice; however, the Federal Highway Administration has issued guidance that the draft version of the PROWAG “are currently recommended best practices, and can be considered the state of the practice that could be followed for areas not fully addressed” in the existing ADAAG requirements.

Due to the widespread acceptance of the PROWAG, and their pending adoption in the future, the standards in this manual are based upon the PROWAG requirements. The designer is encouraged to reference the complete PROWAG document for additional information (www.accessboard.gov). Buildings and other structures not covered by PROWAG must comply with the applicable requirements of the ADAAG.

2. Sidewalks shall be constructed of not less than 3600 P.S.I. concrete and shall be four (4) inches thick, constructed on an adequately graded base, except where a sidewalk crosses a driveway it shall be six (6) inches thick. Subgrade shall be compacted to 95% of the maximum density obtainable with the Standard Proctor Test. The surface of the sidewalk shall be steel trowel and light broom finished and cured with an acceptable curing compound. Tooled joints shall be provided at intervals of not less than five (5) feet and expansion joints at intervals of not more than forty-five (45) feet. The sidewalk shall have a desired lateral slope of 1.5% (2.00% maximum).

EXAMPLE SIDEWALK CONSTRUCTION DIMENSIONS:		
<u>WIDTH</u>	<u>RISE</u>	<u>CROSS-SLOPE</u>
4'	¾"	1.56%
5'	1"	1.67%
6'	1-1/8"	1.56%
8'	1-½"	1.56%

3. Planting strip adjacent to sidewalk shall be graded to ¼ inch per foot (min.) up to 1 ¼ inch per foot (max.), except where excessive natural grades make this requirement impractical. In such cases, the City may authorize a suitable grade.
4. Sidewalk widths shall be a minimum of five (5) feet unless otherwise specified. Where necessary, a 5' x 5' sidewalk is required at least every 200' as required by PROWAG for a passing zone unless otherwise provided by residential driveways, intersecting sidewalk, etc.
5. Approval of sidewalk construction plans must be obtained as part of the plan review process. Except in unusual circumstances, sidewalk must be located a minimum of (8) eight feet from the back of the curb or at the back of the right-of-way. A recorded public sidewalk easement is required for all sidewalk located outside public right-of-way; the width shall be equal to the distance from the right-of-way line to the back of the sidewalk plus two feet or to the face of building, whichever is less. The sidewalk easement must be recorded with the Mecklenburg County Register of Deeds prior to issuance of a certificate of occupancy for the corresponding building(s).

6. Running slope of all ramps shall be up to 7.5% (8.33% maximum). Ramp length is not required to exceed 15' regardless of the resulting slope, which shall be uniform for the length of the ramp. Curb ramps are required where sidewalks intersect curbing at any street intersection and at Type III driveway connections.
7. For City projects only: On CLDS# 10.24A/B/C, 10.25(A/B/C/D only), and 10.27A/B, the curb and gutter across the front of the driveway shall be measured and paid for separately under Curb and Gutter (either 2'-0" valley gutter, vertical curb, or standard 2'-6" curb and gutter as specified on the details). The curb and gutter is to be measured per linear foot along the surface of the top of the curb. The concrete driveway apron is to be measured per square yard.
8. Refer to the WATCH Manual, MUTCD (latest edition), and the Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG) for construction zone pedestrian routes and signalization and controls for actuators. Curb ramps shall be designed and constructed in accordance with the American Disability Act.
9. Where pedestrian routes are contained within a street or right-of-way, the grade of pedestrian access routes shall not exceed the general grade established for the adjacent street or highway.

II. STORM DRAINAGE

A. GENERAL NOTES

1. Unless otherwise specifically set forth herein, all materials, methods of construction and workmanship for the work covered in reference to stormwater infrastructure construction shall conform to the most recent Standards and Specifications of the North Carolina Department of Transportation (NCDOT).
2. Refer to NCDOT Pipe Material Selection Guide for allowable pipe fill heights and specifications. For fill heights less than 2' (measured from top of pipe to bottom of pavement structure) Class IV/Class V Reinforced Concrete Pipe (RCP) will be required. Designs outside of the selection guide will be approved at the discretion of Charlotte Storm Water Services.
3. All pipes must be sourced through an NCDOT approved producer/supplier and they must participate in the NCDOT QA/QC program for each respective pipe material.
4. Reinforced Concrete Pipe (RCP) may be used in all storm drainage applications. Culverts 60" in diameter or greater may be Corrugated Aluminized Metal Pipe (CAMP) or Corrugated Aluminum Alloy Pipe (CAAP). High Density Polyethylene (HDPE) Pipe may be substituted for pipe diameters of 48" or less but shall not be allowed in culvert applications or installations within an arterial street Right of Way maintained by the City of Charlotte.
5. Pipes shall have a minimum diameter of fifteen (15) inches (eighteen (18) inches minimum on cross drain culverts).

6. The maximum allowable pipe slope is 10 percent.
7. All pipes, regardless of material shall have all joints wrapped with a geotextile fabric (NCDOT Section 1056 – Type 2). Geotextile must extend 12” past each side of joint and edges of bands. Geotextile must be secured to the outside of pipe by methods indicated by engineer.
8. All concrete used for drainage structures shall have a minimum compressive strength of 3600 PSI at 28 days. This requirement shall be provided regardless of any lesser compressive strength specified in the North Carolina Department of Transportation Standard Specifications for Roads and Structures.
9. Prior approval by Charlotte Storm Water Services shall be required for the construction of any endwall that is not a NCDOT Roadway Standard Drawing.
10. All graded creek banks and cut/fill slopes shall be at a maximum of two (2) feet horizontal to one (1) foot vertical (2:1) and not to exceed 10’ without terracing or the slopes shall be designed by a Professional Geotechnical Engineer and approved by Charlotte Storm Water Services on a case-by-case basis.

B. STANDARDS FOR DESIGN

1. In accordance with Charlotte Unified Development Ordinance Articles 24 and 25, Charlotte Storm Water Services shall review the drainage plan for compliance with the standards contained in the current edition of the Charlotte Land Development Standards Manual, the Charlotte-Mecklenburg Storm Water Design Manual and all other relevant and appropriate standards established by the City.
2. All storm drainage design shall conform to the standards and specifications as provided in the Charlotte-Mecklenburg Storm Water Design Manual, North Carolina Department of Transportation Standards Specifications for Roads and Structures, and the Charlotte Land Development Standards Manual. In the event of conflicting standards, the more restrictive shall apply.
3. The NCDOT Roadway Standard Drawings have been accepted as approved standards for Land Development projects in the City of Charlotte and City of Charlotte ETJ. See standard #20.00A, B, and C of this manual for a table listing the standards accepted. These standard drawings shall be referenced by NCDOT number or shown on all plans submitted to the City of Charlotte for approval.
4. Culverts must be long enough to accommodate the proposed roadway section with a 2:1 fill slope, or flatter, measured from shoulder point and/or back of grade bench to the toe of slope. Extend the pipe to allow the endwall to be placed at the toe of slope. See CLDSM 10.36A.
5. Endwalls or other end treatments are required on all culverts and at the outlet end of all closed pipe systems. Endwalls are required for pipes 36” and larger.

6. Construct endwalls perpendicular to the centerline of the pipe unless specific site conditions warrant construction of an endwall parallel to the roadway.
7. Sub-surface drainage shall be provided where the ground water level is likely to be near the surface. In capillary soils, the water level should be four (4) to six (6) feet below the surface to prevent the rise of moisture into the subgrade. Subdrains shall be used to lower ground water in low areas in the street.

C. PIPE INSTALLATION

1. All pipe materials referenced herein shall be installed pursuant to Section 300 of the current version of the NCDOT Standard Specifications for Roads and Structures, Pipe installation and 300.01 of the NCDOT Roadway Standard Drawings for method of pipe installation.
2. Storm drainage pipe shall be placed in a straight alignment at uniform grade. All pipes shall be laid with the bell or groove upgrade and the joint entirely interlocking.
3. No changes in alignment shall be allowed except at catch basins, manholes, or other junctions that provide appropriate clean out access. The maximum length between access points is 300 linear feet.
4. Each run of pipe (structure to structure) shall be a single type, class, and material.
5. An NCDOT standard pipe collar or drainage structure is required where pipes from differing manufacturers or materials are joined. Pipes should be on the same grade and alignment and have the same internal diameter where a pipe collar is specified.
6. Lift holes, if present on Reinforced Concrete Pipe are to be repaired per 300-6 (A) of the NCDOT Standard Specifications for Roads and Structures. Alternate repair methods must be submitted to Storm Water for approval prior to construction. Repair must meet or exceed acceptable leakage rates for the pipe joints.
7. All installations of storm drainage infrastructure associated with the subdivision ordinance, unified development ordinance and/or any system conveying runoff into or from a public right of way will require a Closed-Circuit Television (CCTV) inspection and/or Confined Space Entry (CSE) to verify infrastructure was installed correctly and is free of defects and excessive deflection. This inspection should occur after backfilling is completed to final grade but prior to completion of paving operations. See City of Charlotte *Post Installation Inspection of Storm Drainage Pipes and Culverts* for additional information.
8. All flexible pipe, reinforced concrete box culverts, and arch culvert installations require third-party inspection. All inspections shall be performed by a licensed, competent third-party inspection firm and the inspections shall be directed or performed by a North Carolina Professional Engineer. Inspections shall be completed as described in the most recent version of the City of Charlotte Storm Water Services document *Third-Party Inspection for Pipe Installation*.

D. BACKFILL

1. Backfilling of pipe trenches and excavations for drainage structures shall be in accordance with NCDOT standards. Layers shall not exceed six (6) inches loose and each layer shall be compacted thoroughly to the required density of 95% standard proctor density.
2. All backfill shall be non-plastic in nature, free from roots, vegetative matter, waste, construction material or other objectionable material. Said material shall be capable of being compacted by mechanical means to the required density and the material shall have no tendency to flow or behave in a plastic manner under the tamping blows or proof rolling.
3. Materials deemed by the Engineer as unsuitable for backfill purposes shall be removed and replaced with select backfill material.
4. Backfilling of trenches shall be accomplished immediately after the pipe is laid. Do not operate heavy equipment over any pipe or culvert until the pipe or culvert has been properly backfilled and covered with at least three (3) feet of an approved material.
5. Under no circumstances shall water be permitted to rise in un-backfilled trenches after the pipe has been placed.

E. STANDARD PIPE MATERIAL REQUIREMENTS

1. Reinforced Concrete Pipe – RCP
 - a. Pipe shall have 8-foot standard joint lengths. All joints shall be tongue and groove type, with a preformed joint sealant conforming to ASTM C-990. Pipe shall be manufactured in accordance with AASHTO M-170 and/or ASTM C-76. Class of pipe and wall thickness shall be in accordance with the most recent version of the NCDOT Pipe Material Selection Guide.
 - i. Installation of Class IV or higher concrete pipe shall be identified on the design plans. The City inspector shall be given documentation and notification of this information prior to construction. Registered professional shall note on As-Builts that the appropriate class/type of pipe was installed.

F. ALTERNATIVE PIPE MATERIALS AND DESIGN SPECIFICATIONS

1. Performance Pipe Joints - Where reinforced concrete pipes (RCP) and/or culverts are subject to operating under pressure during the design storm event, as defined within the Charlotte Mecklenburg Storm Water Design Manual, an upgraded performance joint design will be required.
 - a. Leak Resistant Joint – Limited leakage is acceptable.

- i. All joints shall be bell and spigot type, with a rubber gasket conforming to ASTM C-443. Pipe shall be manufactured in accordance with AASHTO M-170 and/or ASTM C-76. Class of pipe and wall thickness shall be in accordance with the current version of the NCDOT Pipe Material Selection Guide.
 - b. Special Design Joint – Limited leakage is not acceptable.
 - i. Manufacture provided design will be required.
- 2. Corrugated Aluminized Steel Pipe and Corrugated Aluminum Alloy Pipe
 - a. Aluminum coated (Type 2) steel pipe shall comply with AASHTO M-274 for the coating and AASHTO M-36 for the pipe fabrication. Aluminum alloy pipe shall comply with AASHTO M-196 for material and fabrication.
 - b. Where velocities within the pipe exceed 5 ft/sec for the 2-year storm, field pave a 4-inch-thick reinforced concrete invert, pursuant to AASHTO M-190. 2/5 of the height of the culvert of .5' above the flow height of the 2-year event, whichever is more restrictive. Allowable velocities for the design storm event shall not exceed 10 feet/sec. Invert shall not be constructed until pipe backfill is completed.
 - c. Prior to installation, pH, and resistivity testing of the proposed backfill material is required at two or more locations along the proposed pipe alignment.
 - d. At a minimum, for CAMP and CAAP to be considered, soil and stream-side pH and resistivity values must be within a range of $5.0 < \text{pH} < 9.0$ and resistivity of $r > 1500 \text{ ohm-cm}$.
 - e. Submit manufactures specifications showing that the selected CAMP or CAAP is suitable based on the results of the physical testing of pH and resistivity.
 - f. Minimum wall thickness is 10 gage.
 - g. Each pipe section shall be joined to the next by a coupling band with a minimum of one corrugation overlap at each edge. The coupling bands shall have a minimum of two annular corrugations and fully engage, over the entire pipe periphery, one corrugation on each pipe. Bands shall be fabricated from the same material as the pipe. The minimum band gauges for aluminum pipe and aluminized pipe shall be as specified in AASHTO M-196 and AASHTO M-274, respectively.
 - h. Gaskets, providing a leak resistant joint are required, and shall be either sleeve type or O-ring type and shall meet the requirements for gaskets as specified in AASHTO M-36, Section 9.3
 - i. Where Aluminum or Aluminized metal pipe is in direct contact with concrete a barrier coating must be applied. See NCDOT Thermal Spray Coatings Program for acceptable treatments.
- 3. Corrugated Aluminized Steel and Corrugated Aluminum Alloy Arches and/or Plate.
 - j. Corrugated aluminum alloy structural plate pipe, pipe arches and arches shall consist of aluminum plates and galvanized bolts and nuts of the size, shape and thickness as shown on the approved plans. These structures shall conform to the requirements of AASHTO M-219.
 - k. Where velocities within the pipe/arch exceed 5 ft/sec for the 2-year storm, the walls of the culvert should be protected from abrasion by applying a 4-inch-thick reinforced concrete barrier. 2/5 of the height of the culvert of .5' above the flow height of the 2-year event, whichever is more restrictive. Allowable velocities for the design storm event shall not exceed 10 feet/sec. Barrier shall not be constructed until pipe backfill is completed.

- l. Prior to installation, pH, and resistivity testing of the proposed backfill material is required at two or more locations along the proposed pipe alignment.
 - i. At a minimum, for CAMP and CAAP to be considered, soil and stream-side pH and resistivity values must be within a range of $5.0 < \text{pH} < 9.0$ and resistivity of $r > 1500 \text{ ohm-cm}$.
 - ii. Submit manufactures specifications showing that the selected CAMP or CAAP is suitable based on the results of the physical testing of pH and resistivity.
- m. Minimum wall thickness is 10 gage.
- n. Gaskets, providing a leak resistant joint are required, and shall be either sleeve type or O-ring type and shall meet the requirements for gaskets as specified in AASHTO M-36, Section 9.3.
- o. Where Aluminum or Aluminized metal pipe is in direct contact with concrete a barrier coating must be applied. See NCDOT Thermal Spray Coatings Program for acceptable treatments.

4. High Density Polyethylene Pipe - HDPE

- a. This type of pipe shall comply with AASHTO M-294, Type S for pipe manufacturing.
- b. The bell and spigot joint shall have an O-ring gasket meeting ASTM F477 with the gasket factory installed, placed on the spigot end of the pipe. Pipe joints shall meet all requirements of AASHTO M294.
- c. The minimum length of HDPE pipe permitted for use shall be four (4) feet

5. Reinforced Concrete Box Culverts (RCBC)

- a. All RCBC must have direct access points into the culvert. Catch Basins, Manholes or Junctions that connect to the culvert via small diameter pipes will not be considered acceptable access points.
- b. ALL RCBC must be designed with leak resistant joints.

6. Bottomless/Arch Culverts

- a. If shallow, non-erosive bedrock is found three feet or less below the streambed, proposal of a bottomless(three-sided) culvert may be considered.
 - i. A geotechnical report signed and sealed by a North Carolina Professional Engineer stating that the entire length of the culvert will be bedded on non-erosive bedrock is required.
 - ii. Reinforced concrete footings designed by a North Carolina Professional Engineer tied to the bedrock are required.

G. DRAINAGE STRUCTURES

1. All structures and associated frames, grates and lids must comply with current NCDOT standard details and specifications.
2. All storm drain structures over three (3) feet and six (6) inches in height must have steps which comply with NCDOT 840.66.

3. The interior surfaces of all storm drainage structures shall be pointed up and smoothed to an acceptable standard using mortar mixed to manufacturer's specifications. All pipes shall be cut flush within the interior structure wall.
4. All frames, grates, rings, covers, etc., must conform to the standards set forth in this manual. Supply covers with a minimum of two and a maximum of six 1" diameter vent holes.
5. No Blind/Inaccessible structures will be allowed.
6. Waffle and knockout boxes are prohibited on storm drainage systems within and/or conveying runoff from the public r/w. Boxes with pre-cast openings shall be used.
7. Joints/Sections of pre-cast structures shall use flexible sealants meeting ASTM C990 or rubber gaskets meeting ASTM C443. Sealant type should meet or exceed allowable leakage rates for pipe joints.
8. Drainage structures accepting flexible pipes must provide a resilient connection conforming to ASTM C923 and ASTM C1478.
9. Where Aluminum or Aluminized metal pipe is in direct contact with concrete a barrier coating must be applied. See NCDOT Thermal Spray Coatings Program for acceptable treatments.

H. END TREATMENTS:

1. Endwalls are to be NCDOT standard precast concrete, brick masonry with reinforced concrete footings, or cast-in place, reinforced concrete with reinforced concrete footings.
2. No metal or HDPE end treatments are allowed.
3. Where Aluminum or Aluminized metal pipe is in direct contact with concrete a barrier coating must be applied. See NCDOT Thermal Spray Coatings Program for acceptable treatments.

I. NON-STANDARD STRUCTURES

1. Any non-standards structures must have prior approval by Charlotte Storm Water Services and will require a sealed design by a North Carolina Professional Engineer.

III. PLAN REQUIREMENTS

A. GENERAL NOTES

1. All erosion control measures shall conform to the standards set forth in the Charlotte Land Development Standards Manual, State of North Carolina Erosion and Sediment Control Planning and Design Manual, or the more restrictive of any standards that conflict.
2. All storm drainage design shall conform to the standards and specifications as provided in the Charlotte-Mecklenburg Storm Water Design Manual, Charlotte Land Development Standards Manual, or the more restrictive of any standards that conflict.
3. The following note shall be placed on all site plans, grading plans, and plats.
 - a. The purpose of the Storm Drainage Easement (SDE) is to provide storm water conveyance. Buildings are not permitted in the easement area. Any other objects which impede storm water conveyance or system maintenance are also prohibited.
4. Cite all appropriate standard detail numbers for any structures or specifics used within the plans in reference to the most current copy of the Charlotte Land Development Standards Manual.
5. In areas where the Floodway Regulations are applicable, the Future Conditions Flood Fringe Line, FEMA Flood Fringe Line, Community Encroachment Line, and FEMA Encroachment Line shall be shown on the preliminary plan and the final plat. An application for a Floodplain Development Permit shall be submitted to Mecklenburg County Land Use and Environmental Services (LUESA) in accordance with the requirements set forth in the City/County Floodplain Regulations.

B. EASEMENTS

1. Storm Drainage Easements (SDE) shall be provided for all storm drainage pipes and channels that are installed and/or modified by a developer (builder, property owner, etc.) and convey runoff into or from a public right of way. See CLDSM 20.30 for additional information.
2. Overlapping of storm drainage easements shall be approved at the discretion of Charlotte Storm Water Services.
3. Storm Drainage Easements shall include all end treatments and energy dissipators, lengthen or widen as needed.

C. SUBDIVISIONS -PRELIMINARY PLAN

1. The preliminary plan must include, at a minimum, the information described in Sections 30.4 and 30.6 of the City of Charlotte Unified Development Ordinance.

D. BOND POLICY – SUBDIVISION IMPROVEMENTS

1. Release of the final subdivision plat will not occur until the improvements required for the area of the final plat are constructed and a final inspection has been performed and found to be in conformance with the plans approved by the Charlotte-Mecklenburg Planning Commission., or a security has been posted with the Land Development Bond Coordinator of the applicable department and all required documents are received in their entirety.
2. The security shall be posted and remain in force until the construction is complete and found to be in conformance with the plans approved by the Charlotte-Mecklenburg Planning Commission. The security will be reevaluated after one year from the date of posting.
3. The Applicant shall notify the City that construction is complete according to the appropriate subdivision ordinance and the Charlotte Land Development Standards Manual before any security will be released. A final inspection will be made to check completeness of the project upon notification.
4. One type of security may be replaced by another type of security in certain situations. The amount of the replacement security will be based on the City's estimate of the work remaining. If the estimate of work results in a lower amount, the replacement security will be treated as a reduction. Certain situations will require an increase in a security and in such cases the replacement security shall be required to equal the higher amount.
5. A one-time reduction in security will be allowed if requested in writing by the principal party of the security. However, the security shall never be less than \$10,000 for the City of Charlotte unless approved by the City.

IV. REFERENCES

1. North Carolina Department of Transportation, Standard Specifications for Roads and Structures, latest edition.
2. North Carolina Department of Transportation, Roadway Standards Drawings, latest edition.
3. City of Charlotte Department of Transportation, Work Area Traffic Control Handbook (WATCH), latest edition.
4. City of Charlotte and Mecklenburg County Storm Water Services, Charlotte-Mecklenburg Storm Water Design Manual, latest edition.
5. American Association of State Highway and Transportation Officials most recent edition, A Policy on Geometric Design of Highways and Streets.
6. North Carolina Department of Transportation, Roadway Design Manual, latest edition.
7. NCDEQ -Division of Energy, Mineral, and Land Resources, Erosion and Sediment Control Planning and Design Manual, latest edition.
8. NCDEQ, Storm Water Best Management Practices, latest edition.
9. Charlotte-Mecklenburg SCM Design Manual, latest edition.
10. City of Charlotte, CDOT Pavement Marking Standards, latest edition.
11. The City of Charlotte Urban Street Design Guidelines, adopted by City Council October 22, 2007.
12. Federal Highway Administration, Manual on Uniform Traffic Control Devices (MUTCD), latest edition.
13. United States Access Board, Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG), latest edition.
14. City of Charlotte, Charlotte Streets Manual
15. City of Charlotte, Post Installation Inspection of Storm Drainage Pipes and Culverts, latest edition.
16. Charlotte Storm Water Services, Third-Party Inspection for Pipe Installations, latest edition.

CHARLOTTE LAND DEVELOPMENT STANDARDS MANUAL

SPECIFICATIONS AND SPECIAL PROVISION NOTES

Includes ETJ

The following specifications and special provisions are intended to be used in conjunction with Charlotte Land Development Standard Drawings, NCDOT Roadway Standard Drawings, and NCDOT Standard Specifications for Roads and Structures for all development within the City of Charlotte and the City of Charlotte ETJ unless otherwise directed by the City.

I. STREETS

A. GENERAL NOTES

1. All work and materials shall conform to the latest edition of the North Carolina Department of Transportation Standard Specifications for Roads and Structures *unless otherwise specified in this manual*.
2. All asphalt cuts shall be made with a saw when preparing street surfaces for patching or widening strips.
3. Paper joints shall be used to seal the ends of an asphalt pour so that future extensions can be made without causing rough joints.
4. When placing asphalt against existing surfaces, a straight edge shall be used to prevent “humping” at that location.
5. Stone shall be primed if paving is not complete within seven days following stone base approval.
6. Surfaces shall be tacked when asphalt is being placed over existing asphalt streets or adjoining concrete, storm drain and sanitary sewer structures.

DRAFT

PROPOSED REVISION KEY:

Items in RED with strike-through are removed

Items in RED are new/added

Items in GREEN have been moved within the document

7. In rolling and hilly terrains, sweeping of the stone base and/or application of a tack coat may be required near intersections. These requirements will be established by the City Inspector based on field conditions.
8. ALL concrete used for streets, curb and gutter, sidewalks and drainage structures, etc. shall have a minimum compressive strength of 3600 PSI at 28 days. This requirement shall be ~~provided~~met regardless of any lesser compressive strength specified in the North Carolina Department of Transportation Standard Specifications for Roads and Structures. The contractor shall prepare concrete test cylinders in accordance with Section 1000 of the North Carolina Department of Transportation Standard Specifications for Roads and Structures at the direction of the project inspector. All equipment and cylinder molds shall be furnished by the contractor. It shall be the responsibility of the contractor to protect the cylinders until such time as they are transported for testing. Testing for projects shall be performed by an independent testing lab, at no cost to the City. The contractor shall provide equipment and perform tests on concrete for a maximum slump and air content as defined in Section 1000 of the North Carolina Department of Transportation Standard Specifications for Roads and Structures. These tests shall be performed at a frequency established by the inspector. Materials failing to meet specifications shall be removed by the contractor.
9. All concrete shall be cured with 100% Resin Base, white pigmented curing compound which meets ASTM Specifications C-309, Type 1, applied at a uniform rate at one (1) gallon to 400 square feet within 24 hours of placement of the concrete.
10. All curb and gutter shall be backfilled with soil approved by the Inspector within 48 hours after construction to prevent erosion.
11. All backfill shall be non-plastic in nature, free from roots, vegetative matter, waste, construction material or other objectionable material. Said material shall be capable of being compacted by mechanical means and the material shall have no tendency to flow or behave in a plastic manner under the tamping blows or proof rolling.
12. Materials deemed by the Inspector as unsuitable for backfill purposes shall be removed and replaced with select backfill material.

13. All trenches in the street right-of-way shall be backfilled with suitable material immediately after the pipe is laid. The fill around all pipe shall be placed in layers not to exceed six (6) inches and each layer shall be compacted thoroughly. For Storm Drainage see Backfill under Storm Drainage section.
14. Under no circumstances shall water be permitted to rise in un-backfilled trenches after the pipe has been placed.
15. Compaction requirements shall be attained using mechanical compaction methods. Each six (6) inch layer of backfill shall be placed loose and thoroughly compacted into place.
16. Straight forms shall not be used for forming curb and gutter in curves.
17. All excess concrete on the front edge (lip) of gutter shall be removed when curb and gutter is poured with a machine.
18. All subgrade shall be compacted to 100% of the maximum density obtainable with the Standard Proctor Test to a depth of eight (8) inches, and a density of 95% Standard Proctor for depths greater than eight (8) inches. All tests shall be performed by developer at no cost to the City.
19. A canvas cover or other suitable cover shall be required for transporting plant mix asphalt during cool weather when the following conditions are present:
 - a. Air temperature is below 60 degrees F.
 - b. Length of haul from plant to job is greater than five (5) miles.
 - c. Other occasions at the Inspector's discretion when a combination of factors indicates that material should be covered in order to assure proper placement temperature.
20. Concrete or asphalt shall not be placed until the air temperature measured at the location of the paving operation is at 35 degrees F and rising by 10:00 a.m. Concrete or paving operations should be suspended when the air temperature is 40 degrees F and descending. The contractor shall protect freshly placed concrete or asphalt in accordance with Sections 420 (Concrete Structures), 600 (Asphalt Bases and Pavements), and 700 (Concrete Pavements and Shoulders) of the North Carolina Department of Transportation Standard Specifications when the air temperature is at or below 35 degrees F and the concrete has not obtained an age of 72 hours.

21. The contractor shall always maintain two-way traffic when working within existing streets. The contractor shall place and maintain signs, danger lights, and barricades and furnish watchmen or flagmen to direct traffic in accordance with the latest edition Work Area Traffic Control Handbook (WATCH). Work in the right-of-way of State System Streets may require additional traffic control provisions.
22. The contractor shall do that which is necessary to control erosion and to prevent sedimentation damage to all adjacent properties and streams in accordance with the appropriate City of Charlotte Erosion and Sedimentation Control Ordinance.

B. STANDARDS OF STREET DESIGN

Note: Use of Hilly Terrain criteria is NOT permitted without PRIOR approval of the Director of Transportation.

Note: Design standards that apply for the ETJ are taken from the July 2020 edition of the NCDOT Subdivision Manual. Any revisions to Subdivision Manual will supersede the design standards given in the Charlotte Land Development Standards for ETJ streets. However, under no circumstances shall an NCDOT/ETJ standard be less restrictive than what is required by the City of Charlotte.

1. STREETS (PUBLIC and PRIVATE):

	ALL LOCAL STREETS (Except Industrial & Collector)		LOCAL INDUSTRIAL AND COLLECTOR ONLY	
	<u>Level/Rolling</u>	<u>Hilly</u>	<u>Level/Rolling</u>	<u>Hilly</u>
a. Terrain Classification	0%-15%	15%+	0%-15%	15%+
b. Maximum Grade	10%	12%	8%	10%+
c. Design Speed (mph)	25	20	30	25
d. Minimum Radius (ft.)				
Public Street	150	90	250	175
Private Street	50	50	150	150

	ALL LOCAL STREETS (Except Industrial & Collector)		LOCAL INDUSTRIAL AND COLLECTOR ONLY	
	<u>Level/Rolling</u>	<u>Hilly</u>	<u>Level/Rolling</u>	<u>Hilly</u>
e. Min. Tangent between Horizontal Reverse Curves (ft.)	50	50	100	100
f. K Value (CREST/SAG)	20/20	15/20	28/35	20/20
K Value (STOP Condition)	9	5	14	9

Note: K=Rate of Vertical Curvature for Minimum Sight Distance. Provisions of adequate stopping sight distance may require use of larger K values than the minimums listed above. The Charlotte Department of Transportation, under Section 19-245 of City Code, reserves the right to prescribe more stringent sight distance standards and/or means to achieve adequate sight distance than these listed above.

2. INTERSECTIONS:

a. Maximum Street Grade at Intersections ^{a,b}

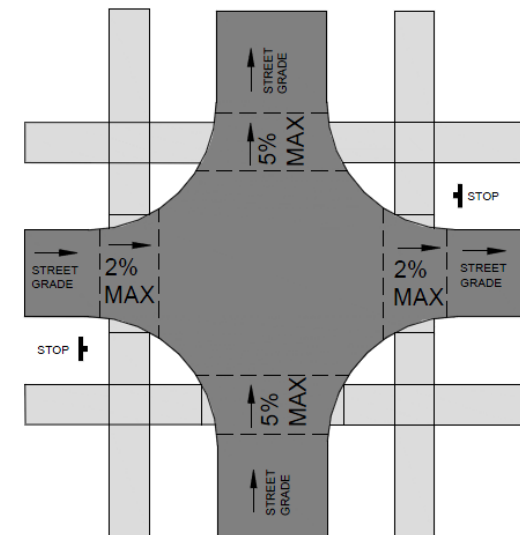
STOP or YIELD Condition: Vertical alignment is 2% maximum through the crosswalk areas (marked or unmarked). Outside of the crosswalk areas the vertical alignment is 5% maximum within 100 feet of an intersection ^c

THROUGH MOVEMENT Condition: Vertical alignment is 5% maximum through the crosswalk areas. Where feasible, it is recommended that the vertical alignment for a through-movement street also be set at 2% maximum through the crosswalk areas (marked or unmarked). Outside of the crosswalk areas, see B.1.b for maximum grade.

b. Midblock Pedestrian Street Crossings: At midblock crossings, the cross slope of the pedestrian street crossing is allowed to equal the street grade

c. Minimum Angle of Intersection is 75 degrees

d. See Charlotte Unified Development Ordinance Section 31.3.D for intersection sight distance requirements.



a Preferred option: Design intersections with a max. 2% street grade through the crosswalk area of all legs of the intersection. This will provide a level intersection where the required sidewalks, curb ramps, and street crossings can be constructed with the use of CLDSM standard details included in the plans. Special attention to drainage design is warranted to ensure that these intersections drain properly. For intersections with street grades greater than 2% in any direction it is strongly recommended that the sidewalks, curb ramps, and street crossings be included as part of the design process and site-specific details of the designs and any alternate layouts shall be included in plans as appropriate.

b Refer to Charlotte Unified Development Ordinance Section 31.1.D regarding potential modification of required street spacing and stub street requirements in areas of steep slopes.

- c 100' is the standard for Level/Rolling Terrain. In areas classified as Hilly Terrain, 100' is preferred length, but 40' minimum may be approved by the Director of Transportation. This only applies within the City of Charlotte limits and not in the ETJ, where NCDOT vertical alignment criteria would govern.

(Please note: Modifications to standards as noted in^b and ^c or the use of "Hilly Terrain" street alignment criteria are typically requested via a subdivision sketch plan submittal. The sketch plan submittal must contain sufficient information to support the request for modified standards. For example, modification requests based upon topographical constraints should include existing and proposed street profiles.)

- e. Minimum Curb & R/W Radius = Taken from Appendix C (Curb Return Radii Guidelines) of USDG

Table 4 - Curb Radii for Local Street Intersections					
From/To	R/Medium	R/Wide	C/Narrow	C/Wide	Industrial
R/Medium	15				
R/Wide	15	10			
C/Narrow	15	25	35		
C/Wide	15	15	30	10	
Industrial	25	15	40	25	50
R=Residential					
C=Commercial					

- f. Minimum Intersection Separation.

Along local streets	125 feet
Along collector streets	200 feet
Along arterials/Uptown Streets	To be determined by CDOT

Intersection offsets/separation from a thoroughfare, at signalized intersections, or at intersections that may become signalized in the future may need to be greater than these minimums and will be determined by CDOT on a case by case basis.

- Design criteria for arterial streets shall be established by the Director of the Department of Transportation on a case by case basis using the latest edition of the American Association of State Highway and Transportation Officials (AASHTO) A Policy on Geometric Design of Highway and Streets and/or NCDOT Roadway Design Manual.
- Intersection corner – A minimum 50' x 50' sight triangle (measured along back of curb or edge of pavement) shall be provided at each intersection corner. An additional 10' x 70' sight triangle shall be provided at intersections connecting to NCDOT maintained roadways. Other sight distance requirements may be required by the NCDOT or CDOT per the Charlotte Unified Development Ordinance (UDO) Section 31.3.D.

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5. Refer to the NCDOT Subdivision Roads Minimum Construction Manual for development criteria for sites located within the City of Charlotte Extraterritorial Jurisdiction (ETJ) within these areas governed by Charlotte Land Development Standards Manual and the NCDOT Subdivision Roads Minimum Construction Standards Manual. The more restrictive standard shall apply.

C. GRADING

1. Proposed street rights-of-way shall be graded to their full width for ditch type streets and a minimum of eight (8) feet behind the curb for curb and gutter sections.
2. Fill embankments shall be formed of suitable material placed in successive layers not to exceed more than six (6) inches in depth for the full width of the cross-section, including the width of the slope area. No stumps, trees, brush, rubbish or other unsuitable materials or substances shall be placed in the embankment. Each successive six (6) inch layer shall be thoroughly compacted by the sheepsfoot tamping roller, 10-ton power roller, pneumatic-tired roller, or other methods approved by the City. Embankments over and around all pipe culverts shall be of select material, placed, and thoroughly tamped and compacted as directed by the City.

D. ROADWAY BASE

1. All roadways shall be constructed with a base course as described on the appropriate Charlotte Land Development Standard Detail Drawing.
2. The material for stone base course shall conform to the requirements of Section 1010, Aggregate for Non-Asphalt Flexible Type Base, and Section 520, Aggregate Base course of the North Carolina Department of Transportation Standard Specifications for Roads and Structures.
3. The stone base shall be compacted to 100% of the maximum density obtainable with the Modified Proctor Test (AASHTO-T180) by rolling with ring or tamping roller or with a pneumatic tired roller with a minimum weight of ten tons. When completed, the base course shall be smooth, hard, dense, unyielding and well bonded.
4. A bituminous concrete base course, as specified on the Standard Detail Drawing may be substituted in lieu of a stone base course.
5. Asphalt base course will only be allowed within widening strips less than five (5) feet in width.

E. ROADWAY INTERMEDIATE AND SURFACE COURSE

1. All public roadways shall be constructed with an intermediate and surface course as described on the appropriate City of Charlotte Land Development Standard Detail Drawing.
2. Plant mixed asphalt shall conform in all respects to Section 610 of the North Carolina Department of Transportation Standard Specifications for Roads and Structures.
3. The final (1) one inch lift of asphalt surface course for Residential Subdivision Streets shall be withheld until a minimum of (75%) Seventy-Five Percent of the Development is occupied (occupied means a certificate of occupancy has been issued) or at least (1) one year has lapsed from the application of the intermediate course layer (All documentation to be provided by the developer and approved by the City Inspector). All known base failures shall be repaired prior to application of the final one inch lift of asphalt surface course.
4. The City inspector shall be given a (24) twenty-four-hour notification to inspect the intermediate course deficiencies. All deficiency repairs are to be monitored by a City Inspector and accepted prior to application of final layer.
5. City inspectors shall be notified prior to using recycled plant mixes.
6. Failure to meet the above requirements may result in the delay or prevention of street acceptance by the City of Charlotte or NCDOT.

F. SIDEWALKS, RAMPS, AND DRIVEWAYS

1. Where sidewalks and pedestrian routes within street crossings (including marked and unmarked crosswalks) are provided, they must be constructed so they are accessible to all potential users, including those with disabilities.

The July 26, 2011 “Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way” was written by the US Access Board and is also known as the Public Right-of-Way Accessibility Guidelines or PROWAG. PROWAG provides more specific information than the existing Americans with disabilities Act Accessibilities Guidelines (ADAAG) for transportation facilities within the right-of-way including pedestrian access routes, signals, and parking facilities. The PROWAG requirements are currently in the development and adoption process and have not been officially adopted by the Department of Justice; however, the Federal Highway Administration has issued guidance that the draft version of the PROWAG “are currently recommended best practices, and can be considered the state of the practice that could be followed for areas not fully addressed” in the existing ADAAG requirements.

Due to the widespread acceptance of the PROWAG, and their pending adoption in the future, the standards in this manual are based upon the PROWAG requirements. The designer is encouraged to reference the complete PROWAG document for additional information (www.accessboard.gov). Buildings and other structures not covered by PROWAG must comply with the applicable requirements of the ADAAG.

2. Sidewalks shall be constructed of not less than 3600 P.S.I. concrete and shall be four (4) inches thick, constructed on an adequately graded base, except where a sidewalk crosses a driveway it shall be six (6) inches thick. Subgrade shall be compacted to 95% of the maximum density obtainable with the Standard Proctor Test. The surface of the sidewalk shall be steel trowel and light broom finished and cured with an acceptable curing compound. Tooled joints shall be provided at intervals of not less than five (5) feet and expansion joints at intervals of not more than forty-five (45) feet. The sidewalk shall have a desired lateral slope of 1.5% (2.00% maximum).

EXAMPLE SIDEWALK CONSTRUCTION DIMENSIONS:		
<u>WIDTH</u>	<u>RISE</u>	<u>CROSS-SLOPE</u>
4'	¾"	1.56%
5'	1"	1.67%
6'	1-1/8"	1.56%
8'	1-½"	1.56%

3. Planting strip adjacent to sidewalk shall be graded to ¼ inch per foot (min.) up to 1 ¼ inch per foot (max.), except where excessive natural grades make this requirement impractical. In such cases, the City may authorize a suitable grade.
4. Sidewalk widths shall be a minimum of five (5) feet unless otherwise specified. Where necessary, a 5' x 5' sidewalk is required at least every 200' as required by PROWAG for a passing zone unless otherwise provided by residential driveways, intersecting sidewalk, etc.
5. Approval of sidewalk construction plans must be obtained as part of the plan review process. Except in unusual circumstances, sidewalk must be located a minimum of (8) eight feet from the back of the curb or at the back of the right-of-way. A recorded public sidewalk easement is required for all sidewalk located outside public right-of-way; the width shall be equal to the distance from the right-of-way line to the back of the

sidewalk plus two feet or to the face of building, whichever is less. The sidewalk easement must be recorded with the Mecklenburg County Register of Deeds prior to issuance of a certificate of occupancy for the corresponding building(s).

6. Running slope of all ramps shall be up to 7.5% (8.33% maximum). Ramp length is not required to exceed 15' regardless of the resulting slope, which shall be uniform for the length of the ramp. Curb ramps are required where sidewalks intersect curbing at any street intersection and at Type III driveway connections.
7. For City projects only: On CLDS# 10.24A/B/C, 10.25(A/B/C/D only), and 10.27A/B, the curb and gutter across the front of the driveway shall be measured and paid for separately under Curb and Gutter (either 2'-0" valley gutter, vertical curb, or standard 2'-6" curb and gutter as specified on the details). The curb and gutter is to be measured per linear foot along the surface of the top of the curb. The concrete driveway apron is to be measured per square yard.
8. Refer to the WATCH Manual, MUTCD (latest edition), and the Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG) for construction zone pedestrian routes and signalization and controls for actuators. Curb ramps shall be designed and constructed in accordance with the American Disability Act.
9. Where pedestrian routes are contained within a street or right-of-way, the grade of pedestrian access routes shall not exceed the general grade established for the adjacent street or highway.

II. STORM DRAINAGE

A. GENERAL NOTES

1. ~~All work and~~ Unless otherwise specifically set forth herein, all materials, methods of construction and workmanship for the work covered in reference to stormwater infrastructure construction shall conform to the latest edition of the NCDOT Standard most recent Standards and Specifications ~~unless otherwise specified in this manual.~~ ALL of the North Carolina Department of Transportation (NCDOT).
2. Refer to NCDOT Pipe Material Selection Guide for allowable pipe fill heights and specifications. For fill heights less than 2' (measured from top of pipe to bottom of pavement structure) Class IV/Class V Reinforced Concrete Pipe (RCP) will be required. Designs outside of the selection guide will be approved at the discretion of Charlotte Storm Water Services.
3. All pipes must be sourced through an NCDOT approved producer/supplier and they must participate in the NCDOT QA/QC program for each respective pipe material.
4. Reinforced Concrete Pipe (RCP) may be used in all storm drainage applications. Culverts 60" in diameter or greater may be Corrugated Aluminized Metal Pipe (CAMP) or Corrugated Aluminum Alloy Pipe (CAAP). High Density Polyethylene (HDPE) Pipe may be substituted for pipe diameters of 48" or less but shall not be allowed in culvert applications or installations within an arterial street Right of Way maintained by the City of Charlotte.

5. Pipes shall have a minimum diameter of fifteen (15) inches (eighteen (18) inches minimum on cross drain culverts).
6. The maximum allowable pipe slope is 10 percent.
7. All pipes, regardless of material shall have all joints wrapped with a geotextile fabric (NCDOT Section 1056 – Type 2). Geotextile must extend 12” past each side of joint and edges of bands. Geotextile must be secured to the outside of pipe by methods indicated by engineer.
- 4.8. All concrete used for drainage structures shall have a minimum compressive strength of 3600 PSI at 28 days. This requirement shall be provided regardless of any lesser compressive strength specified in the North Carolina Department of Transportation Standard Specifications for Roads and Structures.
- ~~2. Prior approval shall be obtained to use pre-cast storm drainage structures in any street right-of-way by Charlotte Storm Water Services. shall be required for the construction of any endwall that is not a~~
- 3.9. ~~Construct non-~~NCDOT Roadway Standard Drawing ~~endwalls of reinforced concrete or as approved by Charlotte Storm Water Services.~~
4. ~~Pipe shall have a minimum diameter of fifteen (15) inches (eighteen (18) inches minimum on cross drain culverts).~~
5. ~~Reinforced concrete pipe may be used in all storm drain applications. High Density Polyethylene Pipe (HDPE) may be substituted for pipe diameters of 48 inches or less. Culverts 60 inches in diameter or greater may be Corrugated Aluminized Metal Pipe (CAMP) or Corrugated Aluminum Alloy Pipe (CAAP) with a minimum 14 gage metal.~~
6. ~~All pipe shall be laid with the bell or groove upgrade and the joint entirely interlocking.~~
7. ~~For all pipes, wrap geotextile (NCDOT Section 1056 – Type 2) around all pipe joints. Extend geotextile at least 12 inches beyond each side of the joint or band. Secure geotextile against the outside of the pipe by methods approved by the engineer.~~
8. ~~Meet minimum and maximum cover requirements of NCDOT Standard Drawing 300.01. Special applications for less than two (2) feet of cover will be reviewed and approved by Charlotte Storm Water Services. Storm pipe design that exceeds these criteria may be approved at the discretion of Charlotte Storm Water Services.~~
9. ~~All pipes in storm drain structures shall be flush with the inside wall.~~
- 10.1. ~~All storm drain structures over three (3) feet and six (6) inches in height must have steps in accordance with standard details set forth in this manual.~~
11. ~~The interior surfaces of all storm drainage structures shall be pointed up and smoothed to an acceptable standard using mortar mixed to manufacturer’s specifications.~~

~~12.1. Storm drainage piping shall be placed in a straight alignment at uniform grade. No changes in alignment shall be allowed except at catch basins, manholes, or other junctions that provide appropriate clean out access. The maximum length between access points is 300 linear feet.~~

~~a.1. A pipe collar meeting NCDOT standards or standard junction structure is required where pipes from two manufacturers or materials are tied together. Pipes should be on the same grade and alignment and have the same internal diameter where a pipe collar is specified.~~

~~13.1. All frames, grates, rings, covers, etc., must conform to the standards set forth in this manual. Supply covers with a minimum of two and a maximum of six 1" diameter vent holes.~~

~~14.10. All graded creek banks and cut/fill slopes shall be at a maximum of two (2) feet horizontal to one (1) foot vertical (2:1) and not to exceed 10' without terracing or the slopes shall be designed by a Professional Geotechnical Engineer and approved by Charlotte Storm Water Services on a case-by-case basis.~~

~~15. PIPE VIDEO STANDARDS: Installation of pipes/culverts consisting of the following approved materials (concrete, high density polyethylene—HDPE, and corrugated aluminum or aluminized) used for the purpose of conveying stormwater runoff in and out of public rights of way, that are eligible for maintenance by the City, is subject to the following:~~

~~a. All storm drainage system installation requires a Closed Circuit Television (CCTV) video as part of the inspection process after installation and prior to the approval process. Pipe larger than 48 inches may require manual entry and inspection (confined space regulations may be applicable). No acceptance of a street(s) or associated map phase(s) will be considered by the City until a CCTV video of the associated storm drainage system is provided to the applicable review agency and the agency has provided a written response noting acceptance. All CCTV video will be performed by a current National Association of Sewer Service Companies Pipeline assessment and Certification Program (NASSCO-PACP) certified contractor and in compliance with NASSCO-PACP standards. All videos, reports, and repair methods will meet the most recent published version of City Standards. The City expects storm drainage systems to be clean, have good alignment, tight joints, no broken or cracked pipes, and built per the approved plans prior to submittal of CCTV video documentation. Any systems that do not meet the above may be rejected by the City.~~

~~b. The storm drainage system owner (developer, builder, property owner, etc.) will provide at their cost the following prior to final inspection and City acceptance:~~

- ~~i. Plat, map or drawing identifying each pipe segment being presented for acceptance with all inlet nodes labeled and corresponding to the accompanying video such that it is clear as to the pipe/culvert being accepted. For example, start of video is at inlet CB1 to JB2 as shown on accompany drawing. (video map segments should match the approved drawings.)~~
- ~~ii. A CCTV video performed by a NASSCO-PACP certified contractor for each pipe/culvert segment being considered for acceptance.~~
- ~~iii. A digital copy of report for each pipe/culvert segment that certifies the condition of pipe as installed is in compliance with the most recent version of NASSCO-PACP methodology and standards. All defects are to be coded and reported per NASSCO-PACP certification guidelines to the City for review, after all repairs have~~

- been made. Any repair or treatment to defects (prior to submittal of video or as observed by the City agency) will be corrected in compliance with Industry Standard approved methods. *Example: by following the American Concrete Pipe Association acceptable methods and applicable material treatments associated with concrete pipe deficiency (broken concrete pipe will be repaired structurally by an approved method.)*
- iv. ~~Deficiencies found/observed by City staff may require an additional CCTV video to document they have been corrected appropriately and repair or treatment followed Industry Standard approved methods. Deficiencies must exceed the ACPA standards for acceptable pipe variations.~~
 - v. ~~The City reserves the right to randomly or at its discretion monitor, evaluate, and review videos and reports submitted by the owner or certified consultants as a quality assurance/quality control (QA/QC) practice. Any discrepancies between the report and the City review may constitute non-acceptance of the approval.~~
 - vi. ~~The name of the contractor who installed the drainage system, and their contact information.~~

~~B.C. BACKFILL~~

- 1. ~~Provide and install backfill per NCDOT standards. Layers shall not exceed six (6) inches loose and each layer shall be compacted thoroughly.~~
- 2. ~~1. All backfill shall be non-plastic in nature, free from roots, vegetative matter, waste, construction material or other objectionable material. Said material shall be capable of being compacted by mechanical means and the material shall have no tendency to flow or behave in a plastic manner under the tamping blows or proof rolling.~~
- 3. ~~1. Materials deemed by the Engineer as unsuitable for backfill purposes shall be removed and replaced with select backfill material.~~
- 4. ~~Backfilling of trenches shall be accomplished immediately after the pipe is laid. Do not operate heavy equipment over any pipe culvert until the pipe culvert has been properly backfilled, covered and compacted with at least three (3) feet of an approved material.~~
- 5. ~~Compaction requirements shall be attained using mechanical compaction methods. Each layer of backfill shall be placed loose and thoroughly compacted in place.~~
- 6. ~~Under no circumstances shall water be permitted to rise in un-backfilled trenches after the pipe has been placed.~~

C. REINFORCED CONCRETE PIPE (RCP) and Culverts

- 1. ~~Concrete pipe used within the street right-of-way shall be a minimum of Class III Reinforced Concrete Pipe. Installation of Class IV or higher concrete pipe shall be identified on the As-Built Plan and the City inspector shall be given documentation and notification of this information prior to construction. All concrete shall be at least 3600 psi.~~
- 2. ~~Joints shall consist of one of the following and should be specified by the Engineer for each respective project as applicable:~~

- ~~a. Preformed joint sealant, which conforms to ASTM C 990 Section 6.2 "Butyl Rubber Sealant" and NCDOT 1032-6.F. Joints utilizing preformed joint sealant shall be used in combination with Type 2 filtration geotextile wrap around all RCP pipe joints.~~
- ~~b. Rubber (elastomeric) gasket seals in accordance with ASTM C 443 which are in compliance with ASTM C 1619, Class C (unless otherwise required to exceed this specification, as specified by the engineer). Joints shall be produced with single offset spigot or with a confined O-ring groove. Rubber Gaskets may be pre-lubricated profile, profile rubber gaskets, or O-ring. Rubber gasket installation shall be per manufacturer's recommendations. Where rubber gaskets meeting this section are specified, no filtration geotextile wrap is required around the joints for RCP.~~
- ~~3. Fill lift holes with a manufactured soil tight lift hole plug or as approved by the manufacturer. Provide the manufacturers approved method for filling lift holes upon request by the City.~~
- ~~4. The maximum pipe slope for reinforced concrete pipe is 10 percent. Provide a special design by a structural engineer for reinforced concrete pipe slopes exceeding 10 percent.~~

~~D. CORRUGATED ALUMINIZED METAL PIPE (CAMP) AND CORRUGATED ALUMINUM ALLOY PIPE (CAAP)~~

- ~~1. Testing requirements:~~
 - ~~a. Perform physical pH and resistivity tests on the soil and water at two or more locations along the proposed culvert alignment. Perform additional tests at the request of the pipe manufacturer. Perform pH and resistivity tests on backfill material prior to installation.~~
 - ~~b. Submit manufacturer specifications showing that the physically collected soil and stream side pH and resistivity values are appropriate for the selected CAMP or CAAP.~~
 - ~~i. At a minimum, for CAMP and CAAP to be considered, soil and water samples should have a pH within the range of $5.0 < \text{pH} < 9.0$ and resistivity of $r > 1500 \text{ ohm-cm}$.~~
- ~~2. Hydraulic considerations:~~
 - ~~a. CAMP and CAAP can be used where velocities are less than 5 feet per second in the 2-year storm events.~~
 - ~~b. Where velocities are greater than 5 feet per second in the 2-year event, field pave a 4-inch thick reinforced concrete invert 2/5 of the height of the culvert or to 0.5 feet above the flow height of the 2-year storm event, whichever is more restrictive. This requirement applies to both buried and non-buried culvert inverts. Field paving should not be completed until the pipe is backfilled.~~
 - ~~i. Where bottomless CAMP and CAAP culverts are proposed, the walls of the culvert should be protected from abrasion by reinforced concrete up to either 2/5 the height of the culvert or to 0.5 feet above the flow height of the 2-year storm event, whichever is more restrictive.~~
- ~~3. Metal end sections, pipe tees, elbows and reducers are not allowed.~~

~~E. HIGH DENSITY POLYETHYLENE PIPE (HDPE)~~

- ~~1. The Product used shall be corrugated exterior/smooth interior pipe (Type S), conforming to the requirements of AASHTO Specification M294 (latest edition) for Corrugated Polyethylene Pipe.~~
- ~~2. Bell and spigot joints shall be required on all pipes inside the right of way. Bells shall cover at least two full corrugations on each section of pipe. The bell and spigot joint shall have an O-ring gasket meeting ASTM F477 with the gasket factory installed, placed on the spigot end of the pipe. Pipe joints shall meet all requirements of AASHTO M294.~~
- ~~3. All flexible pipe installations require third party inspection. All inspections shall be performed by a licensed, competent third party inspection firm and the inspections shall be directed or performed by a North Carolina Professional Engineer. Third party inspection shall be completed as described in the City of Charlotte Storm Water Services document *Third Party Testing for Flexible Pipe Installation* (Rev date 7/28/2022 or current version).~~
- ~~4. The minimum length of HDPE pipe permitted for use shall be four (4) feet. HDPE flared end sections are not allowed.~~

~~F.B. STANDARDS FOR DESIGN~~

- ~~1. All storm drainage design shall conform to the standards and specifications as provided in the Charlotte-Mecklenburg Storm Water Design Manual, North Carolina Department of Transportation Standards Specifications for Roads and Structures, Charlotte Land Development Standards Manual, or the more restrictive of any standards that conflict.~~
- ~~2. Adequate storm drainage shall be provided throughout the development by means of storm drainage pipes or properly graded channels. All pipes shall be of adequate size and capacity, as approved by Charlotte Storm Water Services, to carry all storm water in its drainage area.~~
- ~~3.1. In accordance with Charlotte Unified Development Ordinance Articles 24 and 25, Charlotte Storm Water Services shall review the drainage plan for compliance with the standards contained in the current edition of the Charlotte Land Development Standards Manual and, the Charlotte-Mecklenburg Storm Water Design Manual and all other relevant and appropriate standards established by the City.~~
- ~~2. All storm drainage design shall conform to the standards and specifications as provided in the Charlotte-Mecklenburg Storm Water Design Manual, North Carolina Department of Transportation Standards Specifications for Roads and Structures, and the Charlotte Land Development Standards Manual. In the event of conflicting standards, the more restrictive shall apply.~~
- ~~3. The NCDOT Roadway Standard Drawings have been accepted as approved standards for Land Development projects in the City of Charlotte and City of Charlotte ETJ. See standard #20.00A, B, and C of this manual for a table listing the~~

standards accepted. These standard drawings shall be referenced by NCDOT number or shown on all plans submitted to the City of Charlotte for approval.

4. Culverts must be long enough to accommodate the proposed roadway section with a 2:1 fill slope, or flatter, measured from shoulder point and/or back of grade bench to the toe of slope. Extend the pipe to allow the endwall to be placed at the toe of slope. See CLDSM 10.36A.
5. Endwalls or other end treatments are required on all culverts and at the outlet end of all closed pipe systems. Endwalls are required for pipes 36" and larger.
6. Construct endwalls perpendicular to the centerline of the pipe unless specific site conditions warrant construction of an endwall parallel to the roadway.
- 4.7. Sub-surface drainage shall be provided where the ground water level is likely to be near the surface. In capillary soils, the water level should be four (4) to six (6) feet below the surface to prevent the rise of moisture into the subgrade. Subdrains shall be used to lower ground water in low areas in the street.

The

C. PIPE INSTALLATION

1. All pipe materials referenced herein shall be installed pursuant to Section 300 of the current version of the NCDOT Standard Specifications for Roads and Structures, Pipe installation and 300.01 of the NCDOT Roadway Standard Drawings have been accepted as approved standards to be specified for Land Development projects for method of pipe installation.
2. Storm drainage pipe shall be placed in a straight alignment at uniform grade. All pipes shall be laid with the bell or groove upgrade and the joint entirely interlocking.
3. No changes in alignment shall be allowed except at catch basins, manholes, or other junctions that provide appropriate clean out access. The maximum length between access points is 300 linear feet.
4. Each run of pipe (structure to structure) shall be a single type, class, and material.
5. An NCDOT standard pipe collar or drainage structure is required where pipes from differing manufacturers or materials are joined. Pipes should be on the same grade and alignment and have the same internal diameter where a pipe collar is specified.
6. the Lift holes, if present on Reinforced Concrete Pipe are to be repaired per 300-6 (A) of the NCDOT Standard Specifications for Roads and Structures. Alternate repair methods must be submitted to Storm Water for approval prior to construction. Repair must meet or exceed acceptable leakage rates for the pipe joints.

7. All installations of storm drainage infrastructure associated with the subdivision ordinance, unified development ordinance and/or any system conveying runoff into or from a public right of way will require a Closed-Circuit Television (CCTV) inspection and/or Confined Space Entry (CSE) to verify infrastructure was installed correctly and is free of defects and excessive deflection. This inspection should occur after backfilling is completed to final grade but prior to completion of paving operations. See City of Charlotte *Post Installation Inspection of Storm Drainage Pipes and Culverts* for additional information.
8. All flexible pipe, reinforced concrete box culverts, and arch culvert installations require third-party inspection. All inspections shall be performed by a licensed, competent third-party inspection firm and the inspections shall be directed or performed by a North Carolina Professional Engineer. ~~and Inspections shall be completed as described in the most recent version of the~~ City of Charlotte Storm Water Services document *Third-Party Inspection for Pipe Installation*.

D. BACKFILL

1. Backfilling of pipe trenches and excavations for drainage structures shall be in accordance with NCDOT standards. Layers shall not exceed six (6) inches loose and each layer shall be compacted thoroughly to the required density of 95% standard proctor density.
2. All backfill shall be non-plastic in nature, free from roots, vegetative matter, waste, construction material or other objectionable material. Said material shall be capable of being compacted by mechanical means to the required density and the material shall have no tendency to flow or behave in a plastic manner under the tamping blows or proof rolling.
3. Materials deemed by the Engineer as unsuitable for backfill purposes shall be removed and replaced with select backfill material.
4. Backfilling of trenches shall be accomplished immediately after the pipe is laid. Do not operate heavy equipment over any pipe or culvert until the pipe or culvert has been properly backfilled and covered with at least three (3) feet of an approved material.
5. Under no circumstances shall water be permitted to rise in un-backfilled trenches after the pipe has been placed.

E. STANDARD PIPE MATERIAL REQUIREMENTS

1. Reinforced Concrete Pipe – RCP
 - a. Pipe shall have 8-foot standard joint lengths. All joints shall be tongue and groove type, with a preformed joint sealant conforming to ASTM C-990. Pipe shall be manufactured in accordance with AASHTO M-170 and/or ASTM C-76. Class of pipe and wall thickness shall be in accordance with the most recent version of the NCDOT Pipe Material Selection Guide.

- i. Installation of Class IV or higher concrete pipe shall be identified on the design plans. The City inspector shall be given documentation and notification of this information prior to construction. Registered professional shall note on As-Builts that the appropriate class/type of pipe was installed.

F. ALTERNATIVE PIPE MATERIALS AND DESIGN SPECIFICATIONS

1. Performance Pipe Joints - Where reinforced concrete pipes (RCP) and/or culverts are subject to operating under pressure during the design storm event, as defined within the Charlotte Mecklenburg Storm Water Design Manual, an upgraded performance joint design will be required.
 - a. Leak Resistant Joint – Limited leakage is acceptable.
 - i. All joints shall be bell and spigot type, with a rubber gasket conforming to ASTM C-443. Pipe shall be manufactured in accordance with AASHTO M-170 and/or ASTM C-76. Class of pipe and wall thickness shall be in accordance with the current version of the NCDOT Pipe Material Selection Guide.
 - b. Special Design Joint – Limited leakage is not acceptable.
 - i. Manufacture provided design will be required.
2. Corrugated Aluminized Steel Pipe and Corrugated Aluminum Alloy Pipe
 - a. Aluminum coated (Type 2) steel pipe shall comply with AASHTO M-274 for the coating and AASHTO M-36 for the pipe fabrication. Aluminum alloy pipe shall comply with AASHTO M-196 for material and fabrication.
 - b. Where velocities within the pipe exceed 5 ft/sec for the 2-year storm, field pave a 4-inch-thick reinforced concrete invert, pursuant to AASHTO M-190. 2/5 of the height of the culvert of .5' above the flow height of the 2-year event, whichever is more restrictive. Allowable velocities for the design storm event shall not exceed 10 feet/sec. Invert shall not be constructed until pipe backfill is completed.
 - c. Prior to installation, pH, and resistivity testing of the proposed backfill material is required at two or more locations along the proposed pipe alignment.
 - d. At a minimum, for CAMP and CAAP to be considered, soil and stream-side pH and resistivity values must be within a range of $5.0 < \text{pH} < 9.0$ and resistivity of $r > 1500 \text{ ohm-cm}$.
 - e. Submit manufactures specifications showing that the selected CAMP or CAAP is suitable based on the results of the physical testing of pH and resistivity.
 - f. Minimum wall thickness is 10 gage.
 - g. Each pipe section shall be joined to the next by a coupling band with a minimum of one corrugation overlap at each edge. The coupling bands shall have a minimum of two annular corrugations and fully engage, over the entire pipe periphery, one corrugation on each pipe. Bands shall be fabricated from the same material as the pipe. The minimum band gauges for aluminum pipe and aluminized pipe shall be as specified in AASHTO M-196 and AASHTO M-274, respectively.

- h. Gaskets, providing a leak resistant joint are required, and shall be either sleeve type or O-ring type and shall meet the requirements for gaskets as specified in AASHTO M-36, Section 9.3
- i. Where Aluminum or Aluminized metal pipe is in direct contact with concrete a barrier coating must be applied. See NCDOT Thermal Spray Coatings Program for acceptable treatments.

3. Corrugated Aluminized Steel and Corrugated Aluminum Alloy Arches and/or Plate.

- j. Corrugated aluminum alloy structural plate pipe, pipe arches and arches shall consist of aluminum plates and galvanized bolts and nuts of the size, shape and thickness as shown on the approved plans. These structures shall conform to the requirements of AASHTO M-219.
- k. Where velocities within the pipe/arch exceed 5 ft/sec for the 2-year storm, the walls of the culvert should be protected from abrasion by applying a 4-inch-thick reinforced concrete barrier. 2/5 of the height of the culvert of .5' above the flow height of the 2-year event, whichever is more restrictive. Allowable velocities for the design storm event shall not exceed 10 feet/sec. Barrier shall not be constructed until pipe backfill is completed.
- l. Prior to installation, pH, and resistivity testing of the proposed backfill material is required at two or more locations along the proposed pipe alignment.
 - i. At a minimum, for CAMP and CAAP to be considered, soil and stream-side pH and resistivity values must be within a range of $5.0 < \text{pH} < 9.0$ and resistivity of $r > 1500 \text{ ohm-cm}$.
 - ii. Submit manufactures specifications showing that the selected CAMP or CAAP is suitable based on the results of the physical testing of pH and resistivity.
- m. Minimum wall thickness is 10 gage.
- n. Gaskets, providing a leak resistant joint are required, and shall be either sleeve type or O-ring type and shall meet the requirements for gaskets as specified in AASHTO M-36, Section 9.3.
- o. Where Aluminum or Aluminized metal pipe is in direct contact with concrete a barrier coating must be applied. See NCDOT Thermal Spray Coatings Program for acceptable treatments.

4. High Density Polyethylene Pipe - HDPE

- a. This type of pipe shall comply with AASHTO M-294, Type S for pipe manufacturing.
- b. The bell and spigot joint shall have an O-ring gasket meeting ASTM F477 with the gasket factory installed, placed on the spigot end of the pipe. Pipe joints shall meet all requirements of AASHTO M294.
- c. The minimum length of HDPE pipe permitted for use shall be four (4) feet

5. Reinforced Concrete Box Culverts (RCBC)

- a. All RCBC must have direct access points into the culvert. Catch Basins, Manholes or Junctions that connect to the culvert via small diameter pipes will not be considered acceptable access points.

b. ALL RCBC must be designed with leak resistant joints.

6. Bottomless/Arch Culverts

- a. If shallow, non-erosive bedrock is found three feet or less below the streambed, proposal of a bottomless(three-sided) culvert may be considered.
 - i. A geotechnical report signed and sealed by a North Carolina Professional Engineer stating that the entire length of the culvert will be bedded on non-erosive bedrock is required.
 - ii. Reinforced concrete footings designed by a North Carolina Professional Engineer tied to the bedrock are required.

G. DRAINAGE STRUCTURES

- 1. All structures and associated frames, grates and lids must comply with current NCDOT standard details and specifications.
- 2. All storm drain structures over three (3) feet and six (6) inches in height must have steps which comply with NCDOT 840.66.
- 3. The interior surfaces of all storm drainage structures shall be pointed up and smoothed to an acceptable standard using mortar mixed to manufacturer's specifications. All pipes shall be cut flush within the interior structure wall.
- 4. All frames, grates, rings, covers, etc., must conform to the standards set forth in this manual. Supply covers with a minimum of two and a maximum of six 1" diameter vent holes.
- ~~5.1.ETJ. See standard #20.00A, B, and C of this manual for a table listing the standards accepted. These standard drawings shall be referenced by NCDOT number or shown on all plans submitted to the City of Charlotte for approval.~~
- 5. No Blind/Inaccessible structures will be allowed.
- 6. Waffle and knockout boxes are prohibited on storm drainage systems within and/or conveying runoff from the public r/w. Boxes with pre-cast openings shall be used.
- 7. Joints/Sections of pre-cast structures shall use flexible sealants meeting ASTM C990 or rubber gaskets meeting ASTM C443. Sealant type should meet or exceed allowable leakage rates for pipe joints.
- 8. Drainage structures accepting flexible pipes must provide a resilient connection conforming to ASTM C923 and ASTM C1478.
- 9. Where Aluminum or Aluminized metal pipe is in direct contact with concrete a barrier coating must be applied. See NCDOT Thermal Spray Coatings Program for acceptable treatments.

H. END TREATMENTS:

1. Endwalls are to be NCDOT standard precast concrete, brick masonry with reinforced concrete footings, or cast-in place, reinforced concrete with reinforced concrete footings.
2. No metal or HDPE end treatments are allowed.
3. Where Aluminum or Aluminized metal pipe is in direct contact with concrete a barrier coating must be applied. See NCDOT Thermal Spray Coatings Program for acceptable treatments.

I. NON-STANDARD STRUCTURES

1. Any non-standards structures must have prior approval by Charlotte Storm Water Services and will require a sealed design by a North Carolina Professional Engineer.

H.III. PLAN REQUIREMENTS

A. GENERAL NOTES

1. All erosion control measures shall conform to the standards set forth in the Charlotte Land Development Standards Manual, State of North Carolina Erosion and Sediment Control Planning and Design Manual, or the more restrictive of any standards that conflict.
2. All storm drainage design shall conform to the standards and specifications as provided in the Charlotte-Mecklenburg Storm Water Design Manual, Charlotte Land Development Standards Manual, or the more restrictive of any standards that conflict.
3. The following note shall be placed on all site plans, grading plans, and plats.

a. The purpose of the Storm Drainage Easement (SDE) is to provide storm water conveyance. Buildings are not permitted in the easement area. Any other objects which impede storm water conveyance or system maintenance are also prohibited.

4. Cite all appropriate standard detail numbers for any structures or specifics used within the plans in reference to the most current copy of the Charlotte Land Development Standards Manual.

~~3.5.~~In areas where the Floodway Regulations are applicable, the Future Conditions Flood Fringe Line, FEMA Flood Fringe Line, Community Encroachment Line, and FEMA Encroachment Line shall be shown on the preliminary plan and the final plat. An application for a ~~Floodlands~~Floodplain Development Permit shall be submitted to Mecklenburg County ~~Engineering~~Land Use and Environmental Services (LUESA) in accordance with the requirements set forth in the City/County ~~Floodway~~Floodplain Regulations.

B. EASEMENTS

1. Storm Drainage Easements (SDE) shall be provided for all storm drainage pipes and channels that are installed and/or modified by a developer (builder, property owner, etc.) and convey runoff into or from a public right of way. See CLDSM 20.30 for additional information.

2. Overlapping of storm drainage easements shall be approved at the discretion of Charlotte Storm Water Services.

3. Storm Drainage Easements shall include all end treatments and energy dissipators, lengthen or widen as needed.

~~4.1.Cite all appropriate standard detail numbers for any structures or specifics used within the plans in reference to the most current copy of the Charlotte Land Development Standards Manual.~~

B.C. SUBDIVISIONS -PRELIMINARY PLAN

1. The preliminary plan must include, at a minimum, the information described in Sections 30.4 and 30.6 of the City of Charlotte Unified Development Ordinance.

- ~~2. Storm Drainage Easements shall be provided for all storm drainage pipe and shown on site plans, construction plans and plats with widths specified below. The following note shall be placed on all grading plans and plats; "The purpose of the storm drainage easement (SDE) is to provide storm water conveyance. Buildings are not permitted in the easement area. Any other objects which impede storm water flow or system maintenance are also prohibited."~~

PIPES

<u>Diameter</u>	<u>Width</u>
15" 24"	15'
30" 36"	20'
42" 48"	25'
54" +	30'

CHANNELS

<u>Drainage Area</u>	<u>Channel</u>
<u>(Ac)</u>	<u>Easement Width (feet)</u>
1 45	20'
45 120	30'
120 500	40'
500 +	see std. 20.30

- ~~3.1. Overlapping of storm drainage easements shall be approved at the discretion of Charlotte Storm Water Services.~~

C.D. BOND POLICY – SUBDIVISION IMPROVEMENTS

1. Release of the final subdivision plat will not occur until the improvements required for the area of the final plat are constructed and a final inspection has been performed and found to be in conformance with the plans approved by the Charlotte-Mecklenburg Planning Commission., or a security has been posted with the Land Development Bond Coordinator of the applicable department and all required documents are received in their entirety.
2. The security shall be posted and remain in force until the construction is complete and found to be in conformance with the plans approved by the Charlotte-Mecklenburg Planning Commission. The security will be reevaluated after one year from the date of posting.

3. The Applicant shall notify the City that construction is complete according to the appropriate subdivision ordinance and the Charlotte Land Development Standards Manual before any security will be released. A final inspection will be made to check completeness of the project upon notification.
4. One type of security may be replaced by another type of security in certain situations. The amount of the replacement security will be based on the City's estimate of the work remaining. If the estimate of work results in a lower amount, the replacement security will be treated as a reduction. Certain situations will require an increase in a security and in such cases the replacement security shall be required to equal the higher amount.
5. A one-time reduction in security will be allowed if requested in writing by the principal party of the security. However, the security shall never be less than \$10,000 for the City of Charlotte unless approved by the City.

A.IV. REFERENCES

1. North Carolina Department of Transportation, Standard Specifications for Roads and Structures, latest edition.
2. North Carolina Department of Transportation, Roadway Standards Drawings, latest edition.
3. City of Charlotte Department of Transportation, Work Area Traffic Control Handbook (WATCH), latest edition.
4. City of Charlotte ~~Storm Water Services~~ and Mecklenburg County Storm Water Services, Charlotte-Mecklenburg Storm Water Design Manual, latest edition.
5. American Association of State Highway and Transportation Officials most recent edition, A Policy on Geometric Design of Highways and Streets.
6. North Carolina Department of Transportation, Roadway Design Manual, latest edition.
7. ~~North Carolina Department~~ NCDEQ -Division of ~~Environment~~ Energy, Mineral, and ~~Natural Land~~ Resources, Erosion and Sediment Control Planning and Design Manual, latest edition.
8. ~~NCDENR~~ NCDEQ, Storm Water Best Management Practices, latest edition.
9. Charlotte-Mecklenburg BMPSCM Design Manual, latest edition.
10. City of Charlotte, CDOT Pavement Marking Standards, latest edition.
11. The City of Charlotte Urban Street Design Guidelines, adopted by City Council October 22, 2007.
12. Federal Highway Administration, Manual on Uniform Traffic Control Devices (MUTCD), latest edition.
13. United States Access Board, Proposed Guidelines for Pedestrian Facilities in the Public Right-of-Way (PROWAG), latest edition.
14. City of Charlotte, Charlotte Streets Manual
15. City of Charlotte, Post Installation Inspection of Storm Drainage Pipes and Culverts, latest edition.
16. Charlotte Storm Water Services, Third-Party Inspection for Pipe Installations, latest edition.

NOTES:

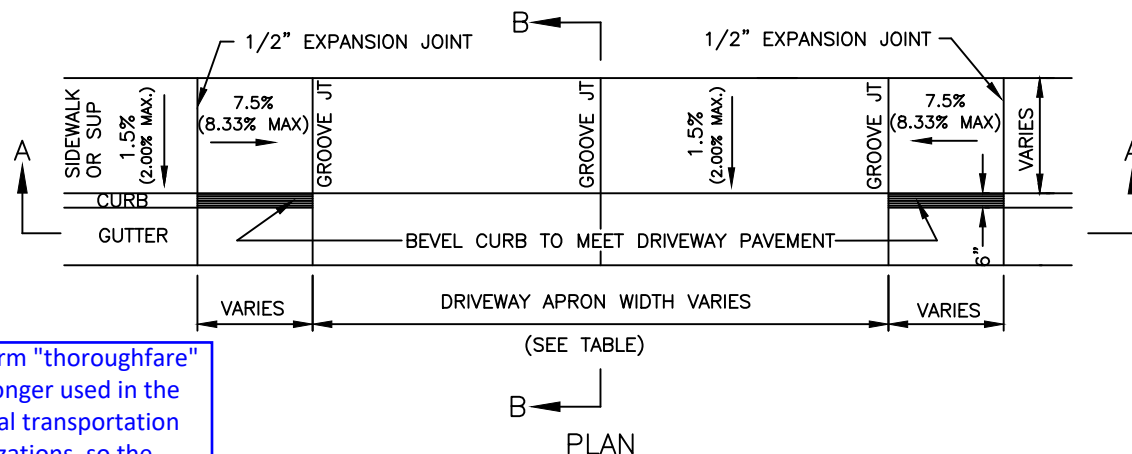
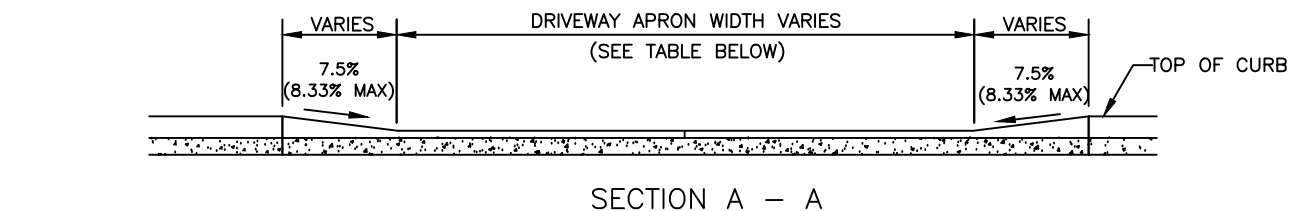
- 1/2" EXPANSION JOINTS REQUIRE INSTALLATION OF ONE 1/2" THICK PIECE OF BITUMINOUS FIBER THROUGH THE ENTIRE SLAB. JOINT MATERIAL SHOULD BE PLACED FLUSH WITH CONCRETE.
- TO LIMIT STORM WATER FLOW DOWN DRIVEWAYS, USE STANDARD 10.24C FOR DRIVEWAYS NEAR LOW POINTS.
- ALL DRIVEWAYS MUST MEET THE CURRENT CITY DRIVEWAY REGULATIONS AND NCDOT REQUIREMENTS FOR SPACING, SIGHT DISTANCE AND OFFSETS FROM PROPERTY LINES AND INTERSECTIONS.
- "A" BREAKOVER SHALL BE 8% OR LESS (A = ALGEBRAIC DIFFERENCE).
- PRIOR APPROVAL IS REQUIRED BY CDOT ON GRADES EXCEEDING WHAT ARE SHOWN.
- ** PER NC IFC SECTION D103.2, FIRE APPARATUS ACCESS ROADS SHALL NOT EXCEED 10 PERCENT IN GRADE.
- REFER TO CHAPTER 32 OF THE UDO FOR MODIFICATIONS RELATED TO TREE PRESERVATION OR CONSTRAINED SPACES.

GENERAL NOTES:

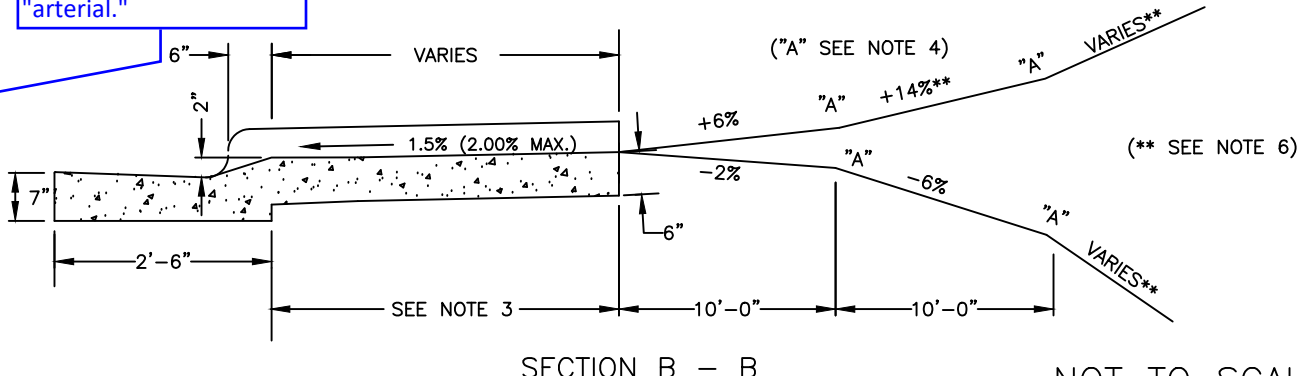
- ALL CONCRETE TO BE 3600 P.S.I. COMPRESSIVE STRENGTH.
- ALL CURB, CURB AND GUTTER AND SIDEWALKS ARE TO BE REMOVED TO THE NEAREST JOINT BEYOND NEW CONSTRUCTION OR CUT WITH A SAW AND REMOVED.
- SAW CUT OR JOINT TO BE PERPENDICULAR TO EDGE OF EXISTING PAVEMENT.
- SEE STD. NO 10.17B FOR DETAIL OF EXPANSION JOINT AND GROOVE JOINT.

DRIVEWAY APRON WIDTH		
TYPE DRIVEWAY	MINIMUM	MAXIMUM
TYPE I-RESIDENTIAL:		
LOCAL/collector	10'	24'
ARTERIAL *	15'	24'
ONE-WAY TYPE II COMMERCIAL	20'	30'
TWO-WAY TYPE II COMMERCIAL	26'	50'

* MUST PROVIDE ON-SITE TURNAROUND



The term "thoroughfare" is no longer used in the regional transportation organizations, so the UDO was written to align with their use of "arterial."



NOT TO SCALE



CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
INCLUDES CHARLOTTE ETJ

COMMERCIAL TYPE II AND RESIDENTIAL TYPE I
DROP CURB DRIVEWAY WITH SIDEWALK ABUTTING
CURB (2'-6" CURB AND GUTTER)

STD. NO.	REV.
10.24A	24

NOTE:

- 1/2" EXPANSION JOINTS REQUIRE INSTALLATION OF ONE 1/2" THICK PIECE OF BITUMINOUS FIBER THROUGH THE ENTIRE SLAB. JOINT MATERIAL SHOULD BE PLACED FLUSH WITH CONCRETE.
- TO LIMIT STORM WATER FLOW DOWN DRIVEWAYS, USE STANDARD 10.24C FOR DRIVEWAYS NEAR LOW POINTS.
- ALL DRIVEWAYS MUST MEET THE CURRENT CITY DRIVEWAY REGULATIONS AND NCDOT REQUIREMENTS FOR SPACING, SIGHT DISTANCE AND OFFSETS FROM PROPERTY LINES AND INTERSECTIONS.
- "A" BREAKOVER SHALL BE 8% OR LESS
(A = ALGEBRAIC DIFFERENCE).
- PRIOR APPROVAL IS REQUIRED BY CDOT ON GRADES EXCEEDING WHAT ARE SHOWN.
- ** PER NC IFC SECTION D103.2, FIRE APPARATUS ACCESS ROADS SHALL NOT EXCEED 10 PERCENT IN GRADE.
- REFER TO CHAPTER 32 OF THE UDO FOR MODIFICATIONS RELATED TO TREE PRESERVATION OR CONSTRAINED SPACES.

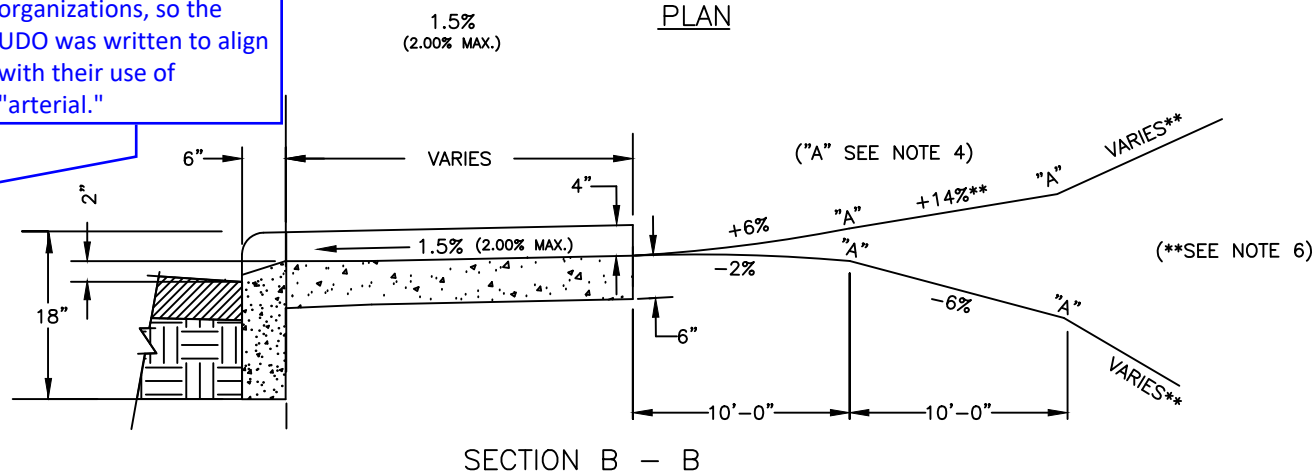
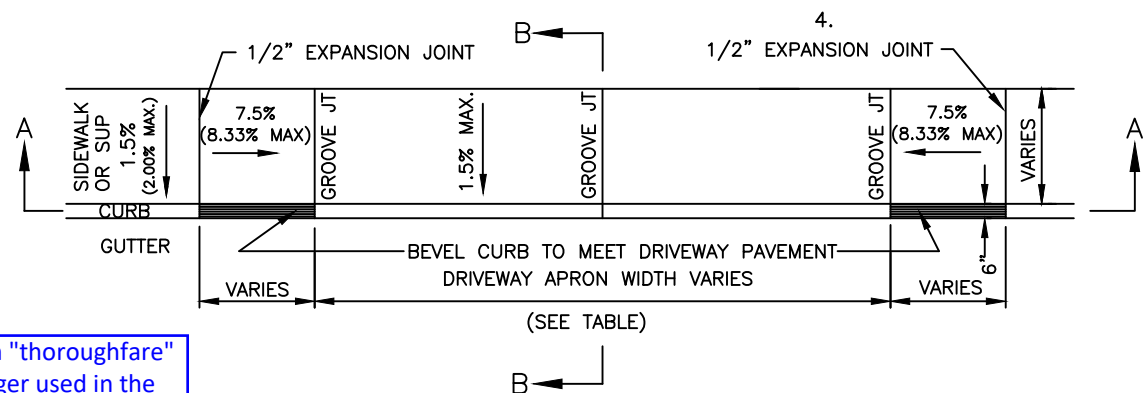
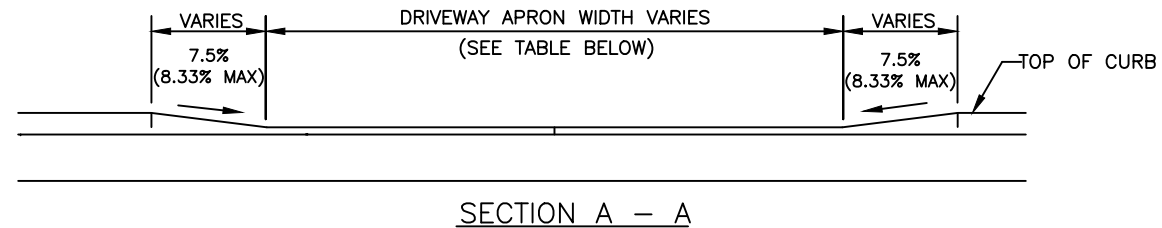
GENERAL NOTES:

- ALL CONCRETE TO BE 3600 P.S.I. COMPRESSIVE STRENGTH.
- ALL CURB, CURB AND GUTTER AND SIDEWALKS ARE TO BE REMOVED TO THE NEAREST JOINT BEYOND NEW CONSTRUCTION OR CUT WITH A SAW AND REMOVED.
- SAW CUT OR JOINT TO BE PERPENDICULAR TO EDGE OF EXISTING PAVEMENT.
- SEE STD. NO 10.17B FOR DETAIL OF EXPANSION JOINT AND GROOVE JOINT.

The term "thoroughfare" is no longer used in the regional transportation organizations, so the UDO was written to align with their use of "arterial."

DRIVEWAY APRON WIDTH		
TYPE DRIVEWAY	MINIMUM	MAXIMUM
TYPE I-RESIDENTIAL		
LOCAL / COLLECTOR	10'	24'
ARTERIAL *	15'	24'
ONE-WAY TYPE II		
COMMERCIAL	20'	30'
TWO-WAY TYPE II		
COMMERCIAL	26'	50'

* MUST PROVIDE ON-SITE TURNAROUND



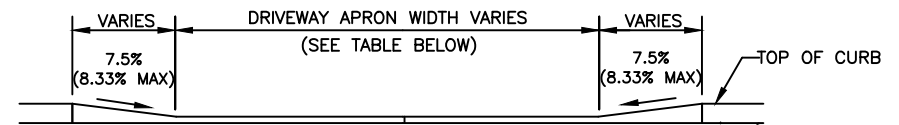
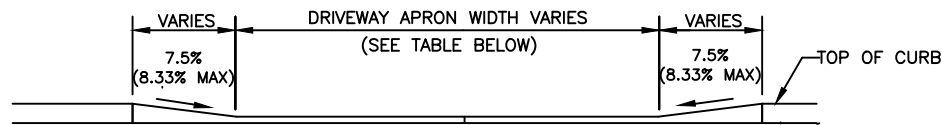
NOT TO SCALE



CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
INCLUDES CHARLOTTE ETJ

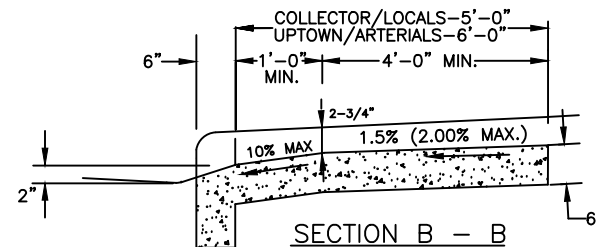
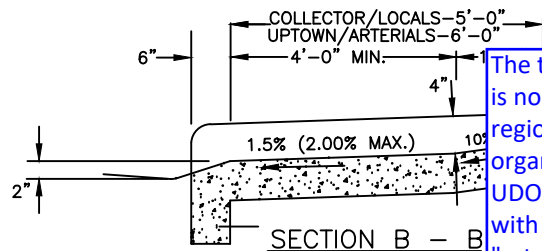
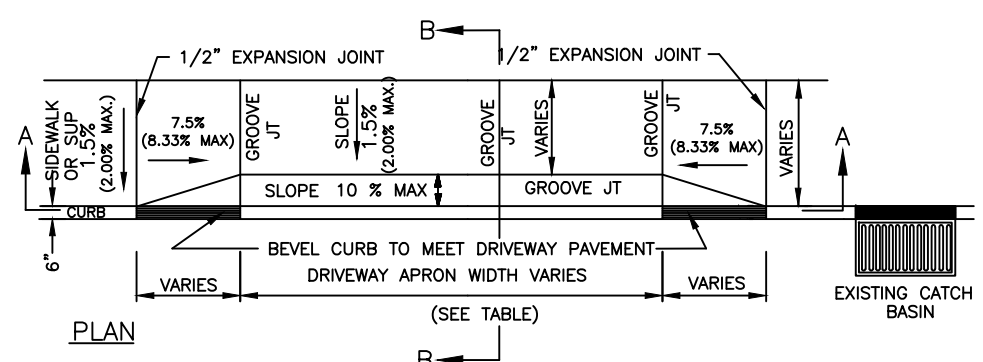
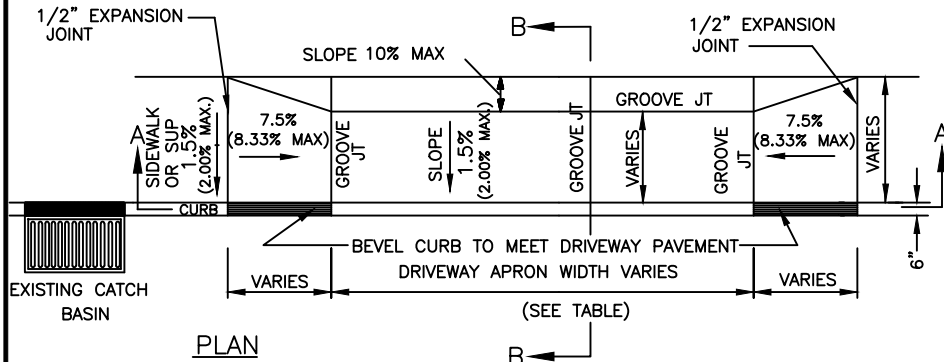
COMMERCIAL TYPE II AND RESIDENTIAL TYPE I DROP CURB
DRIVEWAY WITH SIDEWALK ABUTTING CURB
(6" X 18" VERTICAL CURB)

STD. NO.	REV.
10.24B	24



SECTION A - A

SECTION A - A



The term "thoroughfare" is no longer used in the regional transportation organizations, so the UDO was written to align with their use of "arterial."

DRIVEWAY APRON WIDTH

TYPE DRIVEWAY	MINIMUM	MAXIMUM
TYPE I-RESIDENTIAL:		
LOCAL/collector	10'	24'
ARTERIAL *	15'	24'
ONE-WAY TYPE II COMMERCIAL	20'	30'
TWO-WAY TYPE II COMMERCIAL	26'	50'

* MUST PROVIDE ON-SITE TURNAROUND

NOTES

1. USED AT LOW POINTS IN ROADWAYS WITH 2'-6" CURB AND GUTTER OR 6" X 18" CURB AS DIRECTED BY THE CITY.
2. SEE STANDARDS 10.24A & 10.24B FOR ADDITIONAL DETAILS.
3. ALL DRIVEWAYS MUST MEET THE CURRENT CITY DRIVEWAY REGULATIONS AND NCDOT REQUIREMENTS FOR SPACING, SIGHT DISTANCE AND OFFSETS FROM PROPERTY LINES AND INTERSECTIONS.
4. JOINT MATERIAL SHOULD BE PLACED FLUSH WITH CONCRETE.

NOT TO SCALE



CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
INCLUDES CHARLOTTE ETJ

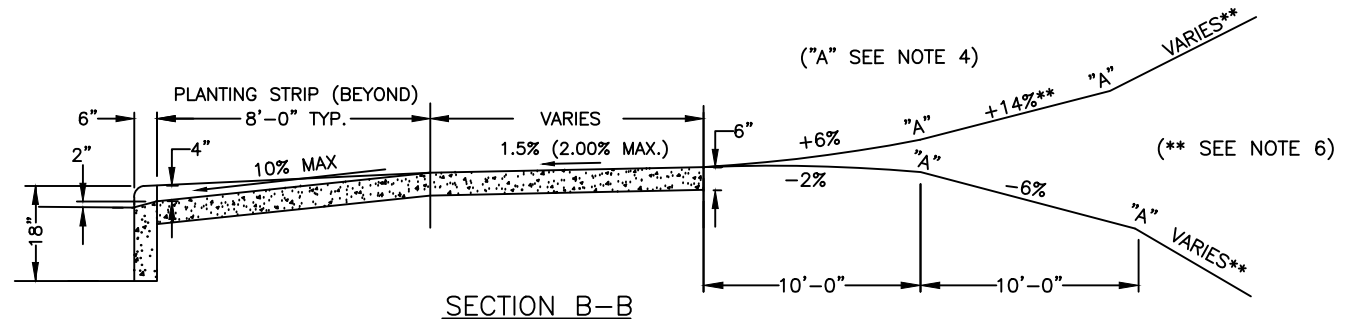
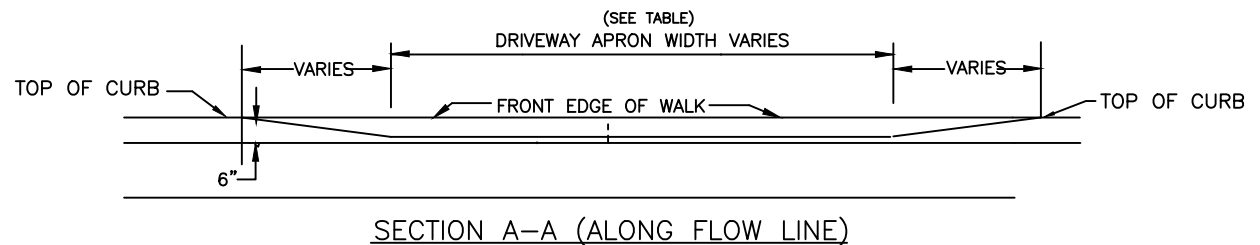
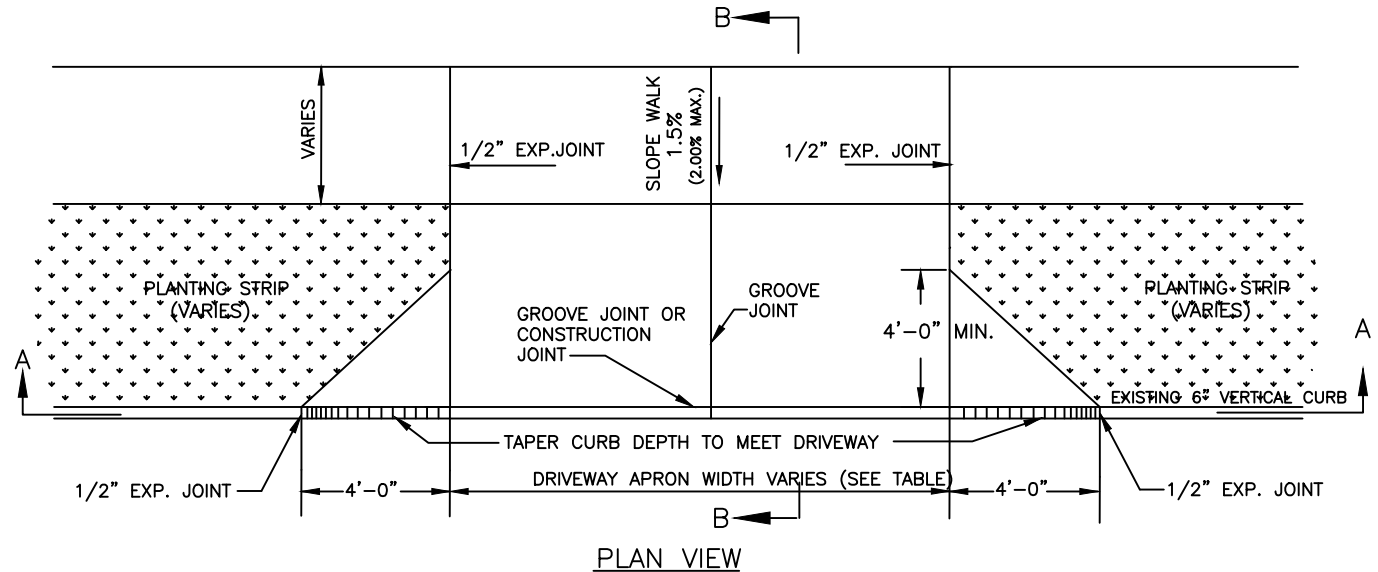
COMMERCIAL TYPE II AND RESIDENTIAL TYPE I DROP CURB
DRIVEWAY WITH SIDEWALK ABUTTING CURB
6" X 18" (VERTICAL CURB)

STD. NO.	REV.
10.24C	24

NOTES:

1. ALL CONCRETE TO BE 3600 P.S.I.
2. ALL CURB OR CURB AND GUTTER AND SIDEWALK ARE TO BE REMOVED TO THE NEAREST JOINT BEYOND NEW CONSTRUCTION OR CUT WITH A SAW AND REMOVED. SAW CUT OR JOINT TO BE PERPENDICULAR TO EDGE OF EXISTING PAVEMENT. SEE STD. NO. 10.17 FOR JOINT DETAIL.
3. ALL DRIVEWAYS MUST MEET THE CURRENT CITY DRIVEWAY REGULATIONS AND NCDOT REQUIREMENTS FOR SPACING, SIGHT DISTANCE, AND OFFSETS FROM PROPERTY LINES AND INTERSECTIONS.
4. "A" BREAKOVER SHALL BE 8% OR LESS.
5. PRIOR APPROVAL IS REQUIRED BY CDOT ON GRADES EXCEEDING WHAT ARE SHOWN.
6. ** PER NC IFC SECTION D103.2, FIRE APPARATUS ACCESS ROADS SHALL NOT EXCEED 10 PERCENT IN GRADE.
7. JOINT MATERIAL SHOULD BE PLACED FLUSH WITH CONCRETE.

The term "thoroughfare" is no longer used in the regional transportation organizations, so the UDO was written to align with their use of "arterial."



NOT TO SCALE

DRIVEWAY APRON WIDTH		
DRIVEWAY TYPE	MINIMUM	MAXIMUM
LOCAL/COLLECTOR	10'	24'
ARTERIAL *	15'	24'

* MUST PROVIDE ON-SITE TURNAROUND



CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
INCLUDES CHARLOTTE ETJ

RESIDENTIAL DROP CURB TYPE I DRIVEWAY WITH
PLANTING STRIP (6" X 18" VERTICAL CURB)

STD. NO.	REV.
10.25C	24

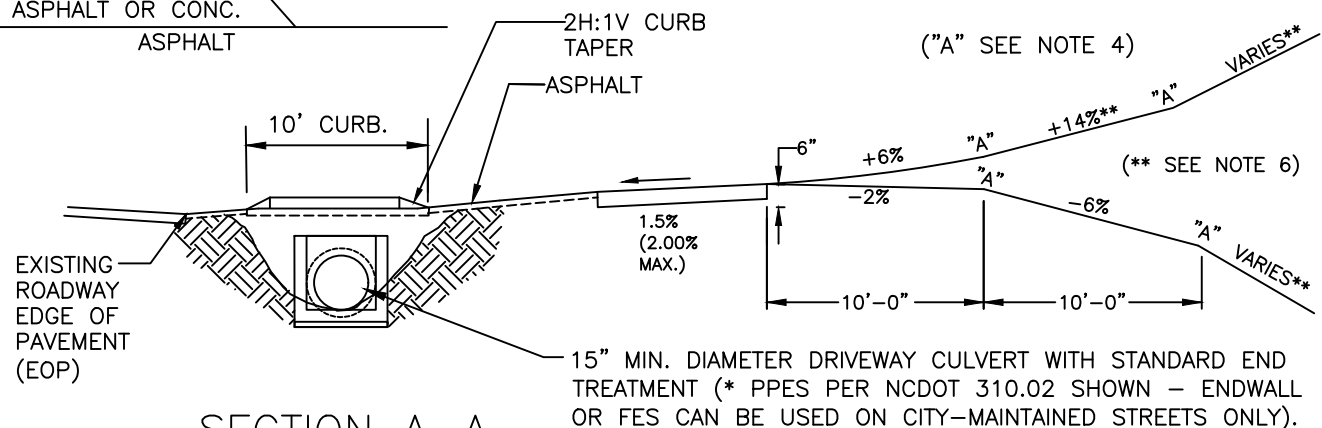


1. TO BE USED ON ROADS WITHOUT CURB AND GUTTER AND WHERE CURB AND GUTTER IS NOT BEING INSTALLED. (MUST MEET BOTH CRITERIA)
2. ALL CONCRETE TO BE 3600 P.S.I. COMPRESSIVE STRENGTH.
3. THIS STANDARD IS TYPICALLY FOR COMMERCIAL APPLICATION – IT IS AN OPTION FOR RESIDENTIAL DRIVEWAY CONSTRUCTION.
4. "A" BREAKOVER SHALL BE 8% OR LESS.
5. ALL CONCRETE TO BE 3600 P.S.I.
6. ** PER NC IFC SECTION D103.2, FIRE APPARATUS ACCESS ROADS SHALL NOT EXCEED 10 PERCENT IN GRADE.
7. ALL DRIVEWAYS MUST MEET THE CURRENT CITY DRIVEWAY REGULATIONS AND NCDOT REQUIREMENTS FOR SPACING, SIGHT DISTANCE, AND OFFSETS FROM PROPERTY LINES AND INTERSECTIONS.
8. PRIOR APPROVAL IS REQUIRED BY CDOT ON GRADES EXCEEDING WHAT ARE SHOWN.
9. JOINT MATERIAL SHOULD BE PLACED FLUSH WITH CONCRETE.

The term "thoroughfare" is no longer used in the regional transportation organizations, so the UDO was written to align with their use of "arterial."

DRIVEWAY APRON WIDTH		
DRIVEWAY TYPE	MINIMUM	MAXIMUM
RESIDENTIAL:		
LOCAL /COLLECTOR	10'	24'
ARTERIAL *	15'	24'
ONE-WAY COMMERCIAL	20'	30'
TWO-WAY COMMERCIAL	26'	50'

* MUST PROVIDE ON-SITE TURNAROUND



SECTION A-A

NCDOT TO APPROVE FOR USE ON NCDOT SYSTEM ROAD

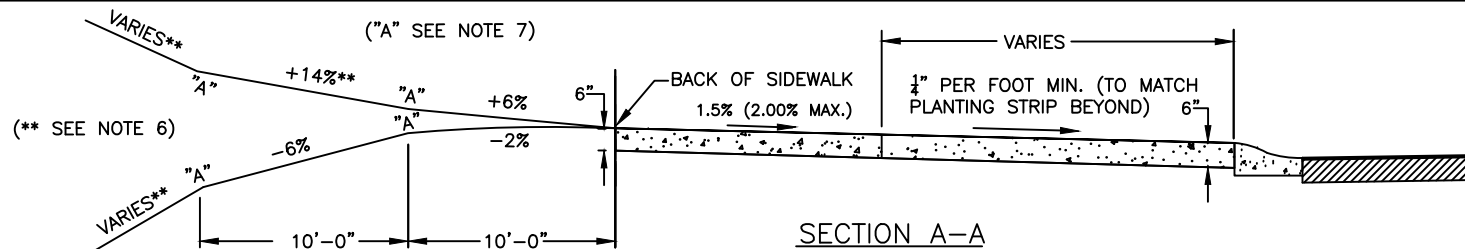


CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
INCLUDES CHARLOTTE ETJ

TYPE IV DRIVEWAY

NOT TO SCALE

STD. NO.	REV.
10.25F	24



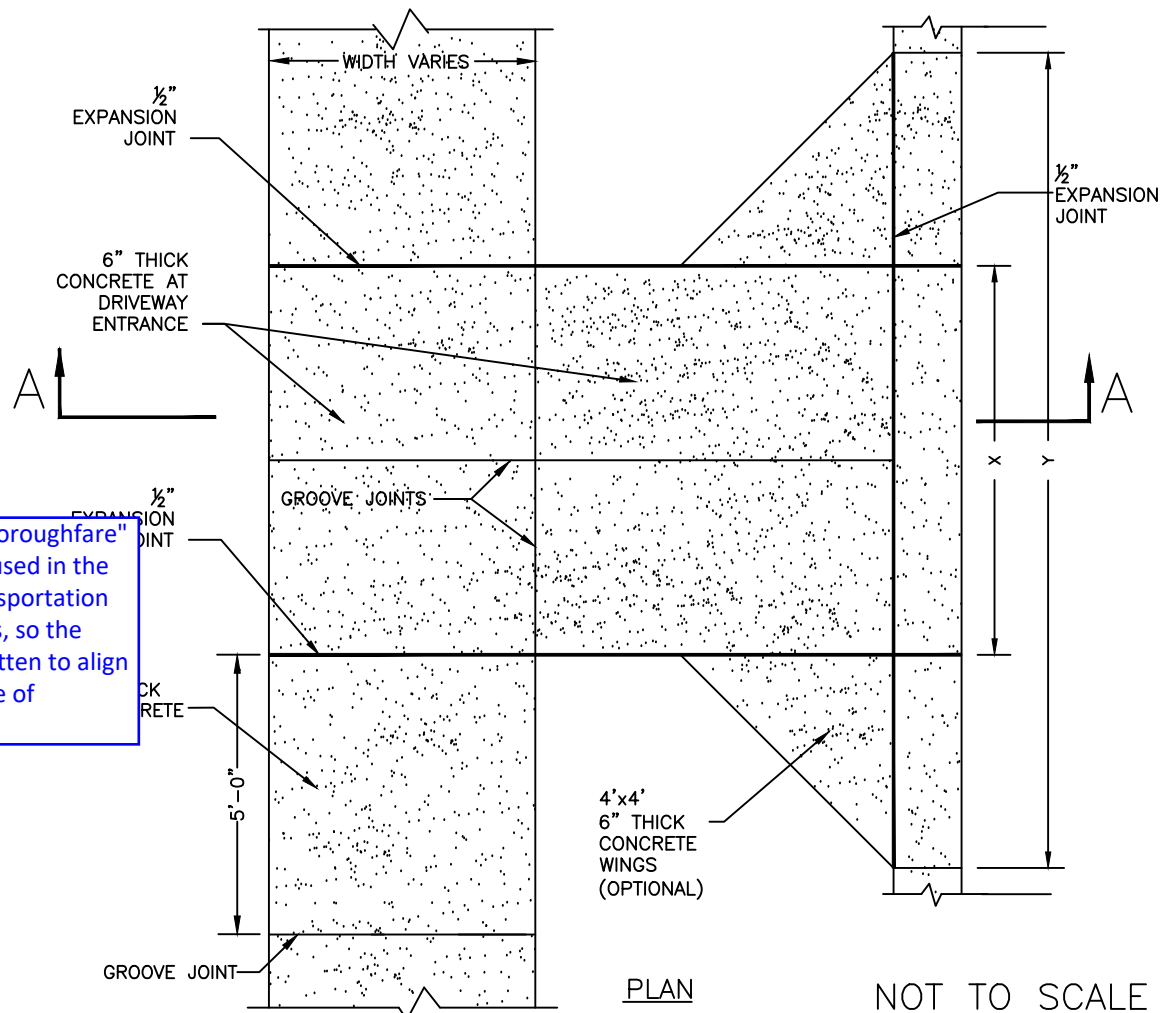
NOTES:

1. THE ELEVATION OF THE SIDEWALK SHALL BE NOT LESS THAN SIX INCHES OR MORE THAN EIGHTEEN INCHES ABOVE THE ROADWAY CROWN. THIS ELEVATION DIFFERENTIAL SHALL BE CONSISTENT WITHIN EACH BLOCK.
2. ALL CONCRETE TO BE 3600 PSI STRENGTH.
3. ALL CONSTRUCTION PRACTICES, INCLUDING COMPACTION, CURING, FINISHING, ETC. SHALL BE IN ACCORDANCE WITH THE CHARLOTTE LAND DEVELOPMENT STANDARDS.
4. PLANTING STRIP SHALL BE GRADED WITH A CROSS SLOPE BETWEEN 1/4 IN. PER FOOT AND 1 1/4 IN. PER FOOT EXCEPT WHERE EXCESSIVE NATURAL GRADES MAKE THIS REQUIREMENT IMPRACTICAL. IN SUCH CASES, THE CITY ENGINEER MAY AUTHORIZE A SUITABLE GRADE
5. ALL DRIVEWAYS MUST MEET THE CURRENT CITY DRIVEWAY REGULATIONS AND NCDOT REQUIREMENTS, INCLUDING BUT NOT LIMITED TO SPACING, SIGHT DISTANCE, AND OFFSETS FROM PROPERTY LINES AND INTERSECTIONS.
6. **PER NC IFC SECTION D103.2, FIRE APPARATUS ACCESS ROADS SHALL NOT EXCEED 10 PERCENT IN GRADE.
7. "A" BREAKOVER SHALL BE 8% OR LESS (A = ALGEBRAIC DIFFERENCE).
8. PRIOR APPROVAL IS REQUIRED BY CDOT ON GRADES EXCEEDING WHAT ARE SHOWN.

DRIVEWAY APRON WIDTH		
	X	Y
TYPE I-RESIDENTIAL:		
LOCAL/COLLECTOR	10' MIN.	30' MAX.***
ARTERIAL *	15' MIN.	30' MAX.***

* MUST PROVIDE ON-SITE TURNAROUND
 *** MAXIMUM WIDTH INCLUDES OPTIONAL WINGS

The term "thoroughfare" is no longer used in the regional transportation organizations, so the UDO was written to align with their use of "arterial."



CITY OF CHARLOTTE
 LAND DEVELOPMENT STANDARDS
 INCLUDES CHARLOTTE ETJ

RESIDENTIAL DRIVEWAY (TYPE I)
 FOR 2'-0" VALLEY GUTTER

STD. NO.	REV.
10.27A	24

- (H) 2'-6" OR 2'-0" STANDARD CURB AND GUTTER, STD. PER 10.17A
- (M) SAFETY RAIL, STD. 50.04A & 50.04B
- (S) CONCRETE SIDEWALK, STD. 10.22 OR SHARED USE PATH, STD. 10.42
- (H1) 2'-0" VALLEY GUTTER, STD. 10.17B
- (H2) CURB TRANSITION STANDARD CURB AND GUTTER TO 2'-0" VALLEY GUTTER, STD. 10.19

Adjusted to illustrate 2:1 slope extension to set the location of endwall/wingwall, and show finished grade to top of endwall.

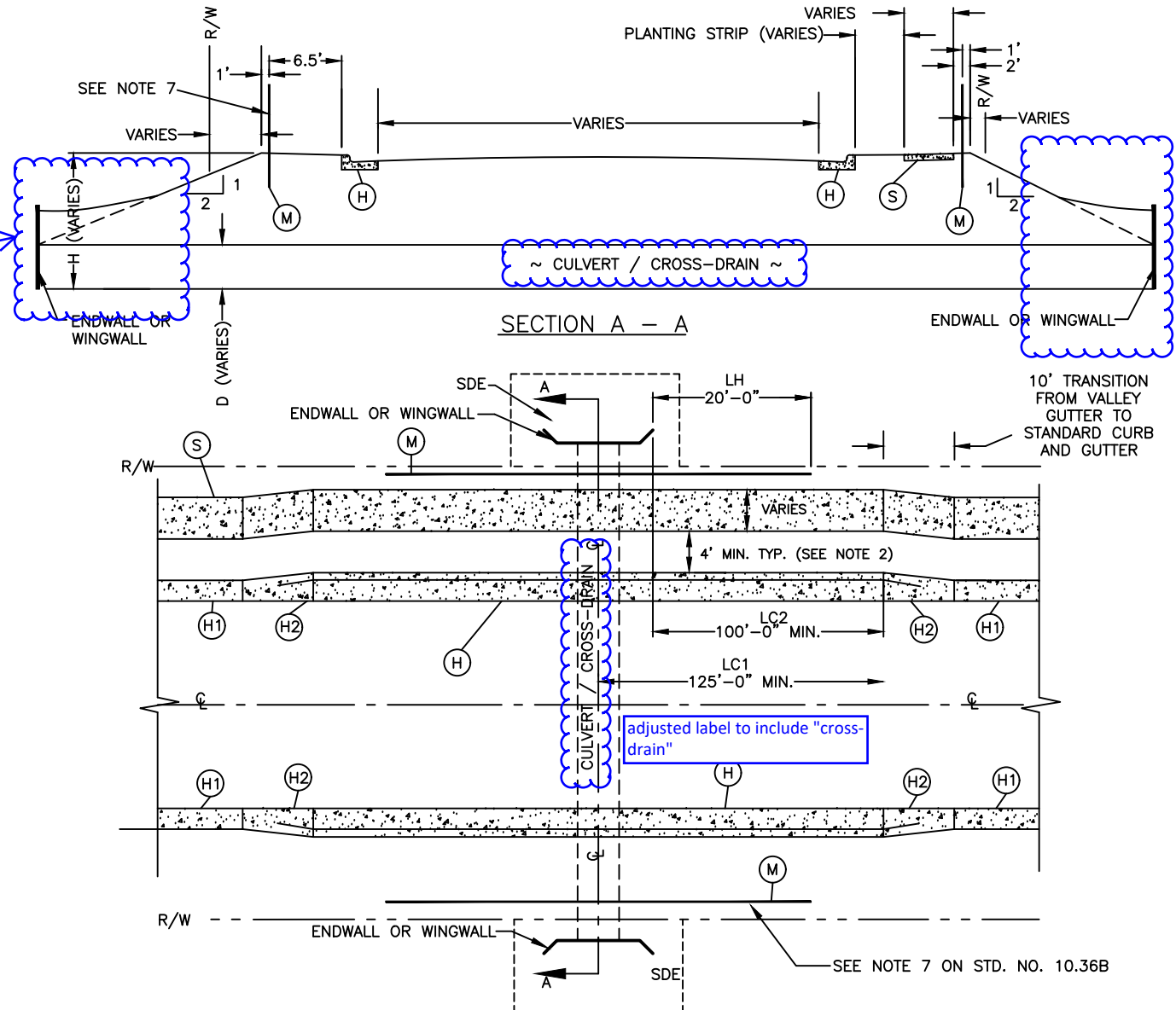
LH = DISTANCE FROM END OF WINGWALL TO END OF SAFETY RAIL.

LC1 = DISTANCE FROM C OF CULVERT TO END OF 2'-6" CURB AND GUTTER.

LC2 = DISTANCE FROM END OF WINGWALL TO END OF 2'-6" CURB AND GUTTER.

NOTES:

- SEE STD. NO. 10.36B FOR GENERAL NOTES AND CLEAR ZONE DISTANCES.
- AN ALTERNATIVE FOR STREETS WITH WIDER PLANTING STRIPS AND SIDEWALKS: IN LIEU OF A PLANTING STRIP ALONG THE CULVERT CROSSING, PROVIDE A MINIMUM 8-FOOT WIDE SIDEWALK LOCATED AT THE BACK OF CURB, FOR LENGTH "LC1" ON EITHER SIDE OF THE CULVERT CENTERLINE.



NOT TO SCALE



CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
INCLUDES CHARLOTTE ETJ

CULVERT CROSSINGS ON RESIDENTIAL AND COMMERCIAL STREETS

STD. NO.	REV.
10.36A	24

816.03 "Geocomposite Shoulder Drain" has been deleted

DWG	SHEET TITLE	SPECIAL REQUIREMENTS AND NOTES
300.01	METHOD OF PIPE INSTALLATION	
310.02	PARALLEL PIPE END SECTION—PRECAST CONCRETE FOR 15" TO 24" PIPE	REQUIRED IN RIGHT OF WAY WITHIN THE ETJ
310.03	CROSS PIPE END SECTION—PRECAST CONCRETE FOR 18" TO 30" PIPE	REQUIRED IN RIGHT OF WAY WITHIN THE ETJ
310.10	DRIVEWAY PIPE CONSTRUCTION USING NO SPECIAL END SECTIONS	ONLY AT LOCATIONS APPROVED BY THE CITY
815.03	PIPE UNDERDRAIN AND BLIND DRAIN	
838.01	CONCRETE ENDWALL FOR SINGLE AND DOUBLE PIPE CULVERTS	NOTE 1
	15" THRU 48" PIPE 90' SKEW	NOTE 1
838.02	CONCRETE ENDWALL AND SLUICE GATE 15" THRU 36" PIPE—90' SKEW	NOTE 1
838.04	CONCRETE ENDWALL FOR SINGLE AND DOUBLE PIPE CULVERTS	NOTE 1
	17"X13"THRU 71"X47" PIPE ARCH 90' SKEW	NOTE 1
838.05	CONCRETE "L" ENDWALL FOR SINGLE PIPE CULVERTS 15" THRU 48" PIPE	NOTE 1
838.06	CONCRETE "L" ENDWALL FOR SINGLE PIPE CULVERTS 17"X13" THRU 71"X47"	NOTE 1
	71"X47" ARCH PIPE	NOTE 1
838.07	CONCRETE ENDWALL FOR SINGLE AND DOUBLE PIPE CULVERTS	NOTE 1
	40"X31" THRU 66"X51" PIPE ARCH 90'SKEW	NOTE 1
838.08	CONCRETE "L" ENDWALL FOR SINGLE PIPE CULVERTS 40"X32"	NOTE 1
	THRU 66"X51" PIPE ARCH	NOTE 1
838.10	CONCRETE ENDWALL FOR OUTFALL 4'—6" OR 8" PIPE	NOTE 1
838.11	BRICK ENDWALL FOR SINGLE AND DOUBLE PIPE CULVERTS	NOTE 1
	15" THRU 48" 90' SKEW	NOTE 1
838.14	BRICK ENDWALL FOR SINGLE AND DOUBLE PIPE CULVERTS 17"X31"	NOTE 1
	THRU 71"X47" 90' SKEW	NOTE 1
838.15	BRICK "L" ENDWALL FOR SINGLE PIPE CULVERTS 15" THRU 48" PIPE	NOTE 1
838.16	BRICK "L" ENDWALL FOR SINGLE PIPE CULVERTS 17"X13" THRU	NOTE 1
	71"X47" PIPE ARCH	NOTE 1
838.17	BRICK ENDWALL FOR SINGLE AND DOUBLE PIPE CULVERTS 40"X31"	NOTE 1
	THRU 66"X51" PIPE ARCH 90'SKEW	NOTE 1
838.18	BRICK ENDWALL FOR SINGLE PIPE CULVERTS 40"X31" THRU	NOTE 1
	66"X51" PIPE ARCH 90' SKEW	NOTE 1
838.20	BRICK ENDWALL FOR OUTFALL 4", 6" AND 8" PIPE	NOTE 1
838.21	REINFORCED CONCRETE ENDWALL FOR SINGLE 54" PIPE 90' SKEW	NOTE 1; SEE CLDS 20.17 FOR SPLASH PAD
838.22	REINFORCED CONCRETE ENDWALL FOR DOUBLE & TRIPLE 54" PIPE 90' SKEW	NOTE 1; SEE CLDS 20.17 FOR SPLASH PAD
838.27	REINFORCED CONCRETE ENDWALL FOR SINGLE 60" PIPE 90' SKEW	NOTE 1; SEE CLDS 20.17 FOR SPLASH PAD
838.28	REINFORCED CONCRETE ENDWALL FOR DOUBLE & TRIPLE 60" PIPE 90' SKEW	NOTE 1; SEE CLDS 20.17 FOR SPLASH PAD
838.33	REINFORCED CONCRETE ENDWALL FOR SINGLE 66" PIPE 90' SKEW	NOTE 1; SEE CLDS 20.17 FOR SPLASH PAD
838.34	REINFORCED CONCRETE ENDWALL FOR DOUBLE & TRIPLE 66" PIPE 90' SKEW	NOTE 1; SEE CLDS 20.17 FOR SPLASH PAD
838.39	REINFORCED CONCRETE ENDWALL FOR SINGLE 72" PIPE 90' SKEW	NOTE 1; SEE CLDS 20.17 FOR SPLASH PAD
838.40	REINFORCED CONCRETE ENDWALL FOR DOUBLE & TRIPLE 72" PIPE 90' SKEW	NOTE 1; SEE CLDS 20.17 FOR SPLASH PAD

revised note

NOTE 1: FOR ALL STRUCTURES – ALL CONCRETE USED FOR DRAINAGE STRUCTURES SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3600 PSI AT 28 DAYS. THIS REQUIREMENT SHALL BE PROVIDED REGARDLESS OF ANY LESSER COMPRESSIVE STRENGTH SPECIFIED IN THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR ROADS AND STRUCTURES.



CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
 INCLUDES CHARLOTTE ETJ

NCDOT STANDARDS
 APPROVED FOR USE IN THE CITY OF CHARLOTTE
 AND CHARLOTTE ETJ

STD. NO.	REV.
20.00A	24

DWG	SHEET TITLE	SPECIAL REQUIREMENTS AND NOTES
838.45	NOTES FOR REINFORCED CONCRETE ENDWALL STANDARD DRAWINGS	NOTE 1 SEE CLDS 20.17 FOR SPLASH PAD
	838.21 THRU 838.40	NOTE 1 SEE CLDS 20.17 FOR SPLASH PAD
838.51	REINFORCED BRICK ENDWALL FOR SINGLE 54" PIPE 90' SKEW	NOTE 1 SEE CLDS 20.17 FOR SPLASH PAD
838.52	REINFORCED BRICK ENDWALL FOR DOUBLE & TRIPLE 54" PIPE 90'SKEW	NOTE 1 SEE CLDS 20.17 FOR SPLASH PAD
838.57	REINFORCED BRICK ENDWALL FOR SINGLE 60" PIPE 90' SKEW	NOTE 1 SEE CLDS 20.17 FOR SPLASH PAD
838.58	REINFORCED BRICK ENDWALL FOR DOUBLE & TRIPLE 60" PIPE 90' SKEW	NOTE 1 SEE CLDS 20.17 FOR SPLASH PAD
838.63	REINFORCED BRICK ENDWALL FOR SINGLE 66" PIPE 90' SKEW	NOTE 1 SEE CLDS 20.17 FOR SPLASH PAD
838.64	REINFORCED BRICK ENDWALL FOR DOUBLE & TRIPLE 66" PIPE 90' SKEW	NOTE 1 SEE CLDS 20.17 FOR SPLASH PAD
838.69	REINFORCED BRICK ENDWALL FOR SINGLE 72" PIPE 90' SKEW	NOTE 1 SEE CLDS 20.17 FOR SPLASH PAD
838.70	REINFORCED BRICK ENDWALL FOR DOUBLE & TRIPLE 72" PIPE 90' SKEW	NOTE 1 SEE CLDS 20.17 FOR SPLASH PAD
838.75	NOTES FOR REINFORCED BRICK ENDWALL STANDARD DRAWINGS 838.51 THRU 838.70	NOTE 1 SEE CLDS 20.17 FOR SPLASH PAD
838.80	PRECAST CONCRETE ENDWALL FOR SINGLE 12" THRU 72" PIPE 90' SKEW	
840.00	CONCRETE BASE PAD FOR DRAINAGE STRUCTURES	
840.01	BRICK CATCH BASIN 15" THRU 54" PIPE	
840.02	CONCRETE CATCH BASIN 12" THRU 54" PIPE	
840.03	FRAME, GRATE BASIN 12" THRU 54" PIPE	TYPE F AND G GRATES ARE OPTIONAL WITHIN THE CITY LIMITS
840.04	CONCRETE OPEN THROAT CATCH BASIN 12" THRU 48" PIPE	NOTE 1; OPENINGS PERMITTED IN 4 SIDES OUTSIDE OF STREET R/W MANHOLE RING AND COVER REQUIRED IN TOP SLAB SEE 840.55
840.05	BRICK OPEN THROAT CATCH BASIN 15" THRU 48" PIPE	NOTE 1; OPENINGS PERMITTED IN 4 SIDES OUTSIDE OF STREET R/W MANHOLE RING AND COVER REQUIRED IN TOP SLAB SEE 840.55
840.14	CONCRETE DROP INLET 12" THRU 30" PIPE	NOTE 1
840.15	BRICK DROP INLET 12" THRU 30' PIPE	NOTE 1
840.16	DROP INLET FRAME AND GRATE FOR USE WITH DWGS. 840.14 & 840.15	NOTE 1
840.17	CONCRETE GRATED DROP INLET TYPE "A" 12" THRU 72" PIPE	NOTE 1
840.18	CONCRETE GRATED DROP INLET TYPE "B" 12" THRU 36" PIPE	NOTE 1
840.19	CONCRETE GRATED DROP INLET TYPE "D" 12" THRU 36" PIPE	NOTE 1
840.20	FRAMES AND WIDE SLOT FLAT GRATES	NOT FOR USE IN PEDESTRIAN/BICYCLE AREAS
840.22	FRAMES AND WIDE SLOT SAG GRATES	NOT FOR USE IN PEDESTRIAN/BICYCLE AREAS
840.24	FRAMES AND NARROW SLOT SAG GRATES	
840.25	ANCHORAGE FOR FRAMES BRICK OR CONCRETE	
840.26	BRICK GRATED DROP INLET TYPE "A" 12" THRU 72" PIPE	
840.27	BRICK GRATED DROP INLET TYPE "B" 12" THRU 36" PIPE	
840.28	BRICK GRATED DROP INLET TYPE "D" 12" THRU 36" PIPE	
840.29	FRAMES AND NARROW SLOT FLAT GRATES	
840.30	DRIVEWAY DROP INLET	
840.39	BICYCLE SAFE STEEL FRAME AND GRATE	

updated note, revised
20.05 to 840.55

added

Added 840.39 - Bicycle
Safe Steel Frame and
Grate.

revised note

NOTE 1: FOR ALL STRUCTURES – ALL CONCRETE USED FOR DRAINAGE STRUCTURES SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3600 PSI AT 28 DAYS. THIS REQUIREMENT SHALL BE PROVIDED REGARDLESS OF ANY LESSER COMPRESSIVE STRENGTH SPECIFIED IN THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR ROADS AND STRUCTURES.



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NCDOT STANDARDS
APPROVED FOR USE IN THE CITY OF CHARLOTTE
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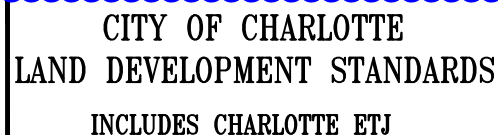
STD. NO.	REV.
20.00B	24

updated
to correct
drawing #
reference

corrected sheet title,
previously listed as
"Concrete Paved Ditches"

removed 310.01, no longer valid

NOTE 1: FOR ALL STRUCTURES - ALL CONCRETE USED FOR DRAINAGE STRUCTURES SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3600 PSI AT 28 DAYS. THIS REQUIREMENT SHALL BE PROVIDED REGARDLESS OF ANY LESSER COMPRESSIVE STRENGTH SPECIFIED IN THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR ROADS AND STRUCTURES.



STD. NO.	REV.
20.00C	24

GENERAL NOTES:

1. FOR STREAMS CARRYING 500 ACRES OR MORE OF SURFACE RUNOFF, THE EASEMENT REQUIREMENT IS TO BE THE WIDTH OF THE STREAM FROM TOP OF BANK TO TOP OF BANK, PLUS (+)10' ON EACH SIDE OF STREAM. (40' MINIMUM WIDTH)
2. FOR OPEN CHANNELS THE MINIMUM EASEMENT MUST CONTAIN THE WIDTH OF THE STREAM FROM TOP OF BANK TO TOP BANK.
3. WIDER EASEMENT WIDTHS MAY BE REQUIRED FOR PIPE DEPTHS GREATER THAN TEN FEET.
4. PIPE SYSTEMS AND OPEN CHANNELS ON PRIVATE PROPERTY SHALL BE PLACED IN A STORM DRAINAGE EASEMENT.

Added notes 5 and 6

5. PIPE SYSTEMS SHALL TYPICALLY BE PLACED ALONG THE CENTERLINE OF THE STORM DRAINAGE EASEMENT
6. WHERE DUAL PIPES ARE PROPOSED, $\frac{1}{2}$ OF THE STANDARD WIDTH FOR THE RESPECTIVE PIPE SIZE SHALL BE OFFSET FROM THE CENTERLINE OF EACH BARREL.

Easement Requirements for Open Storm Drainage Channels

Area in Acreage	Easement Requirement
0-45 ac.	20'
45-120 ac.	30'
120-500 ac.	40'
500 ac.+	see note

Easement Requirements for Storm Drain Pipe

Pipe Size	Easement Requirement
15"	15'
18"	15'
24"	15'
30"	20'
36"	20'
42"	25'
48"	25'
54"+	30'MIN (VARIES)

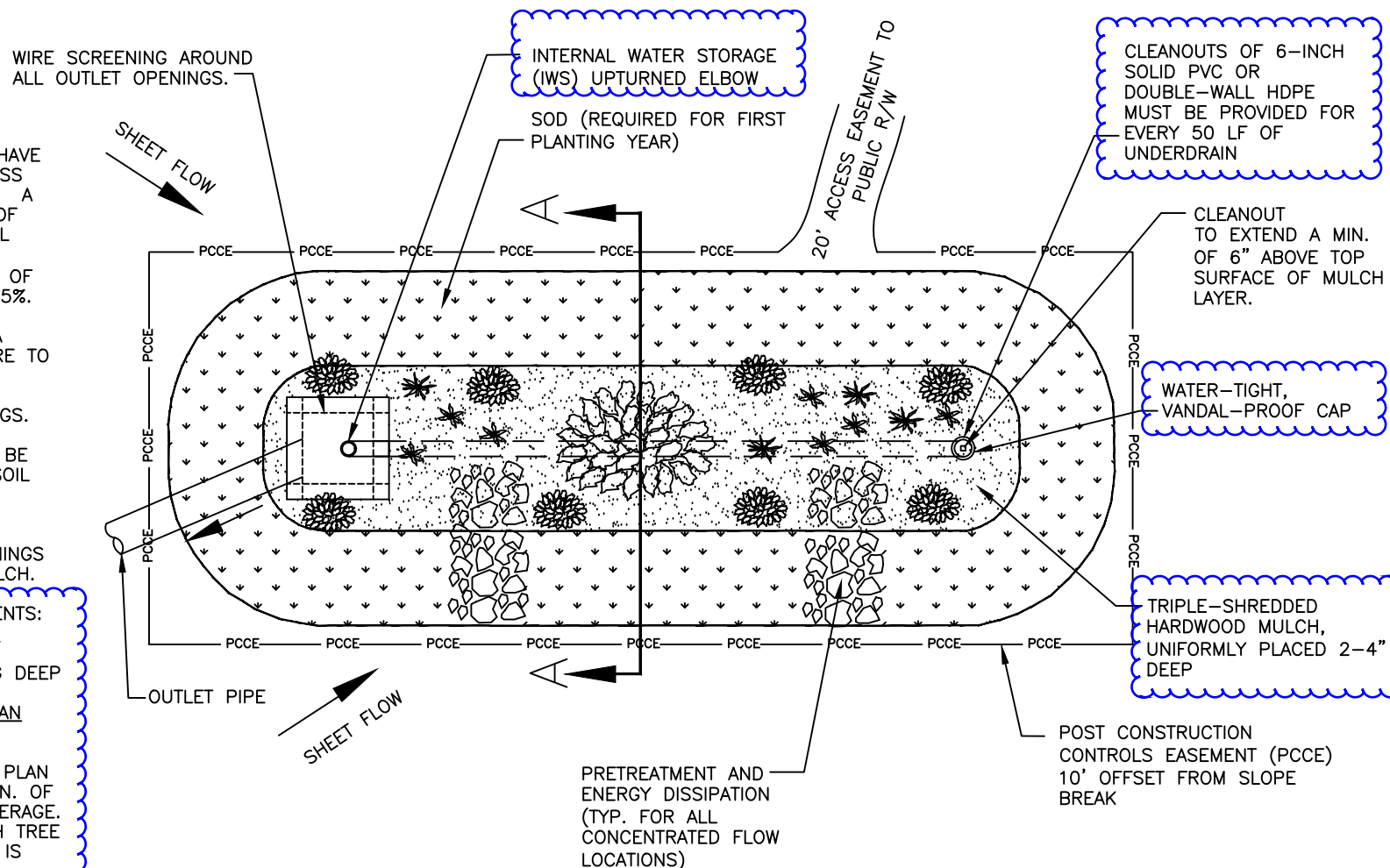
NOT TO SCALE



NOTES:

1. ALL BIORETENTION SHALL HAVE A MINIMUM 20 FOOT ACCESS EASEMENT CONNECTING TO A DEDICATED PUBLIC RIGHT OF WAY. ACCESS ROAD SHALL HAVE MIN. 12' STABILIZED WIDTH, MAX. LONG. GRADE OF 15%, MAX. CROSS-SLOPE 5%.
2. ALL DRAINAGE AREAS TO A BIORETENTION FACILITY ARE TO BE STABILIZED PRIOR TO INSTALLATION OF AMENDED SOILS, MULCH OR PLANTINGS.
3. AMENDED SOIL WILL ONLY BE PERMITTED WITH A VALID SOIL ANALYSIS REPORT.
4. INSTALL WIRE SCREENING AROUND ALL OUTLET OPENINGS TO PREVENT LOSS OF MULCH.

5. PLANTING PLAN REQUIREMENTS:
 - A. SODDED BIORETENTION CELLS ONLY:
USE NON-CLUMPING DEEP ROOTED SPECIES
 - B. VEGETATION OTHER THAN SOD:
AFTER 5 YEARS OF PLANTING PLANTING PLAN SHOULD ACHIEVE MIN. OF 75% OF PLANT COVERAGE. MAX COVERAGE WITH TREE OR SHRUB CANOPY IS 50%.



NOT TO SCALE



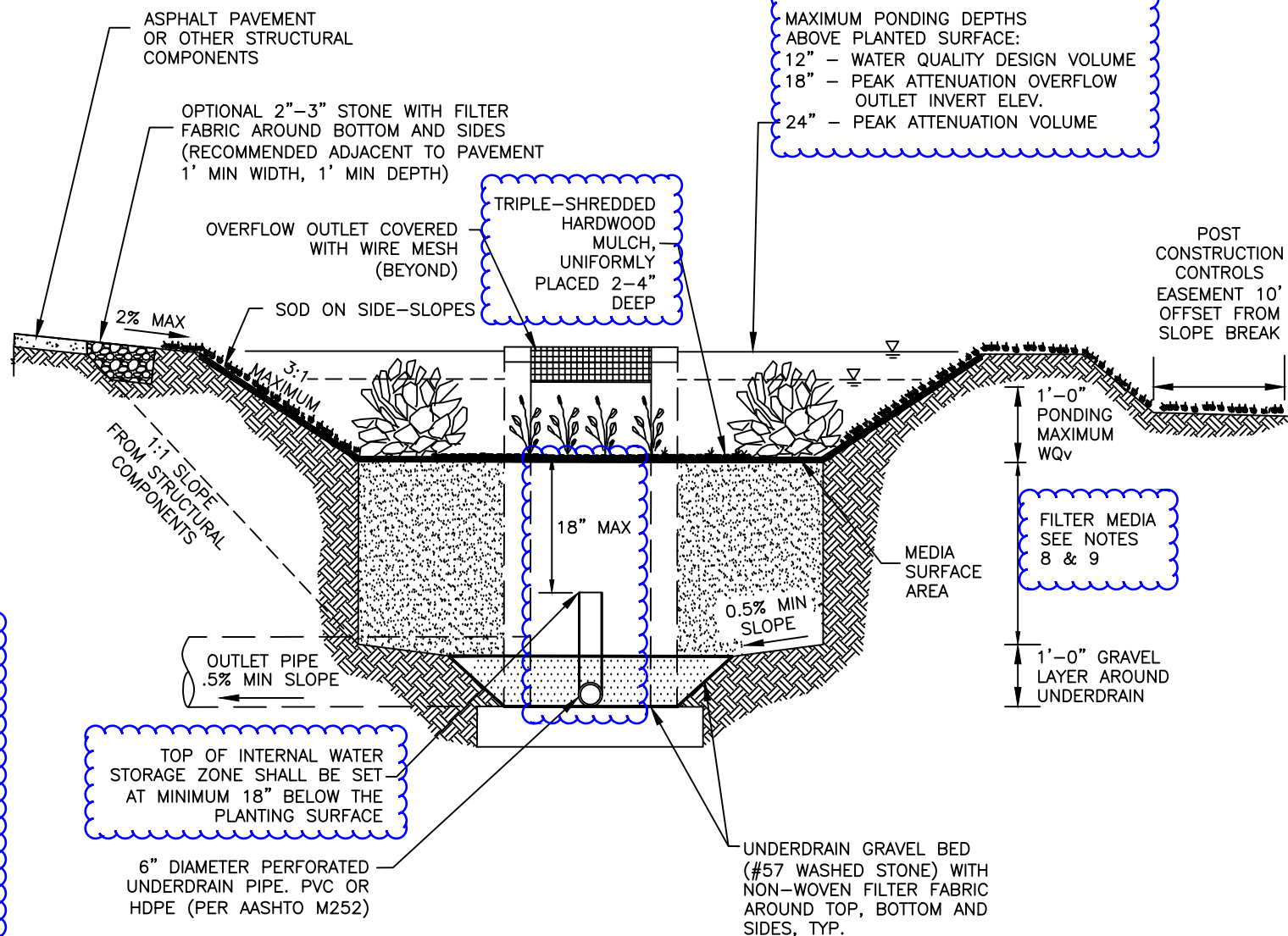
CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
INCLUDES CHARLOTTE ETJ

BIORETENTION PLAN

STD. NO.	REV.
21.00	24

NOTES:

- ALL BIORETENTION FACILITIES SHALL HAVE A MINIMUM 20 FOOT ACCESS EASEMENT CONNECTING TO A DEDICATED PUBLIC RIGHT OF WAY. ACCESS ROAD SHALL HAVE MIN. 12' STABILIZED WIDTH, MAX. LONG. GRADE OF 15%, MAX. CROSS-SLOPE 5%.
- ALL DRAINAGE AREAS TO A BIORETENTION FACILITY ARE TO BE STABILIZED PRIOR TO INSTALLATION OF AMENDED SOILS, MULCH OR PLANTINGS.
- AMENDED SOIL WILL ONLY BE PERMITTED WITH A VALID SOIL ANALYSIS REPORT. NO AMENDED SOIL SHALL BE ALLOWED ON THE SIDE SLOPES.
- INSTALL WIRE SCREENING AROUND ALL OUTLET OPENINGS TO PREVENT LOSS OF MULCH.
- PVC UNDERDRAIN PIPE SHOULD HAVE 3/8" PERFORATIONS SPACED AT 6" CENTERS, MIN. 4 HOLES PER ROW. MAX SPACING OF UNDERDRAIN PIPE IS 10 FEET ON CENTER. HDPE SHALL ADHERE TO AASHTO M252 SPECS.
- UNDERDRAIN CLEANOUTS SHOULD EXTEND A MIN. OF 6" ABOVE TOP SURFACE OF MULCH LAYER.
- ONLY SMALL MATURING TREES ARE ALLOWED TO BE PLANTED IN THE AMENDED SOILS.
- THE MINIMUM DEPTH OF THE MEDIA DEPENDS ON THE DESIGN OF THE CELL AS FOLLOWS:
 - ALL CELLS WITH TREES AND SHRUBS: 36 INCHES
 - CELLS WITHOUT TREES AND SHRUBS:
 - WITH NO INTERNAL WATER STORAGE: 24 INCHES
 - WITH INTERNAL WATER STORAGE: 30 INCHES
- MEDIA SPECIFICATION** - HOMOGENEOUS SOIL MIX ENGINEERED MEDIA BLEND WITH APPROXIMATE VOLUMES OF:
 - 75-85% MEDIUM TO COARSE WASHED SAND (ASTM C33, AASHTO M 6/M 80, ASTM C330, AASHTO M195, OR THE EQUIVALENT);
 - 8-15% FINES (SILT AND CLAY); AND
 - 5-10% ORGANIC MATTER (SUCH AS PINE BARK FINES).



SECTION A-A

NOT TO SCALE



CHARLOTTE

CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
INCLUDES CHARLOTTE ETJ

BIORETENTION CROSS-SECTION

STD. NO.	REV.
21.01	24

ZONE 5 & 6

ZONE 4

ZONE 5 & 6

ZONE 3

REMOVE

PLAN

NOTES:

1. PLANTING ZONES AND PLANT SELECTION PER THE BMP DESIGN MANUAL, CHAPTER 6 & APPENDICES.
2. ALL PLANTINGS SHALL BE LOCAL NATIVE SPECIES.
3. IRRIGATION MAY BE PROVIDED FOR INITIAL ESTABLISHMENT AND DRY SEASONS.
4. ONLY SMALL MATURING TREES ARE ALLOWED TO BE PLANTED IN THE AMENDED SOILS.

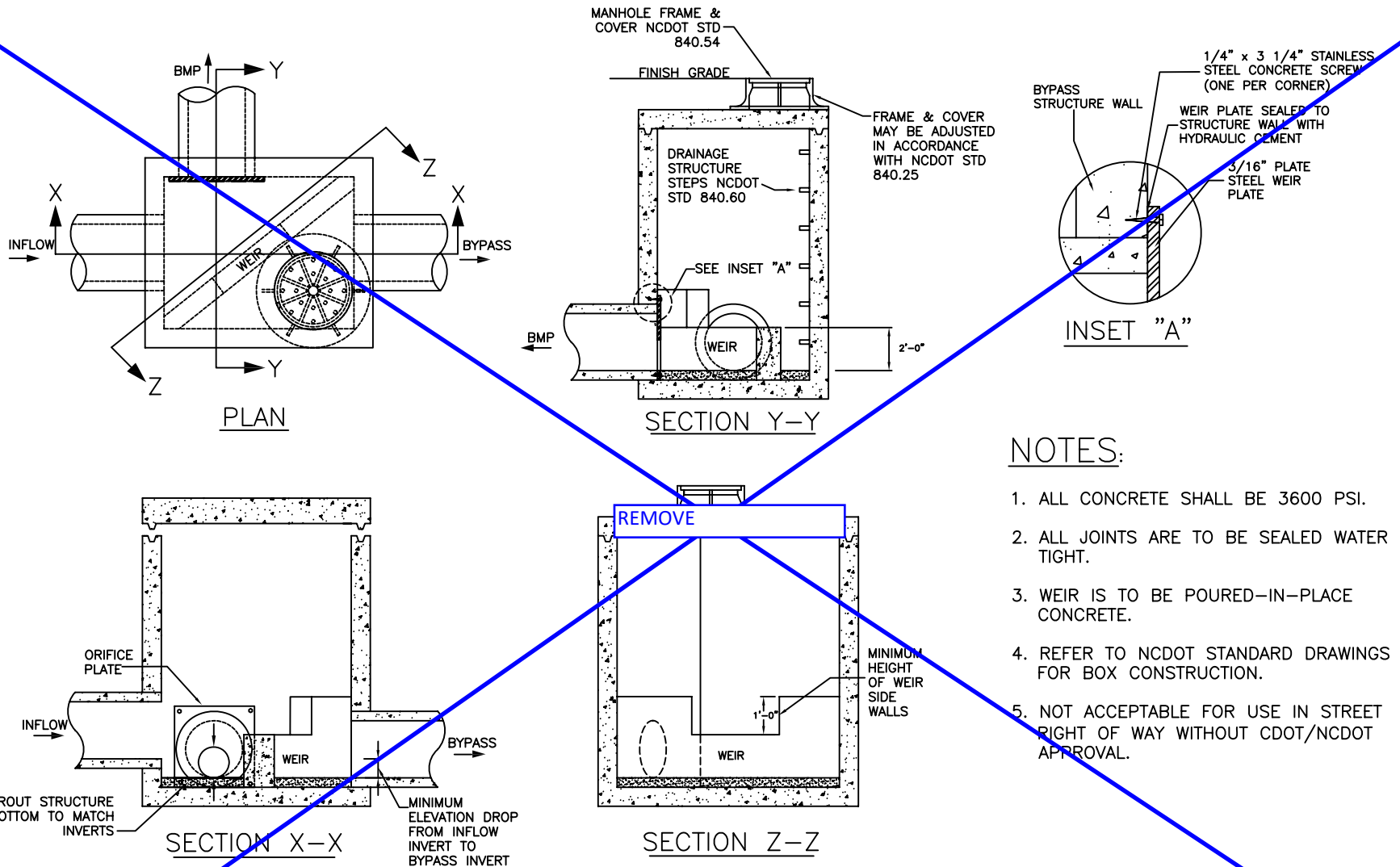
NOT TO SCALE



CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
 INCLUDES CHARLOTTE ETJ

BIORETENTION
PLANTING PLAN
 BMP FIG. 4.1.4

STD. NO.	REV.
21.02	5



NOTES:

1. ALL CONCRETE SHALL BE 3600 PSI.
2. ALL JOINTS ARE TO BE SEALED WATER TIGHT.
3. WEIR IS TO BE POURED-IN-PLACE CONCRETE.
4. REFER TO NCDOT STANDARD DRAWINGS FOR BOX CONSTRUCTION.
5. NOT ACCEPTABLE FOR USE IN STREET RIGHT OF WAY WITHOUT CDOT/NCDOT APPROVAL.

NOT TO SCALE

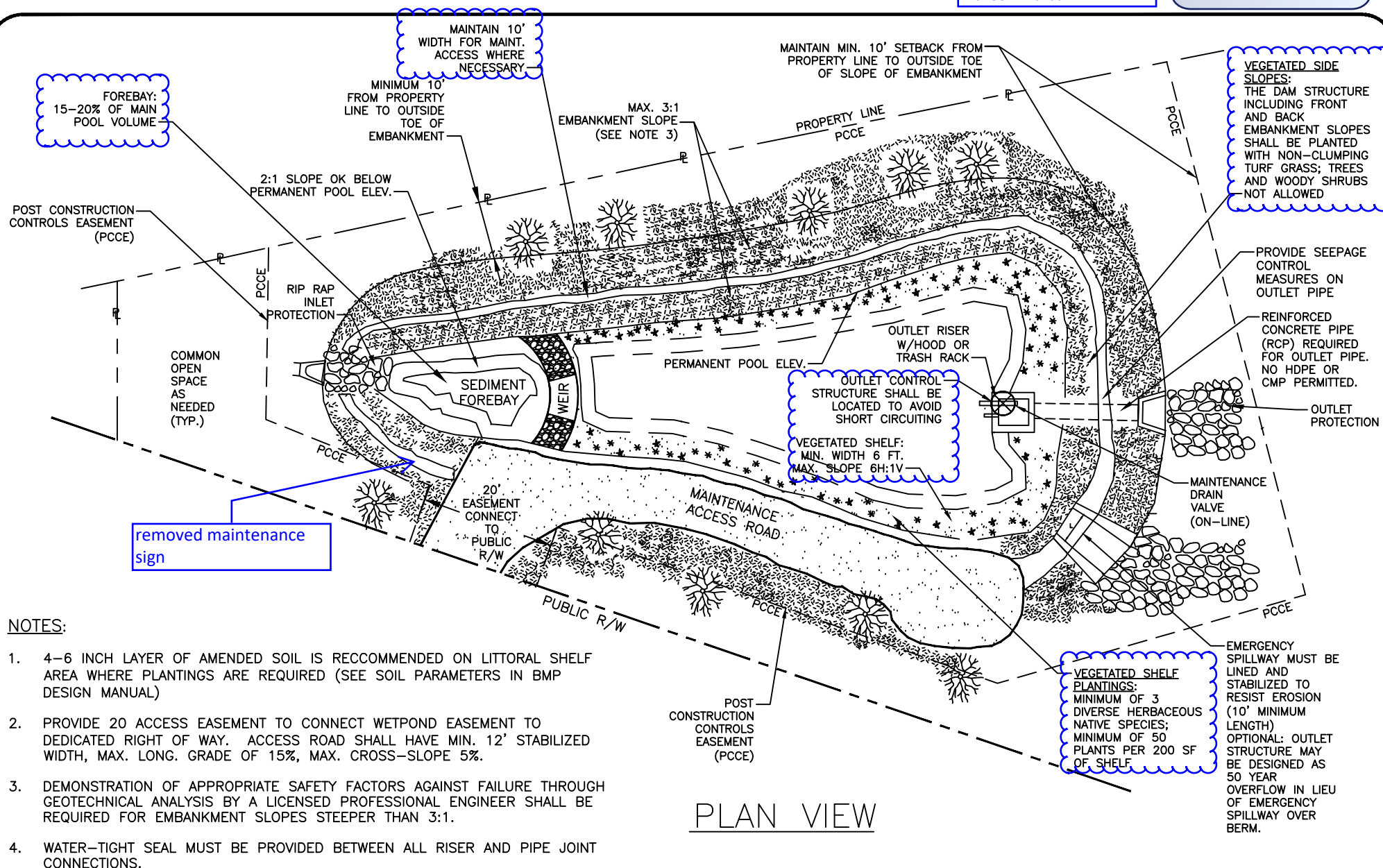


CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
INCLUDES CHARLOTTE ETJ

FLOW SPLITTER STRUCTURE

BMP FIG. 4.1.11

STD. NO.	REV.
21.04	2



PLAN VIEW

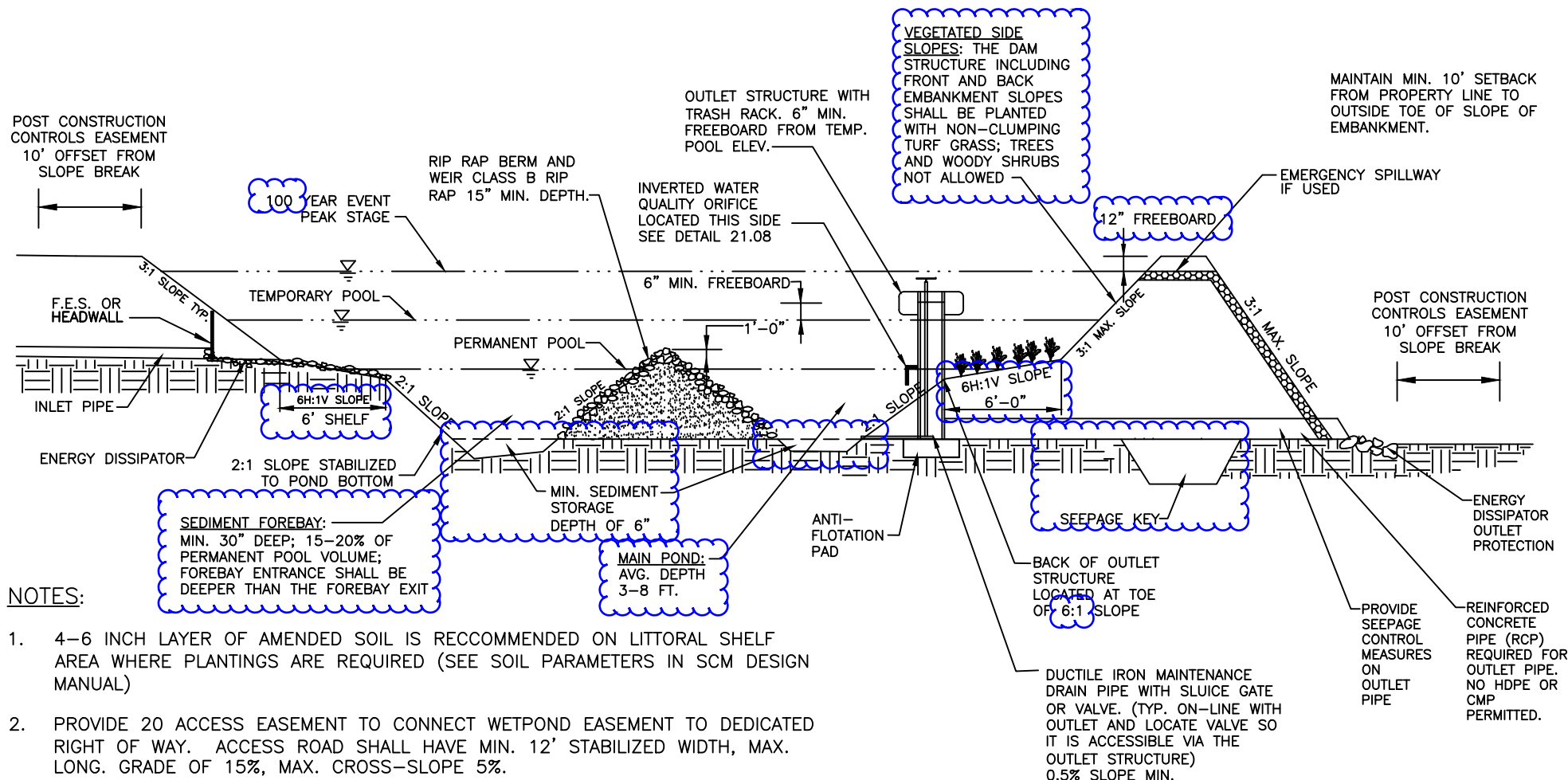
NOT TO SCALE



CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
INCLUDES CHARLOTTE ETJ

WETPOND PLAN

STD. NO.	REV.
21.05	24



NOTES:

1. 4-6 INCH LAYER OF AMENDED SOIL IS RECCOMENDED ON LITTORAL SHELF AREA WHERE PLANTINGS ARE REQUIRED (SEE SOIL PARAMETERS IN SCM DESIGN MANUAL)
2. PROVIDE 20 ACCESS EASEMENT TO CONNECT WETPOND EASEMENT TO DEDICATED RIGHT OF WAY. ACCESS ROAD SHALL HAVE MIN. 12' STABILIZED WIDTH, MAX. LONG. GRADE OF 15%, MAX. CROSS-SLOPE 5%.
3. DEMONSTRATION OF APPROPRIATE SAFETY FACTORS AGAINST FAILURE THROUGH GEOTECHNICAL ANALYSIS BY A LICENSED PROFESSIONAL ENGINEER SHALL BE REQUIRED FOR EMBANKMENT SLOPES STEEPER THAN 3:1.
4. WATER-TIGHT SEAL MUST BE PROVIDED BETWEEN ALL RISER AND PIPE JOINT CONNECTIONS.

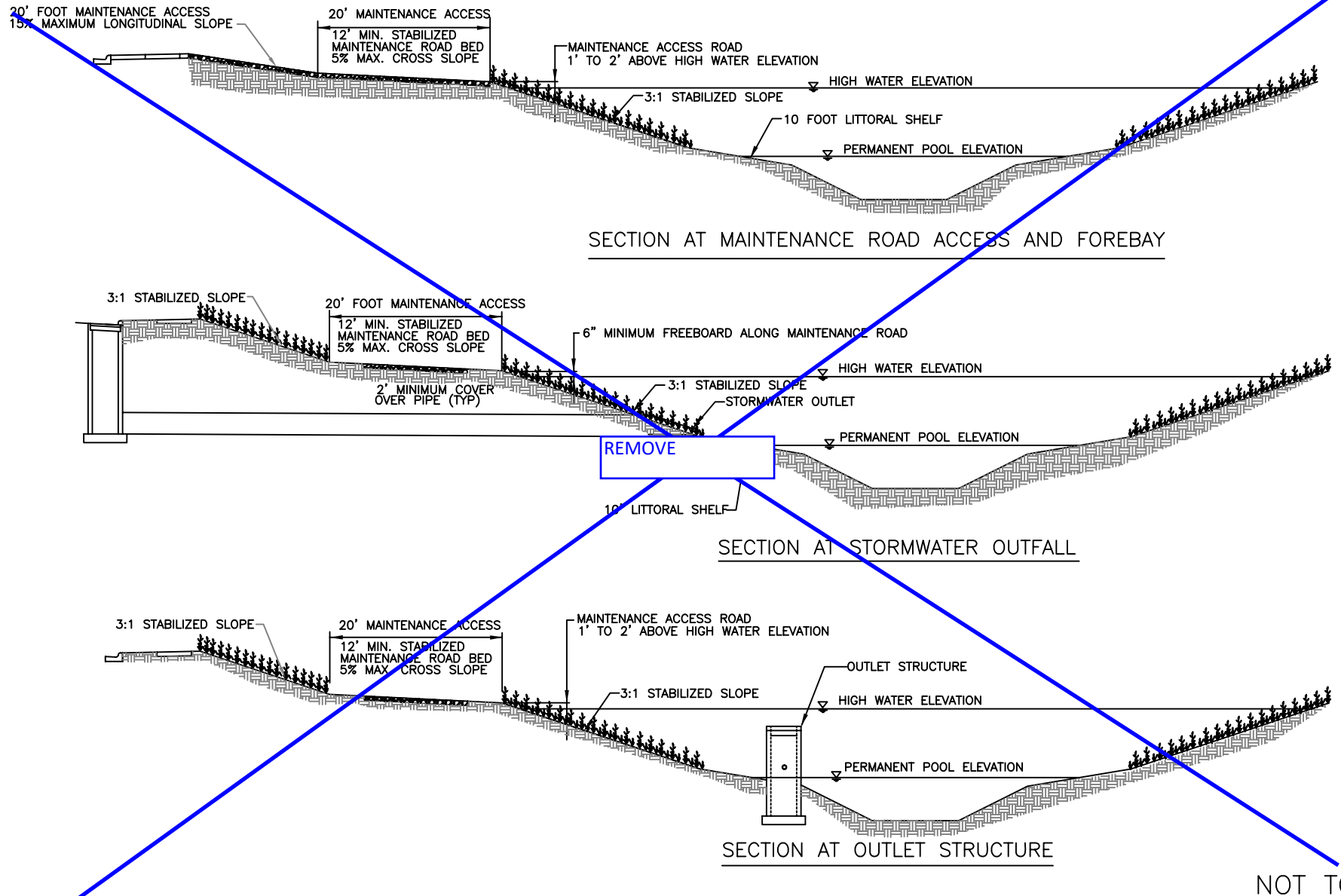
NOT TO SCALE



CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
INCLUDES CHARLOTTE ETJ

WETPOND PROFILE

STD. NO.	REV.
21.06	24



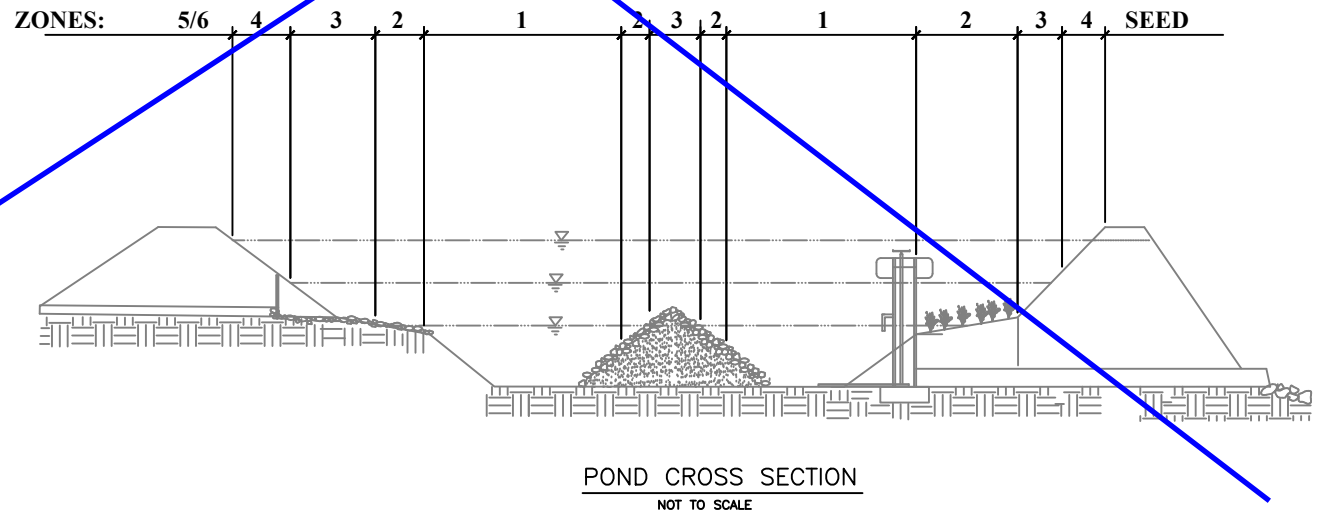
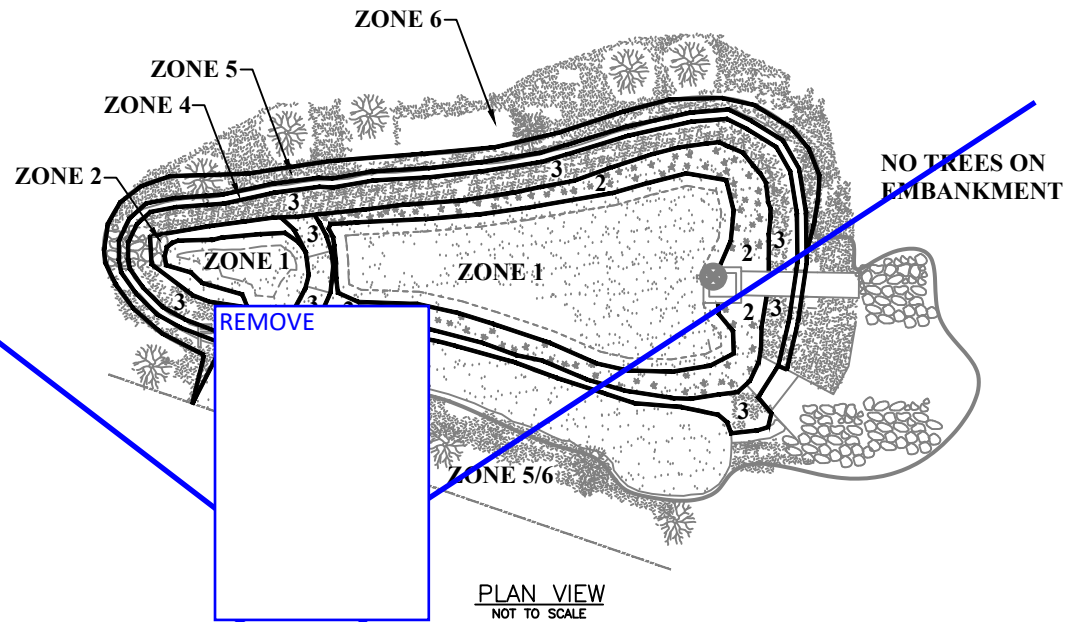
CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
INCLUDES CHARLOTTE ETJ

WETPOND
CROSS SECTIONS
BMP FIG. 4.2.3

STD. NO.	REV.
21.07	2

NOTES:

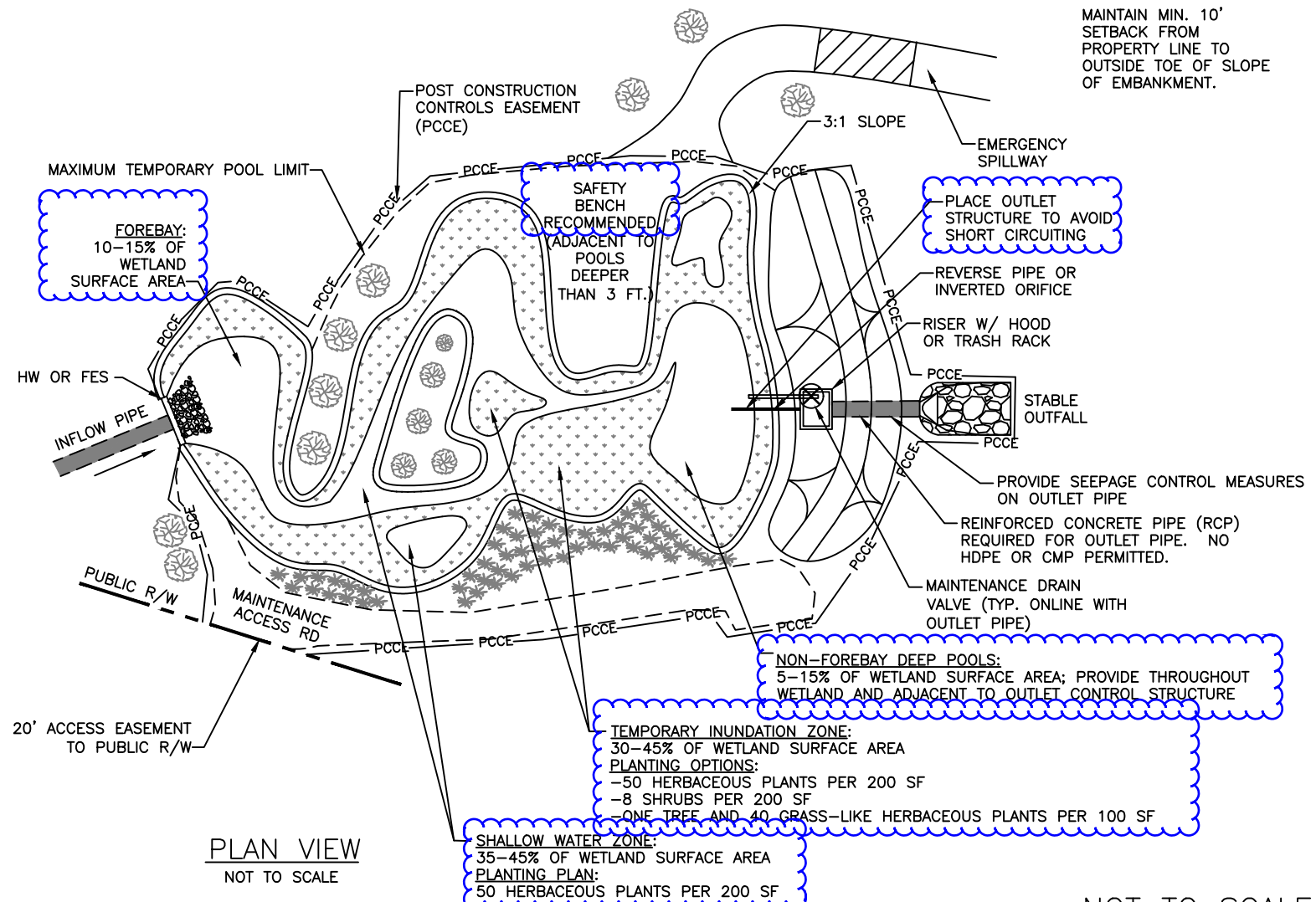
1. PLANTINGS ZONES AND PLANT SELECTION PER THE BMP DESIGN MANUAL, CHAPTER 6 & APPENDICES.
2. ALL PLANTINGS SHALL BE LOCAL NATIVE SPECIES.
3. IRRIGATION MAY BE PROVIDED FOR INITIAL ESTABLISHMENT AND DRY SEASONS.



NOT TO SCALE

NOTES:

1. THE PH, COMPACTION, AND OTHER ATTRIBUTES OF THE FIRST 12" DEPTH OF SOIL SHALL BE ADJUSTED IF NECESSARY TO PROMOTE PLANT ESTABLISHMENT AND GROWTH. (SEE SOIL PARAMETERS IN SCM DESIGN MANUAL)
2. PROVIDE 20' ACCESS EASEMENT TO CONNECT WETLAND EASEMENT TO DEDICATED RIGHT OF WAY.
3. ALL WETLANDS SHALL HAVE A MINIMUM 20 FOOT ACCESS EASEMENT CONNECTING TO A DEDICATED PUBLIC RIGHT OF WAY. ACCESS ROAD SHALL HAVE MIN. 12' STABILIZED WIDTH, MAX. LONG. GRADE OF 15%, MAX. CROSS-SLOPE 5%.
3. DEMONSTRATION OF APPROPRIATE SAFETY FACTORS AGAINST FAILURE THROUGH GEOTECHNICAL ANALYSIS BY A LICENSED PROFESSIONAL ENGINEER SHALL BE REQUIRED FOR EMBANKMENT SLOPES STEEPER THAN 3:1.
4. WATER-TIGHT SEAL MUST BE PROVIDED BETWEEN ALL RISER AND PIPE JOINT CONNECTIONS.



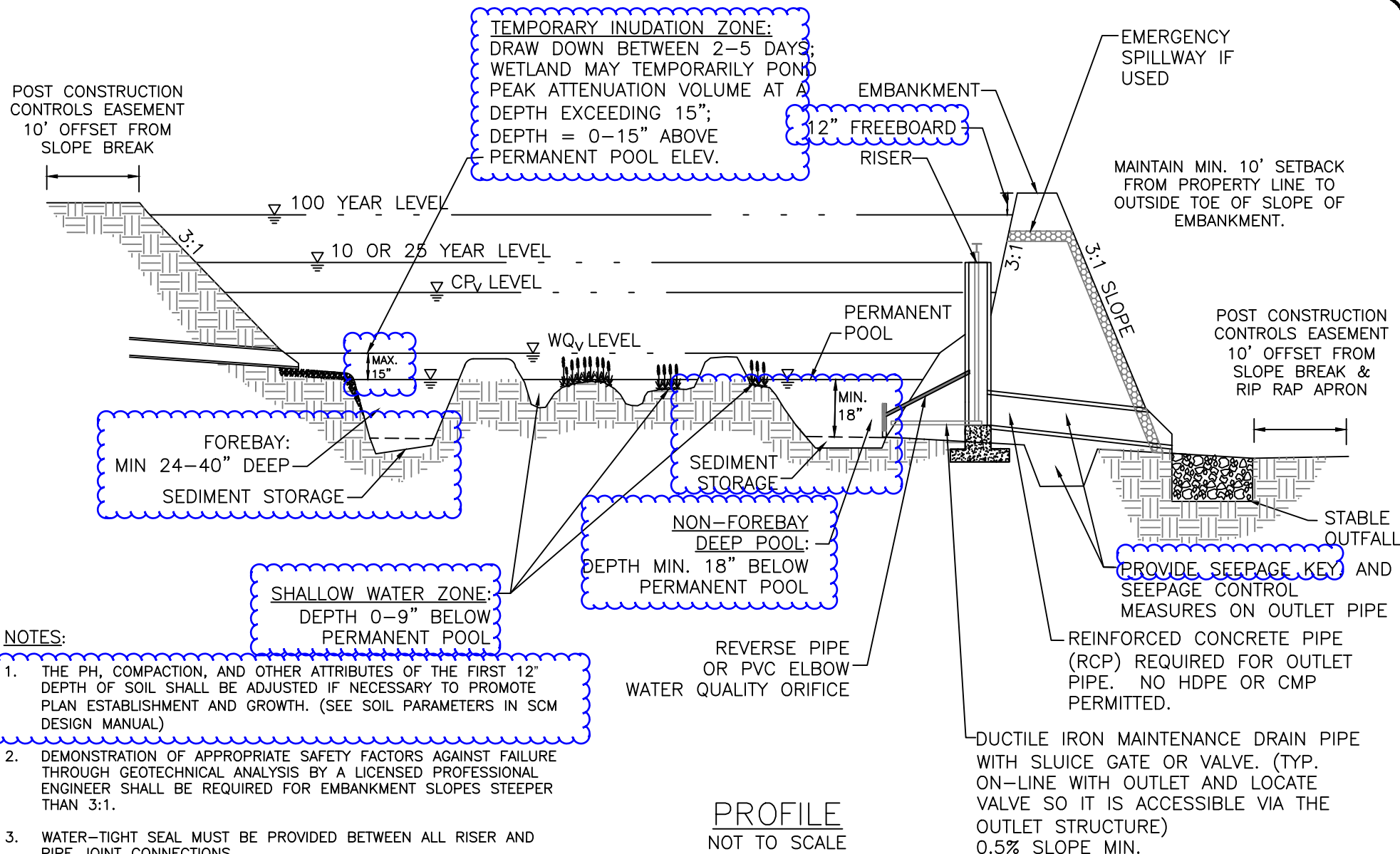
NOT TO SCALE



CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
 INCLUDES CHARLOTTE ETJ

WETLAND PLAN

STD. NO.	REV.
21.10	24



NOT TO SCALE

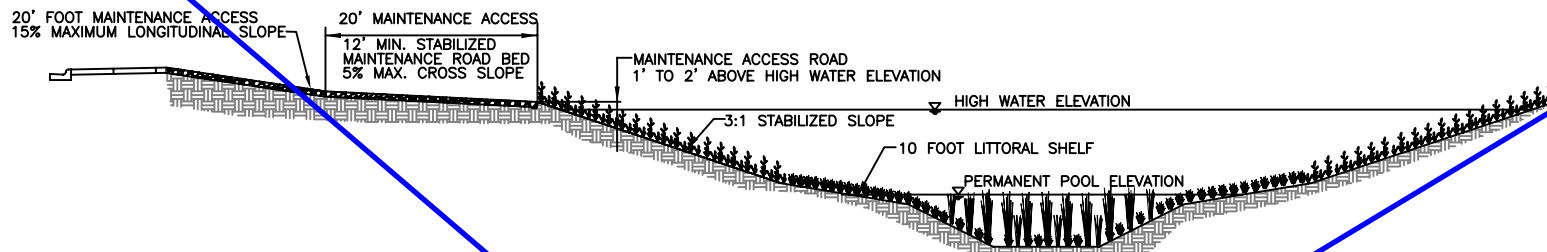


CHARLOTTE

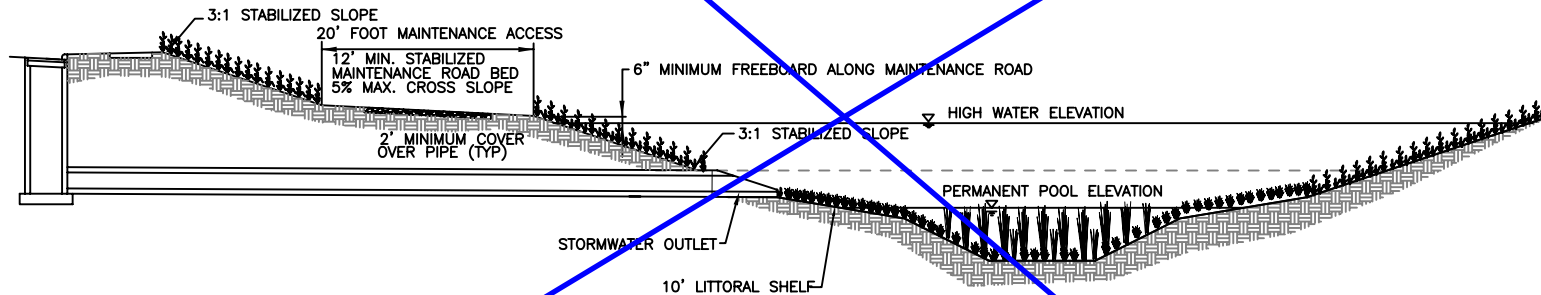
CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
INCLUDES CHARLOTTE ETJ

WETLAND PROFILE

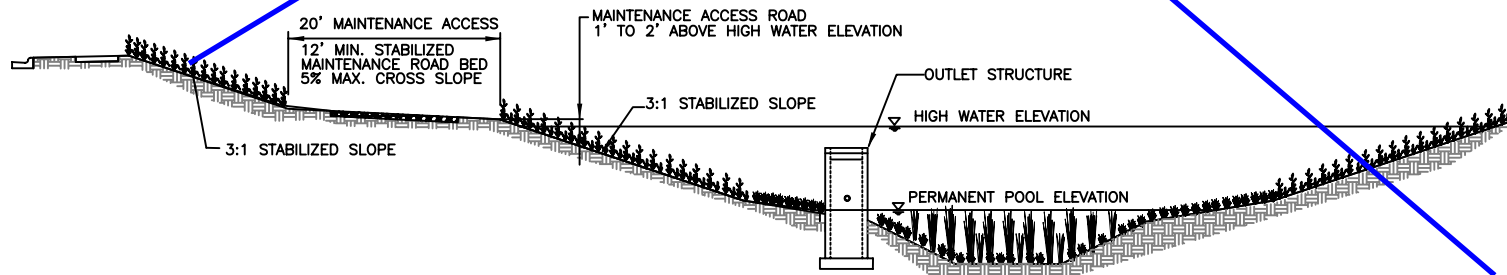
STD. NO.	REV.
21.11	24



SECTION Remove MAINTENANCE ROAD ACCESS AND FOREBAY



SECTION AT STORMWATER OUTFALL

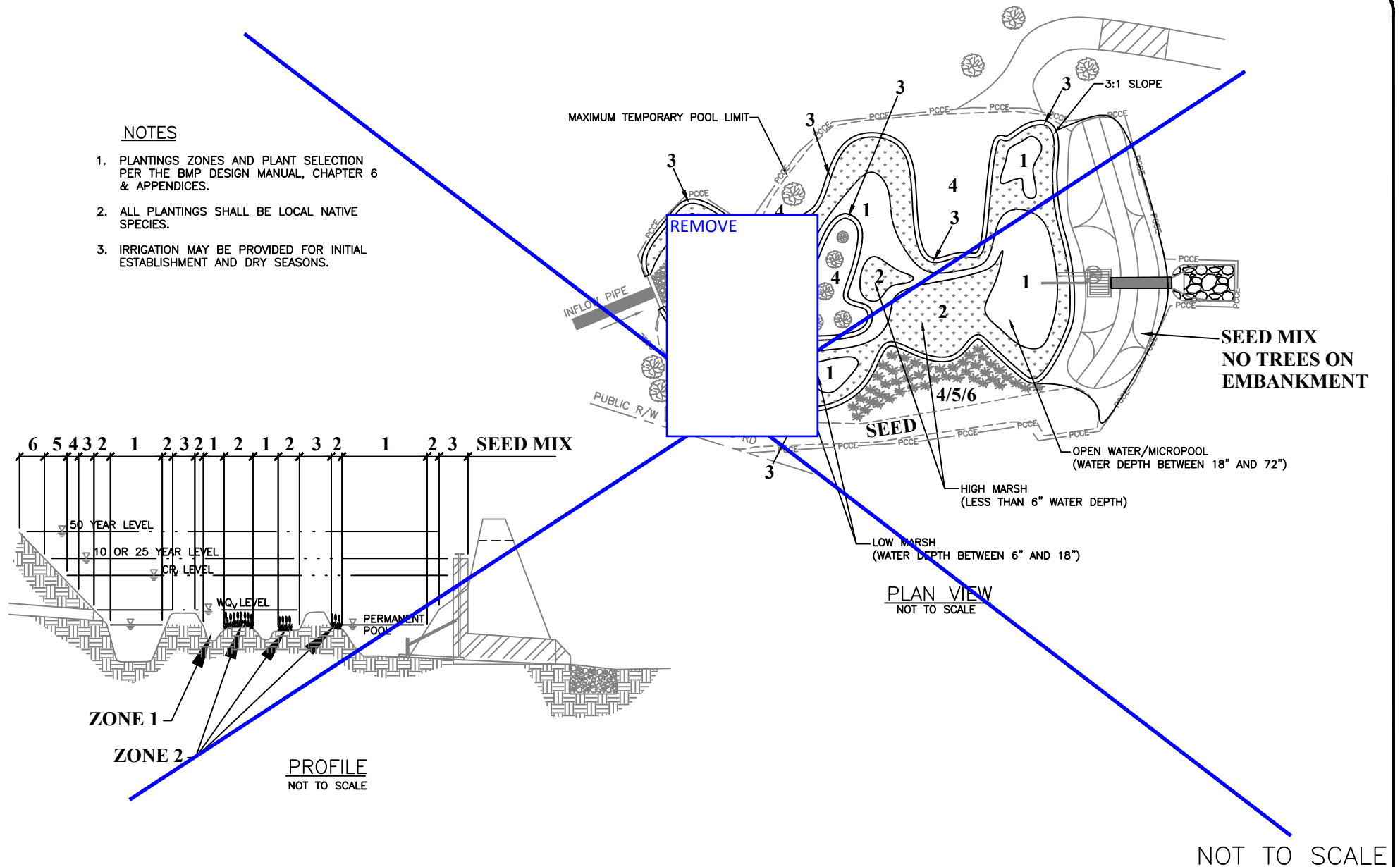


SECTION AT OUTLET STRUCTURE

NOT TO SCALE

NOTES

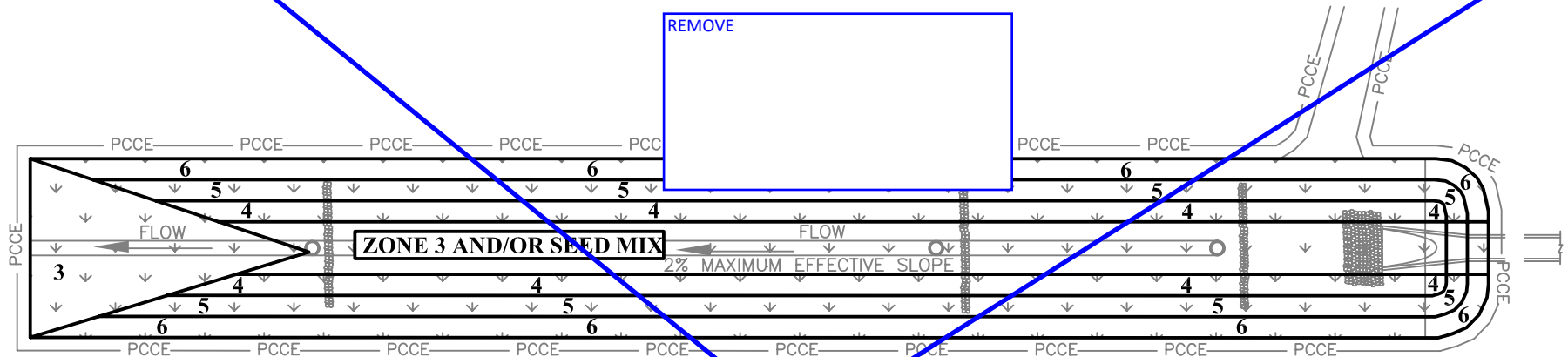
1. PLANTINGS ZONES AND PLANT SELECTION PER THE BMP DESIGN MANUAL, CHAPTER 6 & APPENDICES.
2. ALL PLANTINGS SHALL BE LOCAL NATIVE SPECIES.
3. IRRIGATION MAY BE PROVIDED FOR INITIAL ESTABLISHMENT AND DRY SEASONS.



CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
INCLUDES CHARLOTTE ETJ

WETLAND PLANTING PLAN

STD. NO.	REV.
21.14	18



PLAN VIEW

NOTES

1. PLANTING ZONES AND PLANT SELECTION PER THE BMP DESIGN MANUAL, CHAPTER 6 & APPENDICES.
2. ALL PLANTINGS SHALL BE LOCAL NATIVE SPECIES.
3. IRRIGATION MAY BE PROVIDED FOR INITIAL ESTABLISHMENT AND DRY SEASONS.

NOT TO SCALE

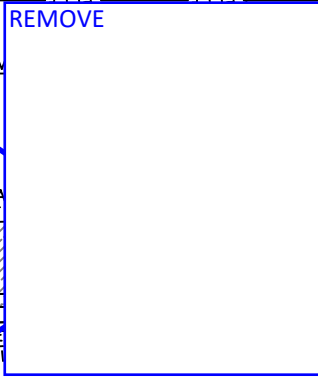
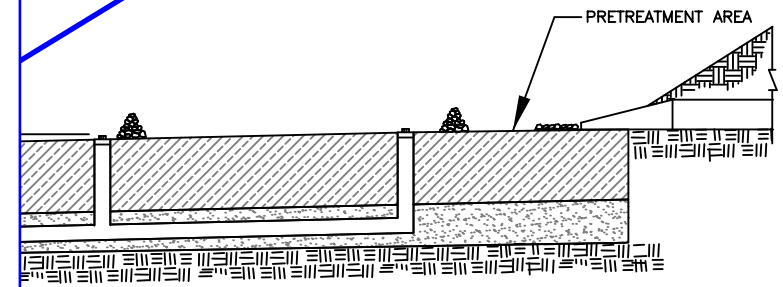
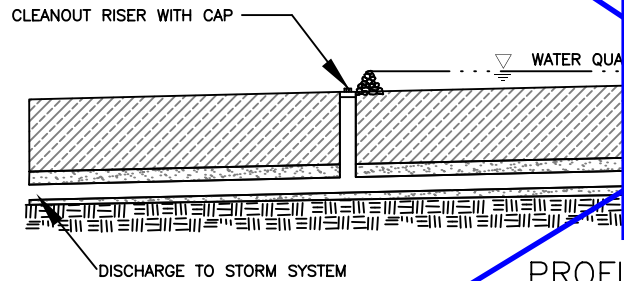
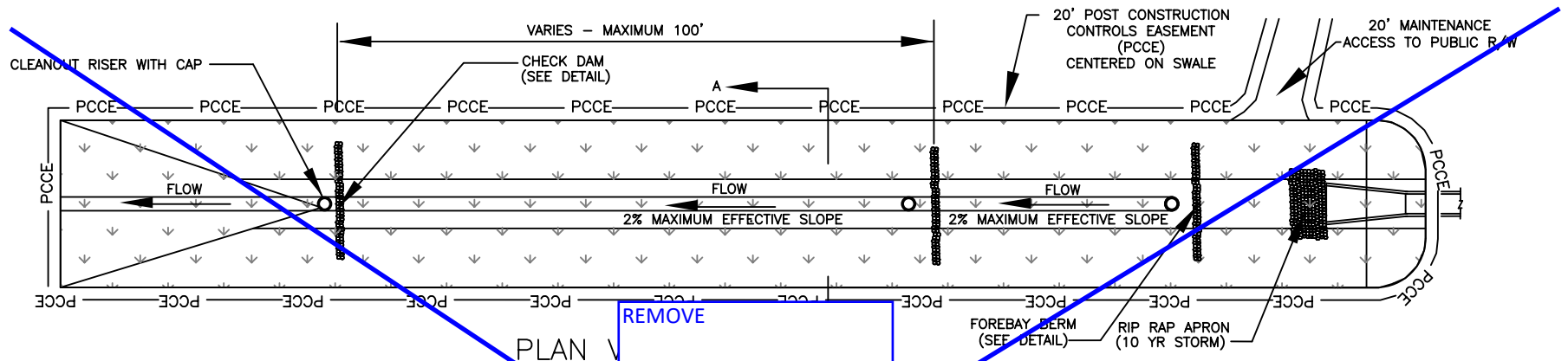


CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
INCLUDES CHARLOTTE ETJ

ENHANCED GRASS SWALE PLANTING PLAN

BMP FIG. 4.4.3

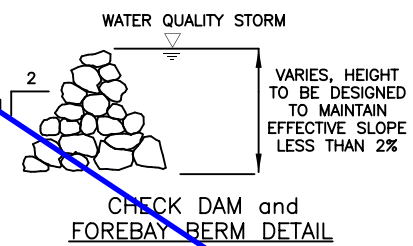
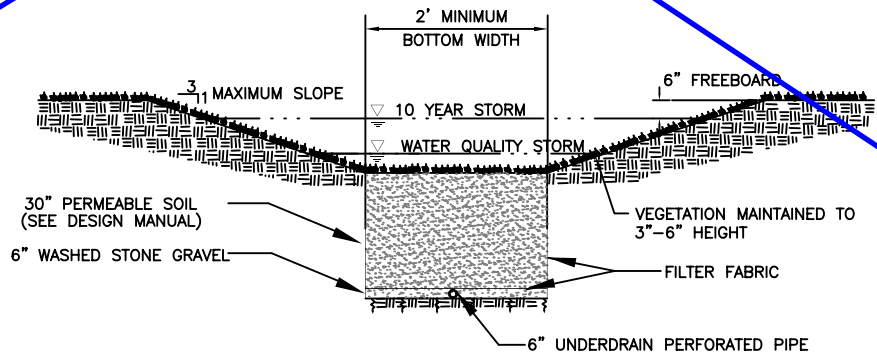
STD. NO.	REV.
21.15	2



PROFILE

NOTES:

- 1. ALL ENHANCED GRASS SWALES SHALL HAVE A MINIMUM 20-FOOT ACCESS EASEMENT CONNECTING TO A DEDICATED PUBLIC RIGHT OF WAY. ACCESS ROAD SHALL HAVE MIN. 12' STABILIZED WIDTH, MAX. LONG. GRADE OF 15%, MAX. CROSS-SLOPE 5%.



SECTION A-A

NOT TO SCALE

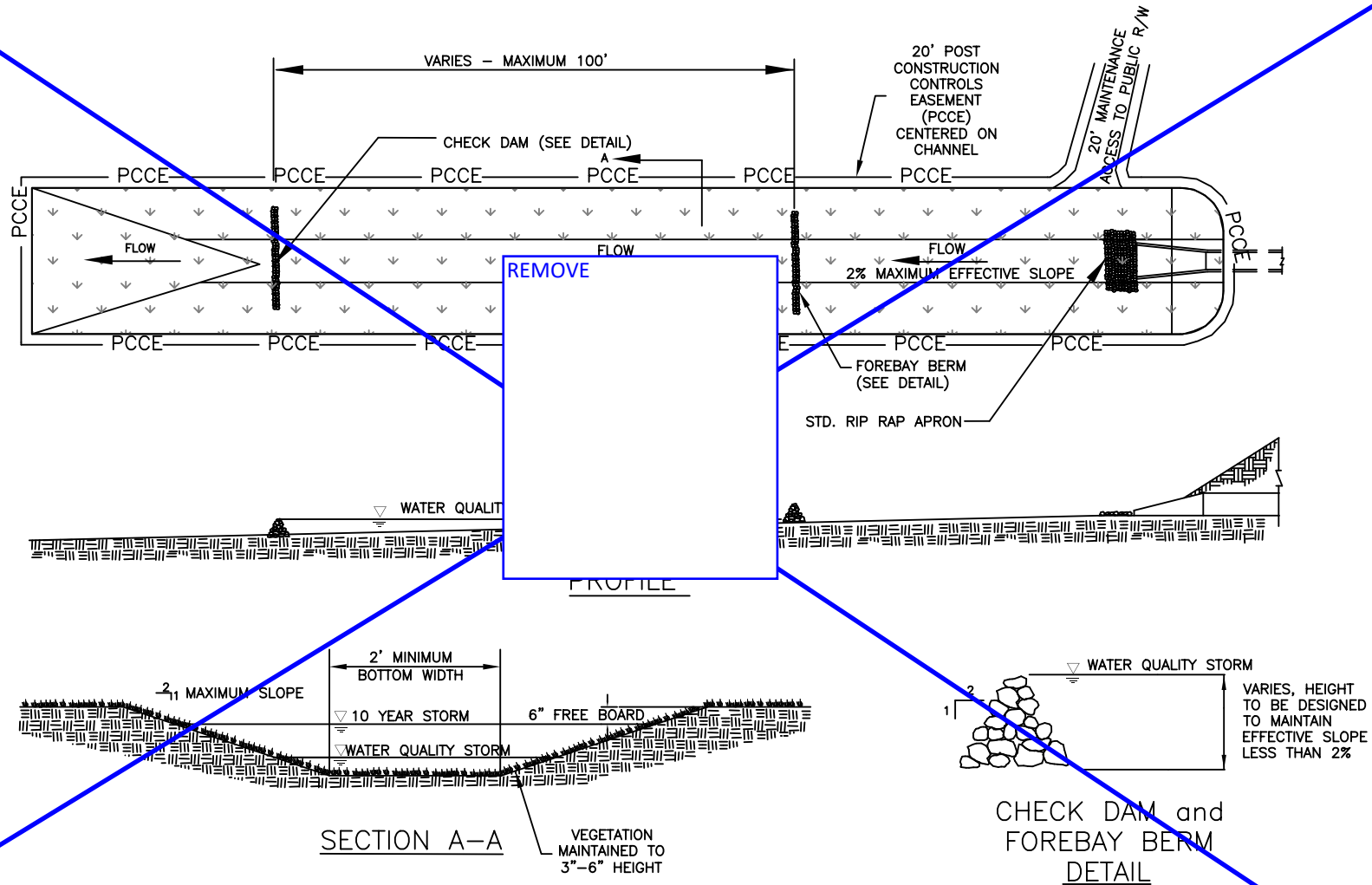


CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
INCLUDES CHARLOTTE ETJ

ENHANCED GRASS SWALE DETAILS
BMP FIG. 4.4.5

STD. NO.	REV.
21.16	5

DRAFT



NOTES:

1. CONNECT GRASS SWALE EASEMENT TO A DEDICATED PUBLIC RIGHT OF WAY WITH A 20-FOOT ACCESS EASEMENT.

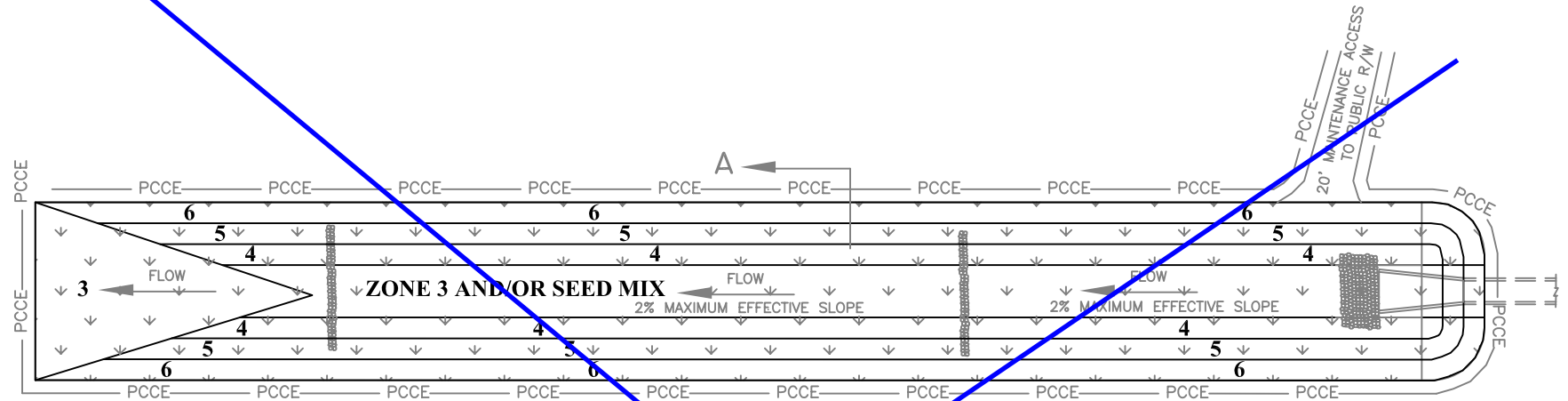
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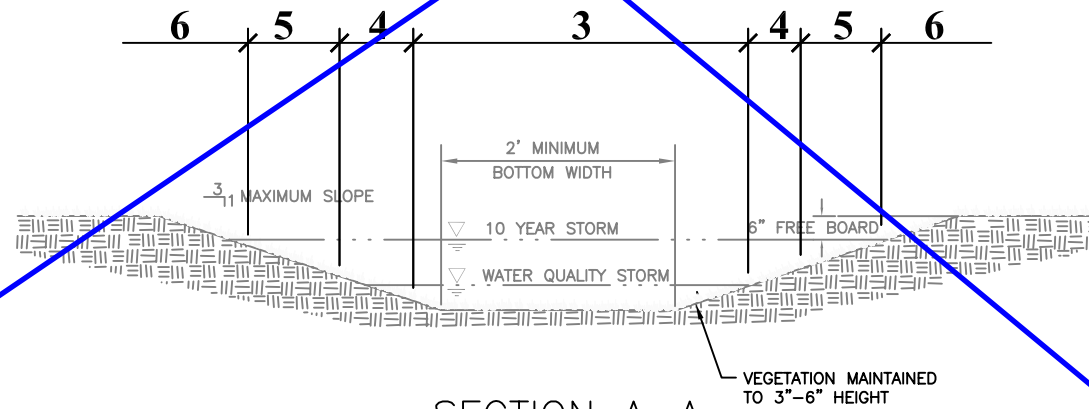
CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
 INCLUDES CHARLOTTE ETJ

GRASS CHANNEL
 BMP FIG. 4.5.2

STD. NO.	REV.
21.17	5



REMOVE



SECTION A-A
NOT TO SCALE

NOT TO SCALE

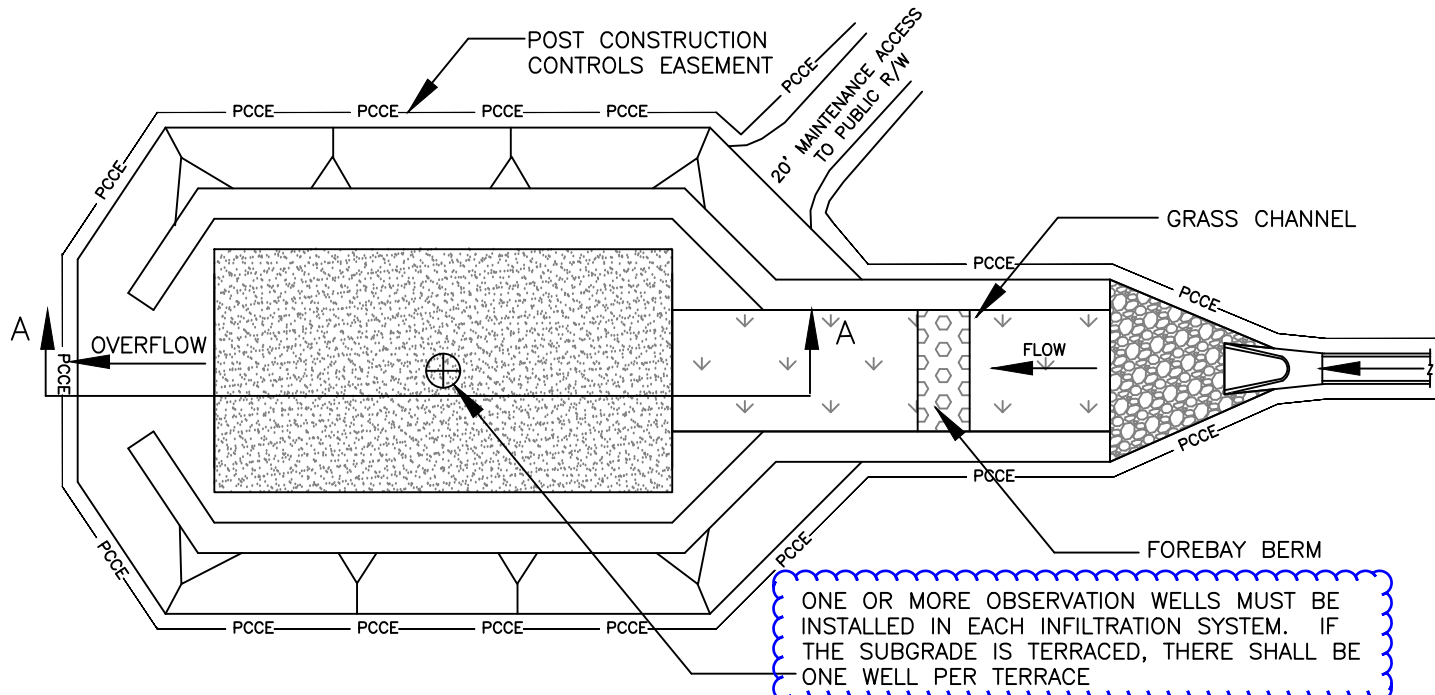


CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
INCLUDES CHARLOTTE ETJ

GRASS CHANNEL PLANTING PLAN

BMP FIG. 4.5.3

STD. NO.	REV.
21.18	2

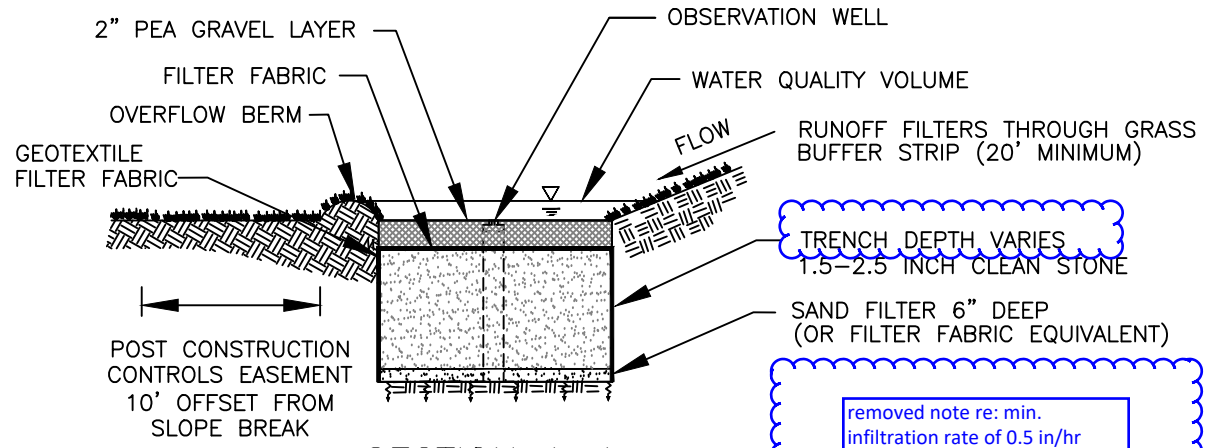


PLAN
NOT TO SCALE

NOTES:

1. CONNECT INFILTRATION TRENCH EASEMENT TO A DEDICATED PUBLIC RIGHT OF WAY WITH A 20-FOOT ACCESS EASEMENT.

2. LINE THE SIDES AND TOP OF THE TRENCH WITH AN APPROPRIATE GEOTEXTILE FILTER FABRIC THAT PREVENTS SOIL PIPING BUT HAS GREATER PERMEABILITY THAN THE PARENT SOIL. THE TOP LAYER OF THE FILTER FABRIC IS SPACED 2-6 INCHES FROM THE TOP OF THE SYSTEM AND SERVES TO PREVENT SEDIMENT FROM PASSING INTO THE STONE AGGREGATE.



SECTION A-A
NOT TO SCALE

NOT TO SCALE

removed note re: min.
infiltration rate of 0.5 in/hr



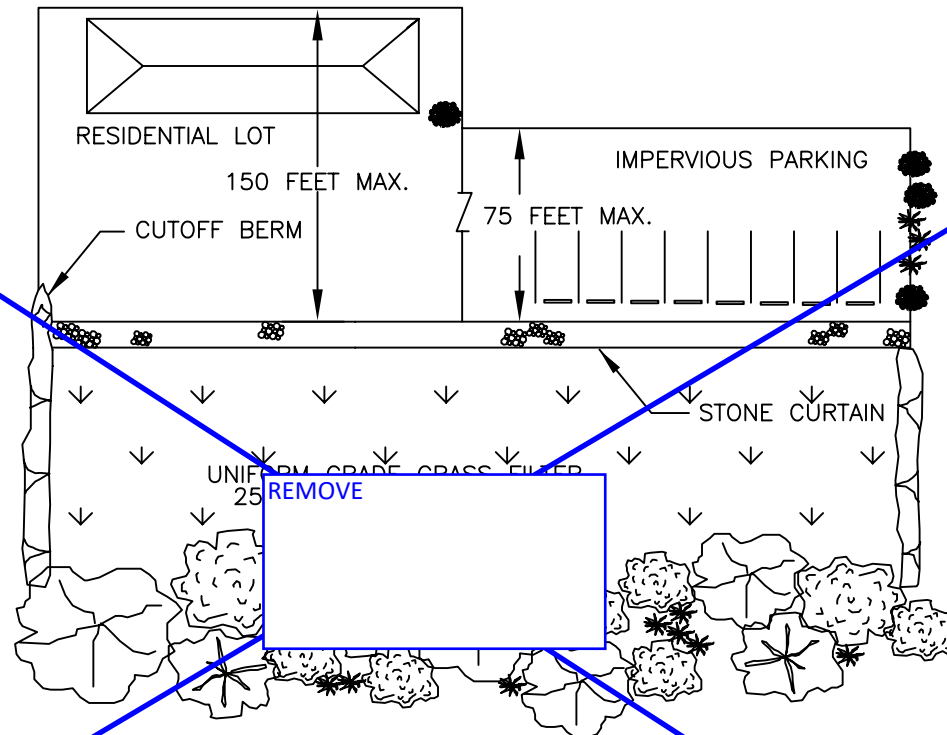
CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
INCLUDES CHARLOTTE ETJ

INFILTRATION TRENCH

STD. NO.	REV.
21.19	24

NOTES:

1. MAXIMUM SLOPE 2% FOR FILTER STRIP AND 5% FOR BUFFER STRIP.
2. 5 ACRE MAXIMUM DRAINAGE AREA.
3. ALL FILTER/BUFFER STRIPS SHALL HAVE A MINIMUM 20 FOOT ACCESS EASEMENT CONNECTING TO A DEDICATED PUBLIC RIGHT OF WAY. ACCESS ROAD SHALL HAVE MIN. 12' STABILIZED WIDTH, MAX. LONG. GRADE OF 15%, MAX. CROSS-SLOPE 5%.



PLAN

STONE CURTAIN 6"x12" PEA GRAVEL PER
ASTM D-448, SIZE #6 (1/8-3/8")
WRAPPED WITH FILTER FABRIC.

IMPERVIOUS PARKING
FLOW

FLOW

UNIFORM GRADE GRASS FILTER

FOREST FILTER

PROFILE

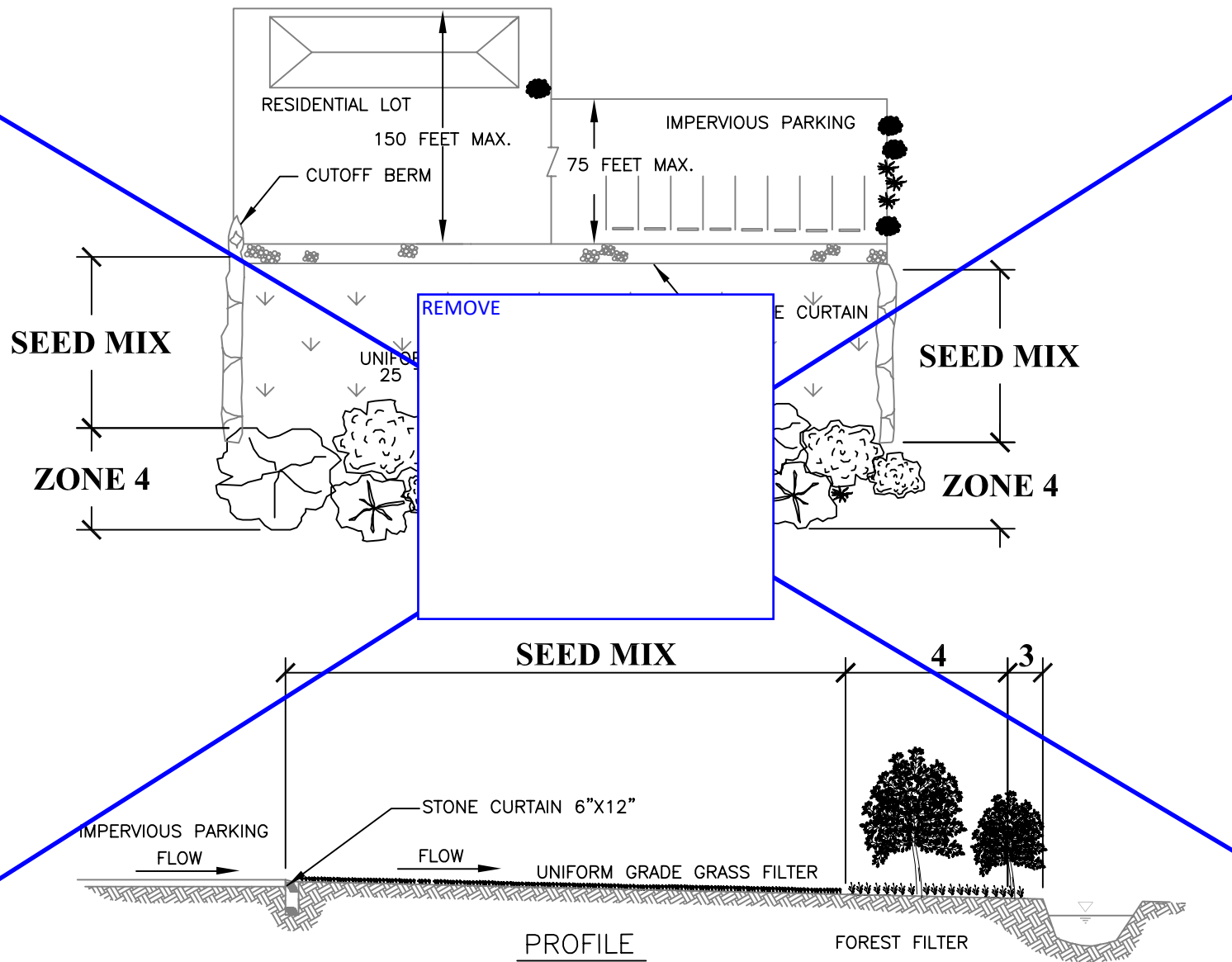
NOT TO SCALE



CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
INCLUDES CHARLOTTE ETJ

BUFFER STRIP
BMP FIG. 4.7.3

STD. NO.	REV.
21.21	2



NOT TO SCALE



CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
INCLUDES CHARLOTTE ETJ

BUFFER STRIP
PLANTING PLAN
BMP FIG. 4.7.4

STD. NO.	REV.
21.22	2

All notes added for consistency with SCM Manual

Removed "1" thick debris screen"

TEMPORARY POOL STAGE:
2' MAX RECOMMENDED FOR WQV
6' MAX FOR ALL OTHER STORMS

MIN. 18" SAND MEDIA DEPTH

CLEANOUT WITH WATER-TIGHT CAP

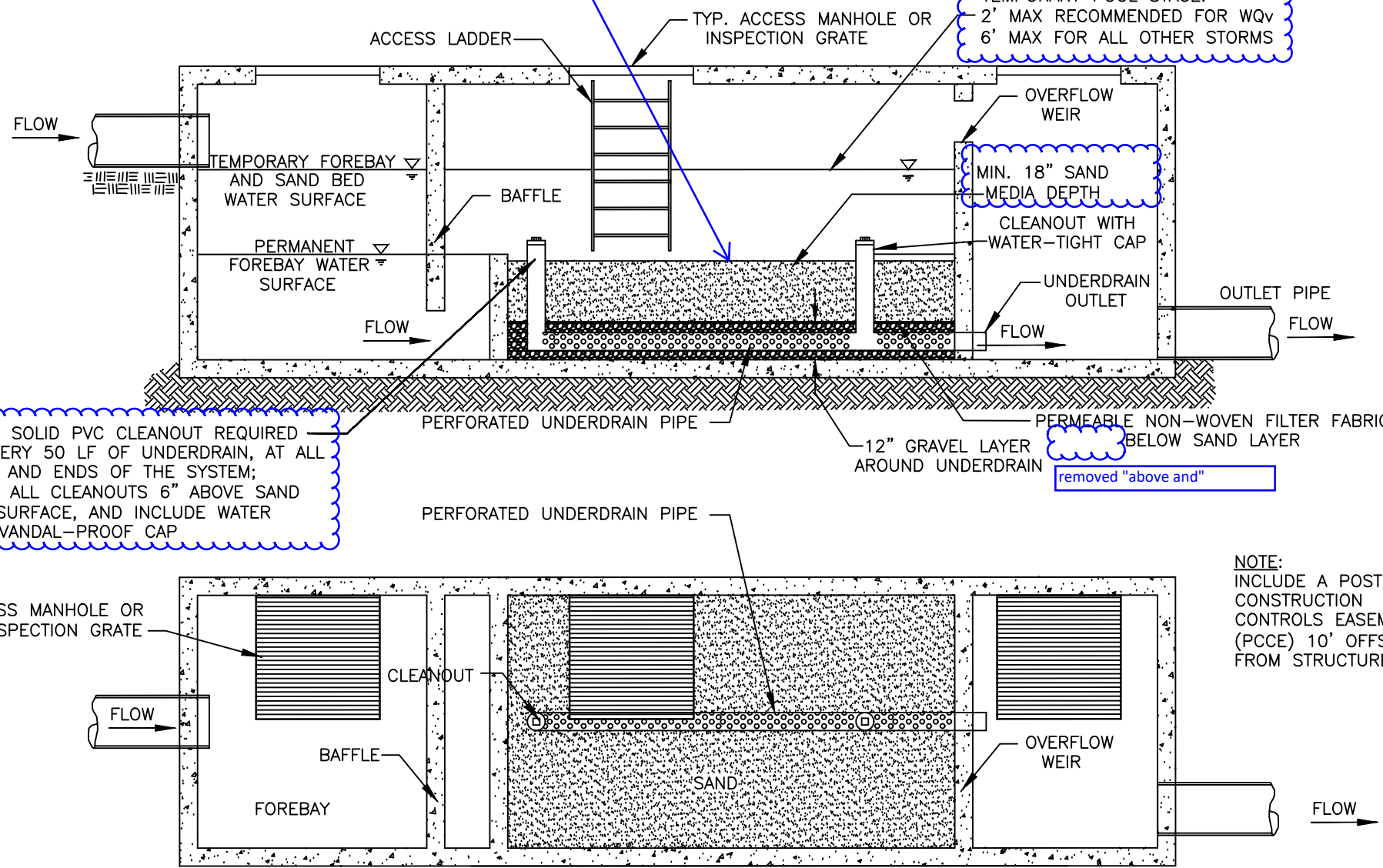
UNDERDRAIN OUTLET

PERMEABLE NON-WOVEN FILTER FABRIC BELOW SAND LAYER

removed "above and"

6-INCH SOLID PVC CLEANOUT REQUIRED FOR EVERY 50 LF OF UNDERDRAIN, AT ALL BENDS, AND ENDS OF THE SYSTEM; EXTEND ALL CLEANOUTS 6" ABOVE SAND MEDIA SURFACE, AND INCLUDE WATER TIGHT, VANDAL-PROOF CAP

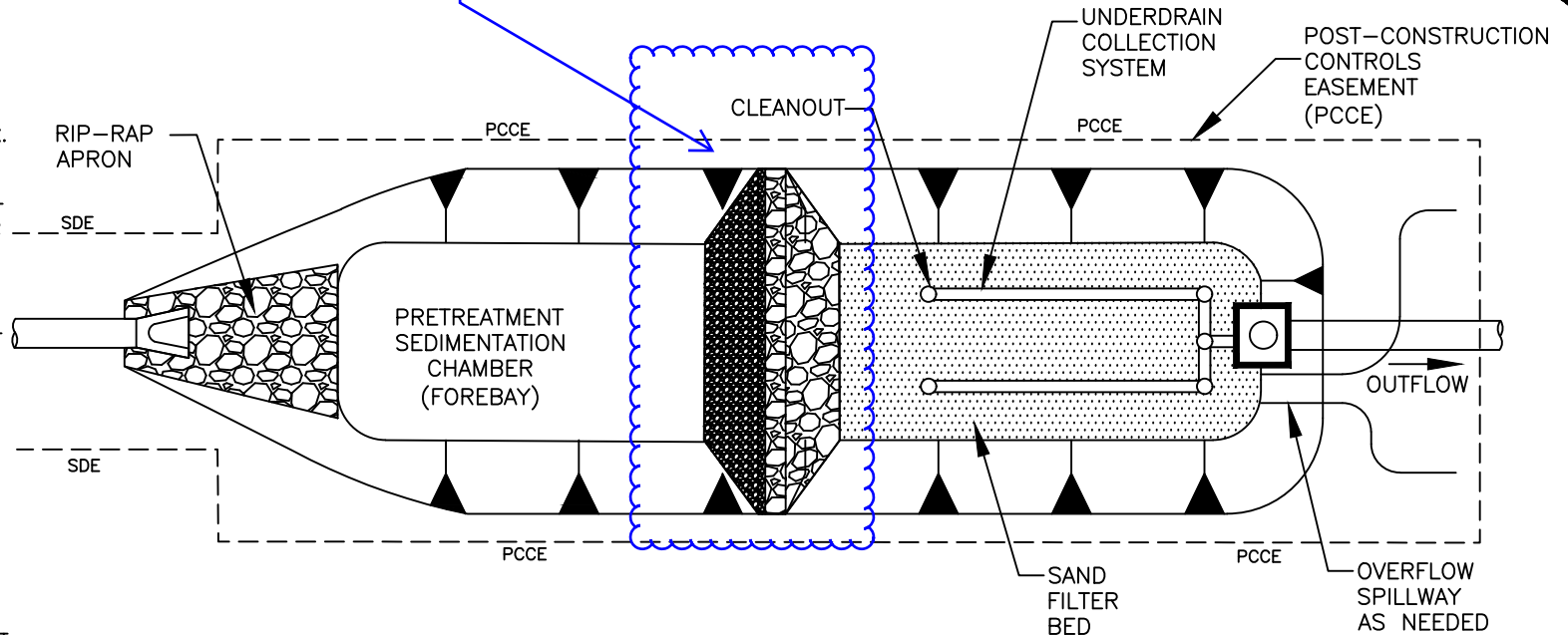
NOTE:
INCLUDE A POST CONSTRUCTION CONTROLS EASEMENT (PCCE) 10' OFFSET FROM STRUCTURE



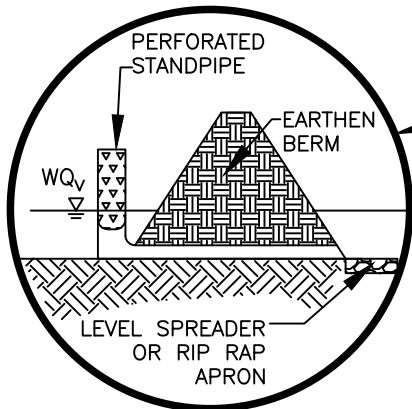
shifted berm over to split basin in half

NOTES:

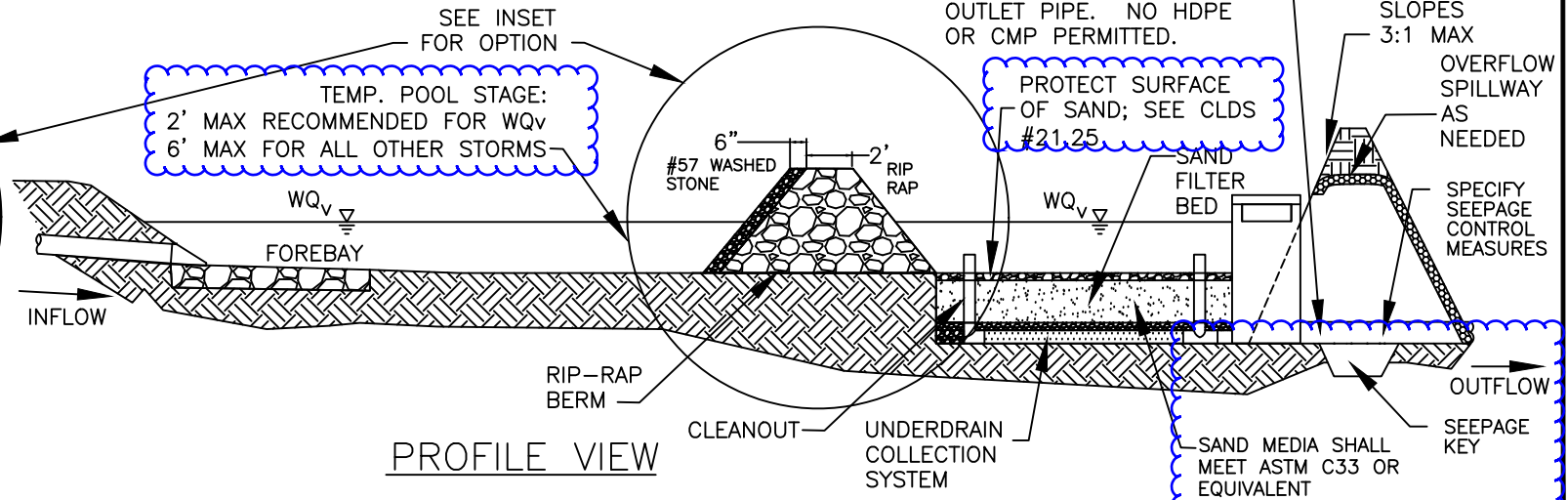
1. ALL SAND FILTERS SHALL HAVE A MINIMUM 20 FOOT ACCESS EASEMENT CONNECTING TO A DEDICATED PUBLIC RIGHT OF WAY. ACCESS ROAD SHALL HAVE MIN. 12' STABILIZED WIDTH, MAX. LONG. GRADE OF 15%, MAX. CROSS-SLOPE 5%. IN ADDITION, A 10-FOOT WIDE PERMANENT MAINTENANCE ACCESS EASEMENT MUST BE PROVIDED AROUND THE PERIMETER OF ALL BMPs TO ALLOW FOR ADEQUATE MAINTENANCE AND REPAIR.
2. ALL DRAINAGE AREAS TO A SAND FILTER FACILITY ARE TO BE STABILIZED PRIOR TO INSTALLATION OF SAND.
3. CLEAN OUTS IN THE UNDERDRAIN SYSTEM ARE TO BE PROVIDED EVERY 50' MINIMUM, AT ALL BENDS, AND ENDS OF THE SYSTEM FOR MAINTENANCE PURPOSES. CLEAN OUTS SHALL HAVE WATER-TIGHT, VANDAL-PROOF CAPS AND EXTEND 6" ABOVE THE SURFACE.
4. DEMONSTRATION OF APPROPRIATE SAFETY FACTORS AGAINST FAILURE THROUGH GEOTECHNICAL ANALYSIS BY A LICENSED PROFESSIONAL ENGINEER SHALL BE REQUIRED FOR EMBANKMENT SLOPES STEEPER THAN 3:1.
5. WATER-TIGHT SEAL MUST BE PROVIDED BETWEEN ALL RISER AND PIPE JOINT CONNECTIONS.



PLAN VIEW



INSET



PROFILE VIEW

NOT TO SCALE

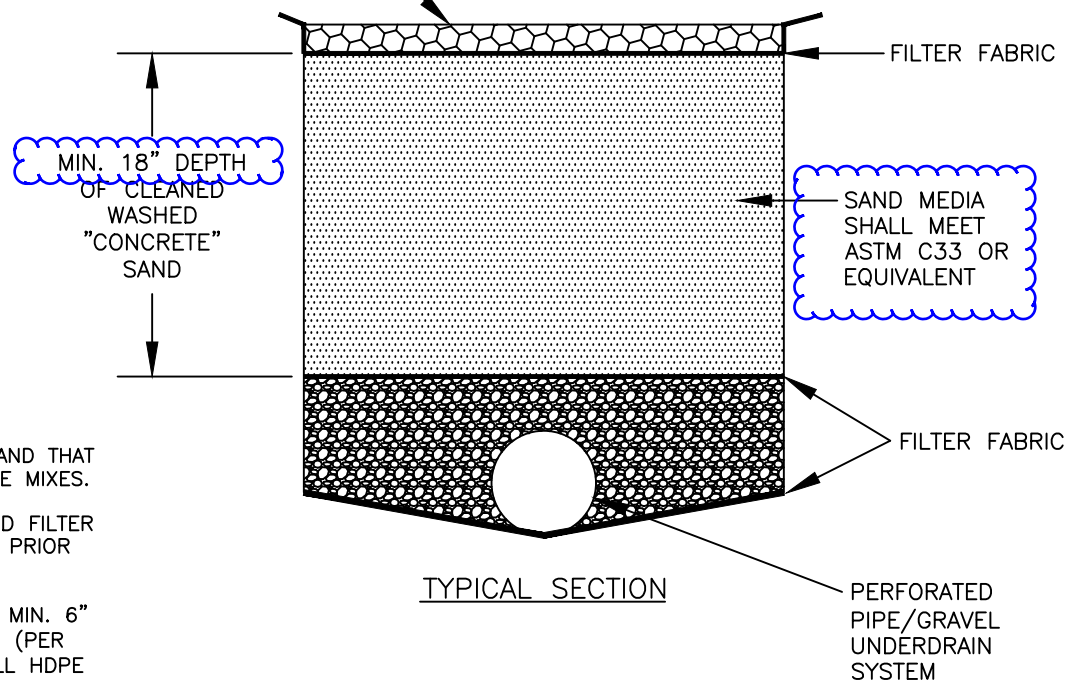


CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
INCLUDES CHARLOTTE ETJ

SURFACE SAND FILTER

STD. NO.	REV.
21.24	24

THE TOP OF SURFACE SAND FILTER MEDIA MUST BE PROTECTED. USE WASHED BERMUDA SOD, OR A FILTER FABRIC WITH A LAYER OF WASHED #2 STONE ON TOP.



NOTES:

1. "CONCRETE" SAND REFERS TO SAND THAT IS COMMONLY USED IN CONCRETE MIXES.
2. ALL DRAINAGE AREAS TO A SAND FILTER FACILITY ARE TO BE STABILIZED PRIOR TO INSTALLATION OF SAND.
3. UNDERDRAIN PIPES SHOULD BE MIN. 6" PERFORATED SCHEDULE 40 PVC (PER AASHTO M278) OR DOUBLE WALL HDPE (PER AASHTO M252). PERFORATIONS SHOULD BE $\frac{3}{8}$ " SPACED 3" ON CENTER ALONG 4 LONGITUDINAL ROWS SPACED 90° APART.

TYPICAL SECTION

Removed old table of NCDEQ details and exceptions, new table includes references to CLDSM/NCDEQ maint procedures

CLDS #	NAME	REFERENCE FOR MAINT. NOTES
30.00	SPECIAL EROSION CONTROL REQUIRMENTS & NOTES	N/A
30.01	TEMPORARY SEDIMENT TRAP	6.60.5
30.02A	SKIMMER SEDIMENT BASIN	6.64.9
30.02B	SKIMMER	6.64.9
30.03A	SEDIMENT BASIN	6.61.8
30.03B	GENERAL NOTES--SEDIMENT BASINS	N/A
30.04	FLEXIBLE PIPE SLOPE DRAIN	6.32.3
30.05	TEMPORARY SILT DITCH	6.20.3 / 6.30.4
30.06A	TEMPORAY SILT FENCE	6.62.7
30.06B	HIGH HAZARD TEMPORARY SILT FENCE	SEE CLDS 30.06B DETAIL
30.06C	SILT FENCE OUTLET	SEE CLDS 30.06C DETAIL
30.06D	SUPER SILT FENCE	SEE CLDS 30.06D DETAIL
30.07	BLOCK AND GRAVEL STONE INLET PROTECTION	6.52.2
30.08	STONE INLET PROTECTION	6.55.3
30.09	HARDWARE CLOTH AND GRAVEL INLET PROTECTION	6.51.2
30.10A	TEMPORARY ROCK CHECK DAM	6.83.3
30.10B	TEMPORARY ROCK CHECK DAM W MATTING & PAM	6.83.3 / 6.86.5
30.10C	TEMPORARY WATTLE CHECK DAM W MATTING	N/A
30.10D	TEMPORARY WATTLE CHECK DAM W MATTING & PAM	N/A
30.11A	STABILIZED CONSTRUCTION ENTRANCE	6.06.2
30.11B	CONSTRUCTION ENTRANCE TIRE WASH	6.06.2
30.11C	CONSTRUCTION ENTRANCE SINGLE FAMILY LOT	6.06.2
30.12	GRAVEL AND RIP RAP FILTER BERM BASIN	6.63.5
30.13	EROSION CONTROL DEWATERING	N/A
30.14	TEMPORARY STREAM CROSSING	6.70.6
30.15	CATCH BASIN INLET PROTECTION	SEE CLDS 30.15 DETAIL
30.16	SLOPE STABILITY	6.02.3
30.17	TEMPORARY SEEDING SCHEDULE	6.10.3
30.18	TEMPORARY ASPHALT DIVERSION BERM	SEE CLDS 30.18 DETAIL
30.19	BAFFLE INSTALLATION	6.65.6
30.20	EMBANKMENT MATTING DETAIL	6.17.12
30.21	BRICK STORM STRUCTURE W TEMPORARY PIPE	N/A
30.22A	BYPASS PUMPING	N/A
30.22B	SUSPENDE BYPASS PIPE	N/A
30.22C	PIPED DIVERSION	N/A
30.23	TURBIDITY CURTAIN	SEE CLDS 30.23 DETAIL

THE NCDEQ MAINTENANCE REFERENCES INDICATED ARE FROM THE NORTH CAROLINA EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL (NCESCPDM, LATEST EDITION) PREPARED BY NC DEPT. OF ENVIRONMENTAL QUALITY (NCDEQ); ALSO REFERENCE NCDOT ROADWAY STANDARD DRAWINGS, LATEST EDITION.



**CITY OF CHARLOTTE
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INCLUDES CHARLOTTE ETJ

EROSION CONTROL STANDARDS LIST & MAINTENANCE REFERENCES

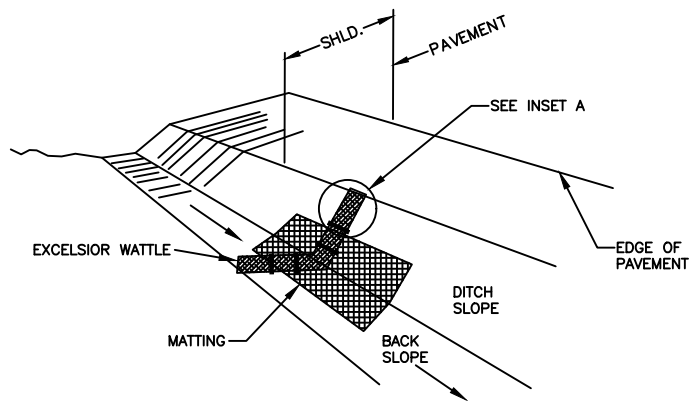
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GENERAL NOTES:

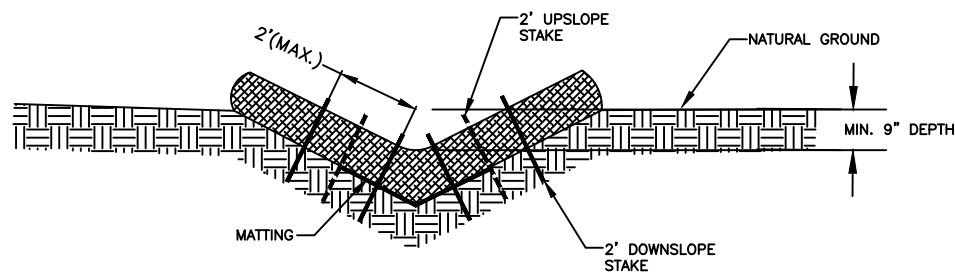
Removed previous notes 5, 12,
and 16 - not relevant to basins

1. AREA UNDER EMBANKMENT SHALL BE CLEARED, GRUBBED, AND STRIPPED OF ANY VEGETATION AND ROOT MATERIAL. THE BASIN AREA SHALL BE CLEARED.
2. THE FILL MATERIAL FOR THE EMBANKMENT SHALL BE FREE OF ROOTS OR OTHER WOODY VEGETATION AS WELL AS OVERSIZED STONES, ROCKS, ORGANIC MATERIAL, OR OTHER OBJECTIONABLE MATERIAL. THE EMBANKMENT SHALL BE COMPACTED BY TRAVERSING WITH EQUIPMENT WHILE BEING CONSTRUCTED. SPILLWAYS SHOULD NOT BE CONSTRUCTED THROUGH FILL SECTIONS. ALL SPILLWAYS SHOULD BE LINED AND/OR RIPRAPPED.
3. SEDIMENT SHALL BE REMOVED AND TRAP RESTORED TO ITS ORIGINAL DIMENSIONS WHEN THE SEDIMENT HAS ACCUMULATED TO A DEPTH SHOWN ON STANDARD. REMOVED SEDIMENT SHALL BE DEPOSITED IN A SUITABLE AREA IN SUCH A MANNER THAT IT WILL NOT ERODE.
4. THE BASIN SHALL BE INSPECTED AFTER EACH RAIN AND REPAIRS MADE AS NECESSARY.
5. ALL SEDIMENT BASIN SLOPES SHALL BE 3:1 OR FLATTER UNLESS CERTIFIED BY REGISTERED GEOTECHNICAL ENGINEER.
6. SEDIMENT BASIN EMBANKMENTS SHOULD BE PROVIDED WITH EROSION CONTROL AND STABILIZATION.
7. STORAGE AREA MAY BE CONSTRUCTED IN ANY SHAPE PROVIDED THE MINIMUM STORAGE VOLUME REQUIREMENT IS MET. THE BASIN SHOULD ALSO BE ORIENTED SUCH THAT THE FILTER AND THE MAIN FLOW OF WATER AND SEDIMENT ARE ON OPPOSITE ENDS ON THE LONGER BASIN DIMENSIONS.
8. THE LENGTH OF THE STONE OUTLET (SPILLWAY) IS TO BE BASED ON A 10 YEAR STORM.
9. WHENEVER TOPOGRAPHY ALLOWS, THE BASIN LENGTH SHOULD BE TWICE (2X) THE BASIN WIDTH, TO ALLOW FOR SETTLING. BAFFLES SHALL BE INSTALLED IN ALL BASINS.
10. CLEANOUT STAKES SHALL BE PLACED IN ALL SEDIMENT BASINS AT THE LOW POINT IN THE BASIN. THE STAKES SHALL BE MARKED SHOWING THE HALF FULL, CLEANOUT POINT, OF THE BASIN.
11. FOR DESIGN OF SEDIMENT BASINS, REFER TO THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY, EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL.
12. FOR SLOPES GREATER THAN 10' IN LENGTH AND PROTECTED BY SILT FENCE AT THE TOE OF THE SLOPE, SLOPE TERRACING WILL BE REQUIRED.
13. THE BERM ON SEDIMENT BASINS SHALL BE SEEDED ONCE FINAL GRADE HAS BEEN REACHED. THE SILT FENCE MAY BE REMOVED IF PERMISSION HAS BEEN GRANTED BY THE CITY LAND DEVELOPMENT INSPECTOR AFTER THE GRASS HAS GERMINATED AND STABLE GROUND HAS BEEN ESTABLISHED.

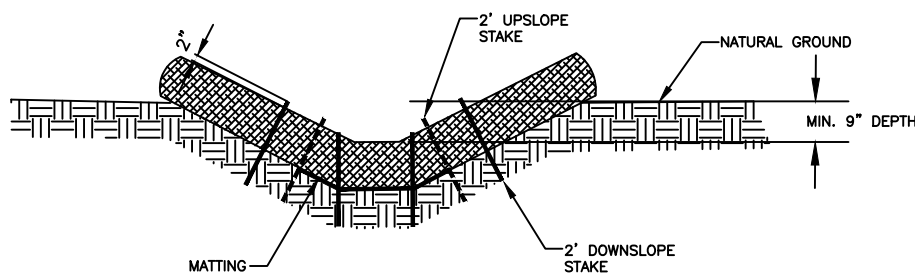




ISOMETRIC VIEW



CROSS SECTION
VEE DITCH



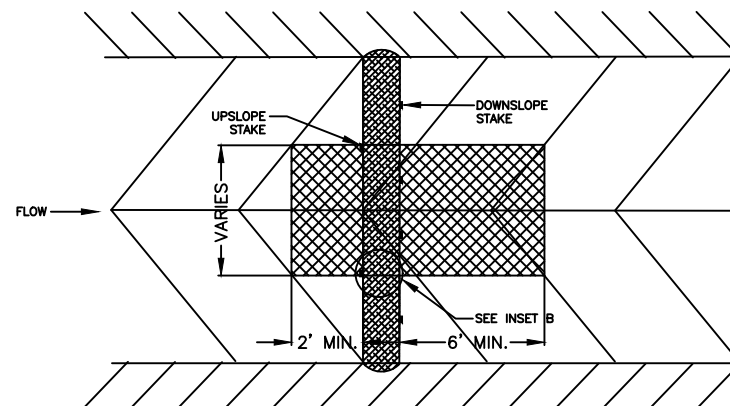
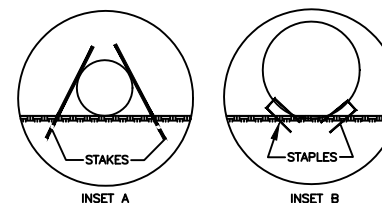
CROSS SECTION
TRAPEZOIDAL DITCH

GENERAL NOTES:

1. USE MINIMUM 12 INCH DIAMETER FIBER WATTLE.
2. USE 2 FT. WOODEN STAKES WITH A 2 IN. X 2 IN. NOMINAL CROSS SECTION
3. ONLY INSTALL WATTLE(S) TO A HEIGHT IN DITCH SO FLOW WILL NOT WASH AROUND WATTLE AND SCOUR DITCH SLOPES AND AS DIRECTED.
4. INSTALL A MINIMUM OF 2 UPSLOPE STAKES AND 4 DOWNSLOPE STAKES AT AN ANGLE TO WEDGE WATTLE TO BOTTOM OF DITCH.
5. PROVIDE STAPLES MADE OF 0.125 IN. DIAMETER STEEL WIRE FORMED INTO A U SHAPE NOT LESS THAN 12" IN LENGTH.
6. INSTALL STAPLES APPROXIMATELY EVERY 1 LINEAR FOOT ON BOTH SIDES OF WATTLE AND AT EACH END TO SECURE IT TO THE SOIL.
7. INSTALL MATTING IN ACCORDANCE WITH SECTION 1631 OF THE NCDOT STANDARD SPECIFICATIONS.

Removed notes about PAM
from this detail

Removed PAM detail



NOT TO SCALE

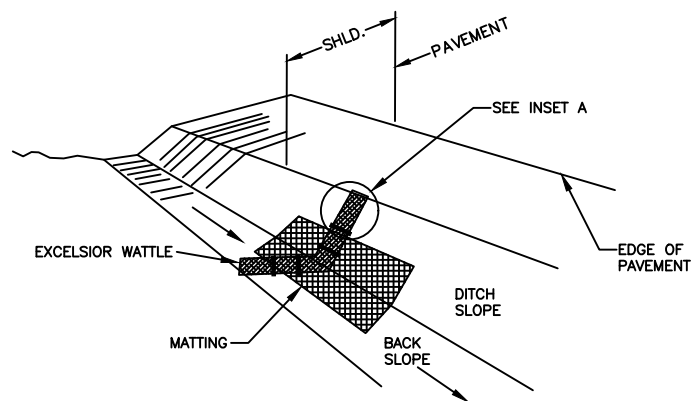


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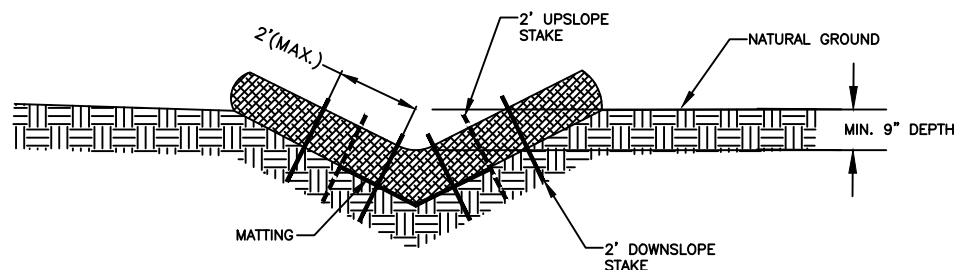
TEMPORARY WATTLE CHECK DAM WITH MATTING

Removed "And PAM" from this
detail title

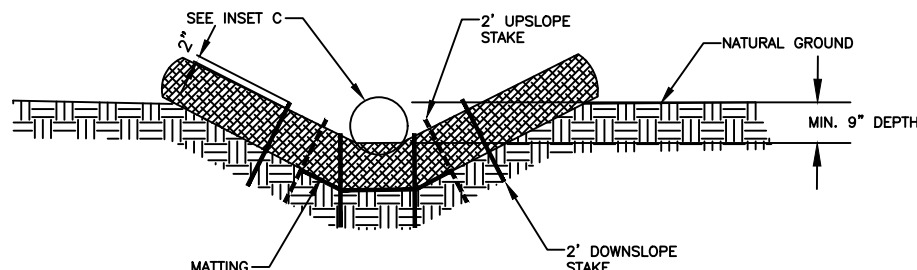
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ISOMETRIC VIEW



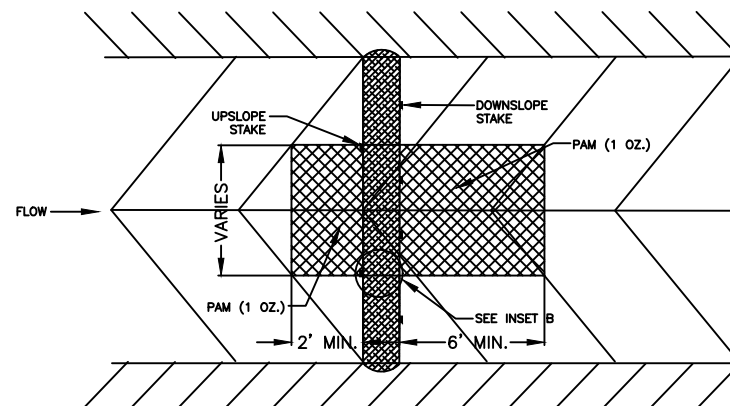
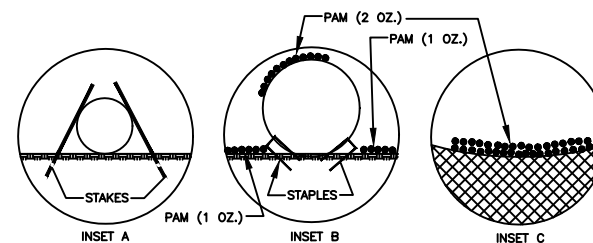
CROSS SECTION
VEE DITCH



CROSS SECTION
TRAPEZOIDAL DITCH

GENERAL NOTES:

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6. INSTALL STAPLES APPROXIMATELY EVERY 1 LINEAR FOOT ON BOTH SIDES OF WATTLE AND AT EACH END TO SECURE IT TO THE SOIL.
7. INSTALL MATTING IN ACCORDANCE WITH SECTION 1631 OF THE NCDOT STANDARD SPECIFICATIONS.
8. PRIOR TO POLYACRYLAMIDE (PAM) APPLICATION, OBTAIN A SOIL SAMPLE FROM PROJECT LOCATION, AND FROM OFFSITE MATERIAL, AND ANALYZE FOR APPROPRIATE PAM FLOCCULANT TO BE APPLIED TO EACH WATTLE.
9. INITIALLY APPLY 2 OUNCES OF ANIONIC OR NEUTRALLY CHARGED PAM OVER WATTLE WHERE WATER WILL FLOW AND 1 OUNCE ON MATTING ON EACH SIDE OF WATTLE. REAPPLY PAM AFTER EVERY RAINFALL EVENT THAT IS EQUAL TO OR EXCEEDS 0.50 IN.



NOT TO SCALE

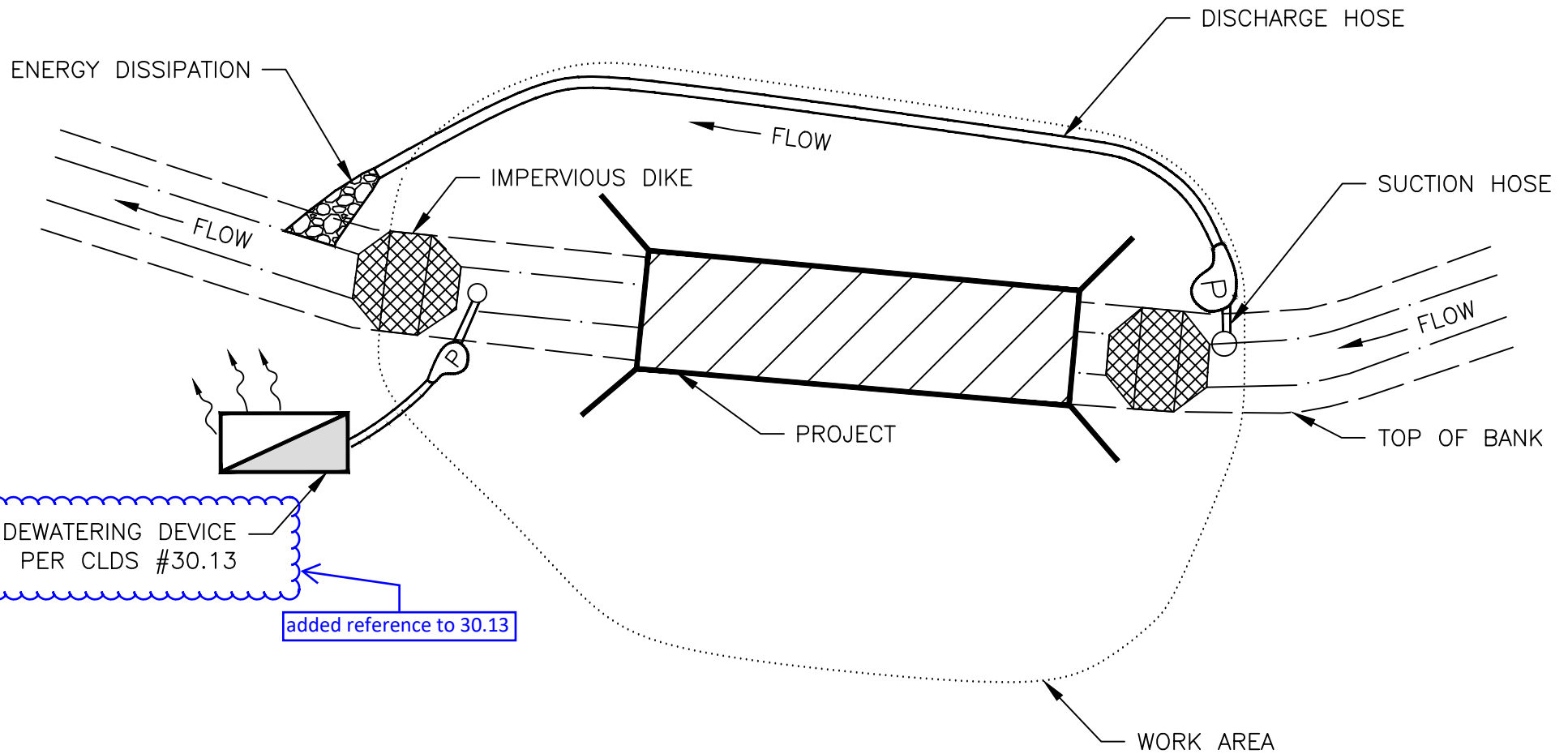


CITY OF CHARLOTTE
LAND DEVELOPMENT STANDARDS
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TEMPORARY WATTLE CHECK DAM WITH MATTING AND PAM

New detail added, to show Checkdam
with PAM, instead of "optional PAM"

STD. NO.	REV.
30.10D	24



NOTE:
ANCHOR ALL PUMPS AND PIPES SECURELY

NOT TO SCALE