# 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.

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 | |
|---|---|---|---|---|
| | Level/Rolling | Hilly | Level/Rolling | Hilly |
| 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 | |
|---|---|---|---|---|
| | Level/Rolling | Hilly | Level/Rolling | Hilly |
| 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 |

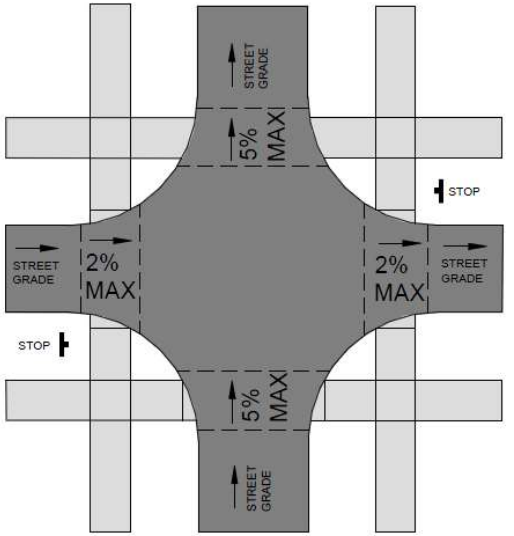
Note: K=Rate of Vertical Curvature for Minimum Sight Distance. Provisions of adequate stopping sight distance may require use of larger K values than the minimums listed above. The Charlotte Department of Transportation, under Section 19-245 of City Code, reserves the right to prescribe more stringent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

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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 that these minimums and will be determined by CDOT on a case by case basis.

3. 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.

4. 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.

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: | | |
|---|---|---|
| WIDTH | RISE | CROSS-SLOPE |
| 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 and culvert applications.
5. 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.
6. Corrugated Aluminized Metal Pipe (CAMP) or Corrugated Aluminum Alloy Pipe (CAAP) may only be used in roadway culvert applications requiring 60" or larger pipe diameters. Culverts are defined as open-ended conduits passing through roadway embankments. CAMP and/or CAAP shall not be used in piped storm drainage collection systems that connect to drainage structures, multiple systems, system outlets, etc.

7. Pipes shall have a minimum diameter of fifteen (15) inches (eighteen (18) inches minimum on culverts).
8. The maximum allowable pipe slope is 10 percent.
9. 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.
10. 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.
11. Prior approval by Charlotte Storm Water Services shall be required for the construction of any endwall that is not a NCDOT Roadway Standard Drawing.
12. 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 and Repair 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 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. Pipe shall have 8-foot standard joint lengths. Unless a leak resistant joint is specified, preformed joint sealant conforming to ASTM C-990 shall be used.
      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, 2/5 of the height of the culvert or .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.
      - At a minimum, for CAMP and CAAP to be considered, soil and stream-side pH and resistivity values must be within a range of $5.0 < pH < 9.0$ and resistivity of $r > 1500$ ohm-cm.
      - Submit manufactures specifications showing that the selected CAMP or CAAP is suitable based on the results of the physical testing of pH and resistivity.
   d. Minimum wall thickness is 10 gage.
   e. 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.
   f. Gaskets that provide 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
   g. 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
    a. 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.
    b. 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 or .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.
    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.
        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 $5.0 < pH < 9.0$ and resistivity of $r > 1500$ 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.
    d. Minimum wall thickness is 10 gage.
    e. Gaskets that provide 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.
    f. 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. A preformed joint sealant used with an external sealing band is acceptable.

6. Bottomless/Arch Culverts
    a. All bottomless/arch culvert must be designed with leak resistant joints. A preformed joint sealant used with an external sealing band is acceptable.
    b. 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 right-of-way. 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 (HDPE, CAMP, CAAP, etc) 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 plastic 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. APPROVED PLANT SPECIES

The following list of trees and shrubs represent the approved plant species that may be used to comply the City of Charlotte Unified Development Ordinance ("Tree Ordinance" section) of the City of Charlotte Code.

**Other species may be allowed with staff approval**

List subject to change

* - Not allowed for required city planting.

**- Not reccomended for required city planting.

† - Cultivars under 15' tall only.

‡- Trees <25' mature height can be planted directly under power lines.

Trees 25'- 40' mature height can be planted at least 20' from power lines.

**Trees**

| Common Name | Scientific Name | City Tree Ordinance Approved | CIP/ROW Approved | City Zoning Approved (**L**arge or **S**mall Maturing) | Duke Transmission Zone(**T**) or Distribution line(**D**) Approved | | Shade Tolerant | Tolerates Poor Drainage | Native | Blooming | Foliage (**D**eciduous, **S**emi-deciduous, or **E**vergreen) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **LARGE MATURING (50'+ H)** | | | | | | | | | | | |
| **Arborvitae, 'Green Giant'** | **Thuja 'Green Giant'** | | x | | | | | x | | | E |
| **Ash, Green** | **Fraxinus pennsylvanica** | | | L | | | x | | x | | D |
| **Ash, White** | **Fraxinus americana** | x | | L | | | | | x | | D |
| **Baldcypress** | **Taxodium distichum** | x | x | L | | | | x | x | | D |
| **Beech, American** | **Fagus grandiflora** | x | x | L | | | | | x | | D |
| **Birch, River** | **Betula nigra** | x | x | L | | | x | x | x | | D |
| **Black Gum** | **Nyssa sylvatica** | x | x | L | | | | | x | | D |
| **Cedar, Deodar** | **Cedrus deodara** | x | x | L | | | | | | | E |
| **Cedar, Eastern Red** | **Juniperus virginiana** | | x | L | | | | | x | | E |
| **Cryptomeria, Japanese** | **Cryptomeria japonica** | x | x | | | | | x | | | E |

## Trees

| Common Name | Scientific Name | City Tree Ordinance Approved | CIP/ROW Approved | City Zoning Approved (**L**arge or **S**mall Maturing) | Duke Transmission Zone(**T**) or Distribution line(**D**) Approved | | Shade Tolerant | Tolerates Poor Drainage | Native | Blooming | Foliage (**D**eciduous, **S**emi-deciduous, or **E**vergreen) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **LARGE MATURING (50'+ H) cont...** | | | | | | | | | | | |
| Dawn Redwood | Metasequoia glyptostroboides | x | x | | | | | | | | S |
| Elm, Princeton | Ulmus americana 'Princeton' | | x | | | | | | | | D |
| Elm, Lacebark | Ulmus parvifolia | x | x | L | | | x | x | | | D |
| Gingko ‡ | Gingko biloba | x | x | L | | | x | x | | | D |
| Hackberry, Common | Celtis occidentalis | x | | L | | | x | x | x | | D |
| Hackberry, Sugar | Celtis laevigata | x | | | | | x | x | x | | D |
| Hemlock, Eastern | Tsuga canadensis | | | L | | | x | | x | | E |
| Hickory, Bitternut | Carya cordiformis | | | L | | | | | x | | D |
| Hickory, Pignut | Carya glabra | | | L | | | | | x | | E |
| Hickory, Shagbark | Carya ovata | | | L | | | | | x | | E |
| Holly, American | Ilex opaca | x | x | S | | | x | | x | | E |
| Honeylocust, Shademaster** | Gleditsia tricanthos inermis 'Shademaster' | | | | | | | | x | | D |
| Hornbeam, European | Carpinus betulus | x | x | S | | | x | x | | | D |
| Kentucky Coffeetree | Gymnocladus dioicus | x | x | | | | x | | x | | D |
| Linden, Little Leaf | Tilia cordata | x | | | | | x | x | | x | D |
| Magnolia, Cucumber | Magnolia acuminata | | x | | | | | | x | x | D |
| Magnolia, Southern | Magnolia grandiflora | x | x | L | | | | x | x | x | E |
| Maple, Freeman | Acer x fremanii | x | x | | | | x | | x | | D |
| Maple, Red * | Acer rubrum | | x | L | | | x | x | x | | D |
| Maple, Sugar | Acer saccharum | x | x | L | | | x | | x | | D |
| Oak, Black | Quercus velutina | | | L | | | x | | x | | D |
| Oak, Fastigiante English | Quercus robur 'Fastigiata' | | x | | | | | | | | D |

## Trees

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|---|---|---|---|---|---|---|---|---|---|---|---|
| **LARGE MATURING (50'+ H) cont...** | | | | | | | | | | | |
| Oak, Laurel | Quercus laurifolia | x | | L | | | x | | x | | D |
| Oak, Live | Quercus virginiana | x | x | L | | | x | x | x | | E |
| Oak, Northern Red* | Quercus rubra | | | L | | | x | | x | | D |
| Oak, Nuttall | Quercus nuttalii | x | x | | | | x | | x | | D |
| Oak, Overcup | Quercus lyrata | x | x | | | | x | x | x | | D |
| Oak, Scarlet** | Quercus coccinea | | | L | | | | | x | | D |
| Oak, Shumard | Quercus shumardii | x | x | L | | | x | | x | | D |
| Oak, Southern Red | Quercus falcata | x | x | L | | | x | | x | | D |
| Oak, Swamp White | Quercus bicolor | | x | L | | | x | x | x | | D |
| Oak, Water | Quercus nigra | | x | L | | | | x | x | | D |
| Oak, White | Quercus alba | | x | L | | | x | | x | | D |
| Oak, Willow | Quercus phellos | x | x | L | | | x | x | x | | D |
| Pecan | Carya illinoensis | | | L | | | | | x | | D |
| Persimmon | Diospyros virginiana | | | L | | | x | | x | | D |
| Pine, Austrian | Pinus nigra | x | | L | | | | x | | | E |
| Pine, Japanese Black | Pinus thunbergi | | | L | | | | | | | E |
| Pine, Loblolly | Pinus taeda | x | x | L | | | | x | x | | E |
| Pine, Shortleaf | Pinus echinata | | x | L | | | | | x | | E |
| Pine, Virginia | Pinus virginiana | x | x | L | | | | | x | | E |
| Poplar, Tulip | Liriodendron tulipfera | x | x | L | | | x | x | x | x | D |
| Sweetgum, Fruitless | Liquidambar styraciflua 'Rotundiloba' | x | x | L | | | x | x | x | | D |
| Sweetgum, Slender | Liquidambar styraciflua 'Slender Silhouette' | | x | | | | x | x | x | | D |
| Zelkova, Japanese * | Zelkova serrata | | | L | | | x | | | | D |

## Trees

| Common Name | Scientific Name | City Tree Ordinance Approved | CIP/ROW Approved | City Zoning Approved (**L**arge or **S**mall Maturing) | Duke Transmission Zone(**T**) or Distribution line(**D**) Approved | | Shade Tolerant | Tolerates Poor Drainage | Native | Blooming | Foliage (**D**eciduous, **S**emi-deciduous, or **E**vergreen) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **MEDIUM MATURING (30'-50'H)** | | | | | | | | | | | |
| Arborvitae, American † | Thuja occidentalis | | x | | D | | | x | x | | E |
| Carolina Silverbell | Halesia carolina | x | x | S | | | x | | x | x | D |
| Chinese Pistache | Pistacia chinensis | x | x | | | | x | x | | | D |
| Crape Myrtle (Biloxi, Natchez)* | Lagerstroemia | | x | | | | | | | | D |
| Dogwood, Flowering ‡ | Cornus florida | x | x | S | D | | x | | x | x | D |
| Dogwood, Kousa ‡- | Cornus kousa | x | x | S | D | | x | | x | x | D |
| Fringetree, Chinese | Chionanthus retusus | x | | | | | x | | | x | D |
| Golden Raintree | Koelreuteria paniculata | | x | S | | | | | | x | D |
| Hawthorne, Green | Crataegus viridis 'Winter King' | x | x | | | | | x | x | x | D |
| Holly, 'Emily Brunner' | Ilex X 'Emily Brunner' | | x | | | | x | | | | E |
| Holly, 'Nellie R. Stevens' | Ilex X 'Nellie R. Stevens' | | x | | | | x | | | | E |
| Holly, Savannah | Ilex X attenuata 'Savannah' | | x | S | | | | x | x | | E |
| Hornbeam, American | Carpinus caroliniana | x | x | S | | | x | x | x | | D |
| Maple, Hedge | Acer campestre | | x | S | | | | x | | | D |
| Maple, Paperbark | Acer griseum | | x | | | | | | | | D |
| Maple, Trident | Acer buergeranum | x | x | | | | x | | | | D |
| Redbud, Chinese ‡ | Cercis chinensis | x | x | | D | | x | | | x | D |
| Sourwood | Oxydendrum arboreum | | | S | | | x | | x | x | D |

## Trees

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|---|---|---|---|---|---|---|---|---|---|---|---|
| **SMALL MATURING (UP-25'H)** | | | | | | | | | | | |
| Arborvitae, Emerald Green | Thuja occidentalis 'Emerald Green' | | x | | | | | | | | E |
| Buckeye, Bottlebrush † | Aesculus parviflora | x | x | | T | | x | | x | x | D |
| Camellia, Sasanuqa | Camellia sasanqua | | x | S | | | x | | | x | E |
| Cherry, Kwanzan | Prunus serrulata 'Kwanzan' | x | | S | | | | | | x | D |
| Cherry, Snowgoose | Prunus serrulata 'Snowgoose' | | x | | | | | | | x | D |
| Cherry, 'Okame' | Prunus X 'Okame' | x | x | | | | | | | x | D |
| Cherry, Weeping | Prunus subhirtella pendula | | | S | | | | | | x | D |
| Cherry, Yoshino | Prunus X yedoensis | x | x | S | D | | | | | x | D |
| Cherrylaurel, Carolina | Prunus caroliniana | | | S | | | x | x | x | x | E |
| Crabapple, Japanese Flowering † | Malus floribunda | | x | S | D | | | | | x | D |
| Crape Myrtle | Lagerstroemia | | x | | | | | | | | D |
| Dogwood, redtwig † | Cornus sericea f. baileyi | | x | | D | | | x | x | x | D |
| Dogwood, Rutger's Hybrid | Cornus kousa X florida | | x | | D | | x | x | | x | D |
| Filbert, American | Corylus americana | x | x | | T,D | | x | | x | | D |
| Fringetree | Chionanthus virginiana | | x | | | | | x | x | x | D |
| Hawthorne, Washington | Crataegus phaenopyrum | x | x | S | | | | x | x | x | D |
| Holly, Foster | Ilex X attenuata 'Fosteri' | x | x | S | | | | x | x | | E |
| Holly, Yaupon | Ilex vomitoria | | x | S | | | x | | x | | E |
| Magnolia, Star † | Magnolia stellata | x | x | S | D | | | x | x | x | D |

## Trees

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|---|---|---|---|---|---|---|---|---|---|---|---|
| **SMALL MATURING (UP-25'H)** | | | | | | | | | | | |
| **Magnilia, Lily Flowered** | **Magnolia liliiflora** | | x | | | | x | | | x | D |
| **Magnolia, 'Little Gem'** | **Magnolia grandiflora 'Little Gem'** | x | x | | | | | x | x | x | E |
| **Magnolia, 'Merrill'** | **Magnolia X loebneri 'Merrill'** | | x | | | | | x | x | x | D |
| **Magnolia, Saucer** | **Magnolia X soulangiana** | x | x | S | D | | | x | x | x | D |
| **Maple, Armur 'Flame' †** | **Acer tataricum ginnala 'Flame'** | x | x | | D | | | x | | | D |
| **Maple, Japanese** | **Acer palmatum** | x | x | | | | x | | | | D |
| **Maple, Purplebow/Shantung** | **Acer truncatum** | | x | | | | | | | | D |
| **Plum, Purpleleaf** | **Prunus cerasifera 'Atropurpurea'** | x | x | S | | | | | | x | D |
| **Redbud, Eastern** | **Cercis canadensis** | x | x | S | D | | x | x | x | x | D |
| **Serviceberry** | **Amelanchier arborea** | x | x | | | | | | x | x | D |
| **Serviceberry, Shadbush †** | **Amelanchier canadensis** | x | x | S | T | | x | | x | x | D |
| **Waxmyrtle** | **Myrica cerifera** | x | | S | | | | x | | | E |

**SHRUBS**

| Common Name | Scientific Name |
|---|---|
| Burford holly * | Ilex cornuta burfordi |
| Camellia * | Camellia japonica |
| Convex Japanese holly * | Ilex crenata `convexa' |
| Dwarf burford holly * | Ilex cornuta burfordi nana |
| Emily brunner holly * | Ilex "Emily Brunner" |
| English holly * | Ilex aquifolium |
| Evergreen euonymus * | Euonymus japonicus |
| Flowering quince | Chaenomeles speciosa |
| Forsythia | Forsythia intermedia |
| Glenn dale azalea * | Azalea hybrida |
| Glossy abelia * | Abelia grandiflora |
| Hetzi Japanese holly * | Ilex crenata `hetzi' |
| Hetzi jumper * | Jumperus chinesis hetzi |
| Indian azalea * | Azalea indica |
| Inkberry holly * | Ilex glabra |
| Japanese aucuba * | Aucuba japonica |
| Kaempferi azalea * | Azalea obtusum Kaempferi |
| Laurel * | Laurus nobilis |
| Loropetalum * | Loropetalum chinense |
| Lusterleaf holly * | Ilex latifolia |
| Oakleaf hydrangea | Hydrangea quercifolia |
| Perny holly * | Ilex pernyi |
| Pfitzer juniper * | Juniperus chinensis pfitzeriana |

| Common Name | Scientific Name |
|---|---|
| Roundleaf Japanese holly * | Ilex crenata `rotundifolia' |
| Sasanqua Camellia * | Camellia sasanqua |
| Witch-hazel | Hammamelis virginiana |
| Yaupon holly * | Ilex vomitoria |
| Wax myrtle * | Myrica cerifera |
| Wild olive * | Osmanthus americana |
| Chinese photinia * | Photinia serrulata |
| Mountain andromeda * | Pieris floribunda |
| Japanese andromeda * | Pieris japonica |
| Pittosporum * | Pittosporum tobira |
| English laurel * | Prunus laurocerasus |
| Podocarpus * | Podocarpus macrophyllus maki |
| Narrow leafed English laurel * | Prunus laurocerasus angustifolia |
| Scarlet firethorn | Pyracantha coccinea |
| Yeddo-hawthorn * | Raphiolepis umbellata |
| Reeves spirea | Spirea cantoniensis |
| Thunberg spirea | Spirea thunbergii |
| Bridalwreath spirea | Spirea prunifolia plena |
| Vanhoutte spirea | Spirea vanhouttei |
| Japanese yew * | Taxus cuspidata |
| Leatherleaf viburnum * | Viburnum rhytidophyllum |
| Laurestinus viburnum * | Viburnum tinus |

* denotes evergreen

**Other species may be allowed with staff approval**

List subject to change

**REFERENCES**


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2. North Carolina Department of Transportation, Roadway Standards Drawings, latest edition.
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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 and Repair of Storm Drainage Pipes and Culverts, latest edition.
16. Charlotte Storm Water Services, Third-Party Inspection for Pipe Installations, latest edition.