Town of Garner

Engineering Manual

July 1, 2022

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INTRODUCTION, PURPOSE, AND SCOPE

A. This manual is a supplement to the Town of Garner Unified Development Ordinance (UDO) and provides more specific engineering design information and details to ensure new development plans are designed/constructed in accordance with Town of Garner specifications. It is intended to be used in tandem with the rules and regulations of the UDO.

B. It is the responsibility of the developer/applicant to perform appropriate due diligence and incorporate any/all future Town and North Carolina Department of Transportation (NCDOT) roadway plans into a site plan for development. Other standards to consider include, but are not limited to:

   1. Town of Garner Comprehensive Plan
   2. Garner Forward Transportation Plan
   3. Town of Garner Forward Comprehensive Growth Plan Map
   4. Town of Garner Greenway Plan
   5. Town Capital Improvement Program (CIP)
   6. NCDOT State Transportation Improvement Plan (STIP)
   7. NCDOT Policy on Street and Driveway Access to Highways Manual
   8. NCDOT Roadway Design Manual
   9. Raleigh Water Public Utilities Handbook (Water & Sewer)
   10. Capital Area Metropolitan Planning Organization (CAMPO) standards
   11. American Association of State Highway and Transportation Officials (AASHTO)
   12. Manual on Uniform Traffic Control Devices (MUTCD)
   13. Public Right-of Way Accessibility Guidelines (PROWAG) and Americans with Disabilities Act (ADA)

C. The word “current” in this document refers to the date of plan submittal.

1. STREET DESIGN STANDARDS

A. Related standard drawings T-1.01 through T-5.08 (Streets).

Refer to Appendix 3.1

1.1 STREETS PLANS AND PERMITTING

A. Right-of-Way Encroachments on Town Maintained Streets

Right-of-way encroachments are approved administratively by Town staff. All permit submittals shall be subject to the Engineering Department submittal guidelines and the current Town Fee Schedule. Some projects may be subject to additional processes based on impact to public right-of-way.

1. Major Encroachments (For application form refer to **Appendix 3.6A**)
    a. Private use of public right-of-way on Town maintained streets must be requested by the property owner to ensure the appropriate, safe, and conscientious use of public facilities and space. Major encroachments include permanent fixtures for private use on public right-of way. Examples include, but are not limited to:
        i. Hardscape (pavers, fences, retaining walls)
        ii. Streetscapes (permanent furniture, benches, bike racks)
        iii. Utilities and Irrigation (stormwater, wells, grease traps, monitoring wells)
        iv. Telecommunication Devices (aerial and underground, towers)
        v. Landscaping
        vi. Building Elements (Balconies, Doors, stairs, landings, ramps)
    b. To begin the Major Encroachment request, the following forms shall be submitted to ROWencroachments@garnernc.gov:
        i. Permit Application for Major Encroachment on Town Right-of-Way
        ii. Completed and Signed Encroachment Agreement
        iii. Certificate of Insurance
        iv. Encroachment Permit Fee
        v. A plan showing the following:
            a) Scaled sketch or plan for encroachment
            b) Photos, brochure, or architectural drawing of proposed encroachment.
2. Minor Encroachments (For application form refer to **Appendix 3.6B**)
    a. Private use of public right-of-way on Town maintained streets must be requested by the property owner to ensure the appropriate, safe, and conscientious use of public facilities and space. Minor encroachments include temporary items for private use on public right-of way. Examples include, but are not limited to:
        i. Outdoor Merchandise (requires annual permit renewal).

ii. Temporary Structures

iii. Street Furniture (movable)

iv. Awnings

v. Exterior Building and Accent Lighting

vi. Overhead Signage

vii. A-Frame Signage

viii. Point of Sale Vending

b. To begin the Minor Encroachment request, the following forms shall be submitted to ROWencroachments@garnernc.gov:

i. Permit Application for Minor Encroachment on Town Right-of-way

ii. Completed and Signed Encroachment Agreement

iii. Encroachment Permit Fee

iv. A plan showing the following:

a) Scaled sketch or plan for encroachment

b) Photos, brochure, or architectural drawing of proposed encroachment

B. Right-of-Way Encroachments on NCDOT Maintained Streets

Requests for right-of-way encroachments on NCDOT maintained streets shall adhere to NCDOT protocol. A Town encroachment is not required on a NCDOT maintained street. The property owner shall submit the form appropriate to the encroachment request to the Wake County, NCDOT District Office 1.

1. NCDOT Street and Driveway Access Permit Application
2. NCDOT Encroachment Application 16.1A (Two Party Non-Utility not related to Road Construction)
3. NCDOT Encroachment Application 16.1B (Two Party for Road Construction)
4. NCDOT Encroachment Application 16.6 (Three Party for Utilities on non-Controlled Access Facilities)
5. NCDOT Encroachment Application 16.6A (Three Party for Utilities on Controlled Access Facilities)

C. NCDOT Coordination

1. It is the responsibility of the applicant/developer to determine whether a street is NCDOT maintained. Town staff can help to provide assistance and information at the request of the applicant.
2. It is typical for projects to include oversight by both the Town of Garner and the NCDOT when a project includes a state-maintained route within or along the frontage of a proposed development.
3. The Town and NCDOT both encourage joint and transparent communication between all parties to avoid conflicting requirements and/or confusion.

4. It is encouraged for applicant to obtain comments from Town staff in advance of NCDOT submittal to avoid the potential of rework or revisions to the plan. The Town of Garner UDO requires additional improvements on street construction in conjunction with site plans. For example, the Town typically requires all development to widen streets to the ultimate section, including curb, sidewalk, and stormwater installation while NCDOT's review may focus more on traffic congestion, driveway access, and overall safety of the facility.
5. Applicant is encouraged to coordinate early and often with Town and NCDOT throughout the development process. The Town and NCDOT processes are separate, therefore, time can be minimized by working with both agencies concurrently.
6. All efforts shall be made by the applicant to have a joint meeting between the applicant, NCDOT, and the Town early in the development process and to ensure proper scoping of the project.
7. When projects are located within the Town's jurisdiction, the Town is required to review and approve site plan submittals, while NCDOT reviews and approves driveway permits and encroachments of work within NCDOT maintained rights of way.
8. The Town of Garner through the UDO requires development frontages to be constructed to the ultimate buildout with curb and gutter. This requirement is above and beyond the Departments requirement to satisfy minimum traffic capacity requirements. The Town of Garner also requires sidewalk installation on all property frontages (including on NCDOT roadways) and maintains such sidewalk following completion and acceptance of the project.
9. The NCDOT Street and Driveway Access Permit Application requires a Local Government Authority's approval prior to submission to NCDOT. Therefore, it is imperative to address Town staff comments and plan approval prior to submitting to the NCDOT for a driveway permit.
10. The Town of Garner has authority to hold Certificates of Occupancy on lots until all work is completed in accordance with approved plans and permits.
11. The Town and NCDOT both have enforcement authority to place a stop work order on any project that is deemed unsafe to the general public and/or workers. This could include, but is not limited to, improper Occupational Safety and Health Administration (OSHA) or construction practices, unsuitable or hazardous materials used inside public right-of-way, or lack of proper traffic/pedestrian control measures. Failure to comply with approved plans and permit conditions may result is a Notice of Violation and/or revocation of permits.

D. Traffic and Pedestrian Control Plans

1. All sidewalk, travel lane, and parking closures must allow for safe vehicular, transit, bicycle, and pedestrian travel through the work zone.
2. Sidewalk closures shall provide an alternate pedestrian route and meet ADA and PROWAG guidelines.
3. Travel lanes and parking lanes shall meet MUTCD standards.
4. Traffic and Pedestrian Control Plans shall include the following at a minimum:
    a. Project location (vicinity map)
    b. Location of existing sidewalks, parking, transit facilities
    c. Travel Lanes, including direction

d. Site accessibility/ADA requirements in accordance with NC Building Code

e. Type and location of barricades

f. Traffic control devices (drums, cones, barricades, etc.)

g. Location of businesses/neighborhoods affected by the work zone

h. Project schedule

i. Construction phasing

j. Any applicable traffic and pedestrian control notes

E. Design Adjustments

1. The purpose of a design adjustment is to allow an applicant/developer to seek a deviation to certain design elements outlined in this Design Manual. This is intended for cases where no practical alternative exists and creates a hardship on compliance. Monetary cost alone is not considered a hardship.

2. A request for a design adjustment should be submitted at the time of an initial application for a site/subdivision plan. It is the applicant's responsibility to request a design adjustment, when necessary. Submitting a design that does not meet current design standards shall not be considered as a substitute for requesting a design adjustment. A design adjustment may also be requested by staff during plan review, if deemed necessary.

3. The design adjustment must be approved prior to any site plan approval.

4. The Town Engineer has ultimate authority to approve a design adjustment to a required standard described in this Design Manual. The Town Engineer may consult other Department Heads, including Planning, Inspections, Fire Department, and Parks and Recreation. Additional time may be necessary should other municipal (Raleigh Water) and/or state (NCDOT) agencies require further review of the design adjustment.

5. The Town Engineer shall provide (in writing by letter or email) reasons for such approval or disapproval. Such communication will be provided to the applicant and property owner and any such person who has filed a written request for notice to the Town Engineer prior to their decision.

6. Within 30 days from date of an application is decided, an appeal of the Town Engineer's action may be made to the Board of Adjustment.

F. Fee in Lieu for Infrastructure

For fee-in-lieu information, see Town of Garner UDO, Article 8.3.11.

G. Surety/Completion Bonds

1. For performance guarantee requirements, see Town of Garner UDO Article 8.1.6 and G.S. 160D-804(g).

2. All improvements shall not be accepted until all below items have been addressed:

   a. Improvements inspected by Town.

   b. Punchlist generated by the Town Engineering Inspector.

c. Punchlist deficiencies completed by applicant and verified by the Town Engineering Inspector.

d. As-built drawings for stormwater submitted and approved by the Engineering Department.

3. An acceptance letter shall be provided to the applicant by the Town Engineer upon approval.

H. Warranty

1. All improvements shall require a 1-year warranty guaranteeing work against defects and workmanship for a period of one year from the date of final acceptance of construction.

2. When improvements are constructed in phases or different times, then the warranty shall continue for 1-year from the date of the final acceptance of the improvement last completed.

3. The provided warranty shall list the Town of Garner as a beneficiary.

I. Bridges

All bridges shall be constructed in accordance with the standards and specifications of the NCDOT, except those bridges to be constructed on private streets in unsubdivided developments may be approved by the Town Engineer if designed by a licensed architect or engineer.

1.2 STREET CLASSIFICATIONS/TYPES

A. Major Thoroughfare

1. Major thoroughfares are high volume streets where mobility and capacity are a primary focus. Major thoroughfares typically have posted speeds of 45 mph or greater. There are generally multiple lanes in each direction and turn lanes for all left turning movements, as well as right turn lanes at key intersections.

2. Medians are preferable on major thoroughfares to provide pedestrian refuges at intersections to reduce crosswalk distance. Outside lanes are typically wider to promote shared bicycle lanes.

3. Sidewalks are required along both sides of the street. In addition, multi-use paths are common along major thoroughfares to provide cyclists with a safer off-street alternative path due to higher vehicular speeds along these facilities.

4. On-street parking and driveway cuts are restricted.

5. Signalization is common along major thoroughfares and pedestrian crossings should include pedestrian signals and high visibility crosswalks at all signalized intersections.

B. Minor Thoroughfare

1. Minor thoroughfares are moderately high-volume streets where mobility is a primary focus. Minor thoroughfares typically have speeds ranging between 35-45 mph. There are generally a minimum of two travel lanes and a raised median that allows for periodic turn lanes for all left turn movements, as well as right turn lanes at key intersections.

2. Medians are preferable on minor thoroughfares to provide pedestrian refuges at intersections to reduce crosswalk distance. Outside lanes are typically wider to promote shared bicycle lanes. Multi-use paths are also preferable on any minor thoroughfares with a posted speed greater than 35 mph to provide cyclists with a safer off-street alternative path along these facilities.

3. Sidewalks are required along both sides of the street.

4. On-street parking and driveway cuts are restricted.
5. Signalization is periodic along minor thoroughfares and pedestrian crossings should include pedestrian signals and high visibility crosswalks at all signalized intersections.

C. Major Collectors

1. Major collectors typically provide two travel lanes and a center turn lane/median, including striped bicycle lanes to accommodate all levels of cyclists.
2. Major collectors typically provide direct links between two thoroughfares.
3. Medians are preferable on major collectors to provide pedestrian refuges at intersections and reduce crosswalk distance, but undivided cross sections are allowable.
4. Median landscaping maintenance will be responsibility of the Homeowner's Association (HOA). A Town of Garner right-of-way encroachment agreement will be required as part of site plan submittal. Planting design shall be submitted and approved with site plan.
5. Posted speed limit shall be 35 mph (maximum).
6. Sidewalks and striped bicycle lanes are required along both sides of the street.
7. On-street parking is not typically permitted but may be allowed if striped spaces are provided that are buffered from travel lanes and bicycle lanes. Perpendicular parking is prohibited.
8. Driveway cuts shall be kept to a minimum.
9. Signalization is limited to connections to major intersections and pedestrian crossings should include pedestrian signals and high visibility crosswalks at all signalized intersections.
10. High visibility crosswalk markings are recommended at high volume and/or mid-block crossings.

D. Industrial Streets

1. Industrial streets typically provide two wide travel lanes, to accommodate large truck traffic that primarily serve industrial and warehouse uses along a street corridor.
2. Industrial streets typically provide direct links between industrial land uses and major collector street or thoroughfares.
3. Posted speed limit is typically 25-30 mph (maximum).
4. Bicycle lanes are encouraged, but wide travel lanes with bicycle accommodations are suitable.
5. Sidewalks are required along both sides of the street.
6. On-street parallel parking is permitted. Perpendicular parking is prohibited.
7. Driveway cuts are permitted.
8. Standard crosswalk markings are recommended at high volume crossings only.
9. Most intersections are stop controlled and traffic signalization is limited.
10. High visibility crosswalk markings are recommended at high volume and/or mid-block crossings.

E. Minor Collector

1. Minor collectors typically provide two travel lanes and a vegetated median that can allow for left turn lanes at major intersections, including striped bicycle lanes or shared wide lanes to accommodate all levels of cyclists.
2. Minor collectors typically provide direct links between local streets and major collectors and/or thoroughfares.
3. Medians are preferable on minor collectors to provide pedestrian refuges at intersections and reduce crosswalk distance, but undivided cross sections are allowable.
4. Median landscaping maintenance will be responsibility of the HOA. A Town of Garner right-of-way encroachment agreement will be required as part of site plan submittal. Planting design shall be submitted and approved with site plan.
5. Posted speed limit shall be 25-30 mph.
6. Sidewalks and striped bicycle lanes are required along both sides of the street.
7. On-street parallel parking and reverse angle parking are allowable if striped spaces are provided outside the standard details and are buffered from both travel lanes and bicycle lanes. Perpendicular parking is prohibited.
8. Driveway cuts shall be minimized to individual lots. Shared access driveways and/or rear alley construction to provide access to development fronting a minor collector is recommended.
9. Most intersections are stop controlled and traffic signalization is limited.
10. High visibility crosswalk markings are recommended at high volume and/or mid-block crossings.

F. Major Local Streets

1. Major local streets typically provide two travel lanes and serve low to medium volumes of traffic.
2. Major local streets typically provide direct links within residential neighborhoods to limited access to abutting residential lots.
3. Do not provide direct continuity or direct connection between thoroughfares.
4. Posted speed limit shall be 25 MPH.
5. Bicycles and vehicles share the travel way.
6. Sidewalks are required along both sides of the street.
7. On-street parallel parking is permitted. Perpendicular parking is prohibited.
8. Driveway cuts are permitted.
9. Most intersections are stop controlled and traffic signalization is limited.
10. Standard crosswalk markings are recommended at high volume crossings only.

G. Minor Local Streets

1. Minor local streets typically provide two travel lanes and serve low volumes of traffic.
2. Minor local streets primarily serve residential areas and provide direct access to abutting lots.
3. Do not provide direct continuity or direct connection to thoroughfares.
4. Posted speed limit shall be 25 mph (maximum).
5. Bicycles and vehicles share the travel way.
6. Sidewalks are required along both sides of the street, however, cul-de-sacs less than 150 feet only require sidewalk on one side.
7. On-street parallel parking is permitted. Perpendicular parking is permitted within townhouse developments.
8. Driveway cuts are permitted.
9. Most intersections are stop controlled and traffic signalization is limited.
10. Pavement markings and crosswalks are not recommended.

H. Private Streets

1. Private streets are typically permitted in non-residential, commercial, office, and multi-family uses.
2. Private streets shall be built to public street standards within the primary travel way (excluding adjoining parking spaces).
3. Parking may be provided as parallel, angled, or perpendicular. Parking spaces shall be configured such that they do not obstruct the primary travel way.
4. Private streets require approved street names and street signs.
5. Private streets are not maintained by the Town.
6. Sidewalks are not required, with the exception to accommodate ADA requirements.
7. Bicycles and vehicles share the travel way.
8. Driveways cuts are permitted.
9. Private streets shall have platted rights-of-way. If a private street is not platted, it shall be considered a private driveway and be subject to the according standards.

I. Private Drives and Rights-of-Way

1. The entrance of unpaved residential driveways shall be graveled for an area of 30 feet in length and 10 feet in width, with a 6-inch depth of stone. Roads, streets, and driveways shall be designed to avoid direct runoff into streams through dispersion onto grassed and vegetated areas wherever possible.
2. The policy of the Town of Garner is that, if the Town improves streets, 100 percent of the costs of improvements shall be assessed to abutting landowners if the following conditions are met:
    a. The streets were never constructed to the standards required in the Town of Garner UDO and/or Design Manual for dedicated streets or its precedent; and

b. On which 75 percent of the dwelling units were constructed after July 1,1981.

3. All private drives and rights-of-way shall be maintained in accordance with Town of Garner standards.

J. Alleys (Public and Private)

1. Alleys provide access to developments as an alternative to front loaded streets. Services, such as garbage/recycling can be provided by alleys.
2. Pavement for all alleys shall be designed to public street standards to support garbage/recycling vehicles.
3. Public alleys require minimum 24-inch curb and gutter (barrier and rolled curb are allowable on alleys).
4. Private alleys may include curb and gutter or 2-foot grassed shoulders (minimum).
5. Private alleys are not Town maintained.
6. On street parking is limited.
7. Driveway cuts are permitted.
8. Public alleys shall include right-of-way dedication of 25 feet minimum width.
9. Private alleys shall provide a minimum 25-foot access easement in support of emergency vehicles, garbage/recycling pickup, and utility access, as required.

Figure 1.1 Street Classification Matrix

Street Classification	Annual Daily Traffic (ADT)	Preferred Street Name Typology	Number of Through Lanes	Posted Speed Limit (Max.)	Median Divided	Bicycle Accommodations	Sidewalks	On-Street Parking	Driveway Cuts	Pavement Striping	Crosswalks
Primary Arterial	> 40,000	Parkway, Boulevard	6-8	55	Required	Off-Road MUP	2-sides	Restricted	Restricted	Yes	Hi-Visibility
Secondary Arterial	20,000-40,000	Parkway, Boulevard	4-6	55	Required	Off-Road MUP	2-sides	Restricted	Restricted	Yes	Hi-Visibility
Major Thoroughfare	10,000-20,000	Road, Drive	4	50	Preferred	Off-Road MUP	2-sides	Restricted	Restricted	Yes	Hi-Visibility
Minor Thorougfare	6,000-10,000	Road, Drive	2-4	40	Preferred	Off-Road MUP	2-sides	Restricted	Restricted	Yes	Hi-Visibility
Major Collector	2,500-6,000	Avenue, Drive	2	35	Preferred	Striped Bike Lanes	2-sides	Parallel Parking Only	Minimized	Yes	Hi-Visibility
Minor Collector	1,500-2,500	Avenue, Drive	2	30	Allowable	Striped Bike Lanes	2-sides	Parallel Parking Only	Minimized	Yes	Standard/ Limited
Industrial Streets	500-1,500	Street, Drive	2	30	Allowable	Share Lane	2-sides	Parallel Parking Only	Unrestricted	Allowable	Standard/ Limited
Major Local Streets	500-1,500	Street, Drive, Way	2	25	None	Share Lane	2-sides	Parallel Parking Only	Unrestricted	Allowable	Standard/ Limited
Minor Local Streets	< 500	Way, Lane, Place, Circle, Court	2	25	None	Share Lane	1-side	Unrestricted	Unrestricted	No	None
Alley	<250	Lane, Way, Place, Loop	1-2	25	None	Share Lane	Unrestricted	Unrestricted	Unrestricted	No	None
Private Streets	< 500	Lane, Way	1-2	25	Unrestricted	Share Lane	Unrestricted	Unrestricted	Unrestricted	Allowable	None

1.3 TRAFFIC IMPACT ANALYSIS

A. See Town of Garner UDO Article 4.9.1.

1.4 SUBDIVISION DEDICATION

A. Major or Minor Thoroughfare Dedication

1. Whenever a subdivision is developed in an area through which a proposed major or minor thoroughfare passes, according to the officially adopted CAMPO Transportation Plan or Garner Transportation Plan, then the developer shall dedicate to the Town a right-of-way as set forth in such plan and shall construct within such right-of-way a street meeting the specifications set forth in this section for a collector street.

2. Whenever a subdivision or new development fronts along an existing major or minor thoroughfare, the development shall dedicate one-half of the right-of-way required for the appropriate street type and build at least one-half of the recommended cross-section as shown in the CAMPO Transportation Plan or the Garner Transportation Plan unless the subdivision or development does not propose street or driveway access to said thoroughfare. When the total peak hour trip generation according to the latest edition of the Institute of Transportation Engineers (ITE) Trip Generation Manual does not exceed a total of 50 trips for a project, the permit issuing authority may require only that a deceleration lane without curb and gutter construction be installed in lieu of full widening.

B. Protection against Defects

1. Where the Town of Garner authorizes occupancy, use, or sale prior to completion of all publicly dedicated facilities and improvements, the developer shall post a performance guarantee, pursuant to Article 8 of the Town of Garner UDO, guaranteeing that the developer shall correct any defects appearing within one year of the initial date of occupancy, use, or sale.
2. An architect, landscape architect or engineer retained by the developer shall certify to the Town that all publicly dedicated facilities and improvements comply with the requirements of the Town of Garner UDO. The Town of Garner shall not accept the offer of dedication of facilities or improvements without this certification.
3. The term defects shall mean any condition requiring the Town to make repairs exceeding the standard maintenance of a facility or improvement.
4. If defects appear, the Town may enforce the guarantee, regardless of whether the facilities or improvements were certified.

C. Road and Sidewalk Requirements in Unsubdivided Developments

1. Within unsubdivided developments, all private roads and access ways shall be designed and constructed to facilitate the safe and convenient movement of vehicular and pedestrian traffic. Width of roads and use of curb and gutter shall be determined based on the density, size, and type of development. The Town Engineer shall determine appropriate road widths and paving specifications based on the street classification system in UDO Article 8.3.1. To the extent not otherwise covered in the Town of Garner UDO, and to the extent that the requirements set forth in this Manual may be relevant to the roads in unsubdivided developments, the requirements of this Manual may be applied to satisfy the standard set forth in this subsection.
2. Whenever a road in an unsubdivided development connects two or more collectors, or major thoroughfare streets in such a manner that any substantial volume of through-traffic is likely to make use of this road, such road shall be constructed in accordance with the standards applicable to subdivision streets and shall be dedicated. In other cases, when roads in unsubdivided developments within the Town are constructed in accordance with the specifications for subdivision streets, the Town may accept an offer of dedication of such streets.
3. The public sidewalks in unsubdivided developments shall be at least 5 feet wide and private walkways shall be at least 4 feet wide, except for walkways constructed along the back of parking bays which shall be at least 6 feet in width in order to accommodate vehicle overhang, unless wheel stops are placed at the ends of these parking spaces, in which case sidewalks shall be at least 4 feet in width.
4. Sidewalks and walkways in unsubdivided developments shall be constructed according to the specifications set forth in this Manual, except that the permit-issuing authority may permit sidewalks and walkways to be constructed with other materials when it concludes that:
    a. Such sidewalks would serve the residents of the development as adequately as concrete sidewalks;
    b. Such sidewalks would be more environmentally desirable or more in keeping with the overall design of the development; or
    c. Such sidewalks could be maintained as adequately as concrete sidewalks.

1.5 BLOCKS AND ACCESS REQUIREMENTS

A. Block Perimeter requirements

See Town of Garner UDO Article 8.3.4.

B. Road stub and connectivity requirements

For connectivity standards, see Town of Garner UDO Article 8.3.4.

C. Site Accessibility and Pedestrian access requirements

See Town of Garner UDO Article 9.1.2.

D. Parking Lot dimensions

See Parking section of this document.

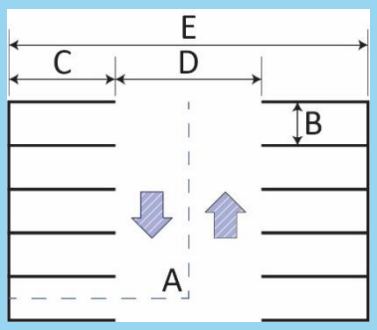
1.6 PARKING

A. Design and Dimensional Standards

1. Parking Spaces
    a. The minimum dimensions for parking spaces perpendicular to the curb shall contain a rectangular area at least 18 feet long and 9 feet wide.
    b. Parallel parking spaces shall have a rectangular area of not less than 24 feet long, and nine feet wide.
    c. Alternative designs may be allowed by the Town Engineer provided that the design is consistent with the dimensions contained in the Institute of Transportation Engineers' Traffic Engineering Handbook.
    d. Parking areas shall conform with the dimensions illustrated below.
    e. Wheel stops are required for parking spaces that are directly adjacent to public sidewalks and required pedestrian walkways and shall be located a minimum of 2.5 feet back from the edge of a sidewalk or walkway.
2. Compact space standards: 8 feet wide and up to 2 feet shorter than a standard space.

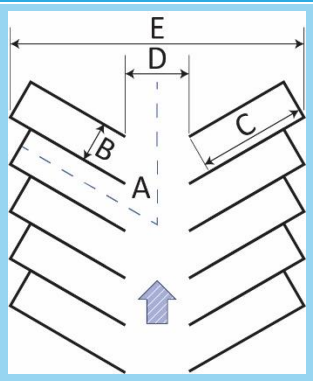
Figure 1.2 Parking Dimensional Standards

90-Degree Parking



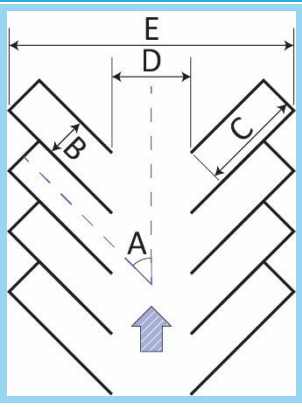
A= 90° B= 9’ C= 18’ D=24’ E= 60’

60-Degree Parking



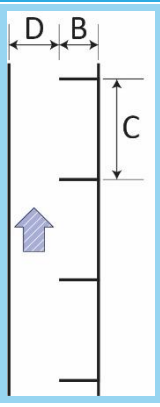
A= 60° B= 9’ C= 18’ D= 18’ E= 62’

45-Degree Parking



A=45° B= 9’ C= 18’ D=14’ E=56’

0-Degree Parking



A= 0° B= 9’ C= 24’ D= Street Width

B. Parking Aisle Widths and Driveways

1. Parking aisle widths shall conform to the following standards:

Figure 1.3 Parking Aisle Widths

Parking Angle	Min. Width: One Row Sharing Aisle	Min. Width: Two Rows Sharing Aisle
90 degrees	42 feet	60 feet
60 degrees	40 feet	62 feet
45 degrees	35 feet	56 feet

2. Driveways shall be at least 10 feet in width for one-way traffic and at least 18 feet in width for two-way traffic.
3. Driveways of 8 to 10 feet in width shall be permitted if all the following are true:
   a. The driveway is less than 50 feet.

b. The driveway does not provide access to more than six spaces.

c. Sufficient turning space is provided so that a vehicle need not back into the street when traveling between drive aisles.

d. The street and the driveway property's land use have low traffic volumes or anticipated low traffic volumes.

4. A variance may provide relief from this requirement.

5. All commercial or industrial development shall require a paved driveway.

a. The design of entrance drives in industrial subdivisions shall be based upon the development standards detailed in Chapter 2 of Policy on Geometric Design of Highways and Streets by AASHTO, dated 1984, as amended.

b. For lots within industrial subdivisions with access onto existing, anticipated or proposed collector streets, the entrance drives shall be developed so turning movements will not encroach onto opposing travel lanes on the collector roadway or the drive through the property.

c. As provided in G.S. § 136-93, no person may construct any driveway entrance or other opening onto a state-maintained street except in accordance with a permit issued by the NCDOT.

C. On-Street Parking in the Public Right-of-Way

On-street parking shall consist of parallel, angular, or perpendicular spaces only in accordance with the chart below.

Figure 1.4 On-Street Parking Dimensions

Parking Angle	Curb With	Stall Depth (measured to back of curb)	Stall Width
90 degrees	8.5 feet	18.0 feet	6.5 feet
60 degrees	9.8 feet	19.8 feet	8.5 feet
0 degrees	22.0 feet	8.0 feet	8.0 feet

1.7 STREET DESIGN STANDARDS

A. Right-of-Way and Street Width Standards

1. Streets and rights-of-way within the Town of Garner are intended for multi-purpose use, as follows:

a. To carry vehicular, cycling, and transit traffic, and, where appropriate, allow on-street parking;

b. To provide a safe and convenient passageway for pedestrian traffic; and

c. To serve as an important link in the Town's drainage system.

2. Right-of-way standards by type of development are presented in the following table. Street widths shall be measured from back of curb to back of curb.

Figure 1.5 Urban Street Standards Table

Street Type	Right-of-Way Width	Pavement Width (Back of Curb to Back of Curb)	Minimum Pavement Edge Treatment	Sidewalk
Access Easement Landlocked Parcel (1 lot)	20 feet	10 feet	None	None
New Subdivision (max. 3 lots)	20 feet	10 feet	24" Shoulder	None
Public Alley	25 feet	24 feet	24" Curb and Gutter	None
Private Alley	25-foot Easement	20 feet (EP-EP)	24" Shoulder	None
Minor Local Street	50 feet	29 feet	30" Curb and Gutter	5 feet, one side
Major Local Street	55 feet	32 feet	30" Curb and Gutter	5 feet, both sides
Industrial Street	65 feet	41 feet	30" Curb and Gutter	5 feet, both sides
Minor Collector	52 feet	75 feet	30" Curb and Gutter	5 feet, both sides
Major Collector*	75 feet	49 feet	30" Curb and Gutter	5 feet, both sides
Minor Thoroughfare*	80 feet	50 feet	30" Curb and Gutter	10' MUP one side, 5 feet one side
Major Thoroughfare*	100 feet	72 feet	30" Curb and Gutter	10' MUP one side, 5 feet one side

* *Dimensions shown shall require review/approval by NCDOT for any state-maintained streets.*

Figure 1.6 Lake Benson District Street Standards Table (Rural Streets)

Street Type	Right-of-Way	Width (Back of Curb)	Shoulder	Sidewalk
Rural Local Street (No curb)	60 feet	24 feet (no curb)	6-foot grassed shoulder, each side	None
Collectors/Thoroughfares	Build to NCDOT standards. No driveway access for lots in a residential subdivision.			

Note: Rural street type shall not be used where public water or wastewater utility service is available.

B. Other Right-of-Way Standards

1. Access Easements

   a. A recorded access easement option is available for existing landlocked lots only. Nothing in this section is intended to allow approval of new lots with easement frontage and access only.

   b. The minimum acceptable access easement width shall be 20 feet.

   c. The access easement shall be paved with, at minimum, gravel 6 inches in depth and 16 feet in width running down the center of the easement.

   d. A full shoulder and ditch section shall be required on the subject property.

2. Arterials and Thoroughfares

   Arterial and thoroughfare right-of-way widths shall be as determined by the Town in consultation with NCDOT. The geometric layout shall meet or exceed NCDOT standards.

C. Design Vehicle Table

All streets shall be designed in accordance with the appropriate design vehicle type.

Figure 1.7 Design Vehicle Table

Street Type	Design Vehicle
Highways	WB-67
Thoroughfares	WB-62
Major Collector	WB-40
Minor Collector	WB-40
Industrial Street	WB-40
Major Local Street	SU-30
Minor Local Street	SU-30
Alley/Accessways	SU-30

D. Horizontal and Vertical Alignment Design

1. Normal crown for all streets shall be ¼ inch per foot.
2. The desirable maximum superelevation rate is 4 percent on new development. Widening of existing facilities may be approved up to 6 percent maximum superelevation when no practical alternative is available. Superelevation is required on major collectors and thoroughfares and should be designed in accordance with current AASHTO's "A Policy on Geometric Design of Highways and Streets".
3. All vertical curves shall be symmetrical parabolic curves.

E. Horizontal and Vertical Design Criteria

Figure 1.8 Street Horizontal and Vertical Design Criteria Table

Street Type	Design Speed (mph)	Minimum Centerline Radius	Maximum Rate of Super-elevation	Minimum Tangent b/w reverse curves	Maximum vertical gradient	Minimum Vertical Curve Length	Minimum K Value	
							Crest	Sag
Major Thoroughfare	50	926	4.0%	400	7	150	84	96
Minor Thoroughfare	45	711	4.0%	325	7	135	61	79
Major Collector	40	533	4.0%	250	8	125	44	64
Minor Collector	35	375	4.0%	200	9	100	29	49
Industrial Street	35	375	4.0%	200	9	100	29	49
Major Local Street	25	150	N/A	100	9	75	12	26
Minor Local Street	25	150	N/A	0	12	50	12	26
Alley/Accessways	20	75	N/A	0	12	50	12	26

F. Street Intersection Spacing Table

Figure 1.9 Street Intersection Spacing Table

Street Type	Intersection Spacing
Thoroughfares > 45 mph	2000’
Thoroughfares <= 45 mph	1200’
Major Collector	600’
Minor Collector	500’
Industrial Street	400’
Major Local Street	300’
Minor Local Street	300’

G. Pavement Designs

Figure 1.10 Pavement Design Table

Street Type	Pavement Design (Minimum)
Thoroughfares > 45 mph	3" S9.5C, 4"I19.0C, 10" ABC
Thoroughfares <= 45 mph	3" S9.5B, 4"I19.0C, 10" ABC
Major Collector	3" S9.5B, 3"I19.0C, 8" ABC
Minor Collector	3" S9.5B, 10" ABC
Industrial Street	3" S9.5B, 3"I19.0C, 8" ABC
Major Local Street	3" S9.5B, 8" ABC
Minor Local Street	2.5" S9.5B, 8" ABC
Alleys (Pubic & Private)	2.5" S9.5B, 8" ABC

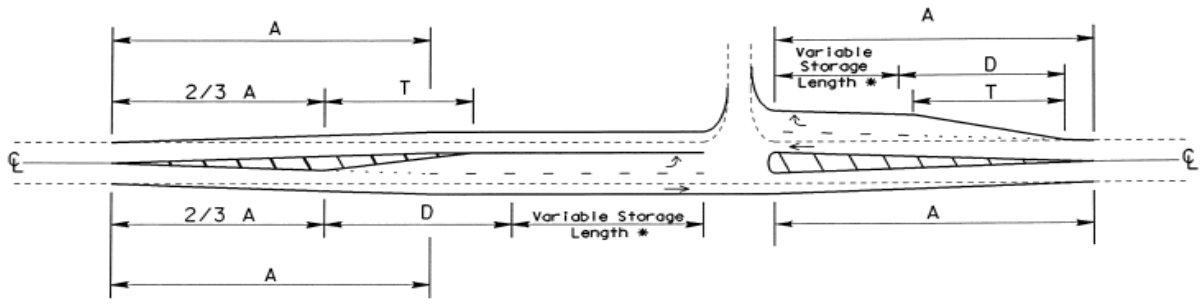
H. Roadway Turn Lane and Transitions

See NCDOT standards for turn lanes.

Figure 1.11 Recommended Treatment for Turn Lanes

Recommended Treatment for Turn Lanes

Symmetrical Widening



Design Speed (mph)	Posted Speed (mph)	Minimum Deceleration Length (D)	Desirable Deceleration Length (D)	Bay Taper Length (T)	Approach / Departure Taper (A)
30	≤ 25	100'	150'	75'	A = $WS^2/60$ (IF S ≤ 40 MPH)
35	30	100'	150'	75'	A = WS (IF S > 40 MPH)
40	35	150'	200'	100'	S = Design Speed
45	40	150'	250'	100'	W = Width of Lateral Shift
50	45	150'	300'	100'	* Storage length for waiting vehicles should be calculated based on the latest version of the Highway Capacity Manual or Policy on Street and Driveway Access to North Carolina Highways.
55	50	200'	500'	150'	
60	55	250'	575'	200'	

Reference: NCDOT

I. Turn Lane Warrants (Left Turn)

Figure 1.12 Turn Lane Warrants (Left Turn) Table

Opposing volume	Advancing Volume (vehicles/hour)			
	5% left turns	10% left turns	15% left turns	20% left turns
40 mph Operating Speed				
800	330	240	180	160
600	410	305	225	200
400	510	380	275	245
200	640	470	350	305
100	720	515	390	340
50 mph Operating Speed				
800	280	210	165	135
600	350	260	195	170
400	430	320	240	210
200	550	400	300	270
100	615	445	335	295
60 mph Operating Speed				
800	230	170	125	115
600	290	210	160	140
400	365	270	200	175
200	450	330	250	215
100	505	370	275	240

Reference: AASHTO Guide for Left turn Lanes on Two-Lane Highways

J. Turn Lane Warrants (Right Turn)

Figure 1.13 Turn Lane Warrants (Right Turn)

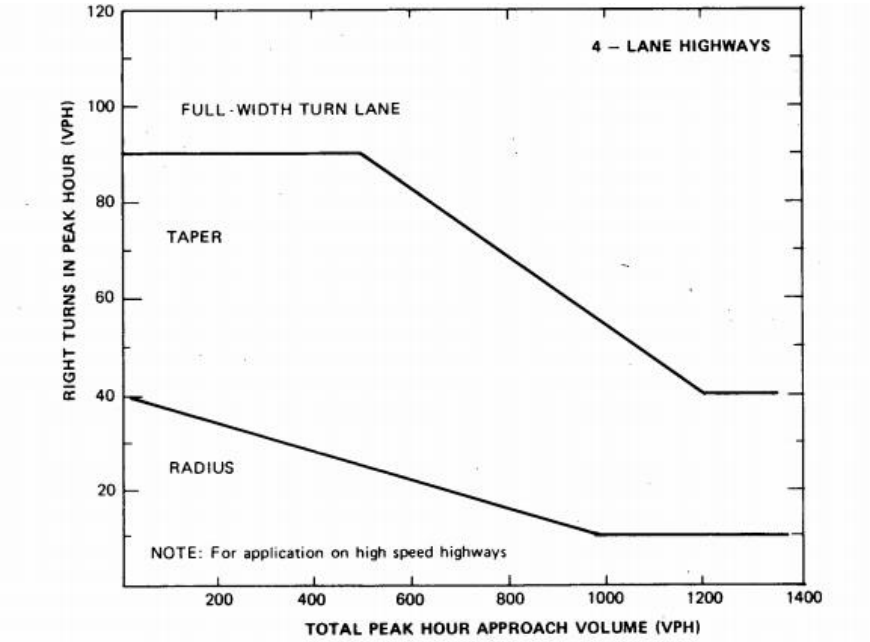


Figure 4-23. Traffic volume guidelines for design of right-turn lanes. (Source: Ref. *4-11*)

Reference: National Cooperative Highway Research Program (NCHRP) 279 "Intersection Channelization Design Guide", Figure 4-23

K. Bicycle Facilities

Bicycle facilities should be constructed in accordance with current National Association of City Transportation Officials (NACTO) design standards.

L. Curb and Gutter

1. Standard 30-inch barrier curb and gutter can be used on all public streets within the Town or its extra-territorial jurisdiction (ETJ).
2. Rolled curb (30-inch) is only permitted in senior living developments (age restricted 55 and over). Rolled curb must be transitioned to barrier curb at all storm drainage boxes and street intersections.
3. The minimum longitudinal grade on curb and gutter for new development is 0.75 percent.

M. Curb Radii

1. Street intersections shall provide appropriate curb radii to allow safe movement of the design vehicles (provide link to previous design vehicle table).
2. Larger than necessary curb radii are discouraged to minimize speeding and longer crosswalk distances at intersections.
3. When radii exceed 25 feet, alternative treatments should be considered (mountable curb, truck aprons, pedestrian refuges, channelized turn lanes) to improve pedestrian access and minimize crosswalk distances across the intersection.
4. All intersections shall accommodate emergency vehicle/fire access.

N. Attention to Accessibility in Street and Sidewalk Construction

1. As provided in G.S. § 136-44.14, whenever curb-and-gutter construction is used on public streets, wheelchair ramps for the handicapped shall be provided at intersections and other major points of pedestrian flow. Wheelchair ramps and depressed curbs shall be constructed in accordance with Town of Garner standard details.
2. In unsubdivided developments, construction of all curb ramps should be constructed in accordance with Town of Garner standard details.

O. Cul-de-sacs

1. The standard maximum length of a cul-de-sac is based on table in Town of Garner UDO Article 8.3.5.E. The length of the cul-de-sac shall be measured from the last point of alternate access.
2. Median islands are generally not allowed in cul-de-sacs. A median may be permitted if cul-de-sac size is increased, and emergency access is readily accommodated. On street parking is prohibited in any cul-de-sac that has a median.
3. The minimum radius for a cul-de-sac is 48.5 feet to back of curb.
4. A 30-foot radius may be used only on cul-de-sacs with a street length of less than 150 feet.

P. Road Stubs/Dead Ends

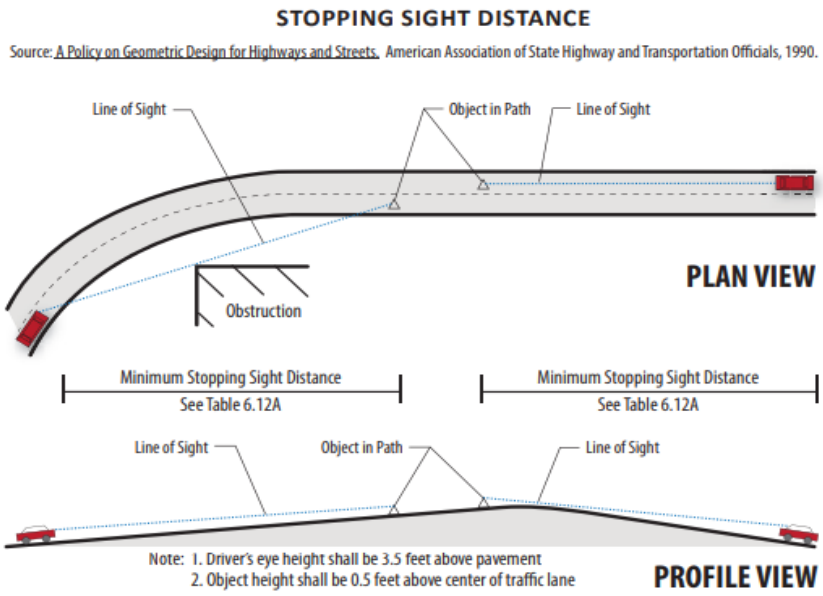
1. All road stubs must include a barricade and signage in accordance with current Town standard details.
2. Temporary turnarounds are required when stub is greater than the permitted length of a cul-de-sac.

Q. Stopping Sight Distance

Figure 1.14 Stopping Sight Distance

Design Speed	Minimum Stopping Sight Distance (feet), Street Grade (%)						
	Upgrades			Flat	Downgrades		
	9%	6%	3%	0%	-3%	-6%	-9%
60	495	515	540	570	600	640	690
55	435	450	470	495	520	555	595
50	375	390	405	425	450	475	510
45	320	335	345	360	380	400	430
40	270	280	290	305	315	335	355
35	225	230	240	250	260	275	290
30	180	185	200	200	205	215	230
25	140	145	150	155	160	165	175

Reference: Table derived from AASHTO 2018 (Tables 3.1 and 3-2) and distances rounded to nearest 5 feet.



Reference: Raleigh Street Design Manual

R. Intersection Sight Distance

Figure 1.15 Intersection Sight Distance for Left Turn from Stop (Passenger Cars)

Design Speed (Major Road)	Posted Speed (Major Road)	2-lane Undivided		3-lane Undivided or 2-lane Divided w/ 12' median		4-lane Undivided		5-lane Undivided or 4 lane Divided w/ 12' median	
		Calculated	Design	Calculated	Design	Calculated	Design	Calculated	Design
25	20	275.6	280	294.0	300	312.4	315	330.8	335
30	25	330.8	335	352.8	355	374.9	375	396.9	400
35	30	385.9	390	411.6	415	437.3	440	463.1	465
40	35	441.0	445	470.4	475	499.8	500	529.2	530
45	40	496.1	500	529.2	530	562.3	565	595.4	600
50	45	551.3	555	588.0	590	624.8	625	661.5	665
55	50	606.4	610	646.8	650	687.2	690	727.7	730
60	55	661.5	665	705.6	710	749.7	750	793.8	795

Reference: Table derived from AASHTO Table 9.7 (Case B1) using the following parameters:
*ISD = 1.47*V*tg where:*
ISD = Intersection sight distance (length of leg of sight triangle along major road)
V = design speed of major road (mph)
tg = 7.5s time gap for 2-lane plus 0.5s for each additional lane

Method of measurement

1. *Driver's eye height shall be a minimum of 3.5 feet above pavement.*
2. *Driver's eye shall be placed 15 feet from edge of pavement.*
3. *Object height (approaching vehicle) shall be 4.25 feet above center of traffic lane.*

Figure 1.16 Minimum Intersection Sight Distance for Right Turn from Stop

Design Speed (Major Road)	Posted Speed (Major Road)	Calculated	Design
25	20	238.9	240
30	25	286.7	290
35	30	334.4	335
40	35	382.2	385
45	40	430.0	430
50	45	477.8	480
55	50	525.5	530
60	55	573.3	575

Reference: Table derived from AASHTO Table 9.9 (Case B2) using the following parameters:
*ISD = 1.47*V*tg where:*
ISD = Intersection sight distance (length of leg of sight triangle along major road)
V = design speed of major road (mph)
tg = 6.5s time gap for 2-lane plus 0.5s for each additional lane

Method of measurement

1. *Driver's eye height shall be a minimum of 3.5 feet above pavement.*
2. *Driver's eye shall be placed 15 feet from edge of pavement.*
3. *Object height (approaching vehicle) shall be 4.25 feet above center of traffic lane.*

S. Relationship of Streets to Topography

1. Streets shall be designed to relate appropriately to the topography of a site. In particular, streets shall be designed to:
   a. facilitate the drainage and stormwater runoff objectives in Garner UDO Article 11, Environmental and Floodplain; and
   b. conform as closely as practicable to the original topography, subject to the design requirements relating to maximum grades set forth below.
2. The maximum grade for street construction shall meet design requirements listed in table in section Q above. However, in no case may streets be constructed with grades that, in the professional opinion of the Town Engineer, create a substantial danger to the public safety or cause any substantial degradation to the street or drainage system.

T. Sight Triangles

Sight triangles shall be maintained in accordance with current AASHTO standards.

1.8 STREETSCAPE ELEMENTS

A. General Utility Easement

1. The placement of utilities along development frontages should be located within the general utility easement, which is located behind the right-of-way.

2. This easement is intended for, but not limited to, fiber optics, power poles, street lighting, telecommunications, cable, and phone.
3. The easement measures a minimum of 3 feet behind the right-of-way line.

B. Sidewalks

1. Sidewalks shall be constructed to allow easy continuation by adjacent properties and to form a safe and convenient network for users.
2. Sidewalk Criteria
   a. The developer shall construct a sidewalk in the public right-of-way, or, where required by topography or other circumstances in duly obtained public easements approved by the Town Council, and along every street upon which the property fronts and along every new street within the development according to the following criteria:
      i. Public sidewalks shall be constructed on both sides of a road or street with four or more lanes; and
      ii. Public sidewalks shall be constructed on at least one side of a road or street designated as a minor local street, cul-de-sac, and both sides of a street designated as a major local street or collector.
   b. There shall be at least 5 feet between the street-side edge of the sidewalk and the back of the curb. Where a drainage ditch exists, there shall be at least 10 feet provided between the street-side edge of the sidewalk and the back of the curb or edge-of-pavement. However, in instances where sidewalks abut streets, street curbs, travel lanes, or on-street parking, the minimum sidewalk width shall be increased by at least 1 foot.
   c. Sidewalks along curb is prohibited except in retrofit situations with no practical alternative.
   d. A Town of Garner Sidewalk Maintenance Easement shall be dedicated if public sidewalk is located outside right-of-way.
3. Sidewalk Width
   a. Sidewalks should be offset from curb a minimum of 5 feet on new development.
   b. The minimum sidewalk width allowed in the Town of Garner is 5 feet and should be free of obstructions. Any vegetation installed shall be conservatively setback from the sidewalk such that full width maturity of such vegetation will not encroach into the sidewalk area.
   c. Public sidewalks in all developments shall meet the following criteria. Where a block has different zoning districts along its length, the higher standard shall be utilized.

Figure 1.17 Sidewalk Width Table

District	RA, R2, RMH, I-2	NC, CMU, MF-1, R4, R8, I-1	TBD, MF-2	AC
Minimum Sidewalk Width	5 feet	6 feet	10 feet	12 feet

C. Multi-Use Paths

1. Multi-use paths (MUPs) may be required along streets and off-street (i.e. greenways) to provide pedestrian and bicyclists access to trails, parks, and recreation.
2. MUPs shall be a minimum of 10 feet in width when installed along public streets and a minimum of 10 feet in width for off-street facilities, such as greenways.
3. All MUPs shall be constructed of asphalt surface in accordance with Town standard details.
4. MUPs along street facilities shall be offset from back of curb a minimum of 5 feet. Any MUPs installed on streets without curb and gutter shall be located behind the swale to provide adequate separation from vehicles.
5. A drainage swale shall be provided on the uphill side of an MUP with crossing pipes when MUPs are at the bottom of embankments that exceed 5 feet in height.
6. A Town of Garner Sidewalk Maintenance Easement shall be dedicated if public sidewalk is located outside right-of-way.

D. Curb Ramps

All curb ramps shall be constructed in accordance with PROWAG and Town standard details.

E. Plantings along public right-of-way

See Town of Garner UDO Article 10.5.

F. Street Furniture

Items subject to the encroachment process include:

1. Bicycle racks
2. Benches
3. Parking Meters
4. Bus Shelters
5. Pedestrian Lighting
6. Planters and/or Flower boxes
7. Trash receptacles
8. Stormwater flow-through planters
9. Rain barrels

G. Street Lighting

See Town of Garner UDO Article 10.2.11.

1.9 STORM DRAINAGE CONSTRUCTION

A. General

1. Except as otherwise stipulated in this specification, all storm drainage shall be performed in accordance with the Town of Garner's Storm Drainage Special Details. In absence of a relevant detail, the work shall be in accordance with Divisions 3 and 8 of the NCDOT Standard Specifications for Roads and Structures, latest edition.
2. Where proposed storm sewers are to be installed under existing roadways, the construction shall be performed in such a way that half of the roadway will be maintained and available to traffic in accordance with the plans, Contract Documents, the NCDOT "Roadway Standard Drawings," and the MUTCD.

B. Quality standards and materials

1. Procedures for handling, laying, protection and use of pipe shall be in accordance with the pipe manufacturer's recommendations and these specifications. Procedures for construction of drainage structures shall be in accordance with these specifications.
2. Reinforced concrete pipes and flared end sections shall conform to Section 1032-6(B) of the NCDOT Standard Specifications for Roads and Structures, latest edition. Joints shall be sealed with a flexible plastic joint material meeting Federal specification SS-S-00210, such as Ram-Nek or a butyl rubber sealant.
3. Corrugated steel pipe shall conform to Section 1032-3 and 1032-4 of the NCDOT Standard Specifications for Roads and Structures, latest edition. Bands for connecting pipe shall be corrugated with a minimum of two corrugations for each pipe. The pipe shall be fully bituminous coated in accordance with the requirements of AASHTO M190. The pipe shall have an asphalt-paved invert.
4. Concrete block or brick shall conform to Section 1040-2 of the NCDOT Standard Specifications for Roads and Structures, latest edition. The block or brick shall be embedded in a mortar bed to form a ½-inch mortar joint.
5. Mortar used in brick masonry and joints shall conform to Section 1040-9 of the NCDOT Standard Specifications for Roads and Structures, latest edition.
6. Precast concrete units shall conform to Section 1077 of the NCDOT Standard Specifications for Roads and Structures, latest edition. The standard joint shall be sealed with a flexible joint material meeting Federal specification SS-S-00210 such as Ram-Nek or a butyl rubber sealant.
7. Foundation conditioning material shall conform to Section 300-9 of the NCDOT Standard Specifications for Roads and Structures, latest edition.
8. Manhole frames and covers shall be in accordance with the Town of Garner Standard Details.
9. Manhole steps shall be in accordance with the Town of Garner Standard Details and NCDOT specifications as directed by such details. Steps shall be designed for a vertical load of 400 pounds and a horizontal pull-out load of 1,000 pounds.
10. Yard inlets, catch basins, and curb inlets shall be in accordance with the Town of Garner Standard Details and NCDOT specifications as directed by such details. Frame, grates, and hoods shall be cast iron and conform to Section 1074-7 in the latest edition of the NCDOT "Standard

Specifications for Roads and Structures" and the dimensional requirements set forth in the latest edition of the NCDOT "Roadway Standard Drawings." Grates shall be stamped with the appropriate NCDOT specification number as evidence of satisfying the above requirements. Hoods shall be stamped with "Drains to Neuse River" or other wording as confirmed by the Engineer. Lettering shall be ¾ inches in height and shall be clean, crisp, and free of defects.

11. Endwalls and reinforced endwalls shall be installed in accordance with Section 838.08 of the NCDOT Standard Specifications for Roads and Structures, latest edition.

C. Construction

1. All storm drainage shall be installed in accordance with Divisions 3 and 8 of the NCDOT Standard Specifications of Roads and Structures, latest edition.
2. Masonry structures and castings shall follow Town of Garner and/or NCDOT Standard Details, latest edition (Refer to **Appendix 3.2**).
3. All storm sewers shall be laid to provide a "true line" between manholes or structures, and they shall be installed at each deflection of line and/or grade.
4. The mortar for brick masonry shall conform to the requirements herein set forth. Excavation shall be made to the required depth and the foundation on which the brick masonry is to be laid shall be approved by the Inspector. The brick shall be laid so that they will be thoroughly bonded into the mortar joints by means of the "shove joint" method: (buttered or plastered joints will not be permitted). The headers and stretchers shall be so arranged as to thoroughly bond the mass. Brickwork shall be of alternate headers and stretchers with consecutive courses in thickness. The joints shall be completely filled with mortar. No spalls or bats shall be used except for shaping round irregular openings or when unavoidable to finish out a course. Competent bricklayers shall be employed on the work and all details of construction shall be in accordance with approved practice and to the satisfaction of the Engineer.
5. Manhole steps shall be set in the masonry as the work is built up, thoroughly bonded, and accurately spaced and aligned.
6. Inverts in storm drainage structures shall be shaped to form a smooth and regular surface free from sharp or jagged edges. They shall be sloped adequately to prevent sedimentation.
7. The castings shall be set in full mortar beds. All castings when set shall conform to the finished grade as established by the Engineer. Any castings not conforming shall be adjusted to the correct grade without extra compensation.
8. All pipes entering catch basins or junction boxes shall enter through a wall and not through a corner of the structure. The pipe shall not project into the drainage structure but shall be finished flush with the inside of the structure.
9. When necessary, the contractor shall provide for the temporary diversion of water or dewatering in order to maintain the storm sewer foundations in a dry condition and shall continue to maintain trenches in a dry condition until backfill and compaction activities are complete.
10. The contractor shall maintain all storm sewers in a condition such that they will function properly from the time the storm sewers are installed until the Town accepts the project. The

Contractor shall thoroughly clean out all storm sewers at no expense to the owner throughout construction.

1.10 ASPHALT CONSTRUCTION

A. General

1. Except as otherwise stipulated in this specification, all asphalt pavement production, installation, and compaction shall be performed in accordance with Division 5 & 6 of the NCDOT Standard Specifications for Roads and Structures, latest edition. The work covered by this section consists of the installation and/or removal of aggregate base course, asphalt concrete surface course, asphalt concrete intermediate course, asphalt concrete base course, asphalt tack coat, asphalt prime coat, Geotextile Interlayer, Asphalt Surface Treatments, and utility adjustments.
2. No base material shall be placed on a Town of Garner roadway until all subgrade, and storm sewer has been inspected and approved by the Town of Garner Inspector and water/sewer utilities and appurtenances have been inspected and approved by the Raleigh Water Inspector.
3. Before the asphalt surface course is placed on the road, the aggregate base course shall be inspected and approved by the Inspector.
4. The Inspector may require field density testing of subgrade soils, ABC stone, and asphalt prior to inspection and/or approval.

B. Materials

1. Subgrade
   a. Subgrade shall be installed, proof rolled, and compacted in accordance with Town of Garner Specification Section 04000 Earthwork, latest edition.
   b. Proof roll inspection shall be scheduled and approved by Town Inspector prior to placement of base course. Failure to obtain inspection may be grounds for removing any ABC layer installed.
   c. Proof rolls shall be performed with a loaded tandem axel dump truck with 10-ton static weight. A weight ticket may be required by the Inspector.
2. Aggregate Base Course
   a. The base course shall consist of an approved coarse aggregate produced in accordance with Section 520 in the NCDOT "Standard Specifications for Roads and Structures." All materials, construction requirements and other provisions in Section 520 shall apply. The subgrade for the coarse aggregate base course shall be constructed in accordance with the requirements of these Specifications.
   b. The subgrade shall be thoroughly compacted and constructed to the line, grade, and cross section on the plans or as directed by the Engineer. Before placing the base course, the subgrade shall be inspected and approved by the Town Inspector and backfilling behind the curb shall be complete.
   c. The base course material shall be placed in lifts not to exceed 8 inches. Each layer shall be graded to the required section and compacted to at least 100 percent of the density as

determined by AASHTO T180. The base material shall be compacted at a moisture content which is approximately that required to produce the maximum density.

d. After final shaping and compacting, the Town Inspector will check the surface of the base for conformance to grade and typical section. The thickness of the base shall be within a tolerance of plus or minus ½ inch of the base thickness required by the plans.

3. Aggregate Base Course and Asphalt Pavement

   a. ABC and asphalt shall be installed, proof rolled, and compacted in accordance with Town of Garner Specification Section 08000 Asphalt Pavement, latest edition.

   b. Proof roll inspection of ABC shall be scheduled and approved by Town Inspector prior to placement of asphalt. Failure to obtain inspection may be grounds for removing asphalt layer installed.

   c. Before placing base course, subgrade shall be inspected and approved by Town Inspector and backfilling behind curb and gutter shall be complete.

   d. Base Course thickness shall be within a tolerance of plus or minus ½ inch as shown on the approved plans.

   e. Proof rolls shall be performed with a loaded tandem axel dump truck with 10-ton static weight. A weight ticket may be required by the Inspector.

   f. All production, delivery, placement, and compaction of asphalt plant mixed bases, intermediate, and surface courses shall conform to Sections 609 and 610 of the NCDOT Standard Specifications for Roads and Structures, latest edition.

   g. All asphalt joints shall be lap joint only. Edges of pavement shall be milled a minimum of 2 feet wide by 1.25-inch thickness to provide lap joint for final asphalt surface layer at all tie-ins. All milling locations shall be repaved within 48 hours.

4. Superpave - Asphalt Concrete Surface Course: Type S 9.5 B, S 9.5 C:

   a. The Superpave surface course shall be Asphalt Concrete Surface Course, Type S 9.5 B, S 9.5 C shall be produced, delivered, placed, tested, compacted, and accepted in accordance with Sections 609 and 610 of the most current version of the NCDOT “Standard Specifications for Roads and Structures.”

   b. Sections of the newly finished pavement shall be protected from traffic until they have become properly hardened. Finished surfaces of the base shall be checked with a 10-foot straightedge, applied parallel to the center of the pavement, and any places that vary more than 1/8 inch as measured from the bottom of the straightedge to the finished course shall be corrected.

5. Superpave - Asphalt Concrete Intermediate Course: Type I 19.0 C

   The Superpave intermediate course shall be Asphalt Concrete Intermediate Course, Type I 19.0 B, I 19.0 C, or I 19.0 D shall be produced, delivered, placed, tested, compacted, and accepted in accordance with Sections 609 and 610 of the most current version of the NCDOT “Standard Specifications for Roads and Structures.”

6. Superpave - Asphalt Concrete Base Course: Type B 25.0 C

The Superpave base course shall be Asphalt Concrete Base Course, Type B 25.0 C or shall be produced, delivered, placed, tested, compacted, and accepted in accordance with Sections 609 and 610 of the most current version of the NCDOT "Standard Specifications for Roads and Structures."

7. Pavement Repair Patch

   Where it is necessary to open cut along or across streets with asphalt surfaces, the pavement shall be replaced in accordance with the Town's Asphalt Pavement Patch Detail or the NCDOT encroachment agreement, whichever is stricter. The replacement surface and/or base shall extend a minimum of 1 foot on each side of the excavated opening. The thickness of the replacement material shall be sufficient to provide a base and surface of equivalent strength to the undisturbed base and surface. The replaced pavement shall meet all applicable material and installation specifications.

8. Asphalt Tack Coat

   The tack coat shall be asphalt or asphalt cement and shall meet the general, material, and construction specifications as specified in Section 605 of the NCDOT "Standard Specifications for Roads and Structures."

9. Asphalt Prime Coat

   Asphalt Prime Coat is not required unless otherwise directed by the plans or Engineer.

10. Asphalt Plant Mix

    The production, delivery, and placement of all types of asphalt plant mixed bases, intermediate, and surface courses shall conform to Sections 609 and 610 of the most current version of the NCDOT "Standard Specifications for Roads and Structures."

C. Construction Methods

ALL OF THE FOLLOWING METHODS SHALL BE SUBJECT TO CHANGE, BASED ON CONTRACTOR'S MEANS AND METHODS. SEE BELOW.

1. Subgrade

   This subgrade shall be prepared and compacted in accordance with Section 500 in the NCDOT "Standard Specifications for Roads and Structures", latest edition.

2. Proofrolling

   a. Equipment: The equipment shall consist of a loaded tandem-axle dump truck or similar pneumatic-tired equipment of a minimum 10-ton static weight. The Contractor is responsible for providing the equipment necessary in order to perform proofrolling.

   b. Method:

      i. After the roadbed has been completed within 0.05 feet of final grade, the roadbed shall then be compacted and tested with two or more coverages unless otherwise directed by the Owner, using a heavy pneumatic-tired roller meeting the requirements listed above. A coverage is considered that stage in the rolling procedure when the entire width of the area being proofrolled has been in contact with the pneumatic tires of the roller.

ii. The roller shall be operated in a systematic manner so that the number of coverages over all areas to be proofrolled can be readily determined and recorded.

iii. The equipment shall be operated at a speed between 2.5 and 3.5 mph. All proofrolling procedures shall be followed to the satisfaction of the Inspector on site during the proofrolling.

c. Corrective Action: If it becomes necessary to take corrective action, such as, but not limited to, underdrain installation, undercut and backfill of unsuitable materials, and aeration of excessively wet material in areas that have been proofrolled, these areas shall be proofrolled again following the completion of the necessary corrections. If the corrections are necessary due to the negligence of the Contractor or weather, the corrective work and additional proofrolling shall be performed by the Contractor.

3. Weather, Temperature, and Seasonal Limitations for Producing and Placing Asphalt

   a. All weather and seasonal limitations shall be in accordance with Sections 610-4 of the most current version of the NCDOT "Standard Specifications for Roads and Structures."

   b. Should rain begin during paving operations, the Owner assumes no responsibility for asphalt left on the trucks at the time that the paving operation is halted.

4. Protection of Material

   The Contractor shall provide and have ready for use at all times enough tarpaulins or covers for use in case of rain, chilly wind, or other delay, for the purpose of covering or protecting any material dumped but not spread.

5. Compacting Asphalt Concrete Mixture

   a. After placing, the mixture shall be thoroughly and uniformly compacted with tandem rollers of 8- or 10-ton model weighing not less than 250 pounds per inch width of roller tread. The number and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition.

   b. Each roller shall be operated by a competent, experienced operator and must be kept in continuous operation as nearly as practicable. Rolling shall start longitudinally at the outer edges and proceed toward the center of the pavement, overlapping on successive trips by at least one half the width of the roller.

   c. The speed of the roller shall be at all times slow enough to avoid displacement of the hot mixture as a result of reversing. Any displacement shall be immediately corrected. Rolling shall proceed at a rate not in excess of 500 square yards per hour per roller and shall continue until no further visible compaction is obtainable and all roller marks have been eliminated.

   d. Rolling shall be started as soon as the mixture will bear the roller without undue misplacement or hairline cracking. Delays in rolling hand raked mixture will not be tolerated.

   e. To prevent adhesion of the mixture to the roller, the wheels shall be kept moistened with water. Places not accessible to the roller shall be thoroughly compacted with hot tamps.

6. Compacted Densities

    a. Compaction and density control of asphalt pavements shall be in accordance with the requirements of Sections 609 and 610 of the most current version of the NCDOT "Standard Specifications for Roads and Structures."

    b. The Contractor shall allow time for the inspections and testing of areas, as needed, and all density test results shall be submitted to the Town's Engineering Inspector for verification.

7. Protection of Pavement

    When edges are not protected, planks of the same thickness shall be placed adjacent to longitudinal or transverse joints until the surface course is completed. Sections of newly finished pavements shall be protected from traffic until they have become properly hardened by temperature cooling.

D. Removal of existing pavement

Milling asphalt pavement shall be in accordance with Section 607 of the latest version of the NCDOT "Standard Specifications for Roads and Structures."

E. Asphalt resurfacing

1. General

    a. Asphalt Resurfacing shall meet all applicable material and installation specifications outlined elsewhere in this manual.

    b. Should construction take place near signalized intersections of a state-maintained roadway, the Contractor shall contact the NCDOT Division Traffic Engineer to schedule the field location of any traffic signal conflicts. The Contractor shall notify the Town of any potential conflict prior to construction. The Contractor shall be responsible for coordinating the conflict relocation with NCDOT during construction.

    c. Construction traffic control shall be provided on each street by the Contractor in strict conformance with NCDOT "North Carolina Supplement to the MUTCD," the MUTCD, the Contract Documents, or as directed by the Engineer. No work shall begin on any street without the proper traffic control measures in place.

    d. Construction traffic control shall be installed and practiced as a means to inform drivers that asphalt tack coat is being placed on the road surface.

    e. The Contractor shall be responsible for spraying or burning all weeds growing on and in the streets. The Contractor shall be responsible for removing and properly disposing of the dead weeds and carefully cleaning each street before beginning asphalt concrete construction operations.

    f. Asphalt resurfacing projects shall have a maximum acceptable elevation difference, between the top of the resurfacing layer and the gutter, of 1.25 inches. The Owner shall not accept any newly resurfaced streets exceeding this maximum elevation difference. Should it be determined that the resurfacing layer is more than 1 inch higher than the gutter elevation the resurfacing shall be removed and replaced or remedied as directed by the Town prior to acceptance.

g. The Contractor shall allow time for the inspection of areas, as needed, by a qualified testing firm.

h. The Contractor shall construct all improvements so as to create and/or maintain positive drainage.

2. Materials

a. Geotextile Interlayer Installation

i. The geotextile interlayer shall be a needle punched, nonwoven engineering fabric made of polypropylene and staple fiber; calendared on one side. It shall be resistant to ultraviolet degradation and have the following properties:

Figure 1.18 Geotextile Interlayer Installation

Geotextile Property	Typical	Test
Grab Tensile Strength (lbs)	101	ASTM D 4632
Grab Elongation (%)	50	ASTM D 4632
Puncture Strength (lbs)	65	ASTM D 4833
Mullen Burst (psi)	220	ASTM D 3786
Trapezoidal Tear (lbs)	45	ASTM D 4533
Mass Per Unit Area (oz/sq yd)	4.1	ASTM D 5261
Thickness (mils)	35	ASTM D 5199
Melting Point (°F)	Greater than 150	ASTM D 276
UV Resistance (%)	70 at 500 hrs	ASTM D 4355

ii. For the tack coat, uncut asphalt cements are preferred, however, cationic or anionic emulsions may be used. For asphalt cements the minimum temperature shall be 150°C, but to avoid damage to the fabric the distributor tank temperatures shall not exceed 160°C. When asphalt emulsions are used, the emulsion shall be cured prior to placing the fabric.

iii. The engineering fabric shall be placed onto the asphalt sealant, calendared side up, prior to the time the asphalt has cooled and lost tackiness. Wrinkles or folds in excess of 1 inch shall be slit and laid flat. In order to maximize fabric contact with the pavement surface, blooming or pneumatic rolling will be required. The fabric joints shall be overlapped sufficiently to ensure full closure of the joint but should not exceed 6 inches. To prevent edge pickup by the paver, transverse joints shall be lapped in the direction of paving.

iv. Quickly following the fabric installation, the hot-mix overlay should be placed evenly. Should the asphalt bleed through the fabric causing construction problems prior to overlay placement, the affected areas shall be blotted by spreading sand. Turning the paver and other vehicles shall be gradual and kept to a minimum to avoid movement of, or damage to the sealant saturated fabric.

F. Speed humps and raised crosswalks

Speed hump and raised crosswalk construction shall meet all applicable material and installation specifications in accordance with standard details.

1.11 EARTHWORK CONSTRUCTION

A. General

Except as otherwise stipulated in this specification, all earthwork shall be performed in accordance with Section 225 of the NCDOT standard specifications for roads and structures, latest edition. The work covered by this section consists of the excavation, placement, and compaction or satisfactory disposal of all materials encountered within the limits of the work necessary for the construction of the project in conformity with the lines, grades, and cross sections shown on the plans or established by the engineer.

B. Unclassified Excavation

1. All material excavated in order to achieve the site lines, grades, and cross sections shown on the plans shall be classified as unclassified excavation.
2. Should hard rock be encountered requiring blasting for removal, a permit for blasting must be obtained, for a fee, from the Town of Garner Fire Marshall or the appropriate jurisdiction a MINIMUM of 24 hours before any explosive material or blasting agents are transported into the corporate limits of Garner.
3. Whenever encountered during work, remove any trash and non-natural debris. Remove all roots and pieces of wood or debris larger than 3 inches in diameter.
4. All suitable material removed in the excavation shall be used as far as practicable in the formation of embankments, subgrades, and shoulders, and at such other places as may be indicated on the plans or directed by the engineer. Unsuitable material and excess excavated material not required for construction of embankments shall be properly disposed of offsite.
5. The intersection of slopes with natural ground surfaces, including the beginning and ending of cut slopes, shall be uniformly rounded as shown on the plans or as may be directed by the engineer. Concurrent with the excavation of cuts, the contractor shall construct intercepting berm ditches or earth berms along and on top of the cut slopes at locations shown on the plans or designated by the engineer. All slopes shall be finished to reasonably uniform surfaces acceptable for seeding and mulching operations (3:1 maximum slope, 2:1 maximum slope allowed in environmentally sensitive areas only). All protruding roots and other objectionable vegetation shall be removed from slopes.

C. Borrow Excavation

Except as otherwise stipulated in this specification, all earthwork shall be performed in accordance with Section 230 of the NCDOT standard specifications for roads and structures, latest edition.

D. Embankment

1. Except as otherwise stipulated in this specification, all earthwork shall be performed in accordance with section 235 of the NCDOT standard specifications for roads and structures, latest edition.
2. Before embankment construction is begun, all vegetation, debris, deleterious and unsuitable material shall be removed from the area within the limits of the embankment. Upon completion of clearing and stripping, the subgrade area to receive embankment shall be uniformly proofrolled under the observation of the engineer. Proofrolling shall be accomplished using a loaded dump truck or similar pneumatic-tired equipment of a minimum 10-ton static weight

making at least four passes over each area. Any areas, which pump or deflect under proofrolling or are otherwise deemed unsuitable by the Town shall be stabilized or bridged as directed by the Inspector.

3. Embankment material and backfill material shall consist of clean, readily compactible earthen material with a maximum particle size of 2 inches. Embankment material shall be free from debris, organic matter, frozen or deleterious material.

4. The embankment material shall be deposited and spread in successive, uniform, approximately horizontal layers of not more than 8 inches in depth, loose measurement, for the full width of the cross section, and shall be kept approximately level by the use of effective spreading equipment. Each layer of the embankment shall be thoroughly compacted as hereinafter specified. Hauling shall be distributed over the full width of the embankment, and in no case will deep ruts be allowed to form during the construction of the embankment. The embankment shall be properly drained at all times.

5. Backfill materials placed around and over pipe culverts, box culverts, and arch culverts, and embankment materials placed around other structures, shall be clean select material. The material shall be placed and compacted in a manner, which will avoid unbalanced loading and will not produce undue stress on the structure. Such embankments shall be placed in loose layers not to exceed 6 inches in depth and each layer shall be thoroughly compacted as hereinafter specified. All pipe culverts, box culverts, and arch culverts, after being backfilled as specified in this subsection, shall be protected by a 3-foot cover of fill at any time that heavy hauling equipment is permitted to cross during construction of the roadway. Any damage or displacement to culverts or other structures due to the contractor's operation shall be corrected or repaired by the contractor prior to final acceptance.

6. During construction and until final acceptance, the contractor shall construct temporary or permanent earth berms along the outer edges of the top surface of the embankment, construct temporary ditches, shape the embankment surface to provide for the drainage of surface runoff along and throughout the length of the embankments, and use any other methods necessary to maintain the work covered by this section so that the work will not contribute to excessive soil erosion.

E. Undercut Excavation

Except as otherwise stipulated in this specification, all earthwork shall be performed in accordance with Section 225-4 of the NCDOT Standard Specifications for Roads and Structures, latest addition.

F. Fine Grading

Performance of all work shall be in accordance with Section 500 of the NCDOT Standard Specifications for Roads and Structures.

G. Ditch Excavation

Except as otherwise stipulated in this specification, all ditch excavation shall be performed in accordance with Section 240 of the NCDOT Standard Specifications for Roads and Structures, latest addition.

H. Blasting

1. Obtain required permits for blasting (e.g., from Town of Garner Fire Marshall) prior to blasting, 24-hours **minimum**.
2. Except as otherwise stipulated in this specification, all blasting shall be performed in accordance with Section 220 of the NCDOT Standard Specifications for Roads and Structures, latest addition.
3. Blasting is allowable for the removal of rock, as defined herein unless specifically prohibited by the Town, owner, engineer or a utility owner with an existing utility within the proximity of the proposed blast site.
4. Store, handle, and use explosives in accordance with all applicable local, state, and federal regulations and in accordance with the provisions of the "Manual of Accident Prevention and Construction" of the Associated General Contractors of America, inc. Federal regulations include, but are not limited to, title 27, chapter 11, part 555 of the Code of Federal Regulations (CFR) and OSHA Standards – Part 1926, Subpart U.
5. Provide seismographic monitoring during progress of blasting operations.
6. Take all necessary precautions to protect life and property, including the use of an approved blasting mat where there exists the danger of throwing rock or overburden. Keep the explosive materials that are on the job site in specially constructed boxes provided with locks. Failure to comply with this specification shall be grounds for suspension of blasting operations until full compliance is made. No blasting shall be allowed unless a galvanometer is employed to check cap circuits. Where blasting takes place within 500 feet of a utility, structure, or property which could be damaged by vibration, concussion or falling rock, keep a blasting log containing the following information for each and every shot. This log shall be kept in an orderly manner and made available to the Town upon request.
    a. Date of shot
    b. Time of shot
    c. Crew supervisor
    d. Number and depth of holes
    e. Approximate depth of overburden
    f. Amount and type of explosive used in each hole
    g. Type of caps used (instant or delay)
    h. The weather
    i. Seismograph instrument and readings
7. Use explosives in such a way to minimize vibration to existing utilities and structures.
8. Provide only experienced personnel for blasting in accordance with accepted practices. Contractor is responsible for safety of life and damage to property resulting from the use of explosives.
9. The Town reserves the right to require the removal of rock by other means if blasting operations result in possible hazardous conditions.

1.12 CAST IN PLACE CONCRETE CONSTRUCTION

A. General

Except as otherwise stipulated in this section, all cast in place concrete shall be in accordance with Section 1000 of the NCDOT Standard Specifications for Roads and Structures, latest addition.

B. Materials

1. Portland cement concrete for curb and gutter, driveways, driveway aprons, wheelchair ramps, sidewalks, traffic islands, paved ditches, or concrete transitional sections for drainage structures and other items as specified on the plans shall have a minimum 28 day compressive strength of 2,500 psi in accordance with Class B concrete as described in Section 1000 of the NCDOT "Standard Specifications for Roads and Structures" unless otherwise specified in the Contract Documents. Portland cement concrete for structures, culverts and other items as specified on the plans shall be Class A or Class AA in accordance with NCDOT "Standard Specifications for Road and Structures." Dyed concrete is not allowed in construction of driveway aprons or public sidewalks .
2. Joint filler shall be a non-extruding joint material conforming to Section 1028-1 of the NCDOT Standard Specifications for Road and Structures, latest edition.
3. Aggregate for portland cement concrete shall meet the requirements for fine and course aggregate of Section 1014 of the NCDOT Standard Specifications for Road and Structures, latest edition.
4. Portland Cement and admixtures shall meet the requirements of Section 1000 of the NCDOT Standard Specifications for Road and Structures, latest edition.
5. Water for mixing or curing the concrete shall be free from injurious amounts of oil, salt, acid, or other products injurious to the finished product.
6. Detectable warnings for proposed curb ramps shall consist of integrated raised truncated domes. The description, size and spacing shall conform to the Town of Garner Standard Details.
    a. Use material for detectable warning systems as shown herein. Material and coating specifications must be stated in the Manufacturers Type 3 Certification and all Detectable Warning systems must be on the NCDOT Approved Products List.
    b. Install detectable warnings created from one of the following materials: precast concrete blocks or bricks, clay paving brick, gray or ductile iron castings, mild steel, stainless steel, and engineered plastics, rubber or composite tile. Only one material type for detectable warning will be permitted per project, unless otherwise approved by the Engineer.
        i. Detectable Warnings shall consist of a base with integrated raised truncated domes, and when constructed of precast concrete they shall conform to the material requirements of Article 848-2 of the NCDOT Standard Specifications, latest edition.
        ii. Detectable Warnings shall consist of a base with integrated raised truncated domes, and may be comprised of other materials including, but not limited, to clay paving brick, gray iron or ductile iron castings, mild steel, stainless steel, and engineered plastics, rubber or composite tile, which are cast into the concrete of the curb ramps. The material shall have an integral color throughout the thickness of the material. The detectable warning

shall include fasteners or anchors for attachment in the concrete and shall be furnished as a system from the manufacturer.

7. Prior to installation, the Contractor shall submit to the Engineer assembling instructions from the manufacturer for each type of system used on the project. The system shall be furnished as a kit containing all consumable materials and consumable tools, required for the application. They shall be capable of being affixed to or anchored in the concrete curb ramp, including green concrete (concrete that has set but not appreciably hardened). The system shall be solvent free and contain no volatile organic compounds (VOC). The static coefficient of friction shall be 0.8 or greater when measured on top of the truncated domes and when measured between the domes in accordance with ASTM C1028 (dry and wet). The system shall be resistant to deterioration due to exposure to sunlight, water, salt or adverse weather conditions and impervious to degradation by motor fuels, lubricants and antifreeze.
8. When steel or gray iron or ductile iron casting products are provided, only products that meet the requirements of Subarticle 106-1(B) of the NCDOT Standard Specifications (latest edition) may be used. Submit to the Engineer a Type 6 Certification, catalog cuts and installation procedures at least 30 days prior to installation for all.

C. Quality Assurance

1. Concrete shall be only plant-mixed, transit-mixed or ready-mixed concrete. **The time elapsing from mixing to placing the concrete shall not exceed 90 minutes**. Concrete shall not be deposited on frozen subgrade and shall not be poured when the air temperature is falling and below 40°F, and the predicted low temperature for the succeeding 24-hour period is less than 32°F.
2. All concrete when placed in the forms shall have a temperature of between 50°F and 90°F and shall be maintained at a temperature of not less than 50°F for at least 72 hours for normal concrete and 24 hours for high early strength concrete, or for as much time as is necessary to secure proper rate of airing and designed compressive strength. The use of admixture, retarders, and accelerators shall be used as directed by the Engineer.

D. Construction Methods

1. Proportioning of Concrete: The concrete shall be mixed in proportions discussed herein and approved by the Engineer.
2. Mixing Concrete: The concrete shall be mixed by machine on the job or at a central mixing plant. A batch mixer of any approved type may be used. The method of measuring the materials for the concrete, including water, shall be one which will insure separate and uniform proportions of each of the materials at all times. The mixing shall continue at least 1.5 minutes after all ingredients have been emptied before receiving material for the succeeding batch.
3. A central mixing plant shall not be used until approved by the Engineer and shall be certified by the NCDOT. The concrete from a central plant shall be delivered and deposited at the consistency specified without segregation. **The time elapsing from mixing to placing the concrete shall not exceed 90 minutes.**
4. Concrete shall be mixed only in such quantities as are required for immediate use and all such material shall be used while fresh and before initial set has taken place. Any concrete in which set has begun shall not be used in the work. Retempering of concrete will not be allowed.

5. Subgrade: The subgrade shall be excavated to the required depth below the finished surface in accordance with the plans to the lines and grades established by the Engineer. All soft yielding material or other unsuitable material shall be removed and replaced with suitable material and the subgrade shall be compacted thoroughly and finished to a firm, smooth surface. **No curb and gutter, driveways, driveway aprons, wheelchair ramps, sidewalks, or traffic islands shall be poured until the subgrade is approved by the inspector.**

6. Forms: The forms shall be of metal and of the necessary dimensions to construct the combined curb and gutters specified in the plans. Wood forms may be used where conditions make the use of metal forms impractical. **The use of wood forms must be approved by the Engineer.** The forms shall be set true to the line and grade established by the Engineer and held rigidly in position, so as to prevent leakage of mortar and springing out of line when the concrete is placed in them. The forms shall be true in line, free from warping or bending. **No concrete shall be placed until the forms and subgrades have been approved by the Inspector.**

7. Placing of Concrete: The subgrade shall be moistened and the concrete shall be placed in the forms and tamped sufficiently to bring the mortar to the surface, after which it shall be finished smooth and even by means of a wooden float.

8. Curb and gutter shall be constructed in place in uniform sections 10 feet in length. The joints between sections shall be formed by steel templates 1/6-inch in thickness and of the width and depth of the curb and gutter. The templates shall be left in place until the concrete has set sufficiently to hold its shape but shall be removed while the forms are still in place.

9. Machine poured concrete curb and gutter will be scored at 15-feet intervals with expansion joints located at intervals no greater than 50 feet.

10. Expansion joints shall be ½-inch in width and shall be placed between all rigid objects at a distance of no more than 50 feet apart and shall extend the full depth of the concrete with the top of the filler ½ inch below the finished surface.

11. Finishing: The edges of the curb and gutter shall be finished with an approved edging tool of ½-inch radius. Joints shall be similarly finished immediately after the templates have been removed.

12. Curing: Contractor may select method of curing provided that the method is approved by the Engineer and that the means and methods of curing conform to standards specified by current AASHTO or American Society for Testing and Materials (ASTM) specifications.

13. Removing Forms: Forms shall not be removed from freshly placed concrete until it has set for at least 12 hours. Forms shall be carefully removed in such a manner as to prevent damage to the edges of the concrete. Any honeycombed areas along the sides shall be filled promptly with mortar composed of one part cement and two parts of fine aggregate.

14. Cold Weather and Night Concreting: Concreting shall be done when weather conditions are favorable unless otherwise directed by the Engineer. Concrete operations shall be discontinued when a temperature of 40°F is reached on a falling thermometer and may be continued when temperature reaches 35°F on a rising thermometer. **No concreting shall be attempted when local weather bureau indicates temperature below freezing within the ensuing 24 hours unless proper precautions are made to protect the concrete by covering with thermal insulation satisfactory to the Engineer.** The Contractor shall be responsible for the quality and strength of

the concrete laid during cold weather and any concrete damaged by frost action or freezing shall be removed and replaced as directed by the Engineer at the Contractor's expense.

15. The Contractor may be permitted by the Engineer to proceed with concrete operations during cold weather in temperatures of not less than 25°F at placing time provided that the Contractor furnishes an approved admixture and uses an amount per batch not to exceed 2 percent by weight of the total amount of cement, and further provided that he takes other precautions deemed necessary by the Engineer to prevent concrete from freezing during curing period.
16. No more concrete shall be laid than can be properly finished and covered during daylight, unless adequate artificial light satisfactory to the Engineer is provided.
17. Protection of Concrete: Immediately after the forms have been removed and all honeycombed areas repaired, the back of the curb shall be backfilled to prevent underwash. Traffic shall be excluded from crossing the concrete for a period of approximately 14 days, by erection and maintenance of suitable barricades, unless otherwise specified in the Contract Documents or by the Engineer. Contractor shall be responsible for any damage resulting from traffic or vandalism until accepted by the Engineer, and he shall remove and replace any concrete damaged as directed by the Inspector.

E. Construction methods - Curb & gutter, Driveways, Driveway aprons, Wheelchair ramps, Sidewalks, and Traffic islands

1. Areas of concrete to be removed shall be sawcut before removing. The sawcut shall provide a smooth, straight edge approximately 2 inches deep before breaking away the adjacent concrete.
2. Concrete shall be constructed in accordance with Section 825 of the NCDOT Standard Specifications for Road and Structures (latest edition) and shall be given a “sidewalk finish,” except as otherwise noted herein.
3. Brooming of the concrete surface shall be done transverse to the direction of traffic. Joint spacing shall not be less than 5 feet. Where existing sidewalks are being widened, transverse joints shall be located so as to line up with existing joints in the adjacent existing sidewalk. Grooved joints shall not be sealed.
4. **No backfill** shall be placed adjacent to the curb and gutter, driveways, driveway aprons, wheelchair ramps, or sidewalks **until at least three curing days have elapsed**, as defined in Section 825-9 of the NCDOT Standard Specifications for Road and Structures, latest edition. However, all backfill shall be placed within four calendar days after the completion of this 3-curing-day time period. Backfill shall clean earthen material free of all debris and shall be compacted to a degree comparable to the adjacent undisturbed material or as directed by the inspector.
5. Prior to placing detectable warnings in proposed concrete curb ramps, adjust the existing subgrade to the proper grade and in accordance with Article 848-3 of the 2012 Standard Specifications. Prior to placing detectable warnings in existing concrete curb ramps, saw cut to the full depth of the concrete, for other material remove as necessary, and adjust the existing subgrade to the proper grade and in accordance with Article 848-3 of the 2012 Standard Specifications.
6. Install all detectable warning in proposed concrete curb ramps or to retrofit existing curb ramps in accordance with the manufacturer’s recommendations.

2. STORMWATER STANDARDS

A. Standard details T-3.01 through T-3.16 (Stormwater). See Appendix 3.2.

2.1 STORMWATER REQUIREMENTS SUMMARY

A. State and Local Program Requirements for the Town of Garner

The Town of Garner currently has two local programs and one state program in place. See Section Two of this document for detailed standards.

1. The Town of Garner Stormwater Program for Nitrogen Control was implemented in 2001 and updated in 2022. The four minimum measures of this program are new development review/approval, illegal discharges, retrofit location, and public education. This program covers the entire jurisdiction, including the ETJ.

2. The Water Supply Watershed Protection plan was approved by EMC in 1995. This plan was a part of the Swift Creek Land Management Plan for municipalities that have waters that drain to Lake Wheeler, Swift Creek and Lake Benson. This plan does not cover the entire jurisdiction, but a smaller area that drains to Lake Benson. The plan includes several density options for development that are as follows: 6 percent low density for the Critical Area, 12 percent low density for the non-critical area, and 70 percent high density for the non-residential area.

3. The Town of Garner also currently has a MS4 NPDES Phase II Program in place, which was implemented in 2005. The six minimum measures of this program are public education and outreach, public involvement and participation, illicit discharge detection and elimination, construction site runoff controls, post-construction site runoff controls, and pollution prevention and good housekeeping for municipal operations. This program covers the entire jurisdictional area of the Town of Garner.

B. Town of Garner Illicit Discharge Detection and Elimination

1. The Town of Garner has a program to prevent, identify and remove illicit/illegal discharges as required by the Neuse Stormwater Rule and MS4 NPDES Phase II permit. Illicit/Illegal discharges are flows in the stormwater collection system that are not associated with stormwater runoff or an allowable discharge. Allowable and prohibited discharges are listed in the tables that follow.

Figure 2.1 Allowable and prohibited discharges

Discharges allowable to the stormwater collection system		
Waterline Flushing	Landscape Irrigation	Diverted Stream Flows
Uncontaminated Rising Ground Water	Uncontaminated Ground Water Infiltration	Uncontaminated Pumped Ground Water
Discharges from Potable Water Sources	Foundation Drains	Uncontaminated Air Conditioning Condensation
Irrigation Water	Springs	Water from Crawl Space Pumps
Footing Drains	Lawn Watering	Single Family Residential Car Washing

Discharges allowable to the stormwater collection system		
Flows from Riparian Habitats and Wetlands	NPDES permitted discharges	Fire Fighting Emergency Activities
Dechlorinated Backwash and Draining Associated with Swimming Pools (through a vegetated buffer)	Wash Water from Non-Commercial Cleaning of Buildings	

Types of Discharges prohibited to stormwater collection system		
Dumping of Oil, Anti-Freeze, Paint, Cleaning Fluids	Commercial Car Wash	Industrial Discharges
Contaminated Foundation Drains	Cooling Water Unless No chemicals added and has NPDES permit	Wash Water from Commercial and Industrial Activities
Sanitary Sewer Discharges	Septic Tank Discharges	Washing Machine Discharges
Chlorinated Backwash and Draining Associated with Swimming Pools		

2. The legal authority for identifying, prohibiting, and removal of discharges not allowed to the stormwater collection system is contained in Chapter 17, Article VI of the Garner Town Code.

C. Calculating Peak Runoff Volume

The Town of Garner requires peak flow reduction for the 1-year, 10-year and 25-year storm and sometimes the 100-year storm. Design of any detention devices required to reduce post development peak flow shall use the design method contained in Elements of Urban Stormwater Design (Malcolm) or any current applicable method that is approved by the Engineering Department. The emergency spillway in stormwater devices shall be designed to hold the 100-year storm with a recommended one foot of freeboard. The peak flow control requirement is not required for developments that meet any of the following conditions:

1. The increase in peak flow between pre- and post-development conditions does not exceed ten percent (note that this exemption makes it easier to conduct redevelopment activities).
2. The proposed new development meets all the following criteria: overall impervious surface is less than fifteen percent, and the remaining pervious portions of the site are utilized to the maximum extent practical to convey and control the stormwater runoff.
3. It can be demonstrated that detention will increase local flooding problems downstream. In addition, detention for the 10-year and 25-year storm will not be required when it can be demonstrated that the increase in total peak flow at local flood prone areas downstream will increase only an insignificant (less than 2.0 percent) amount.

D. Town of Garner Water Supply Watershed Protection Plan Stormwater Requirements

1. Within the Garner Swift Creek Watershed, impervious surface may not exceed 12 percent of land area, per lot or per subdivision development.

a. Exceptions to impervious limits may be granted to a maximum of 35 percent for residential development and a maximum of 70 percent (non-residential), known as the high-density option.

b. Exceptions for these cases are permitted where the stormwater runoff from a 1.0-inch rainfall event is retained by retention ponds, or other approved devices designed to achieve 85 percent total suspended solids as approved by the North Carolina Department of Environmental Quality (NCDEQ) and the Town of Garner, constructed in accordance with best management practices.

2. Within that part of the Swift Creek Watershed Protection Area designated as the Lake Benson Conservation (LBC) zoning overlay district, the impervious surface may not exceed 6 percent of land area per lot, except where runoff as described above is retained by retention ponds or other approved devices constructed pursuant to best management practices in which case it may not exceed, but may be a maximum of 35 percent.

E. Town of Garner MS4 NPDES Phase II Stormwater Requirements - Post Construction Stormwater Runoff Controls

Development plans will be reviewed for stormwater compliance with the Neuse Riparian Buffers, water supply watershed protection rules, the Neuse stormwater regulations and NPDES Phase II permit regulations. This includes adequacy of nutrient calculations, Stormwater Control Measure (SCM) design, Operations and Maintenance (O&M) Agreements, public access and maintenance easements for SCMs as well as any other federal, state or local government rules.

F. Town of Garner Stormwater Program for Nitrogen Control Stormwater Requirements

1. The Neuse Stormwater Rule document (updated in 2022) identifies a threshold for development of 24 percent built-upon area (BUA). Regulated and cumulative BUA is calculated based on the entire site minus existing BUA. If this total exceeds 24 percent, then a SCM is required for treatment of nitrogen.

2. Developers shall have the option of partially offsetting projected nitrogen loads by funding wetland or riparian area restoration through private mitigation banks or the NCDEQ Division of Mitigation Services.

3. New development shall comply with the requirements for protecting and maintaining riparian buffers as specified in 15A NCAC 2B .0233.

4. Except in certain situations, stormwater detention will be required on new projects. The design standard for detention will be based upon peak flow reduction to predevelopment (existing) conditions for the 1-year, 10-year, 25-year and in some cases the 100-year return frequency storm events.

5. For complete description of these rules, please see the Town of Garner Stormwater Program for Nitrogen Control document.

G. Calculating Nitrogen Export from New Development

1. The nitrogen export from each new development must be calculated. This export will be calculated in pounds per acre per year (lbs/ac/yr).

2. Nutrient loading rate reductions resulting from the use of SCMs shall be determined through the use of the tool most recently approved by the NCDEQ, or through an alternative method that meets or exceeds criteria determined by the NCDEQ.
    a. Provides project site loading reduction estimates from the installation of NCDEQ Division of Energy, Mineral and Land Resources (DEMLR) approved SCMs;
    b. Reductions apply to the portion of the project's runoff volume that is directed to the SCMs;
    c. The method partitions the runoff volume processed by the SCM among hydrologic fates and assigns nutrient concentrations to each of those fates; and
    d. The method is supported by the weight of evidence from available, current, and applicable research.

2.2 SCM'S, INSPECTION & MAINTENANCE, AND RIPARIAN BUFFERS

A. SCM Design Criteria

Developers shall utilize any stormwater control measure that has been approved by the NCDEQ. There are many approved options for SCMs that reduce nitrogen from new development. SCMs shall be designed to meet the most recent and relevant Minimum Design Criteria (MDC) set forth in the Rules by the NCDEQ. Underground proprietary systems may be used if they have been approved by NCDEQ. All SCMs require regular maintenance, and some have varying performance depending on soil type and the season. It is crucial to consider the issues of aesthetics, long-term maintenance, safety, and reliability in SCM design.

B. SCM Operations and Maintenance (Refer to Appendix 3.4)

1. The maintenance of any SCM installed to achieve nitrogen loading and/or flow attenuation requirements for a development shall be the responsibility of the property owner or other identified responsible party. In the case of residential or commercial subdivisions, this may be an HOA or other applicable responsible party.
2. There shall be an O&M Agreement and Memorandum of Agreement for every engineered stormwater control.
    a. The O&M Agreement shall specify all operation and maintenance work necessary for the function of all engineered stormwater control components within the system.
    b. The O&M Agreement shall require the owner to maintain, repair and, if necessary, reconstruct the engineered stormwater controls, and shall state the terms, conditions, and schedule of maintenance for the engineered stormwater controls.
    c. The O&M Agreement shall specify methods to be used to maintain or restore the engineered stormwater controls to design specifications in the event of failure.
    d. The O&M Agreement shall require the applicant or owner to maintain, repair, or reconstruct the engineered stormwater controls in accordance with the approved design plans.
    e. The O&M Agreement shall be binding on all subsequent owners of the site, portions of the site, and lots, or parcels served by the engineered stormwater control.

f. Until the transference of all property, sites, or lots served by the engineered stormwater control, the original owner or applicant shall have primary responsibility for carrying out the provisions of the O&M Agreement.

3. The O&M Agreement must be approved by the Stormwater Administrator prior to development plan approval, and it shall be referenced either at time of Certificate of Occupancy for commercial development or during construction drawing review for residential subdivisions and shall be recorded with Wake County Register of Deeds along with a Memorandum of Agreement. A copy of the recorded Memorandum of Agreement plus O&M Agreement shall be given to the Stormwater Administrator within 14 days following its recordation.

4. A 20-foot public access and maintenance easement around all stormwater control measures that connect to the public right-of-way shall be recorded on the plat for each new development to grant to the Town of Garner a right of entry to the property to inspect, monitor, maintain, repair, or reconstruct the engineered stormwater control; however, in no case shall the right of entry, of itself, confer an obligation on Town of Garner to assume responsibility for the engineered stormwater controls.

5. Cross-access private easements are required when a device treats runoff from more than one single property so that all property owners whose property drains to that device may access it. This easement must be accessible from all properties involved or from the public right-of-way.

C. SCM Inspection Program

1. Private property owners are required to provide an annual SCM inspections and maintenance report that is to be certified and sealed by a qualified individual. These inspections shall begin once as-built drawings have been reviewed and accepted by the Town and then will continue on an annual basis. Inspection reports are documented within a Town of Garner online system and photographs are kept as record. A list of any deficiencies or repairs needed for the systems shall be clearly stated in the report provided to the Town along with a maintenance plan provided by the owner/responsible party. The property owner/responsible party shall have 90 days to correct all deficiencies and make all repairs to the satisfaction of the Town Engineer. Failure to satisfactorily complete the repairs within the ninety days will cause the SCM to be declared a nuisance as provided for in Section 6-17 of the Garner Town Code. Abatement of the nuisance will proceed as provided for in Chapter 6, Article II of the Garner Town Code.

2. The Town of Garner shall have access to all privately-owned SCMs for inspections purposes. If the owner or occupant of any property refuses to permit such inspection, the Stormwater Administrator shall proceed to obtain an administrative search warrant pursuant to G.S. § 15-27.2 or its successor. No person shall obstruct, hamper, or interfere with the Stormwater Administrator while carrying out his or her official duties.

3. Checklists for annual inspections can be found attached to the O&M Agreement that correspond to SCMs located at the development site.

D. Performance Security Measures

The Town of Garner may, at its discretion, require the submittal of a performance security or bond with surety, cash escrow, letter of credit or other acceptable legal arrangement prior to issuance of a permit in order to ensure that the engineered stormwater controls are installed by the permit

holder as required by the approved stormwater management plan, and/or maintained by the owner as required by the O&M Agreement.

E. Development Closeout Process

At project close out and/or Certificate of Occupancy, all stormwater as-builts for SCMs and public storm drain infrastructure will be reviewed and approved by the Town of Garner Engineering Department. Upon acceptance of these structures and controls by the Town of Garner, SCMs will then be the responsibility of the property owner to maintain, and they will be inspected annually by Town Engineering Department staff. Any maintenance items will be reported to the property owner and measures will be taken as described earlier in Subsection C: SCM Inspections Program.

F. Riparian Buffers

1. Riparian areas shall be protected on new developments in accordance with the Riparian Buffer Rule (15A NCAC 2B .0233). The Riparian Buffer Rule requires that 50-foot riparian buffers be maintained on all sides of intermittent and perennial streams, ponds, lakes and estuaries in the Neuse River basin. The rule includes some uses that are allowable within the riparian buffer and some that are allowable with mitigation. The table of uses in 15A NCAC 2B .0233(6) lists those uses that are allowable in the riparian buffer and is presented in **Appendix B** of the Garner Nitrogen Control Manual.
2. No new development shall be allowed within the first 50 feet adjacent to a waterbody that is shown on either the Unites States Geological Survey (USGS) topographic map or the Natural Resources Conservation Service (NRCS) Soil Survey maps unless the owner can show that the activity has been approved by NCDEQ. NCDEQ approval may consist of the following:
    a. An Authorization Certificate that documents that NCDEQ has approved an allowable use such as a road crossing or utility line. A detailed list of allowable uses is included in the table of uses in 15A NCAC 2B .0233(6).
    b. An opinion from NCDEQ that vested rights have been established for the proposed development activity.
    c. A letter from NCDEQ documenting that a variance has been approved for the proposed development activity.
    d. A letter from NCDEQ documenting that, based upon a field stream classification inspection, the USGS topographic map and the NRCS soil survey maps are in error and an intermittent and perennial stream, pond, or lake does not exist.

2.3 STORMWATER DESIGN AND LAYOUT

A. Location

1. All public and private stormwater systems shall be installed in public right-of-way or within private drainage easements. This includes all closed pipe systems, as well as any open channels that serve greater than two lots.
2. Ensure all storm systems meet horizontal and vertical clearance requirements from water/sanitary sewer in accordance with the Raleigh Water Public Utilities Handbook.
3. Discharge points shall be a minimum of 20 feet downhill from the building envelope.
4. Inlets shall not be placed in travel areas of roadways, driveways, or parking lots.

B. Drainage Easements

1. Easements shall be provided for any development that involves more than two lots. Easement width is based upon pipe width in the following manner:
   a. 20-foot minimum width for all pipes.
   b. 30-foot minimum width for pipes over 48 inches.
   c. The easement width for pipe depths over 10 feet shall be specified by Town of Garner (TOG) Stormwater staff.
2. Drainage Channels
   a. Only drainage channels centered on the associated culvert or watercourse shall be allowed.
   b. Drainage channels should tie to existing easements, existing watercourses, or other appropriate locations when possible.
   c. Channel shall be provided in the following widths:

Figure 2.2 Drainage Easement Width

Drainage Area, acres	Easement Width
<10	20’
10-25	40’
25-50	60’
50-100	80’
>100	60’ or floodway width, whichever is greater

C. Maintenance

1. Per Town of Garner Storm Drain Policy, The Town of Garner will only maintain or correct storm drainage or permanent drainage facilities that lie within the Town right-of-way or on Town-owned property, unless the exemptions listed in Garner’s Storm Drain Policy are met.
2. The maintenance of all private storm drainage easements or channels for a development shall be the responsibility of the property owner or other identified responsible party.
3. Maintenance by the property owner shall be performed as follows:
   a. At least once annually, remove excess sediment, especially from the upstream edge, to maintain original contours and grading.
   b. At least once annually, repair any erosion and regrade the channel to ensure that the runoff flows evenly in a thin sheet.
   c. At least once annually, inspect vegetation and revegetate the channel to maintain a dense growth of vegetation.
   d. Grass shall be mowed at least twice annually to a minimum height of 6 inches.

2.4 STORMWATER SIZING AND CALCULATION STANDARDS

A. Curb Inlets

The following design standards should be followed unless the designer requests and receives approval for alternative designs from the Town Engineer.

1. All curb inlets on public or private streets shall be designed to accommodate a 2-year rainfall event.
    a. Maximum gutter spread allowable is ½-lane (2-foot gutter pan plus half lane width) during such event. In areas with striped bike lanes, parking lane, or full width shoulder, no encroachment into travel lane allowed.
    b. Inlets should be located on uphill side of intersections.
    c. Inlets are not allowed in:
        i. Travelways of road or parking lots;
        ii. Driveway aprons; or
        iii. Turnout radii of driveways/intersections.
2. There is a minimum gutter gradient of 0.75 percent on new development. Warped gutter is permitted when lesser slopes are encountered.
3. Sag inlets should be designed to accommodate double capacity to account for clogging.
4. Calculation of Inlet Capacity
    a. Capacity of curb opening inlets shall be calculated using the Rational Method for areas 100 acres or less. For areas greater than 100 acres, the Soil Conservation Service (SCS) method shall be used.
    b. Calculations shall be done using the most updated coefficients from the North Carolina Erosion and Sediment Planning and Design Manual.
    c. Intensity - use/provide latest rainfall intensity graphs for Raleigh area.
    d. TC-10 minimum, Nomograph, Kinematic Wave method, or Kirpich Equation.

B. Junctions

1. No blind boxes shall be permitted. All structures must have top access for maintenance at every bend in the storm pipe system.
2. When maintenance of a structure transitions from public to private, a junction box shall be added at the right-of-way line.

C. Pipes and Channels

The following design standards should be followed unless the designer requests and receives approval for alternative designs from the Town Engineer:

1. Pipes and channels shall be built to a minimum 10-year design flow.
2. Velocity shall be a minimum 2 feet per second during 2-year storm.
3. Use Manning's Equation and nomographs to calculate flow.

4. Minimum 15-inch diameter pipe size in public right-of-way.
5. Maximum pipe length
    a. 300 feet for pipes less than or equal to 48-inch diameter.
    b. 400 feet for pipes greater than 48-inch diameter.
6. Change in pipe size shall be limited to 0.20-foot drops unless approved by Town Engineer.
    a. When pipe size increases, soffits must be matched.
    b. No decrease in pipe size downstream shall be permitted without a detailed study on maintenance submitted to the Town Engineer.
7. Grass channels must be 3:1 side slope maximum, bank stabilization based on tractive force analysis.
8. Side slopes shall be 3:1 maximum, except at stream crossings. Slopes exceeding 3:1 slope require approval by the Town Engineer.

D. Culvert Crossings Standards

The following design standards should be followed unless the designer requests and receives approval for alternative designs from the Town Engineer.

1. Culvert crossings shall be built to a 25-year design flow standard with freeboard.
    a. 2 feet of freeboard in 10-year storm.
    b. 1 foot of freeboard in 100-year storm.
2. No overtopping allowed in 100-year storm unless granted approval from the Town Engineer.
3. All roads must be constructed above 100-year flood elevation.

E. Headwalls Standards

The following design standards should be followed unless the designer requests and receives approval for alternative designs from the Town Engineer:

1. Headwall design must follow NCDOT drainage design standards.
2. 2:1 maximum slope from pipe invert to top of berm.
3. Only standard NCDOT concrete walls shall be permitted.

F. Discharge Points

1. Discharge points should be designed to minimize impacts of concentrated flow to downstream properties.
2. No outlets across walkways shall be permitted.

G. Floodplains, Riparian Buffers, and Impoundments

1. SCMs in floodplains shall be built to a 100-year design flow standard.
2. No impoundments over 15 feet deep from invert in 100-year storm (without approval from Dam Safety.)
3. No roads (public or private) to be constructed on dams without approval of Town Engineer.

4. Street crossings of riparian buffers or streams shall be as close to perpendicular angle as possible.

2.5 STORM DRAINAGE MATERIALS

A. Materials

1. Reinforced Concrete Pipe (RCP) may be used in all storm drain applications.
2. The following pipe materials are acceptable on Town maintained streets where concrete is used for all end treatments:
   a. High Density Polyethylene (HDPE)
   b. Polypropylene Pipe (PPE)

B. Sizing

A 60-inch maximum pipe diameter must be observed for HDPE and PPE pipe.

2.6 STORM DRAINAGE INSTALLATION

A. Storm Drainage Pipe

1. Trenching and backfill shall be completed in accordance with the latest edition of the NCDOT Standards & Specifications.
2. Dissimilar pipe connections required at transitions to RCP. Refer to Standard Details (Appendix).
3. The developer must provide notice of pipe installation to the Town of Garner Inspector at least 24 hours prior to installation.
4. Pipes should not enter corners of waffle style box.
5. Pipes shall be installed at true line and grade using laser equipment.
6. Cover for pipes within the right-of-way shall be provided based on the following table:

Figure 2.3 Pipe Clearance Distance

Minimum Pipe Distance from Invert to Subgrade	
Pipe Size	**Clearance Distance**
15-inch	2.4 feet
18-inch	2.7 feet
24-inch	3.3 feet
30-inch	3.8 feet
36-inch	4.4 feet
42-inch	4.9 feet
48-inch	5.4 feet
54-inch	6.0 feet
60-inch	6.5 feet
66-inch	7.0 feet
72-inch	7.6 feet

7. Outside of the right-of-way, pipes shall have a minimum 1-foot cover.
8. Maximum pipe cover is 20 feet, unless approved by Town Engineer.
9. All reinforced concrete pipe should be Class III or higher.
10. Pipe slope specifications:
    a. Minimum slope 0.5 percent.
    b. Maximum slope 12 percent, unless approved by Town Engineer.
11. All pipes shall be flush with inside wall of box. Voids shall be filled with non-shrink grout. Pipes should be cleaned prior to inspection.
12. Television video will be required for any pipes not safely accessible by inspector or to be privately maintained.

B. Stormwater Structures

1. Materials and installation will be required to meet the standards and specifications set forth in the latest edition of the NCDOT Standards & Specifications.
2. Curb inlets shall be straight and in line with curb and gutter.
3. Inlets should be cleaned prior to inspection.
4. Steps shall be built to current NCDOT standards.
5. Concrete, brick, and block elements shall be built to current NCDOT standards.
6. Manhole frames and covers shall be built to current NCDOT standards.
7. Manhole covers shall be labeled “STORM SEWER”.

C. Outlets

1. Flared end sections (FES) shall be used on all outlets less than 60 inches in diameter or on multiple culverts less than 36 inches in diameter.
2. Headwalls shall be used for any outlets exceeding these size parameters.
3. Energy dissipators are required at all discharge points with filter fabric underliner.
4. Outlets shall include scour protection at drainage ways.
5. All headwalls and endwalls shall be built to NCDOT standards.
6. SCM outlet structures shall only be made of concrete.

2.7 AS-BUILTS – STORMWATER AND STREETS

A. As-built Drawings

1. As-Built drawings are required following the completion of new construction. As-builts shall be approved by the Town of Garner prior to project close-out or Certificate of Occupancy for the property. The plans shall be certified by an NC-registered engineer, landscape architect, or land surveyor.
2. As-built drawings shall be submitted to the Engineering Department at asbuilts@garnernc.gov.

3. As-built submittals should include:
    a. 1 hard copy and electronic copy of all documents
    b. Plans must be submitted on 24-inch X 36-inch sheets.
    c. Submittal fee in accordance with latest Town fee schedule.
4. As-Built drawings shall be submitted in accordance with the As-Built Submittal Checklist **(Refer to Appendix 3.8).**
5. Spatial data shall be submitted to the Town of Garner following approval of as-builts. Shapefiles with XYZ coordinates shall be submitted to the Engineering Department for the following information:
    a. Points (inlets, junctions, SCM's)
    b. Lines (pipes)

B. As-Built Construction Surveys and Engineer's Certifications

Projects involving the construction of infrastructure or SCMs shall require as-built surveys and engineer's certification of the improvements. Submittal for review by the relevant authorities shall adhere to the following schedule:

1. All water and/or sewer as-built surveys and engineer's certificates must be submitted to and accepted by the City of Raleigh prior to Certificate of Occupancy issuance.
2. For single-building site plans, stormwater as-built surveys and engineer's certificates must be submitted to and accepted by the Town of Garner prior to the issuance of a Certificate of Occupancy.
3. After 70 percent of lots in a subdivision phase or multi-building site plan under construction have received building permits, as-built surveys and engineer's certificates must be submitted to and accepted by the relevant authorities prior to the issuance of any additional building permits.
    a. Water and/or sewer submitted to and approved by Raleigh Water;
    b. Streets (for subdivisions) and/or stormwater submitted to and approved by Town of Garner.

3. APPENDIX

3.1 STREET DESIGN STANDARD DETAILS

3.2 STORMWATER STANDARD DETAILS

3.3 STORM DRAIN POLICY

3.4 OPERATIONS & MAINTENANCE MANUAL FOR STORMWATER CONTROL MEASURES

3.5 OPERATIONS & MAINTENANCE SCM INSPECTION REPORT AND CHECKLISTS

3.6 RIGHT-OF-WAY ENCROACHMENTS

A. Major Encroachment Application

B. Minor Encroachment Application

C. Encroachment Agreement

3.7 TOWN OF GARNER CONSTRUCTION DRAWING CHECKLIST

3.8 TOWN OF GARNER AS-BUILT SUBMITTAL CHECKLIST

3.9 TOWN OF GARNER BOND REQUIREMENTS

3.10 LINKS

A. Town of Garner Stormwater Program for Nitrogen Control

B. Town of Garner MS4 Stormwater Management Plan

C. Raleigh Water Standard Details

D. Raleigh Water Public Utilities Handbook

E. Raleigh Water As-Built & Acceptance Requirements

F. Wake County Sediment and Erosion Control

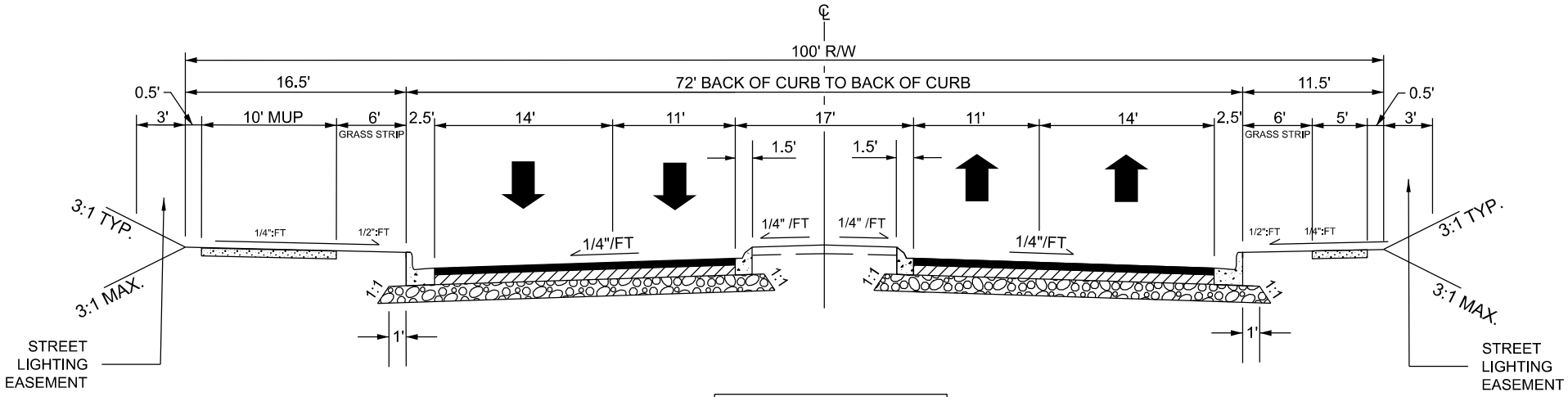
G. North Carolina Stormwater Design Manual

H. US Army Corps of Engineers Permitting

I. NCDEQ Riparian Buffer Rules and Permitting

J. NCDEQ Water Supply Watershed Program

NOTE:
FOR ALL SIDEWALKS, USE 5' STANDARD WIDTH. FOR MULTI-USE PATHS, USE 10' STANDARD WIDTH.

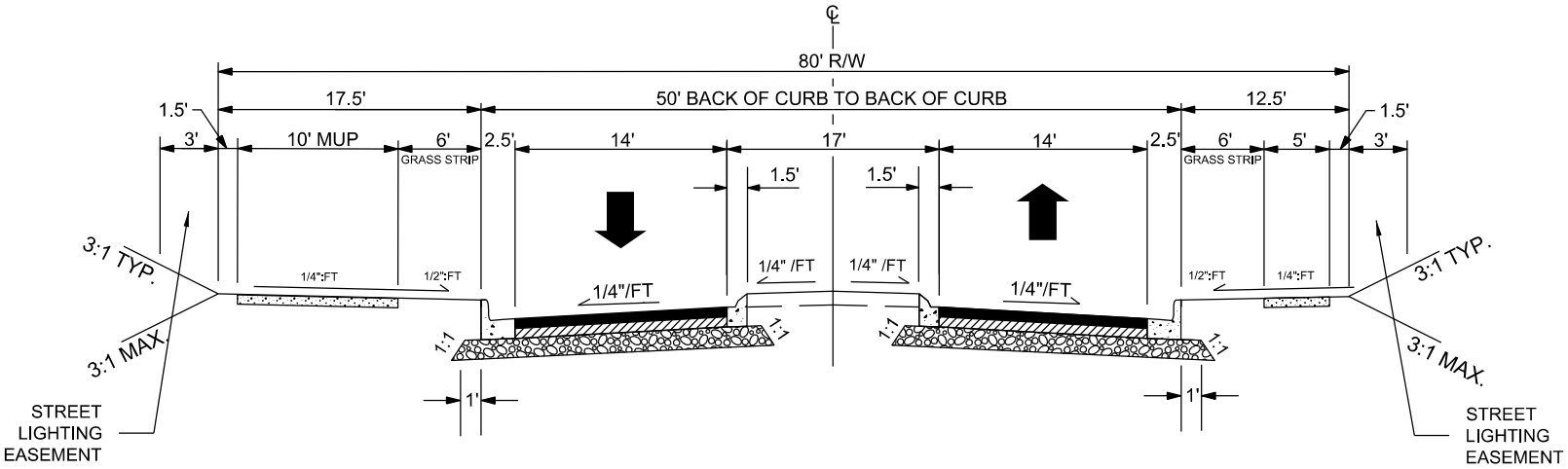


PAVEMENT DESIGN

3" - S9.5B, (2-1.5" LIFTS)
4" - I19.0C
10" - ABC

MAJOR THOROUGHFARE STREET SECTION		DESIGNED BY: TOG	REVISED FEB. 2022
TOWN OF GARNER, N.C.		APPROVED BY: CSJ	STD. NO. T-1.01

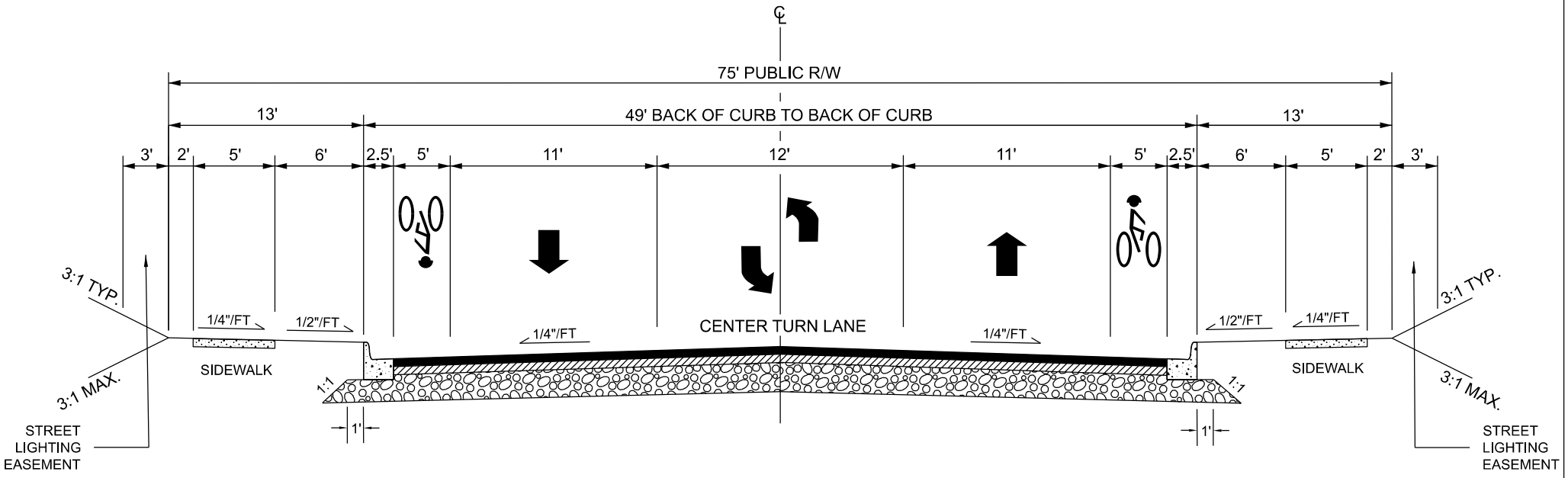
NOTE: FOR ALL SIDEWALKS,
USE 5' STANDARD WIDTH.
FOR MULTI-USE PATHS, USE
10' STANDARD WIDTH.



PAVEMENT DESIGN

3" - S9.5B, (2-1.5" LIFTS)
4" - I19.0C
10" - ABC

MINOR THOROUGHFARE STREET SECTION	DESIGNED BY: TOG	REVISED FEB. 2022
TOWN OF GARNER, N.C.	APPROVED BY: CSJ	STD. NO. T-1.02

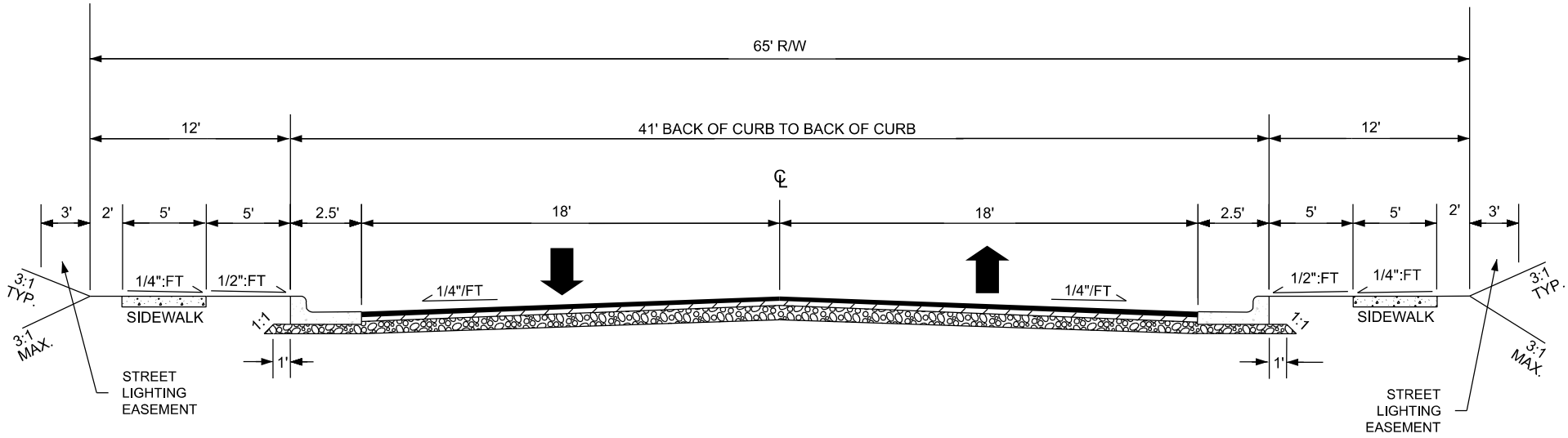


PAVEMENT DESIGN

3" - S9.5B, (2-1.5" LIFTS)
3" - I19.0C
8" - ABC

RAISED MEDIAN ALTERNATIVE:
THE 12' CENTER TURN LANE MAY BE SUBSTITUTED WITH A 17' RAISED GRASS MEDIAN (1.5' CURBS AND 14' GRASS) AND R/W WIDTH OF 80'.

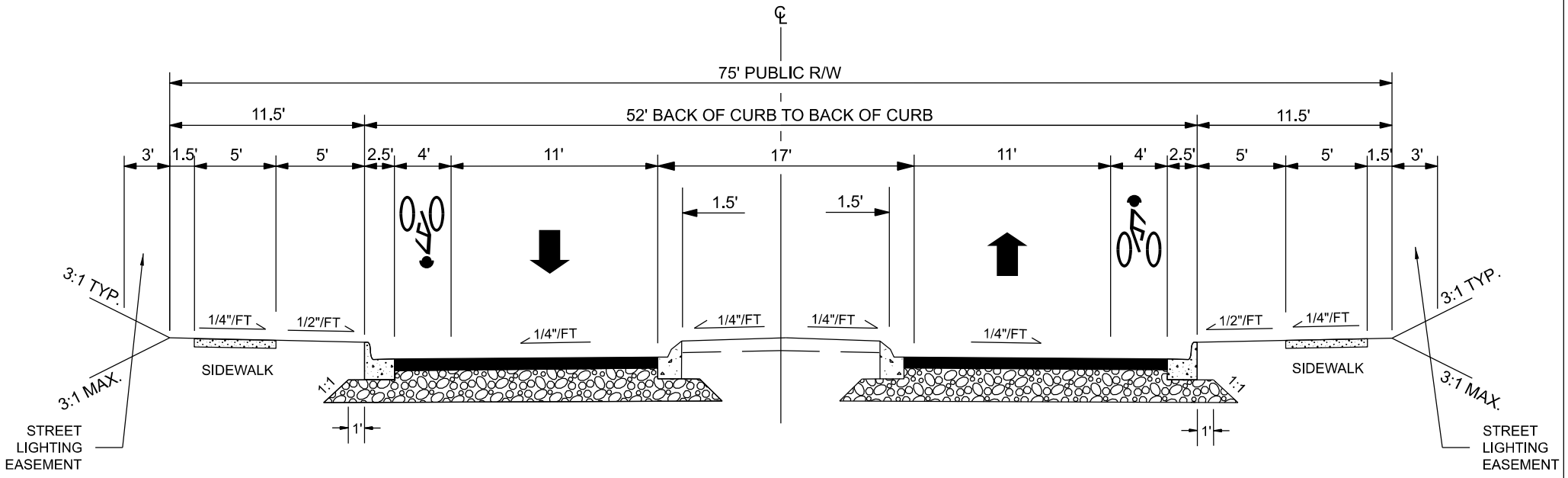
TOWN OF GARNER, N.C.	MAJOR COLLECTOR STREET WITH BIKE LANES	DESIGNED BY: TOG	REVISED FEB. 2022
		APPROVED BY: CSJ	STD. NO. T-1.03



PAVEMENT DESIGN

3" - S9.5B, (2-1.25" LIFTS)
3" - I19.0C
8" - ABC

	INDUSTRIAL STREET SECTION	DESIGNED BY: TOG	REVISED FEB. 2022
	TOWN OF GARNER, N.C.	APPROVED BY: CSJ	STD. NO. T-1.04



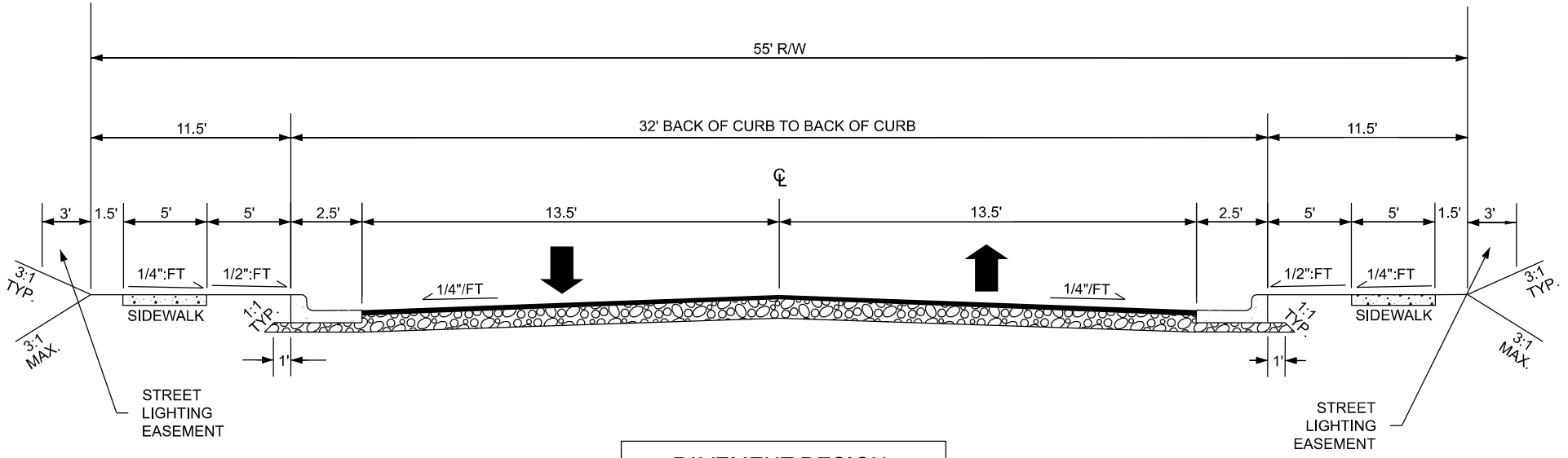
PAVEMENT DESIGN

3" - S9.5B (2-1.5" LIFTS)
10" - ABC

TOWN OF GARNER, N.C.

MINOR COLLECTOR STREET

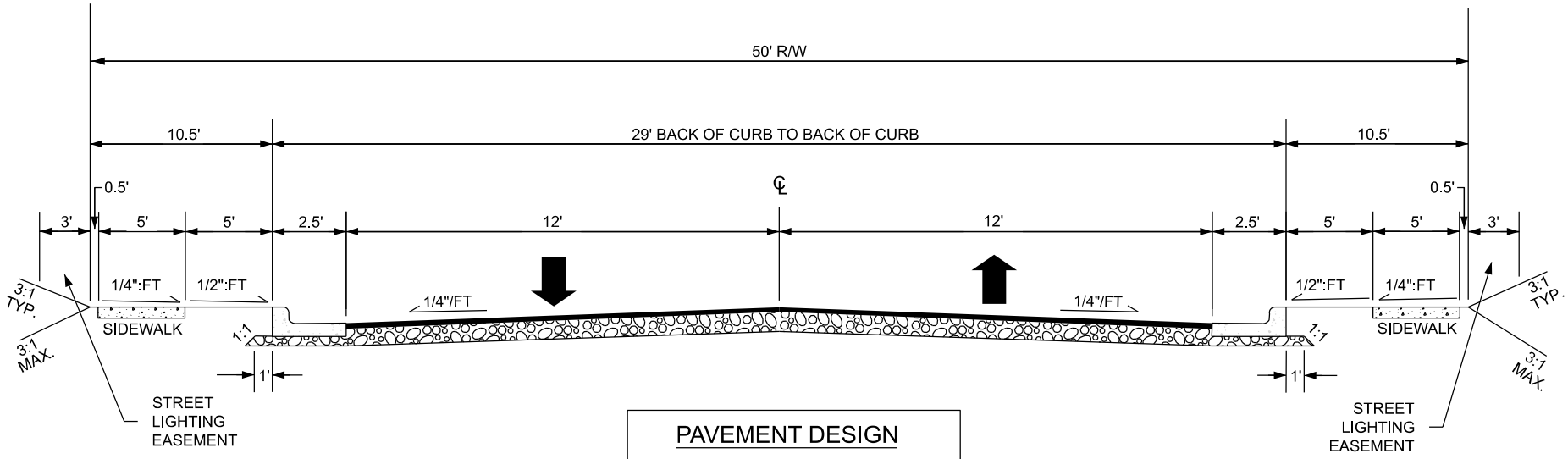
DESIGNED BY:	REVISED
TOG	FEB. 2022
APPROVED BY:	STD. NO.
CSJ	T-1.05



PAVEMENT DESIGN

2.5" - S9.5B (2-1.25" LIFTS)
8" ABC

TOWN OF GARNER, N.C.	MAJOR LOCAL STREET SECTION	DESIGNED BY: TOG	REVISED FEB. 2022
		APPROVED BY: CSJ	STD. NO. T-1.06



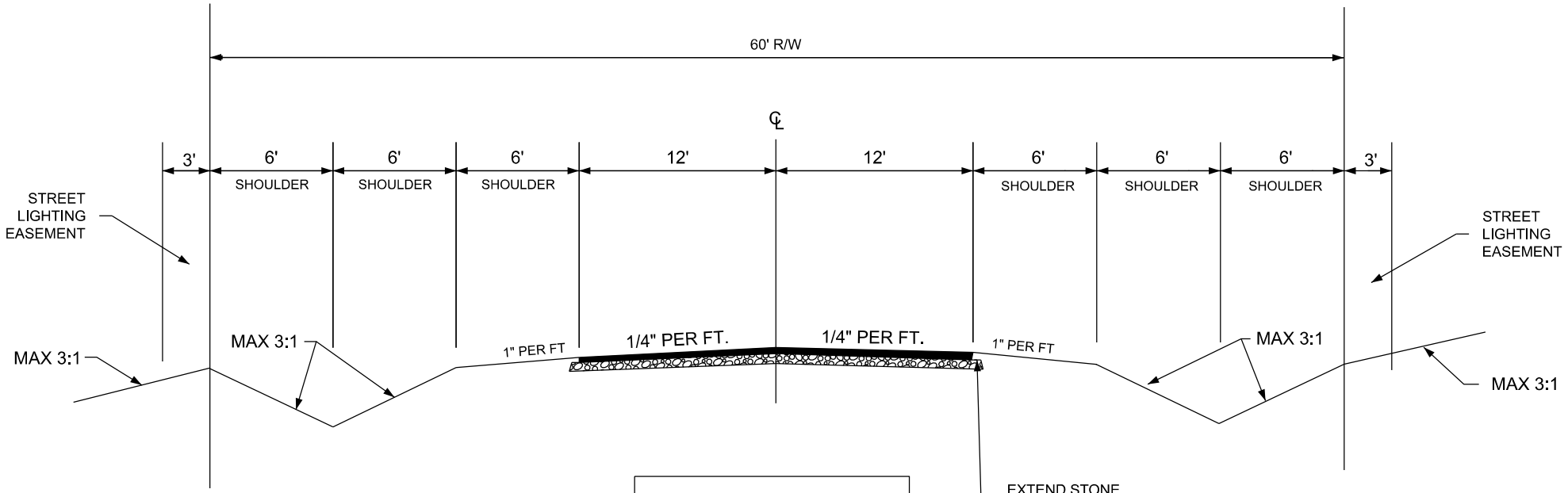
PAVEMENT DESIGN

2.5" - S9.5B (2-1.25" LIFTS)
8" - ABC

MINOR LOCAL STREET SECTION

TOWN OF GARNER, N.C.

DESIGNED BY:	REVISED
TOG	FEB. 2022
APPROVED BY:	STD. NO.
CSJ	T-1.07



PAVEMENT DESIGN

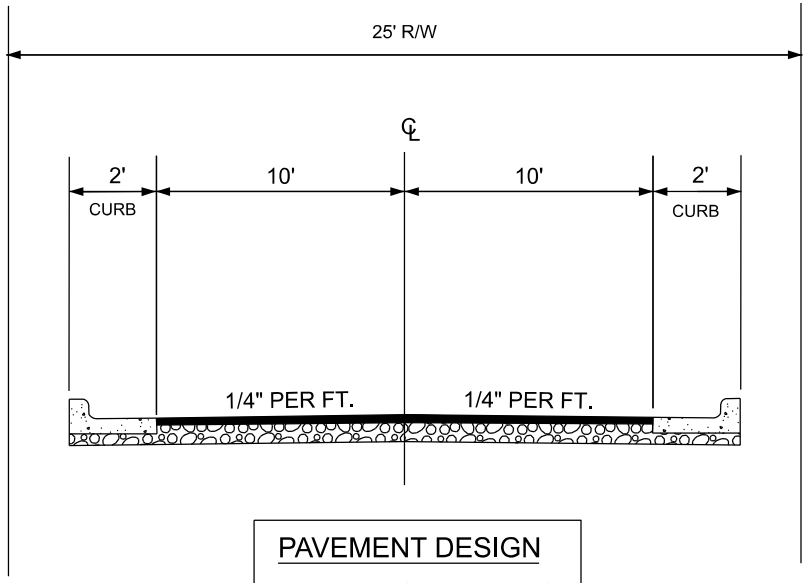
2.5" - S9.5B (2-1.25" LIFTS)
8" - ABC

LOCAL STREET SECTION (NO CURB)

TOWN OF GARNER, N.C.

DESIGNED BY:	REVISED
TOG	FEB. 2022
APPROVED BY:	STD. NO.
CSJ	T-1.08

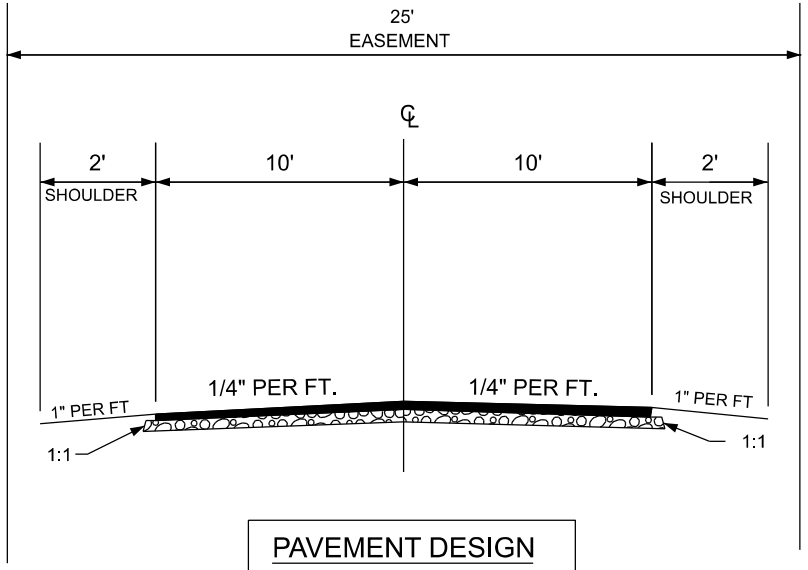
PUBLIC



PAVEMENT DESIGN

2.5" - S9.5B (2-1.25" LIFTS)
8" - ABC

PRIVATE

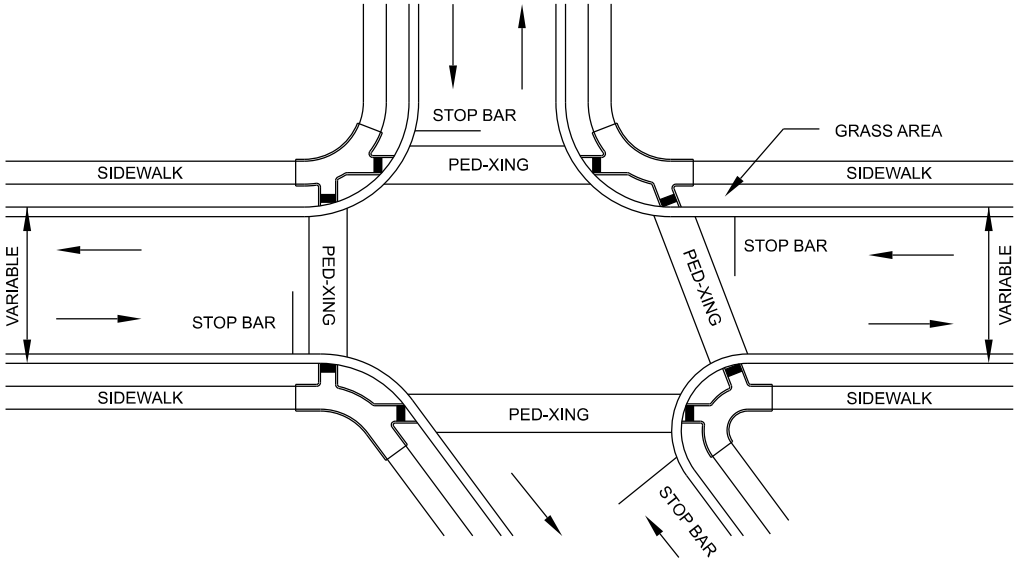


PAVEMENT DESIGN

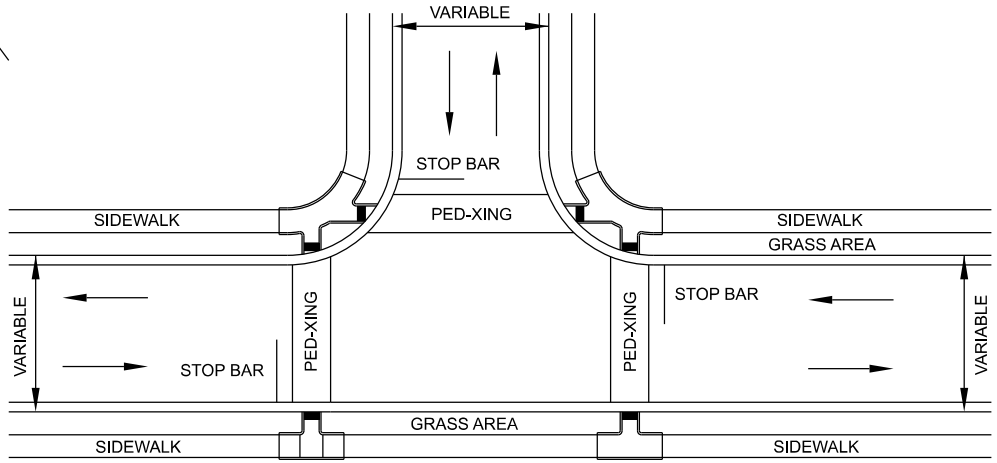
2.5" - S9.5B (2-1.25" LIFTS)
8" - ABC

NOTE:
1. ALLEYS MAY BE SLOPED IN A SINGLE DIRECTION RATHER THAN CROWNED.
2. 'V' SHAPED ALLEYS ARE DISCOURAGED AND ARE NOT ALLOWED ON PUBLIC STREETS.

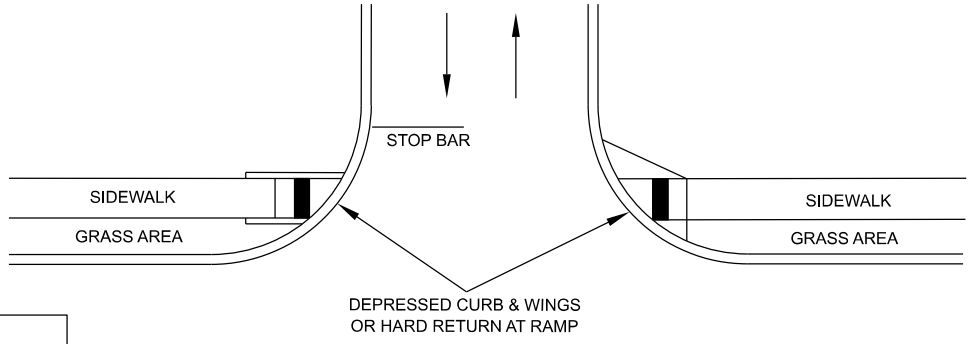
TOWN OF GARNER, N.C.	ALLEY CROSS SECTION	DESIGNED BY: TOG	REVISED FEB. 2022
		APPROVED BY: CSJ	STD. NO. T-1.09



DETAIL SHOWING TYPICAL LOCATION OF SIDEWALK ACCESS RAMPS, PEDESTRIAN CROSSWALKS AND STOP BARS.

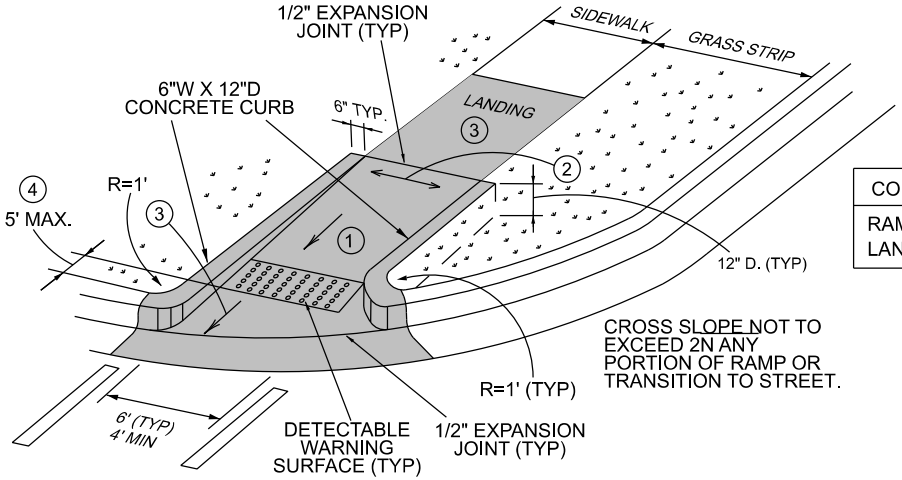


DETAIL SHOWING TYPICAL LOCATION OF SIDEWALK ACCESS RAMPS PEDESTRIAN CROSSWALKS AND STOP BARS FOR TEE INTERSECTION.



FOR RAMPS AT ASPHALT TO ASPHALT STREET TYPE DRIVEWAYS OR PRIVATE STREET TIE IN.

TOWN OF GARNER, N.C.	CURB RAMPS	DESIGNED BY: TOG	REVISED FEB. 2022
		APPROVED BY: CSJ	STD. NO. T-2.01.1

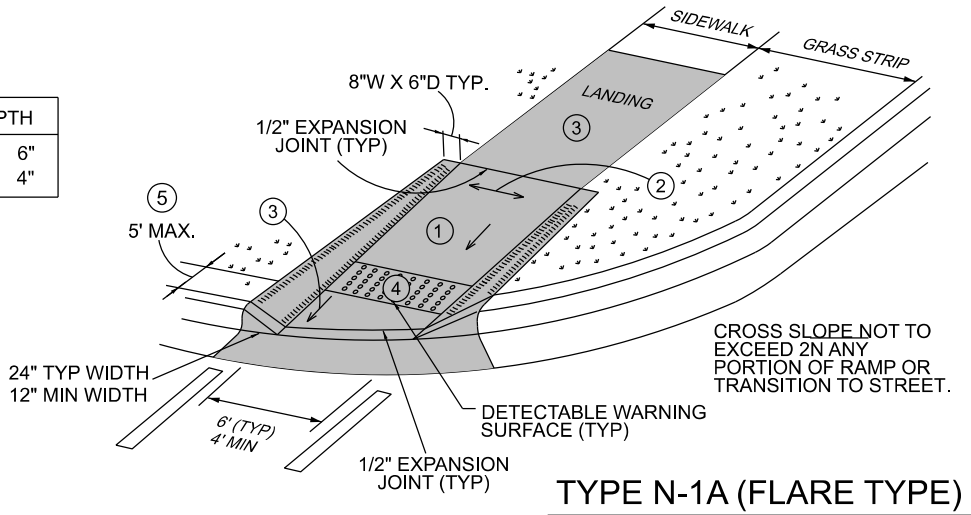


CONCRETE DEPTH	
RAMP / FLARE	6"
LANDING	4"

TYPE N-1 (CURB TYPE)

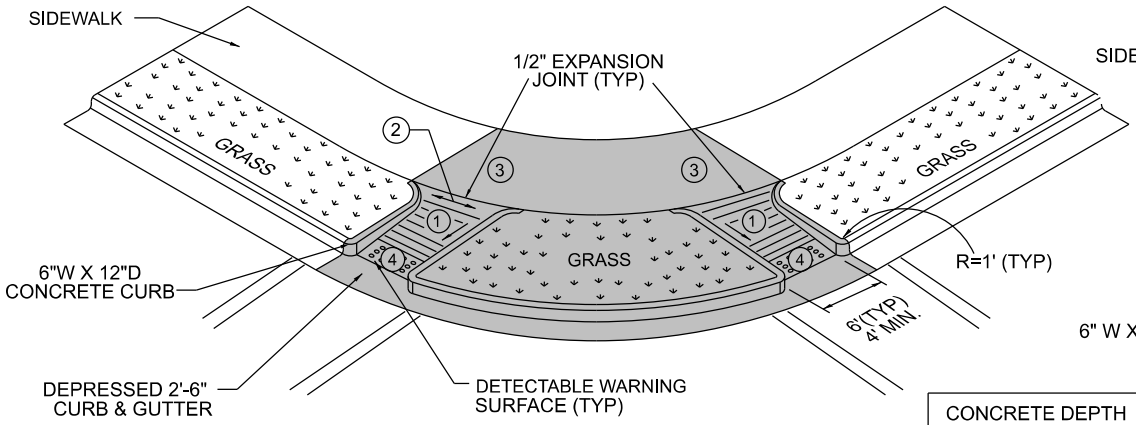
1. 8.33% (12:1) MAX RAMP SLOPE
2. CROSS SLOPE: 2.00%
3. CURB RAMPS REQUIRE A (4'-0") MINIMUM LANDING WITH A MAXIMUM CROSS SLOPE AND LONGITUDINAL SLOPE OF 2.00% WHERE PEDESTRIANS PERFORM TURNING MANEUVERS. SLOPE TO DRAIN TO CURB.
4. IF LENGTH EXCEEDS 5', TRUNCATED DOMES SHALL BE INSTALLED ALONG THE BACK OF THE CURB COVERING THE FULL WIDTH OF THE RAMP.

PAY LIMITS FOR CURB RAMP



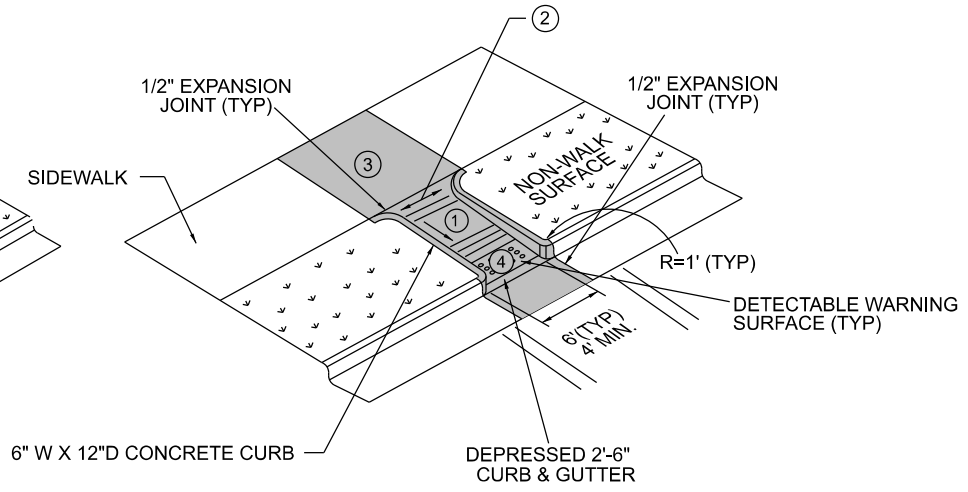
TYPE N-1A (FLARE TYPE)

NOTE: USE SMALL FLARES ONLY WHEN A CURB TYPE DIRECTLY CONFLICTS WITH APPROACHING VEHICULAR TURNING MOVEMENTS.



CONCRETE DEPTH	
RAMP / FLARE	6"
LANDING	4"

TYPE N-2 (RADIUS)



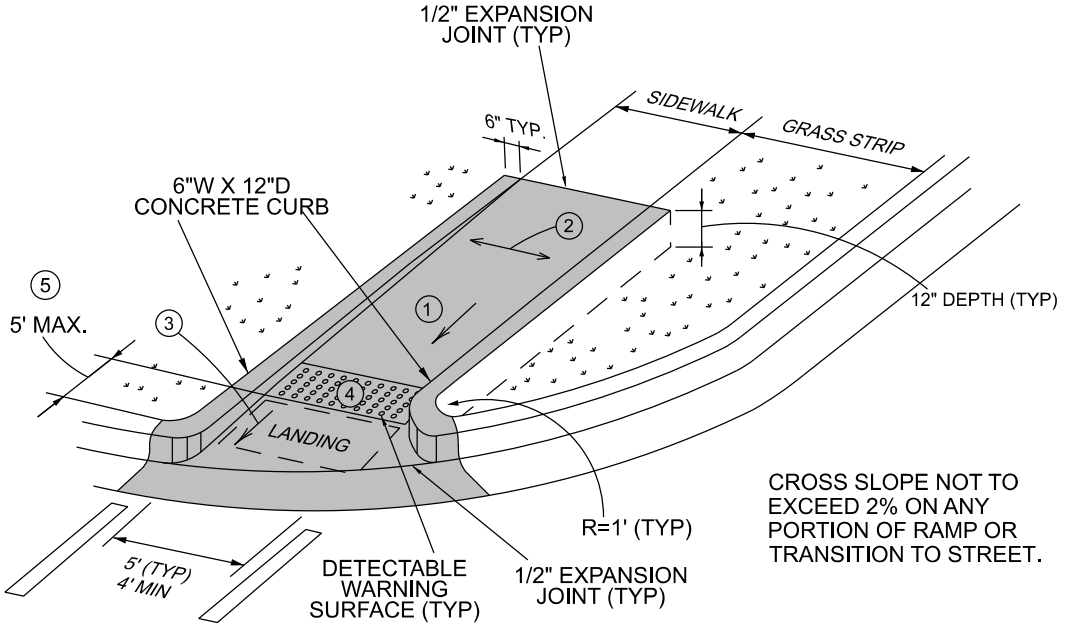
TYPE N-2 (TEE INTERSECTION)

TOWN OF GARNER — Growth and Prosperity — CHARTERED 1905

CURB RAMPS - NEW DEVELOPMENT

TOWN OF GARNER, N.C.

DESIGNED BY:	REVISED
TOG	FEB. 2022
APPROVED BY:	STD. NO.
CSJ	T-2.01.2



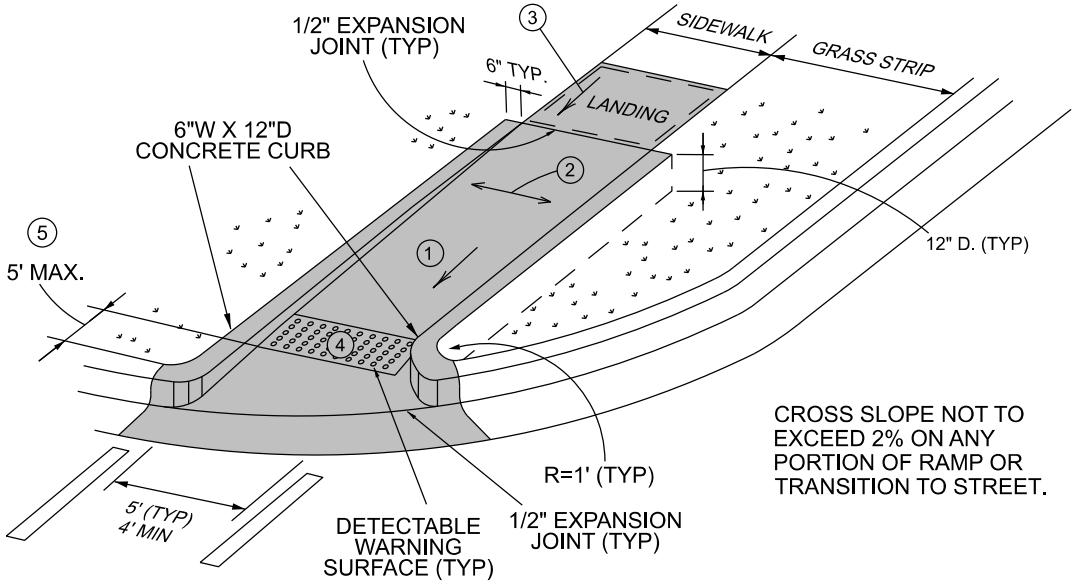
PAY LIMITS FOR CURB RAMP

CROSS SLOPE NOT TO EXCEED 2% ON ANY PORTION OF RAMP OR TRANSITION TO STREET.

CONCRETE DEPTH	
RAMP	6"
LANDING	4"

TYPE N-4

1. SLOPE TO MEET GRADE, 15' MAXIMUM.
2. CROSS SLOPE: 2.00%
3. CURB RAMPS REQUIRE A (4'-0") MINIMUM LANDING WITH A MAXIMUM CROSS SLOPE AND LONGITUDINAL SLOPE OF 2.00% WHERE PEDESTRIANS PERFORM TURNING MANEUVERS. SLOPE TO DRAIN TO CURB.
4. RAMPS AND DOMES SHALL BE INSTALLED THE SAME WIDTH AS THE SIDEWALK.
5. IF LENGTH EXCEEDS 5', TRUNCATED DOMES SHALL BE INSTALLED ALONG THE BACK OF THE CURB COVERING THE FULL WIDTH OF THE RAMP.



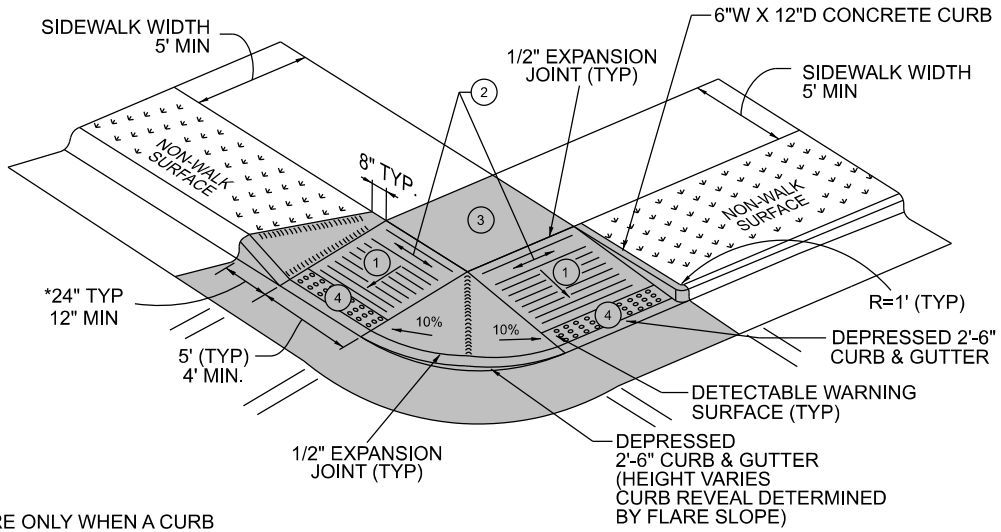
CROSS SLOPE NOT TO EXCEED 2% ON ANY PORTION OF RAMP OR TRANSITION TO STREET.

TYPE N-4A

TOWN OF GARNER, N.C.

CURB RAMPS - NEW DEVELOPMENT

DESIGNED BY:	REVISED
TOG	FEB. 2022
APPROVED BY:	STD. NO.
CSJ	T-2.01.3



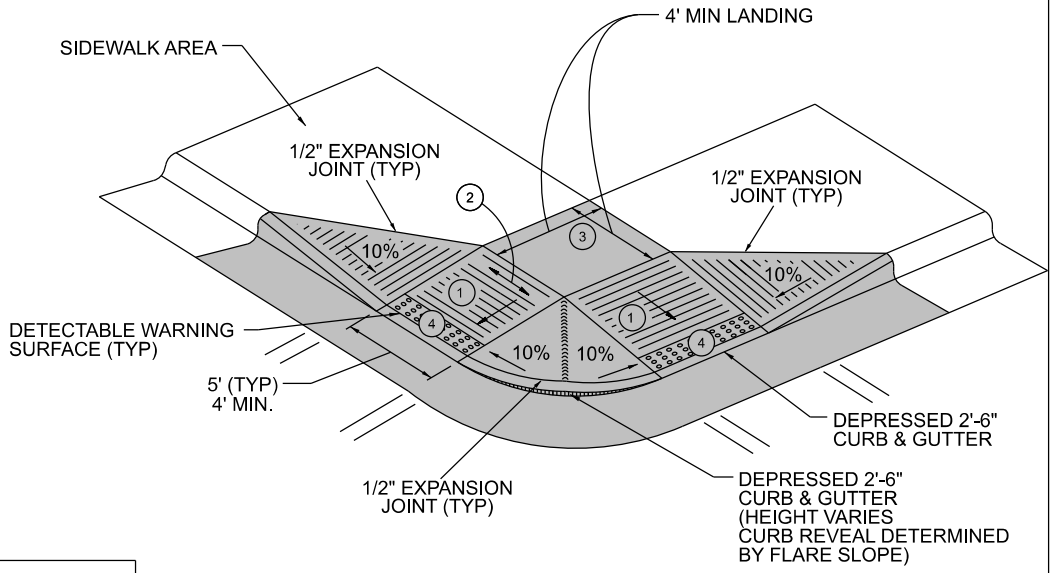
PAY LIMITS FOR CURB RAMP

CONCRETE DEPTH	
RAMP / FLARE	6"
LANDING	4"

NOTE: * USE SMALL FLARE ONLY WHEN A CURB WOULD DIRECTLY CONFLICT WITH APPROACHING VEHICLE TURNING MOVEMENTS.

TYPE N-3

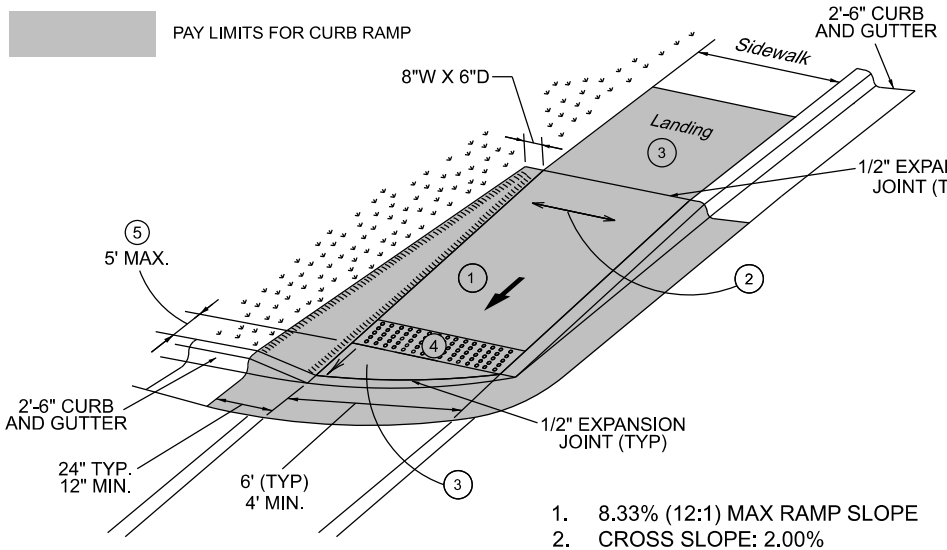
1. 8.33% (12:1) MAX RAMP SLOPE
2. CROSS SLOPE: 2.00%
3. CURB RAMPS REQUIRE A (4'-0") MINIMUM LANDING WITH A MAXIMUM CROSS SLOPE AND LONGITUDINAL SLOPE OF 2.00% WHERE PEDESTRIANS PERFORM TURNING MANEUVERS. SLOPE TO DRAIN TO CURB.
4. RAMPS AND DOMES SHALL BE INSTALLED THE SAME WIDTH AS THE SIDEWALK.



CONCRETE DEPTH	
RAMP / FLARE	6"
LANDING	4"

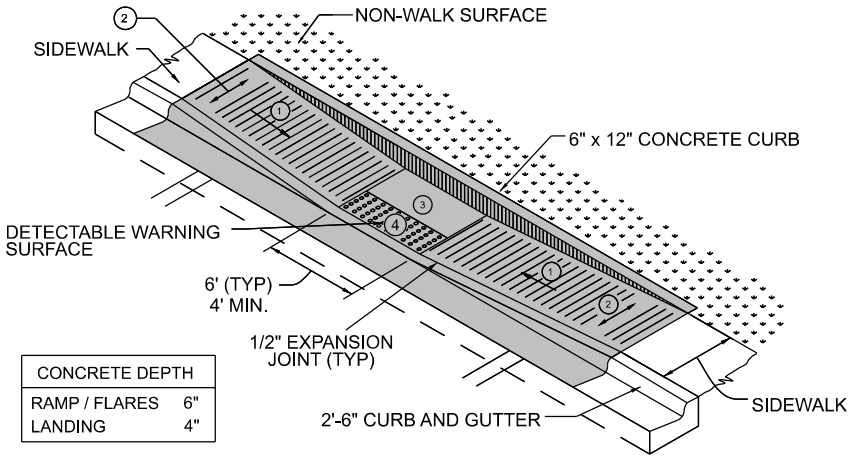
TYPE N-3A
(COMMERCIAL/RETAIL USE)

CURB RAMPS - NEW DEVELOPMENT	DESIGNED BY: TOG	REVISED FEB. 2022
TOWN OF GARNER, N.C.	APPROVED BY: CSJ	STD. NO. T-2.01.4



TYPE R-1

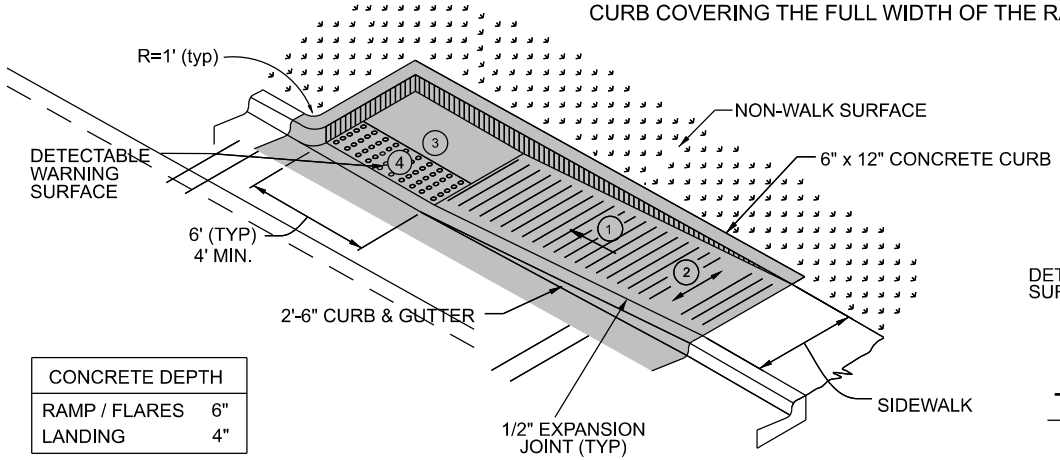
1. 8.33% (12:1) MAX RAMP SLOPE
2. CROSS SLOPE: 2.00%
3. CURB RAMPS REQUIRE A (4'-0") MINIMUM LANDING WITH A MAXIMUM CROSS SLOPE AND LONGITUDINAL SLOPE OF 2.00% WHERE PEDESTRIANS PERFORM TURNING MANEUVERS. SLOPE TO DRAIN TO CURB.
4. RAMPS AND DOMES SHALL BE INSTALLED THE SAME WIDTH AS THE SIDEWALK.
5. IF LENGTH EXCEEDS 5', TRUNCATED DOMES SHALL BE INSTALLED ALONG THE BACK OF THE CURB COVERING THE FULL WIDTH OF THE RAMP.



CONCRETE DEPTH	
RAMP / FLARES	6"
LANDING	4"

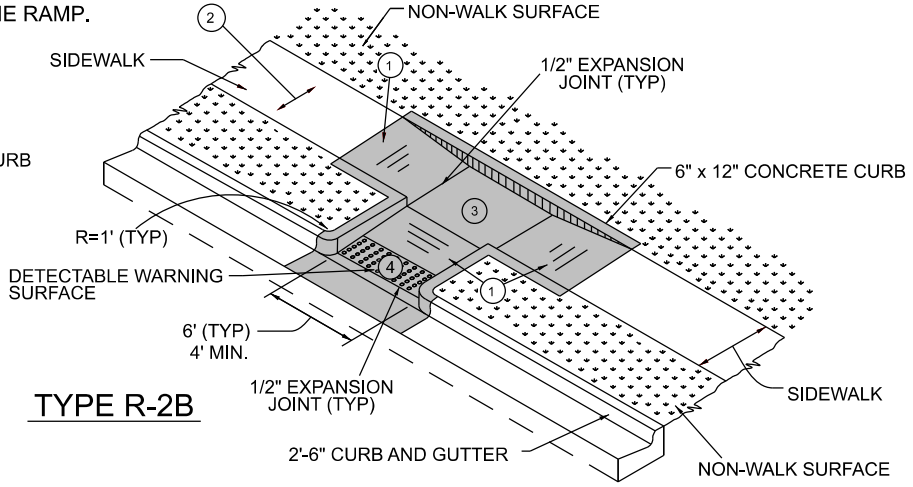
TYPE R-2

(USE ONLY WHERE WATER WILL NOT POND WITHIN LANDING)



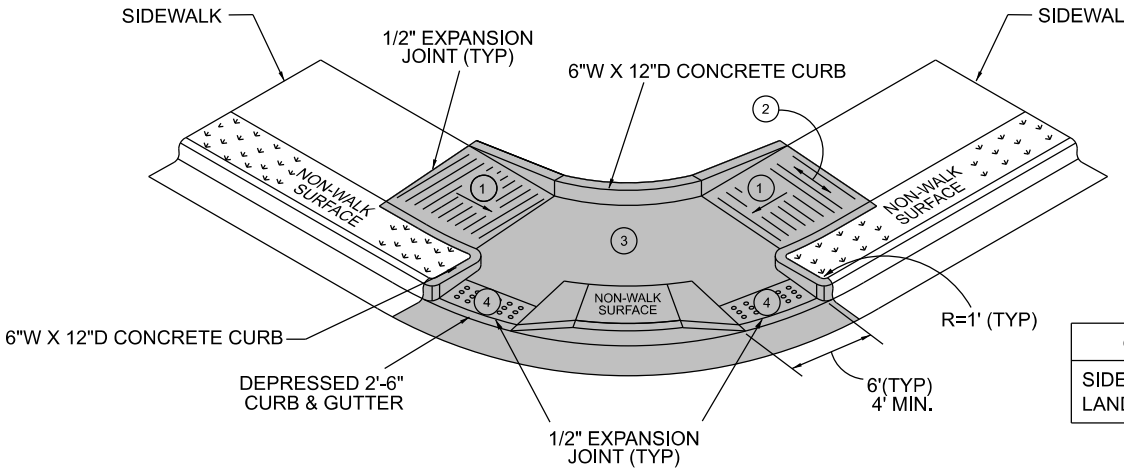
CONCRETE DEPTH	
RAMP / FLARES	6"
LANDING	4"

TYPE R-2A



TYPE R-2B

TOWN OF GARNER, N.C.	CURB RAMPS - RETROFIT	DESIGNED BY: TOG	REVISED FEB. 2022
		APPROVED BY: CSJ	STD. NO. T-2.01.5

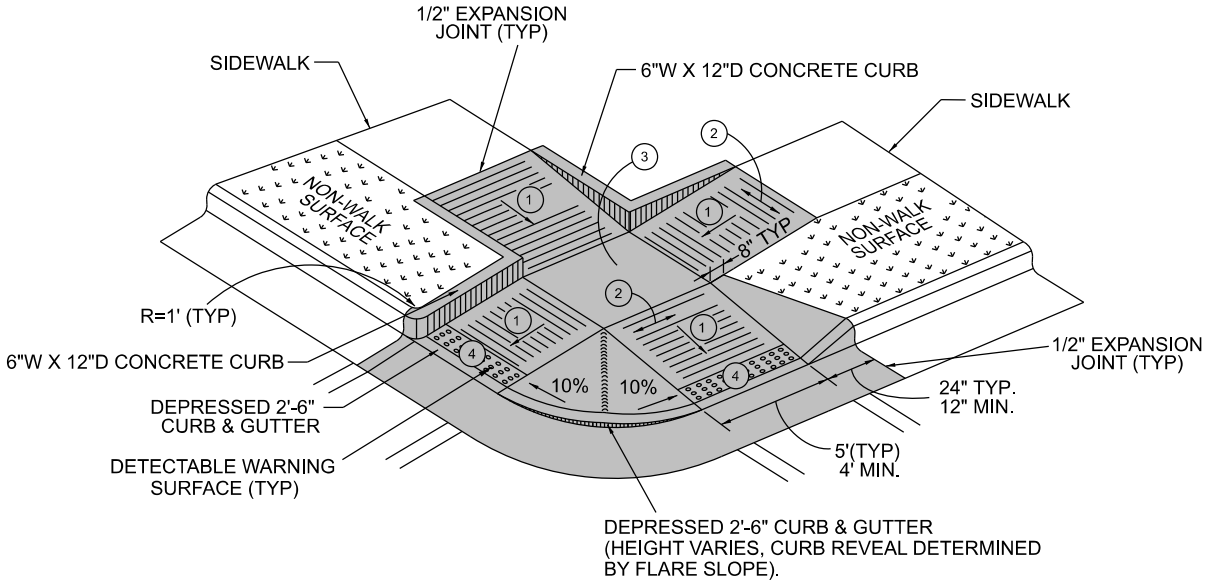


PAY LIMITS FOR CURB RAMP

CONCRETE DEPTH	
SIDE RAMPS	4"
LANDING & OPENINGS	6"

TYPE R-3

1. 8.33% (12:1) MAX RAMP SLOPE
2. CROSS SLOPE: 2.00%
3. CURB RAMPS REQUIRE A (4'-0") MINIMUM LANDING WITH A MAXIMUM CROSS SLOPE AND LONGITUDINAL SLOPE OF 2.00% WHERE PEDESTRIANS PERFORM TURNING MANEUVERS. SLOPE TO DRAIN TO CURB.
4. RAMPS AND DOMES SHALL BE INSTALLED THE SAME WIDTH AS THE SIDEWALK.



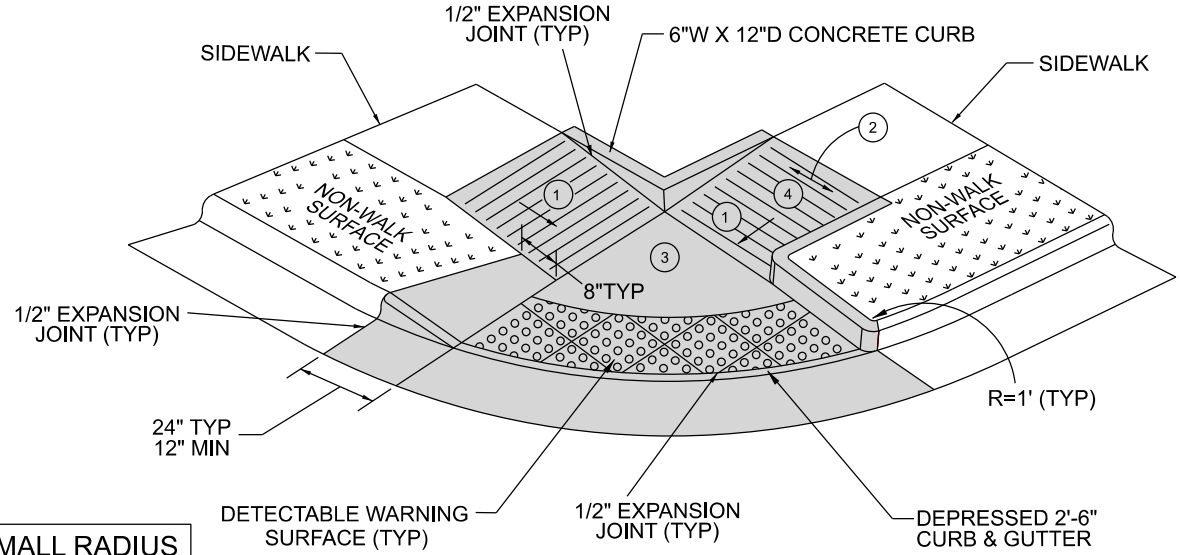
CONCRETE DEPTH	
SIDE RAMPS	4"
LANDING & CURB RAMPS	6"

TYPE R-4

TOWN OF GARNER, N.C.

CURB RAMPS - RETROFIT

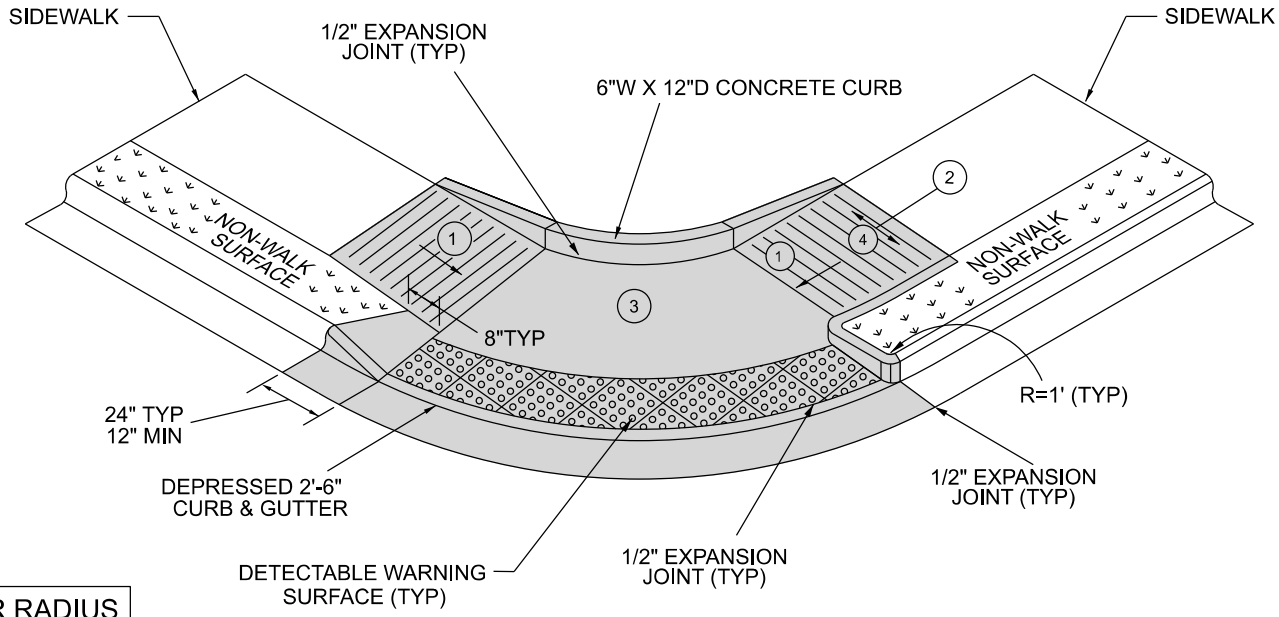
DESIGNED BY:	REVISED
TOG	FEB. 2022
APPROVED BY:	STD. NO.
CSJ	T-2.01.6



PAY LIMITS FOR CURB RAMP

CONCRETE DEPTH	
SIDE RAMPS	4"
LANDING & CURB RAMPS	6"

SMALL RADIUS LESS THAN 15'



1. 8.33% (12:1) MAX RAMP SLOPE
2. CROSS SLOPE: 2.00%
3. CURB RAMPS REQUIRE A (4'-0") MINIMUM LANDING WITH A MAXIMUM CROSS SLOPE AND LONGITUDINAL SLOPE OF 2.00% WHERE PEDESTRIANS PERFORM TURNING MANEUVERS. SLOPE TO DRAIN TO CURB.
4. RAMPS SHALL BE INSTALLED THE SAME WIDTH AS THE SIDEWALK.

LARGER RADIUS 15' OR GREATER

CURB RAMPS - RETROFIT - SHARED FLARE

TOWN OF GARNER, N.C.

DESIGNED BY:	REVISED
TOG	FEB. 2022
APPROVED BY:	STD. NO.
CSJ	T-2.01.7

CURB RAMPS
GENERAL NOTES

1. STANDARD CURB RAMPS HAVE BEEN DEVELOPED IN ACCORDANCE WITH THE AMERICANS WITH DISABILITIES ACT (ADA) AND PUBLIC RIGHT OF WAY ACCESS GUIDELINES (PROWAG).

2. CURB RAMPS SHALL BE PROVIDED AT LOCATIONS AS SHOWN ON THE PLANS OR AS DIRECTED BY THE ENGINEER. SIDEWALK ACCESS RAMPS SHALL BE LOCATED AS INDICATED IN THE DETAIL, HOWEVER, THE LOCATION MAY BE ADJUSTED IN COORDINATION WITH EXISTING LIGHT POLES, FIRE HYDRANTS, DROP INLETS, ETC.

3. DOUBLE WHEELCHAIR RAMPS ARE TO BE INSTALLED AT ALL PUBLIC STREET INTERSECTIONS WHERE SIDEWALK IS REQUIRED.

4. THE WALKING SURFACE SHALL BE SLIP RESISTANT. THE COLOR FOR THE DETECTABLE WARNING AREA SHALL BE GRAY, CHARCOAL, OR BLACK FOR CONTRAST.

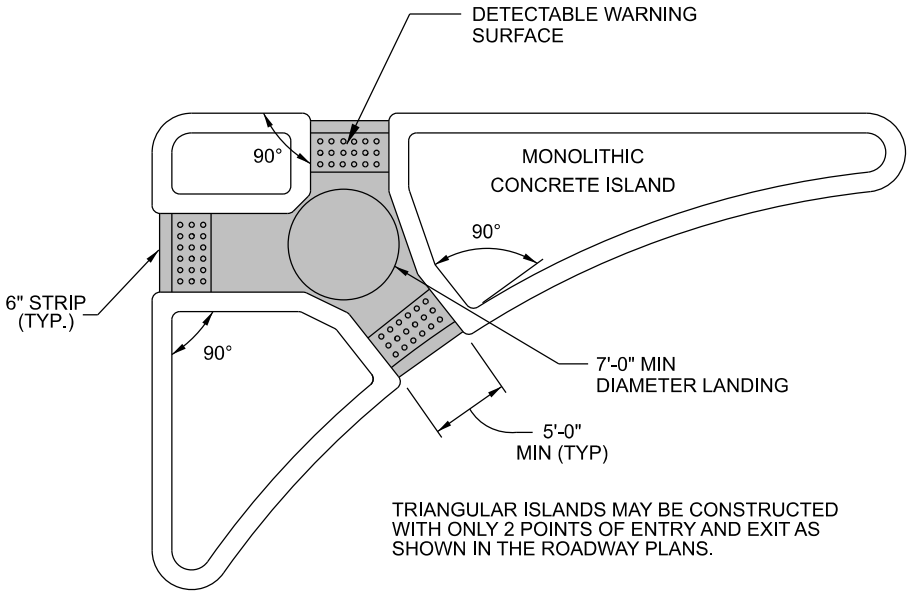
5. NO SLOPE ON THE SIDEWALK ACCESS RAMP SHALL EXCEED 1"/FT (12:1) IN RELATIONSHIP TO THE GRADE OF THE STREET.

6. IN NO CASE SHALL THE WIDTH OF THE SIDEWALK ACCESS RAMP BE LESS THAN 48". ALL RAMPS SHALL BE INSTALLED THE SAME WIDTH AS THE SIDEWALK.

7. USE CLASS A (3000 PSI) CONCRETE WITH A SIDEWALK FINISH IN ORDER TO OBTAIN A ROUGH NONSKID SURFACE.

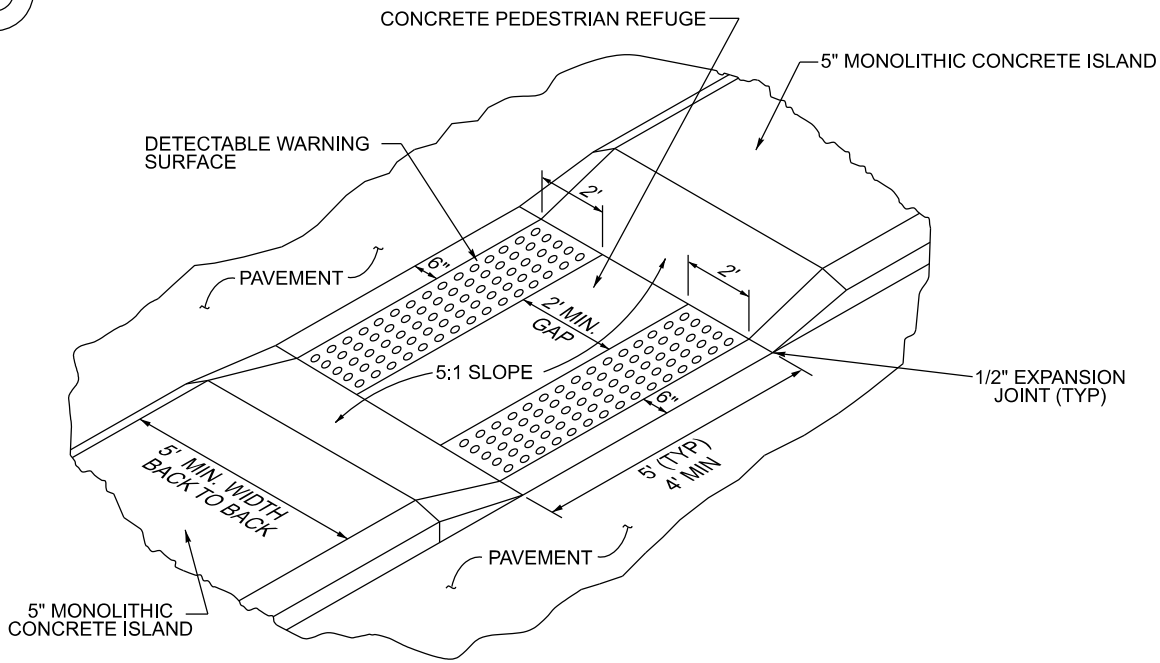
8. A 1/2" EXPANSION JOINT INSTALLED FULL DEPTH WILL BE REQUIRED WHERE THE CONCRETE SIDEWALK ACCESS RAMP JOINS THE CURB AND ALSO WHERE NEW CONCRETE ABUTS EXISTING CONCRETE.

9. CURB RAMPS SHOULD BE PLACED PARALLEL TO THE DIRECTION OF TRAVEL.



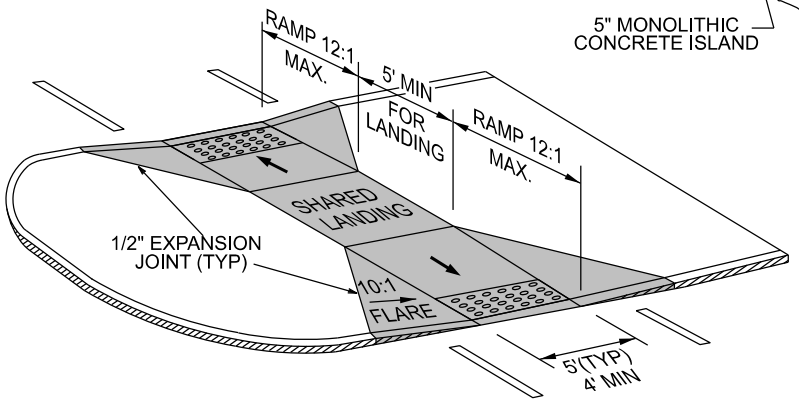
TRIANGULAR ISLAND WITH CUT THROUGH

PAY LIMITS FOR CURB RAMP



MEDIAN ISLAND WITH CUT THROUGH

(MEDIANS ≤ 20')

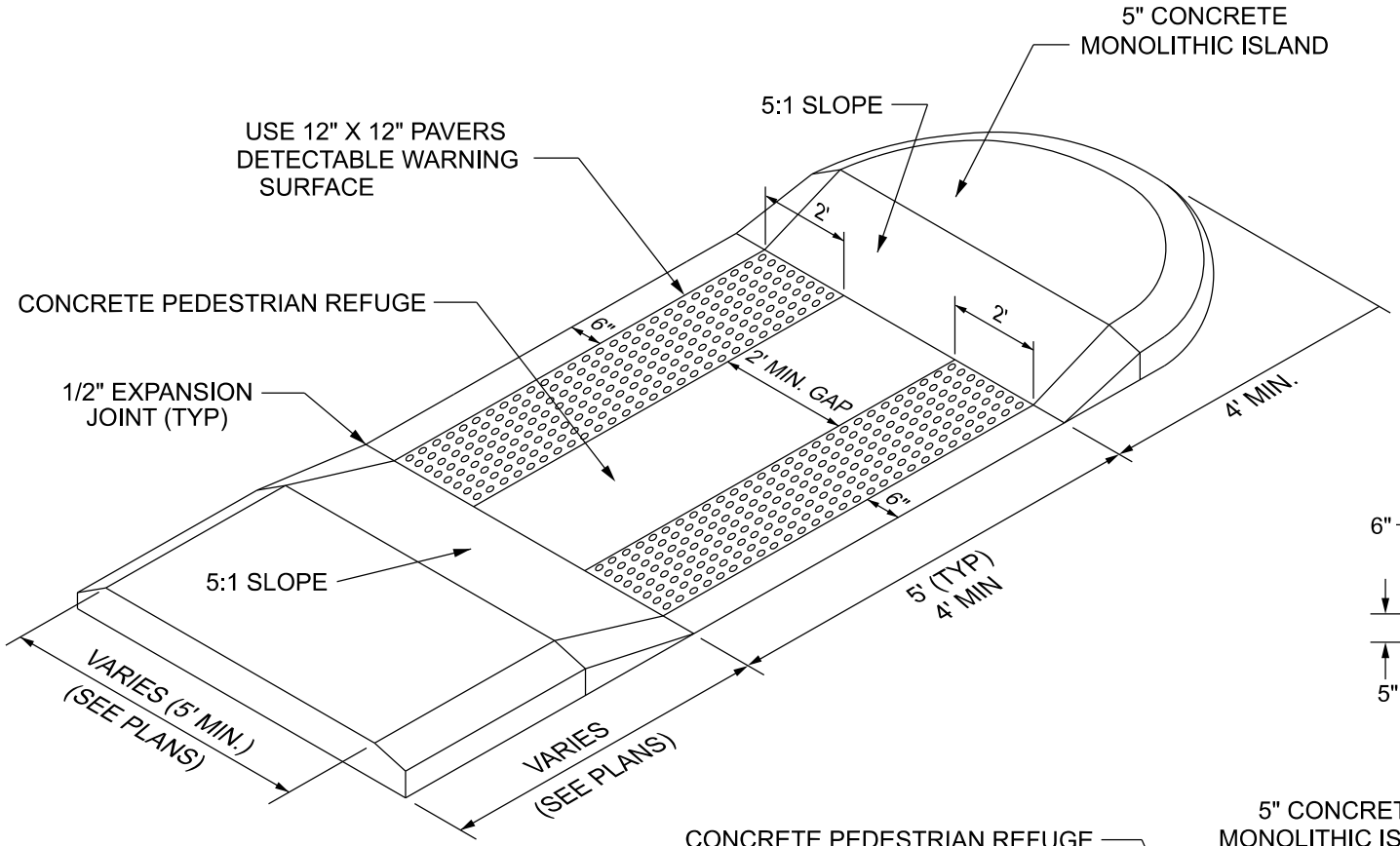


MEDIAN ISLAND CURB RAMPS

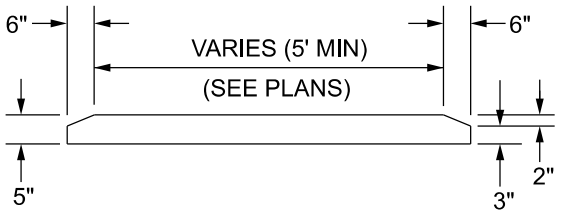
(MEDIANS WIDER THAN 20')

CURB RAMPS - MEDIAN ISLAND CUT-THROUGHS	DESIGNED BY: TOG	REVISED FEB. 2022
TOWN OF GARNER, N.C.	APPROVED BY: CSJ	STD. NO. T-2.01.9

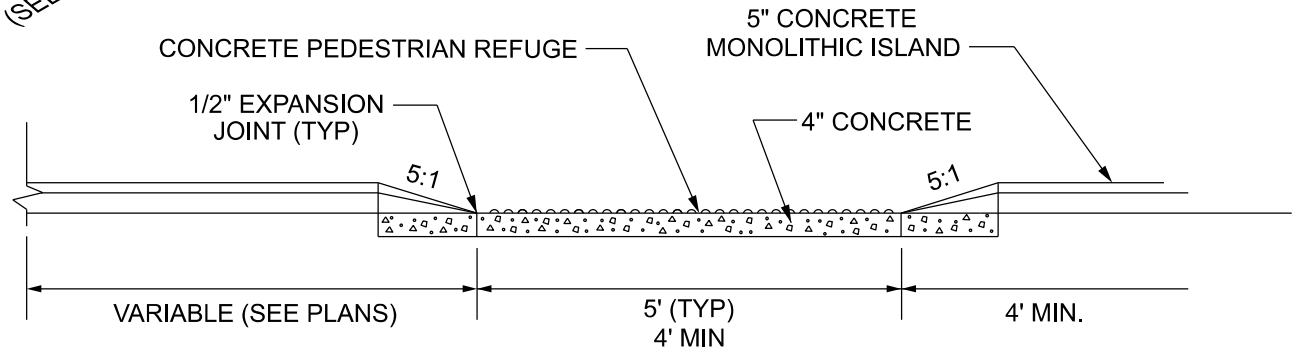
ISOMETRIC VIEW



CROSS SECTION VIEW



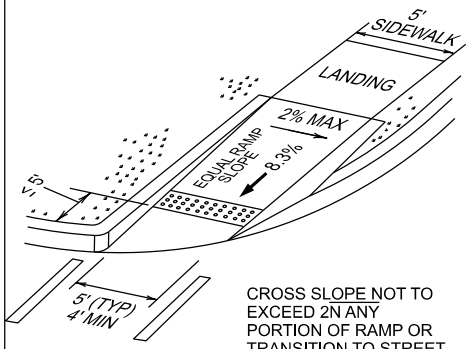
PROFILE VIEW



TOWN OF GARNER, N.C.

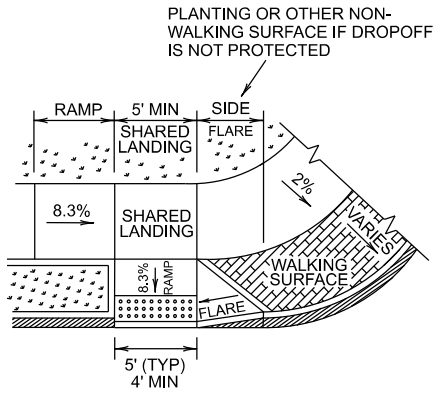
PEDESTRIAN REFUGE	DESIGNED BY: TOG	REVISED FEB. 2022
	APPROVED BY: CSJ	STD. NO. T-2.02

TYPE N-1, N-1A & R-1

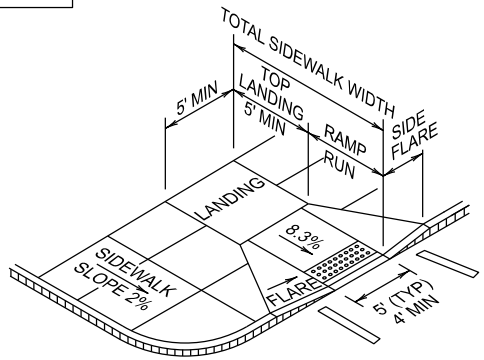


CROSS SLOPE NOT TO EXCEED 2N ANY PORTION OF RAMP OR TRANSITION TO STREET.

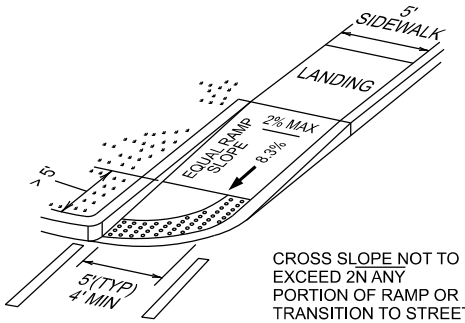
TYPE N-2 & N-3



TYPE N-3A

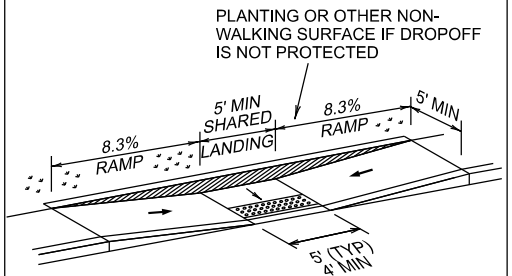


TYPE R-1A



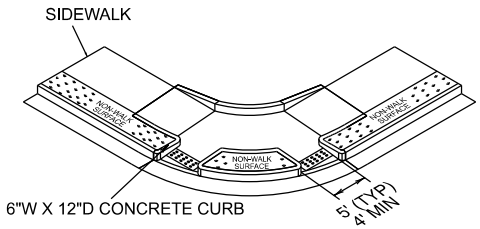
CROSS SLOPE NOT TO EXCEED 2N ANY PORTION OF RAMP OR TRANSITION TO STREET.

TYPE R-2

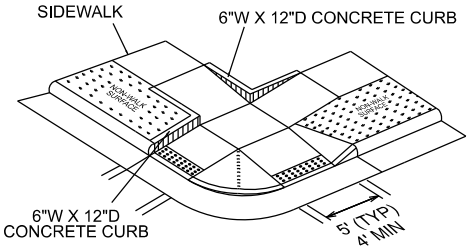


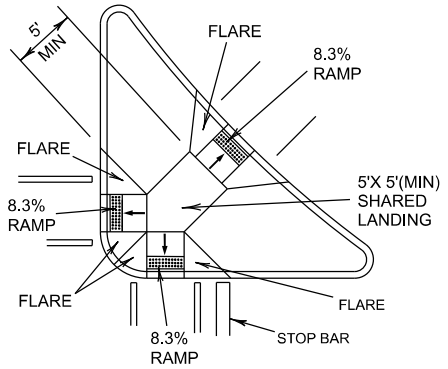
PARALLEL CURB RAMP

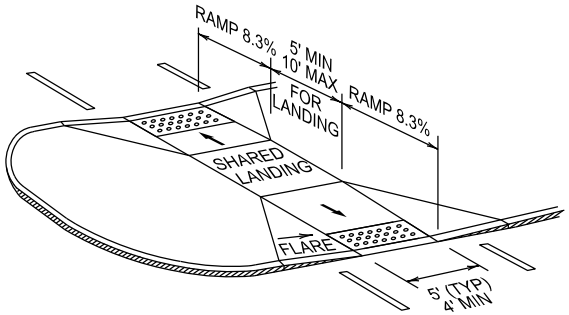
TYPE R-3



TYPE R-4



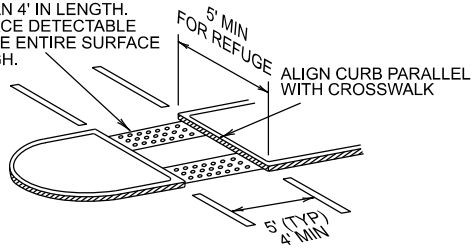




CURB RAMPS AT MEDIAN ISLANDS

DETECTABLE WARNING SURFACE SHALL EXTEND FULL WIDTH OF SIDEWALK OR RAMP

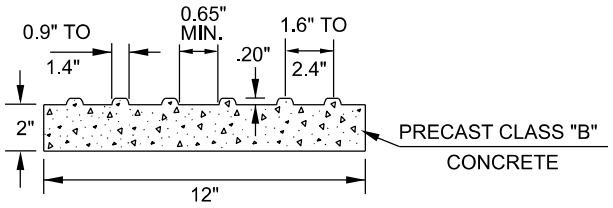
2' STRIP IF CUT THROUGH IS GREATER THAN 4' IN LENGTH. OTHERWISE PLACE DETECTABLE WARNING ON THE ENTIRE SURFACE OF CUT THROUGH.



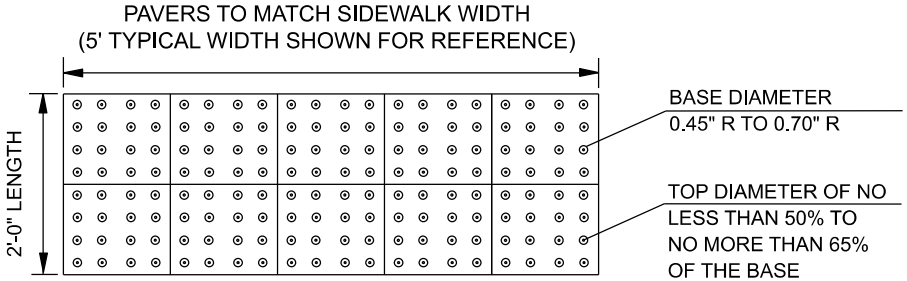
LOCATIONS OF DETECTABLE WARNING SURFACES

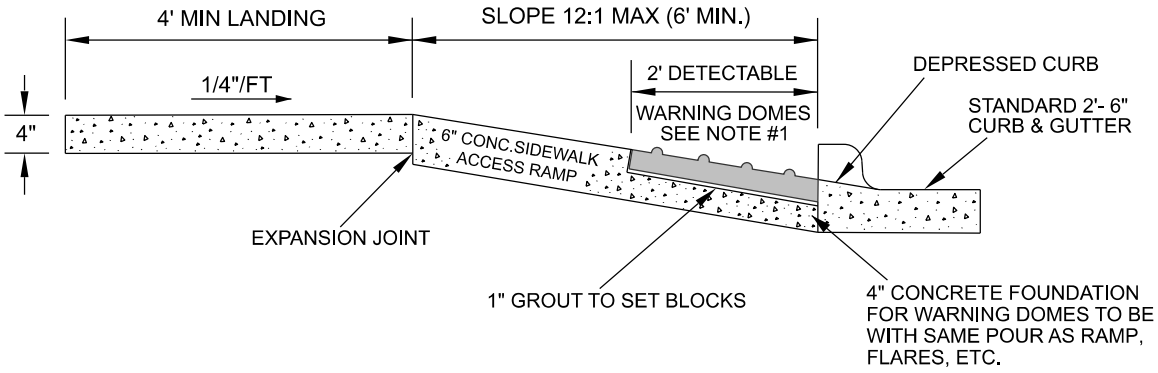
TOWN OF GARNER, N.C.

DESIGNED BY:	REVISED
TOG	FEB. 2022
APPROVED BY:	STD. NO.
CSJ	T-2.03.1



DETECTABLE WARNING
DOMES CONCRETE PAVER





RAMP SECTION

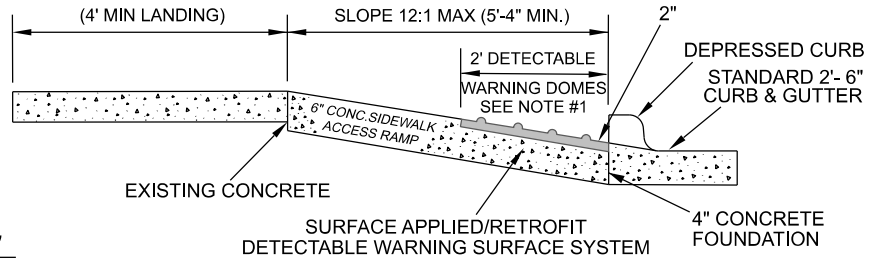
WITH DETECTABLE WARNING PAVERS

NOTES:

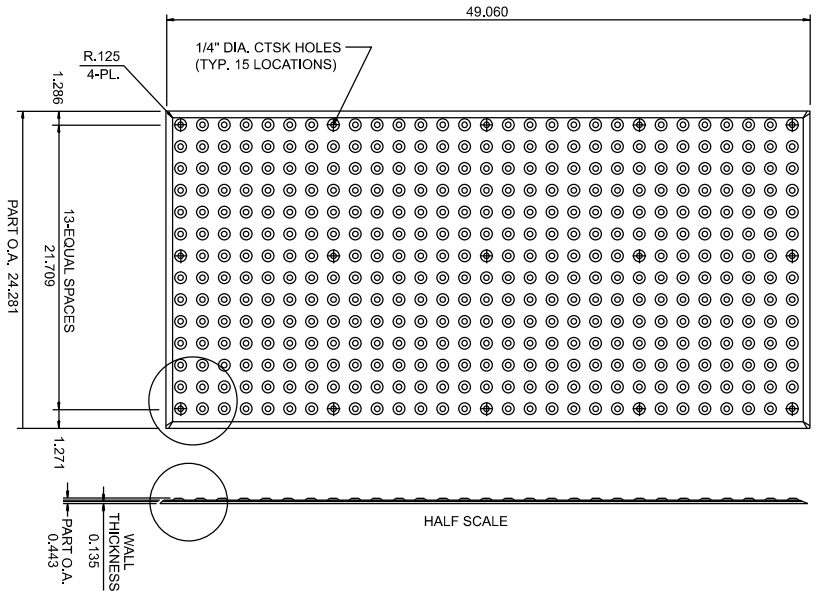
1. DETECTABLE WARNING DOMES SHALL COVER 2'-0" LENGTH AND FULL WIDTH OF THE RAMP FLOOR AS SHOWN ON DETAIL. SIZE OF PAVER SHALL BE 1' X 1'.

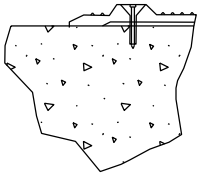
2. THE COLOR FOR THE DETECTABLE WARNING AREA SHALL BE YELLOW, GRAY, CHARCOAL, OR BLACK FOR CONTRAST.

TOWN OF GARNER, N.C.	DETECTABLE WARNING SURFACE PAVERS	DESIGNED BY: TOG	REVISED FEB. 2022
		APPROVED BY: CSJ	STD. NO. T-2.03.2

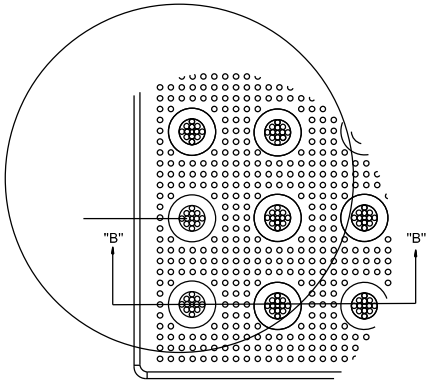


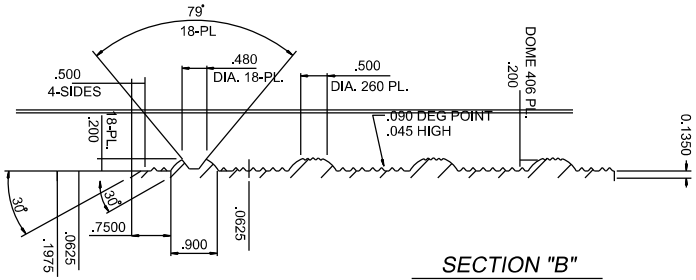
SECTION "A-A"
WITH DETECTABLE WARNING PAVERS





TILE INSTALLATION
VIEW B 4X SCALE





SECTION "B"
TYPICAL SECTION

NOTES:

1. DETECTABLE WARNING DOMES SHALL COVER 2'-0" LENGTH AND FULL WIDTH OF THE RAMP FLOOR AS SHOWN ON DETAIL.

2. THE COLOR FOR THE DETECTABLE WARNING AREA SHALL BE GRAY, CHARCOAL, OR BLACK FOR CONTRAST.

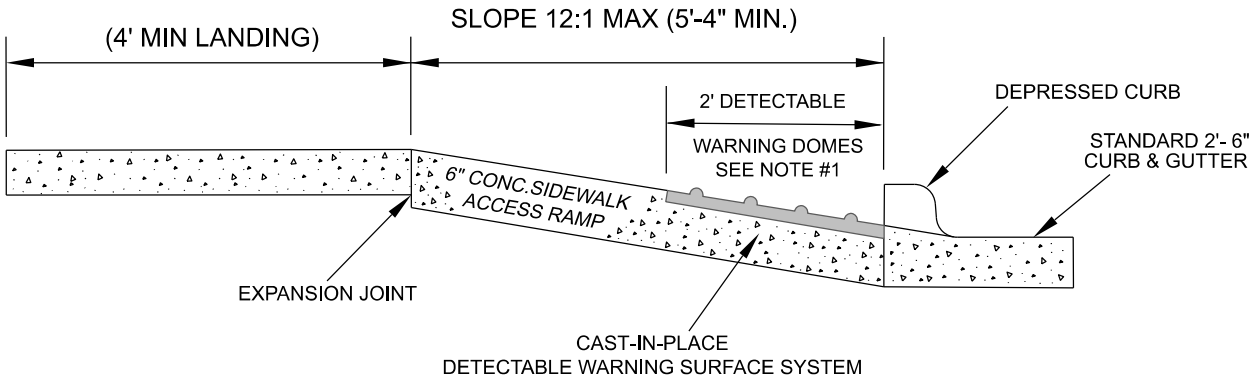
NOTE:
THIS APPLICATION ONLY TO BE USED WHEN RETRO FITTING EXISTING BARRIER FREE RAMPS

RETROFIT ONLY

DETECTABLE WARNING SURFACE - SURFACE APPLIED	DESIGNED BY: TOG	REVISED FEB. 2022
TOWN OF GARNER, N.C.	APPROVED BY: CSJ	STD. NO. T-2.03.3

RAMP SECTION

WITH DETECTABLE WARNING SURFACE
CAST-IN-PLACE SYSTEM



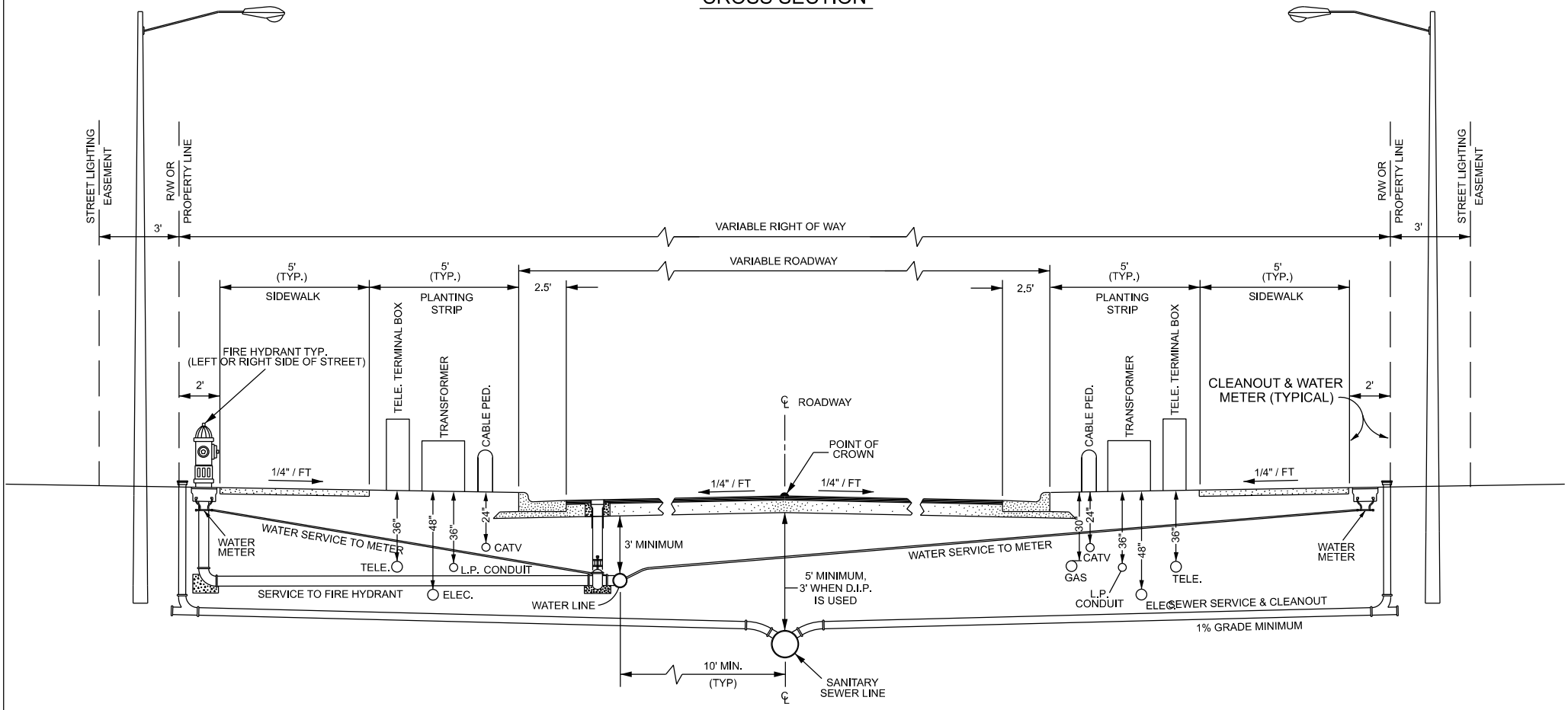
NOTES:

1. DETECTABLE WARNING DOMES SHALL COVER 2'-0" LENGTH AND FULL WIDTH OF THE RAMP AS SHOWN ON DETAIL.

2. THE COLOR FOR THE DETECTABLE WARNING AREA SHALL BE GRAY, CHARCOAL, OR BLACK FOR CONTRAST.

TOWN OF GARNER, N.C.	DETECTABLE WARNING SURFACE - CAST-IN-PLACE	DESIGNED BY: TOG	REVISED FEB. 2022
		APPROVED BY: CSJ	STD. NO. T-2.03.4

CROSS SECTION

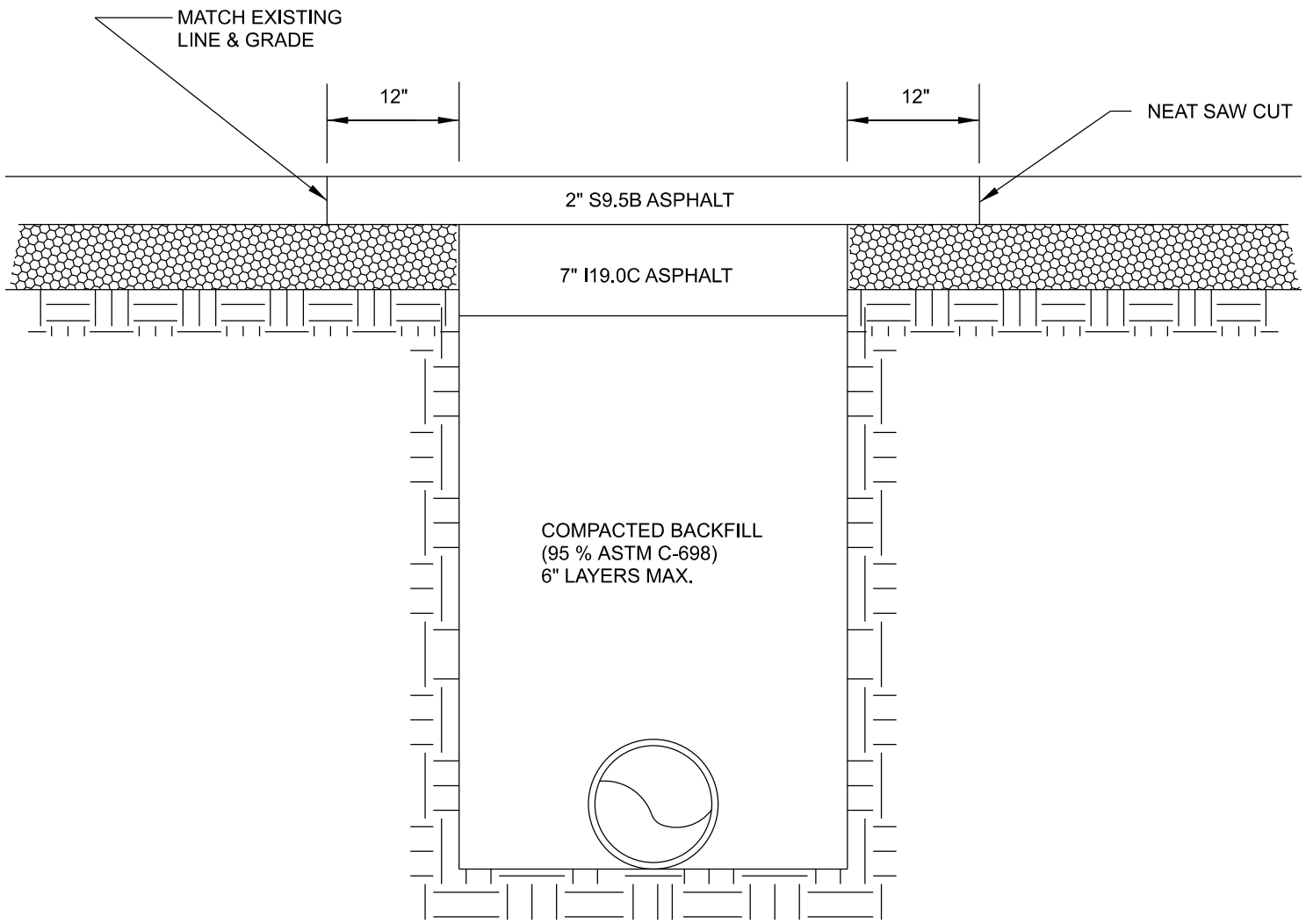


NOTES:

1. WATER AND/OR SANITARY SEWER LINES SHALL BE A MINIMUM OF TWO FEET FROM THE EDGE OF THE CURB AND GUTTER.
2. ENCROACHMENT ONTO TOWN MAINTAINED RIGHT OF WAY SHALL FOLLOW CONDITIONS OF THE APPLICABLE ENCROACHMENT AGREEMENT OR FRANCHISE AGREEMENT.
3. FOR HYDRANT LOCATION SEE PUBLIC UTILITIES STANDARD DETAIL W-4.

TOWN OF GARNER, N.C.	STANDARD UTILITY LOCATIONS IN STREET	DESIGNED BY: TOG	REVISED FEB. 2022
		APPROVED BY: CSJ	STD. NO. T-3.01

NOTE: ALL VERTICAL ASPHALT SURFACES SHALL BE TACK COATED.

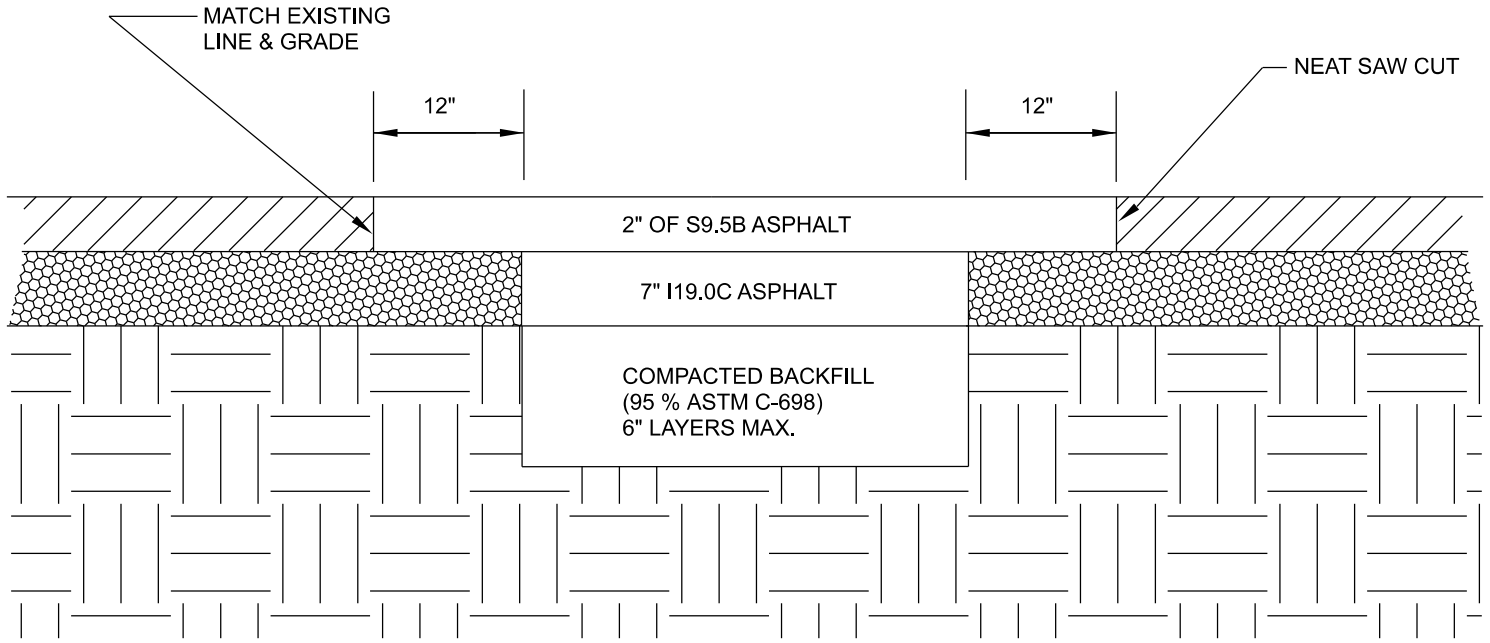


UTILITY TRENCH PAVEMENT REPAIR

TOWN OF GARNER, N.C.

DESIGNED BY:	REVISED
TOG	FEB. 2022
APPROVED BY:	STD. NO.
CSJ	T-3.02

NOTE: ALL VERTICAL ASPHALT SURFACES SHALL BE TACK COATED.



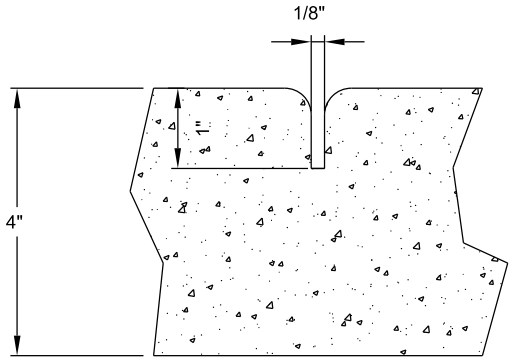
TOWN OF GARNER, N.C.

TYPICAL PAVEMENT REPAIR

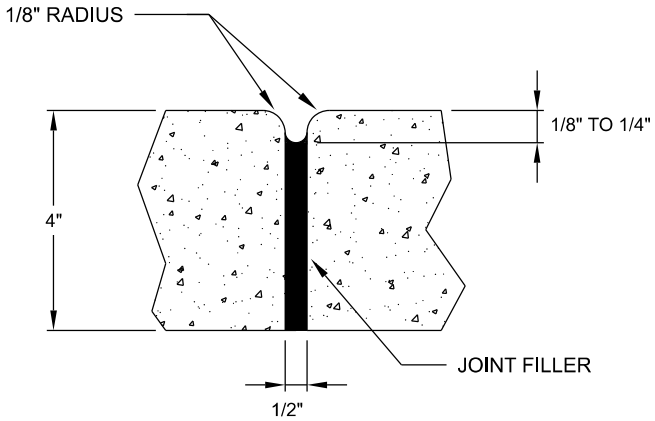
DESIGNED BY:	REVISED
TOG	FEB. 2022
APPROVED BY:	STD. NO.
CSJ	T-3.03

GENERAL NOTES:

1. A GROOVE JOINT 1" DEEP WITH 1/8" RADII SHALL BE REQUIRED IN THE CONCRETE SIDEWALK WITH JOINT SPACING EQUAL TO THE WIDTH OF SIDEWALK, UP TO 10' WIDTH. WIDER THAN 10' REQUIRES SPECIAL DESIGN (SEE DETAIL #3.08) FOR MULTI-USE PATH).
2. ONE 1/2" EXPANSION JOINT WILL BE REQUIRED AT INTERVALS OF NOT MORE THAN 45' AND MATCHING EXPANSION/CONSTRUCTION JOINT IN ADJACENT CURB. A SEALED 1/2" EXPANSION JOINT WILL BE REQUIRED WHERE THE SIDEWALK JOINS ANY RIGID STRUCTURE.
3. SIDEWALK AT DRIVEWAY ENTRANCES TO BE 6" THICK.
4. WIDTH OF SIDEWALK ON THOROUGHFARE STREETS SHALL BE A MINIMUM OF 6'. WIDTH OF SIDEWALKS IN THE CENTRAL BUSINESS DISTRICT WILL BE DETERMINED BY THE NCDOT.
5. WIDTH OF SIDEWALKS ON NON-THOROUGHFARE STREETS SHALL BE BASED ON TYPICAL STREET SECTION, A MINIMUM OF 5'. SIDEWALK TO BE POURED TO END OF RADIUS AT INTERSECTING STREETS.
6. CONCRETE COMPRESSIVE STRENGTH SHALL BE 3600 PSI IN 28 DAYS.
7. ZONING CONDITIONS MAY REQUIRE ADDITIONAL WIDTH SIDEWALKS WHICH SHALL SUPERSEDE THESE STANDARD DIMENSIONS SHOWN.
8. LIDS FOR JUNCTION BOXES AND UTILITY VAULTS SHALL BE NON-SKID AS SPECIFIED BY ENGINEER.
9. JOINT MATERIALS SHALL LIMIT SHRINK/SWELL SO POST CONSTRUCTION INSTALLATION RESULTS IN A MAXIMUM OF 1/4" FROM FLUSH.



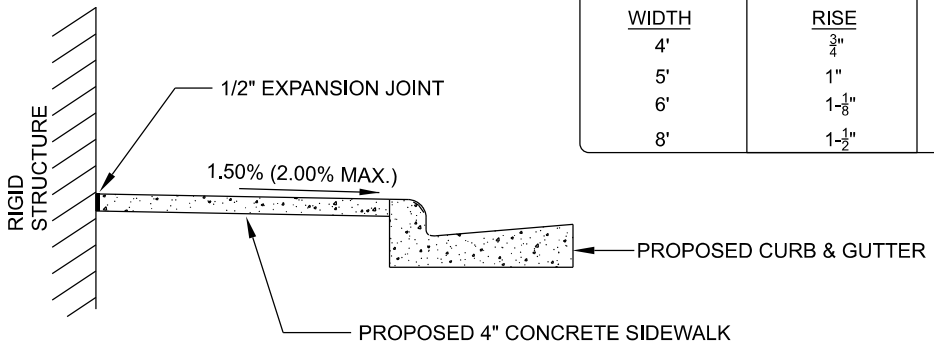
GROOVE JOINT IN SIDEWALK



TRANSVERSE EXPANSION JOINT IN SIDEWALK

EXAMPLE SIDEWALK CONSTRUCTION DIMENSIONS:

WIDTH	RISE	CROSS-SLOPE
4'	$\frac{3}{4}$"	1.56%
5'	1"	1.67%
6'	1-$\frac{1}{8}$"	1.56%
8'	1-$\frac{1}{2}$"	1.56%

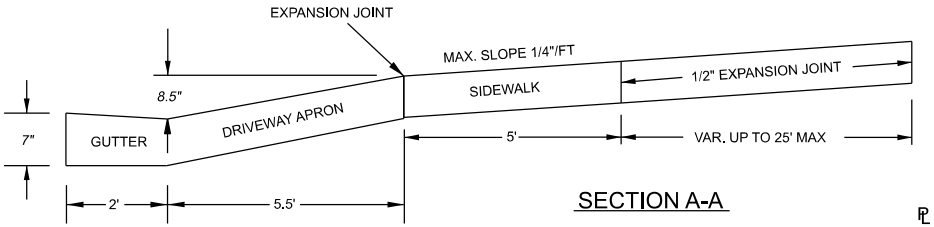


DETAILS SHOWING EXPANSION JOINTS IN CONCRETE SIDEWALK

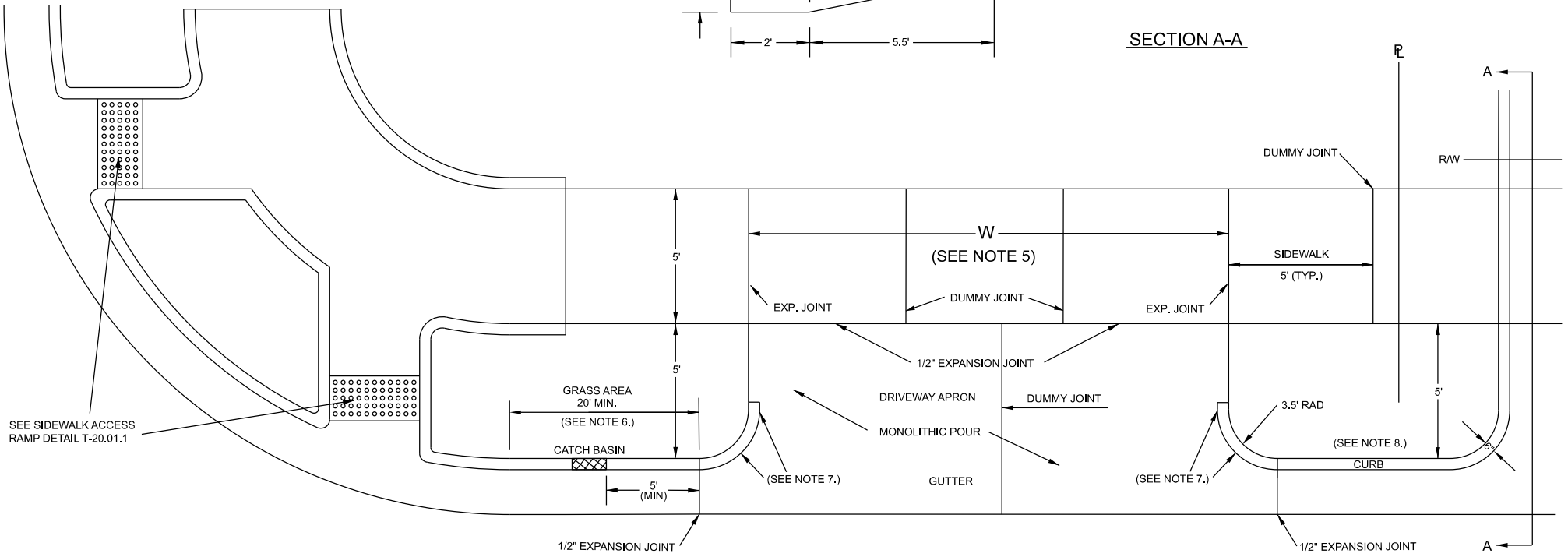
TOWN OF GARNER, N.C.	CONCRETE SIDEWALKS	DESIGNED BY: TOG	REVISED FEB. 2022
		APPROVED BY: CSJ	STD. NO. T-4.01

W-DIMENSION AS SHOWN ON PLAN VIEW SHALL BE AS FOLLOWS:

- **10' MINIMUM, 18' MAXIMUM FOR RESIDENTIAL DRIVEWAYS**
- **36' MAXIMUM FOR COMMERCIAL DRIVEWAYS**



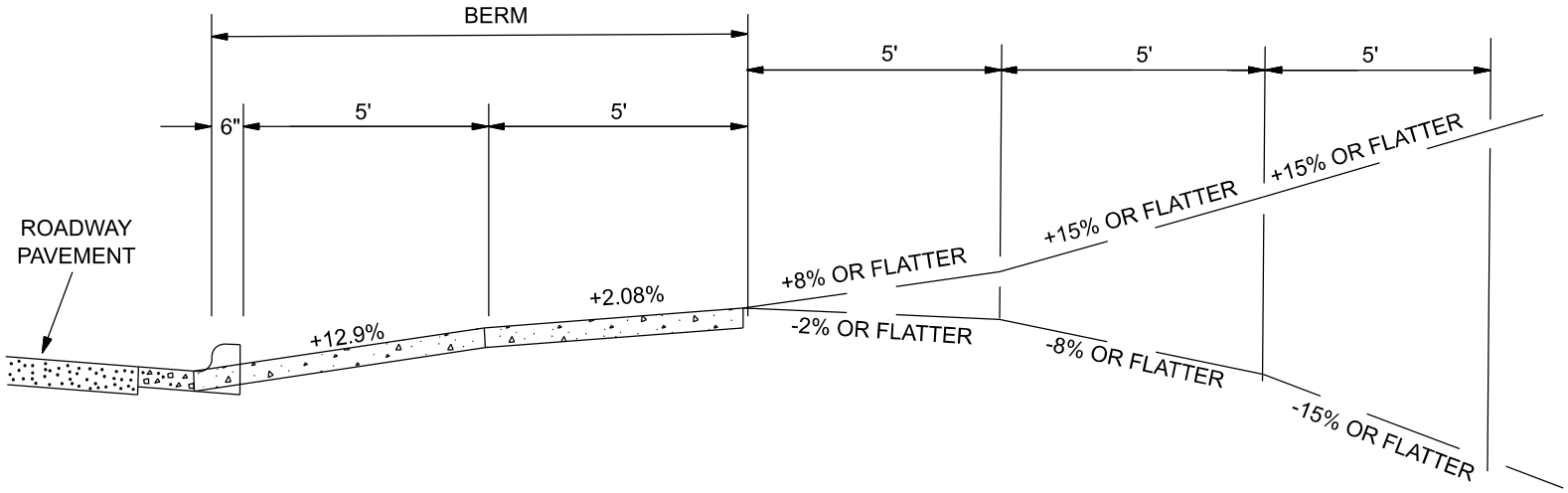
SECTION A-A



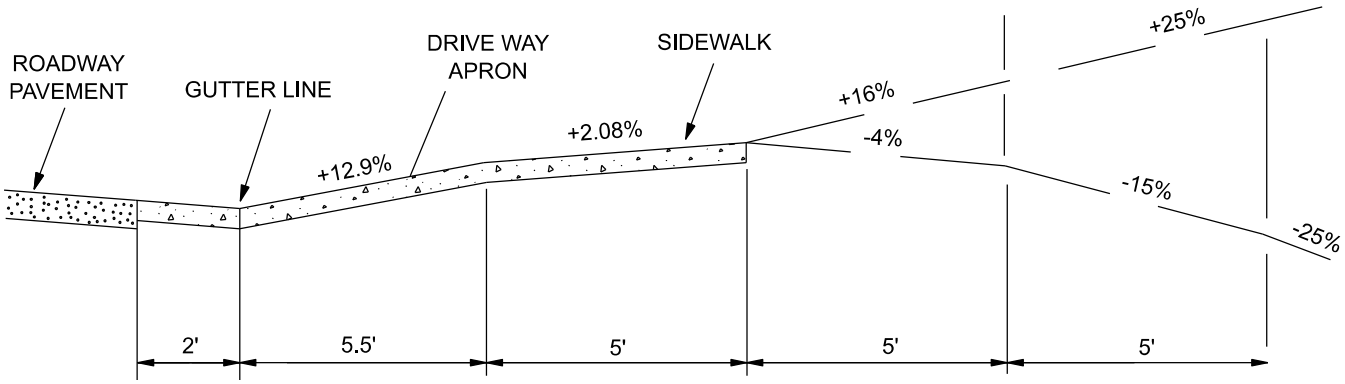
NOTES:

1. WHEN A DRIVEWAY IS TO BE CONSTRUCTED WHERE FINAL LAYER OF ASPHALT HAS BEEN PLACED, THE CURB CAN BE SAWCUT IN A STRAIGHT LINE AND REMOVED. IF THE FINAL LAYER HAS NOT BEEN PLACED, THE ENTIRE CURB AND GUTTER SHALL BE REMOVED AND THE DRIVEWAY SHALL BE A MONOLITHIC POUR USING 3000 PSI, MAX. 4" SLUMP CONCRETE.
2. EXPANSION MATERIAL SHALL EXTEND THE FULL DEPTH OF THE CONCRETE. 1/2" EXPANSION JOINTS ALONG SIDEWALK SHALL BE LOCATED AT NOT MORE THAN 40' INTERVALS & DUMMY CONSTRUCTION JOINTS AT 6' INTERVALS. DUMMY JOINTS SHALL BE AT LEAST 1/3 THE SLAB THICKNESS IN DEPTH.
3. SLOPE ON UNPAVED AREAS BETWEEN BACK OF CURB & SIDEWALK SHALL BE 1/4" PER FT.
4. NO EXPOSED AGGREGATE OR OTHER SPECIAL SURFACE TREATMENTS IN ROW.
5. THE DISTANCE FROM THE END OF A STREET CURB RADIUS TO THE BEGINNING OF THE DRIVEWAY RADIUS SHOULD BE MINIMUM OF 20'.
6. CURB RADIUS TO BE DISSIPATED BETWEEN LIMITS NOTED ABOVE.
7. 7' MIN. BETWEEN DRIVEWAYS ON ADJACENT LOTS.
   45' MIN. BETWEEN DRIVEWAYS ON SAME LOT.
8. NO RADIUS ENCROACHMENT SHALL BE ALLOWED ACROSS AN ADJOINING PROP. FRONTAGE. THIS IS DETERMINED BY EXTENDING A LINE FROM THE PROPERTY CORNER PERPENDICULAR TO THE R/W TO THE CURB AND GUTTER LOCATION.
9. ALL CONCRETE MUST BE POURED ON SAME DAY AS INSPECTION OR RE-INSPECTION IS REQUIRED.
10. DRIVEWAY RADIUS SHALL BE A MINIMUM OF 5' FROM ANY CATCH BASIN.

TOWN OF GARNER, N.C.	DRIVEWAY AND SIDEWALK DETAIL	DESIGNED BY: TOG	REVISED FEB. 2022
		APPROVED BY: CSJ	STD. NO. T-4.02



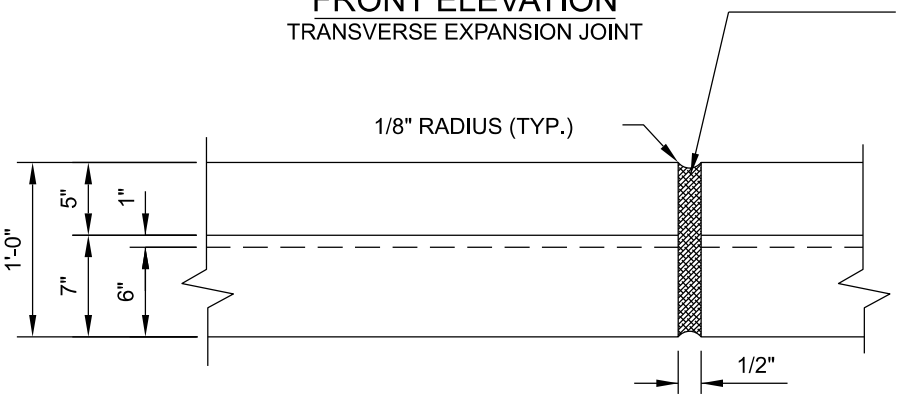
DESIRABLE DRIVEWAY GRADES



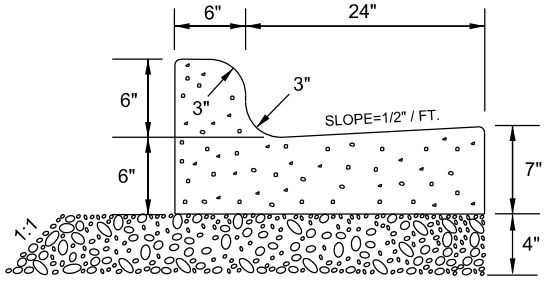
MAXIMUM GRADES

	DRIVEWAY GRADES	DESIGNED BY: TOG	REVISED FEB. 2022
	TOWN OF GARNER, N.C.	APPROVED BY: CSJ	STD. NO. T-4.03

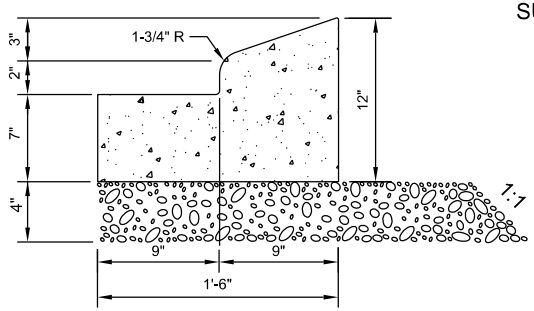
FRONT ELEVATION
TRANSVERSE EXPANSION JOINT



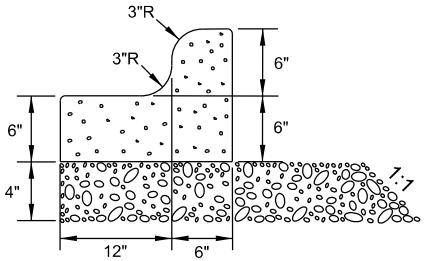
NOTES:
1. 10' MAXIMUM BETWEEN DUMMY JOINTS.
   15' MAXIMUM BETWEEN DUMMY JOINTS ON MACHINE POURS.
2. 1/2" EXPANSION JOINT EVERY 50'.
3. 3000 PSI CONCRETE MINIMUM, 4" SLUMP MAXIMUM.
4. LIQUID MEMBRANE CURING COMPOUND SHALL MEET THE REQUIREMENTS OF SECTION 1026-2 OF NCDOT STANDARDS & SPECIFICATIONS FOR ROADS AND STRUCTURES.
5. ALL CONSTRUCTION JOINTS SHALL BE FILLED WITH JOINT FILLER AND SEALER IN ACCORDANCE WITH NCDOT ROADWAY STANDARD DETAIL 846.01 THE JOINT MATERIAL SHALL CONFORM TO SECTION 1028-2 OF NCDOT STANDARD & SPECIFICATIONS FOR ROADS AND STRUCTURES.
6. REFER TO NCDOT DETAIL 846.01 FOR CURB AND GUTTER SUPERELEVATION RATES.



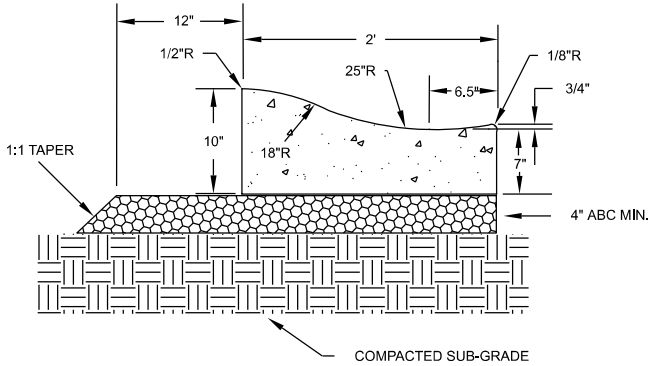
30" CURB & GUTTER



MEDIAN CURB AND GUTTER
SIDE ELEVATION

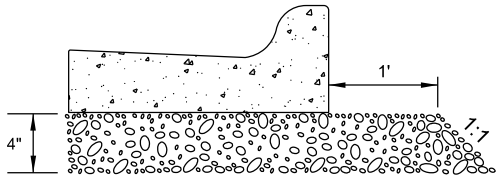


MEDIAN CURB AND GUTTER
(NON-MOUNTABLE)



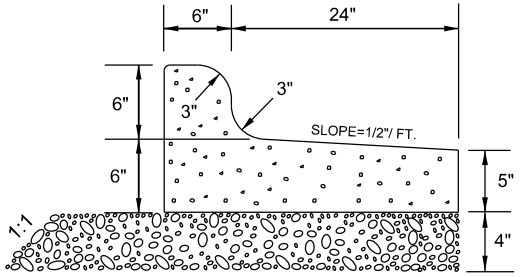
ROLLED CURB

NOTE: ROLLED CURB IS INTENDED FOR USE IN PRIVATE STREET AND/OR PUBLIC STREETS WITHIN SENIOR LIVING DEVELOPMENTS



4" COMPACTED A.B.C. UNDER STANDARD CURB & GUTTER (MIN)

NO VALLEY CURB SHALL BE USED AT INTERSECTIONS, HYDRANTS, ETC.

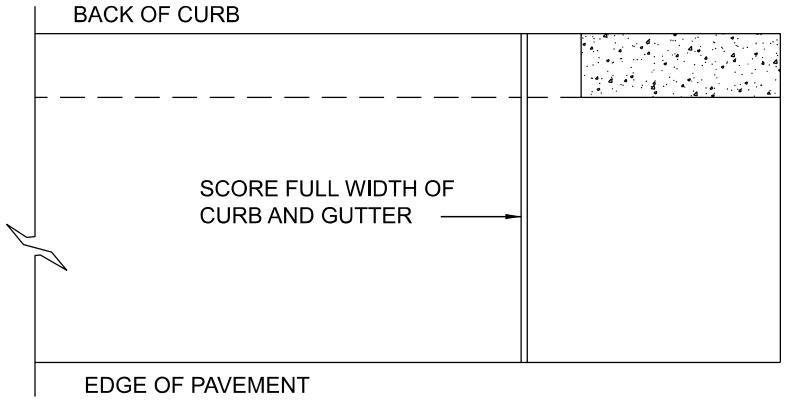


SPILL CURB DETAIL

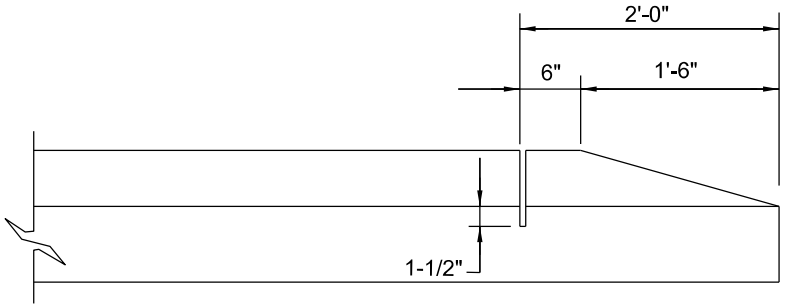
TOWN OF GARNER, N.C.

CURB AND GUTTER

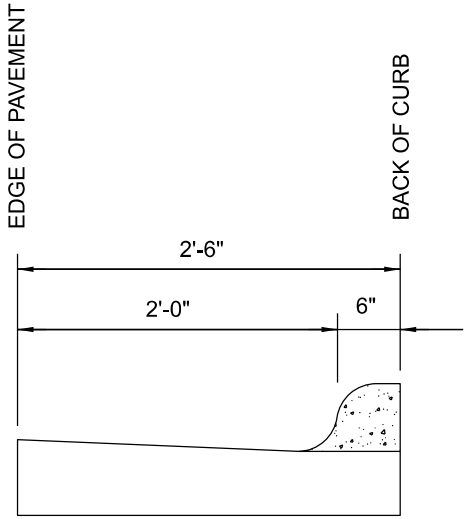
DESIGNED BY:	REVISED
TOG	FEB. 2022
APPROVED BY:	STD. NO.
CSJ	T-4.04



PLAN

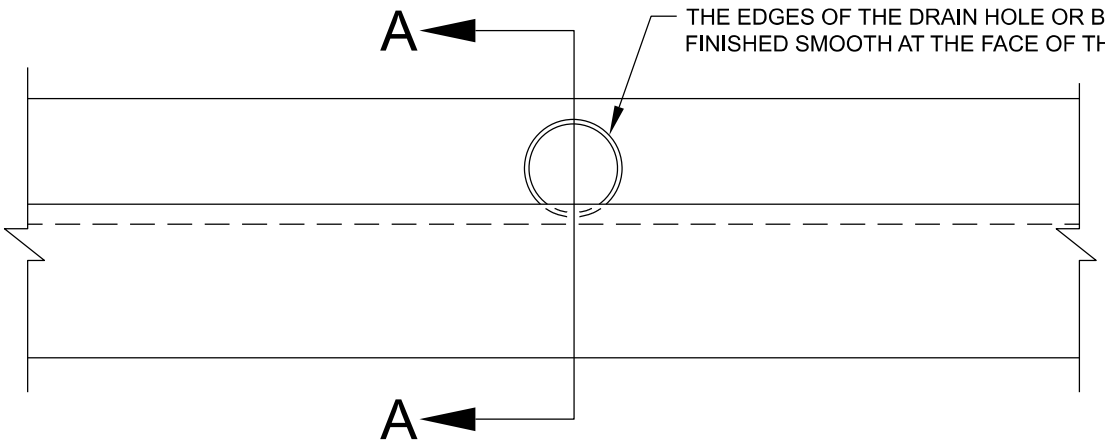


FRONT

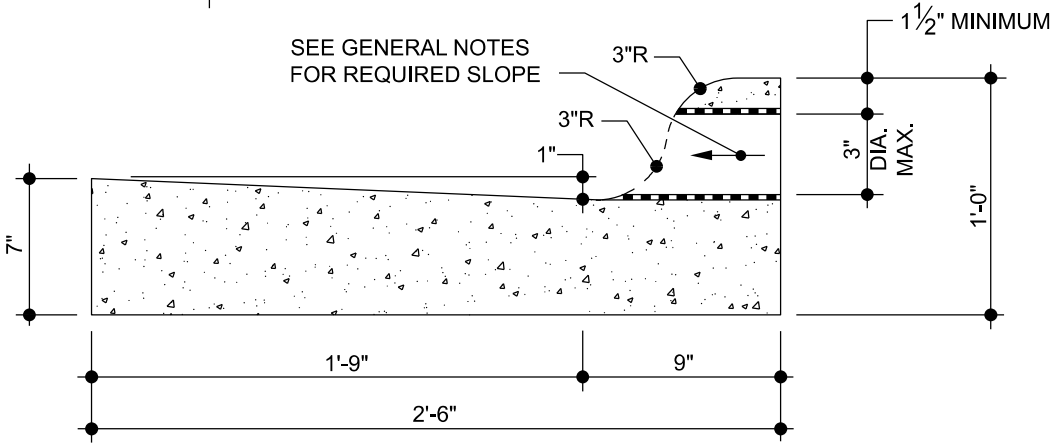


END

STANDARD METHOD OF ENDING CURB AND GUTTER	DESIGNED BY: TOG	REVISED FEB. 2022
TOWN OF GARNER, N.C.	APPROVED BY: CSJ	STD. NO. T-4.05



FRONT VIEW

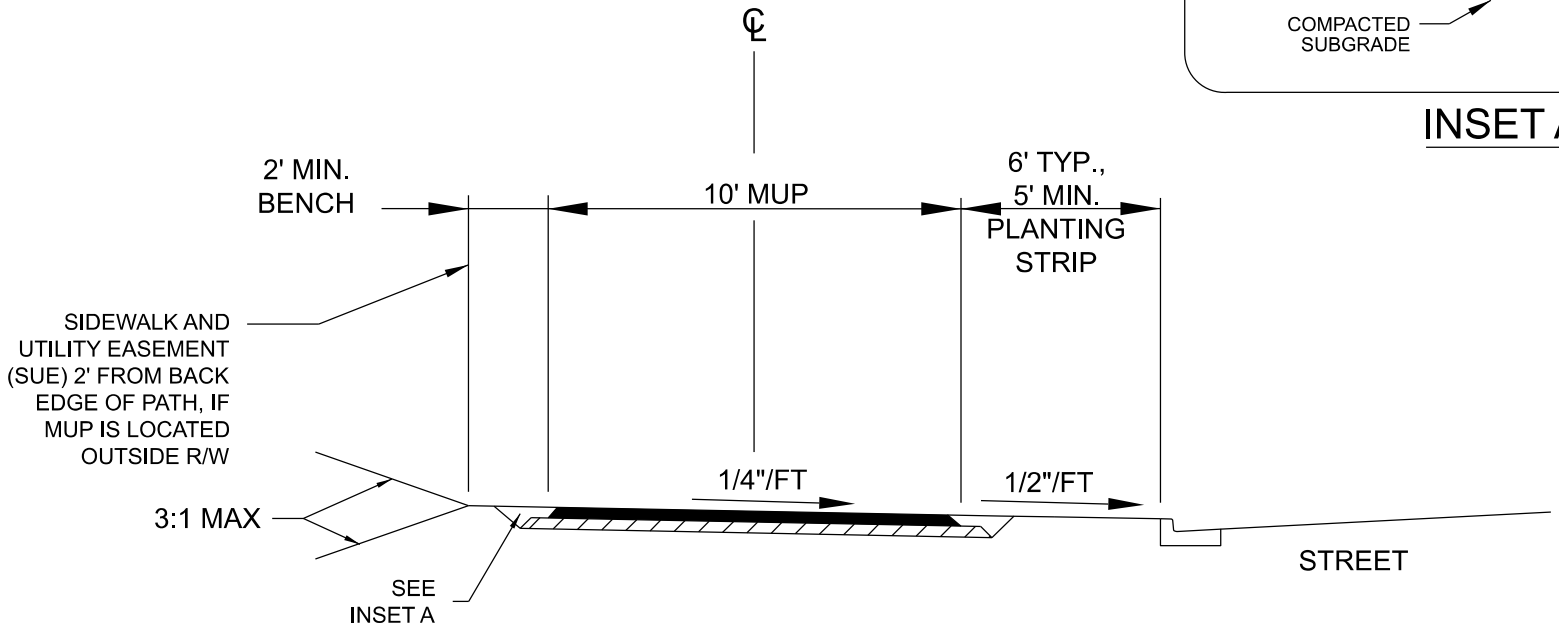


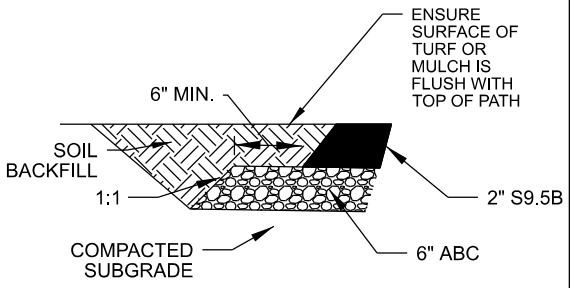
SECTION A-A

GENERAL NOTES:

1. CURB DRAINS SHALL NOT BE CONSTRUCTED WITHIN 18 INCHES OF CONTRACTION OR EXPANSION JOINTS.
2. OPENING GRADE MAY VARY BETWEEN A MAXIMUM SLOPE OF 1/2" PER FT. AND A MINIMUM OF 1/4" PER FT.
3. MORE THAN ONE HOLE MAY BE INSTALLED PROVIDED THE HOLES ARE LOCATED WITH 18 INCHES MINIMUM SPACING.
4. IN LIEU OF CUTTING THE CURB TO INSTALL A 3 INCH PIPE, A 4 INCH CONCRETE BORE MAY BE USED.
   A) BORE OR REMOVE & REPOUR 5 FOOT SECTION OF CURB, NO CUTTING OUT TOP OF CURB.
   B) MAY NEED PERMIT AND/OR ENCROACHMENT AGREEMENT FROM THE PUBLIC WORKS AND/OR TRANSPORTATION & FACILITIES DEPARTMENTS.

STANDARD CURB DRAIN	DESIGNED BY: TOG	REVISED FEB. 2022
TOWN OF GARNER, N.C.	APPROVED BY: CSJ	STD. NO. T-4.06



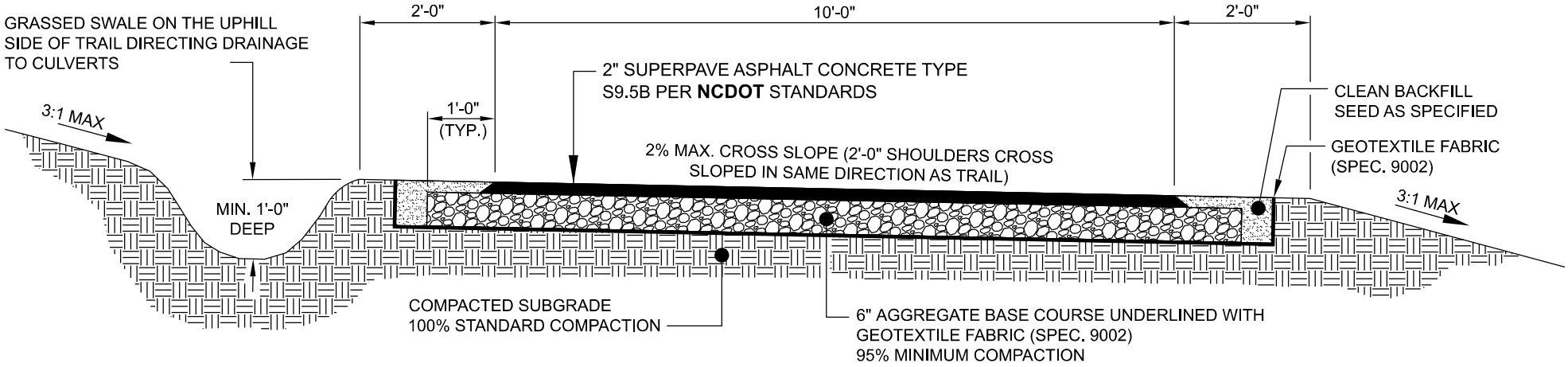


INSET A

NOTE:

1. AT INTERSECTIONS WITH STREETS OR DRIVEWAYS, RAMP WIDTH MUST MATCH MULTI-USE PATH WIDTH.

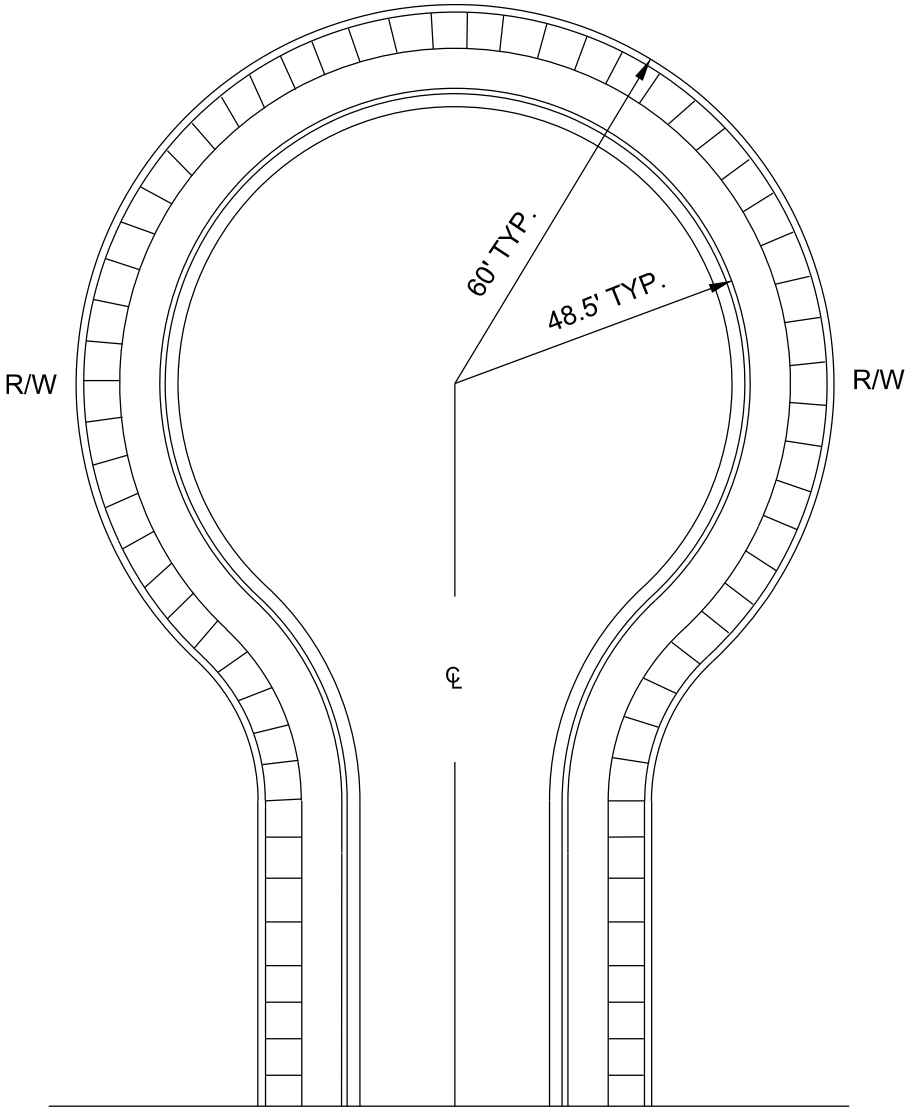
TOWN OF GARNER, N.C.	MULTI-USE PATH	DESIGNED BY: TOG	REVISED FEB. 2022
		APPROVED BY: CSJ	STD. NO. T-4.07



NOTES:

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

STANDARD 10-FT ASPHALT GREENWAY TRAIL		DESIGNED BY: TOG	REVISED FEB. 2022
TOWN OF GARNER, N.C.		APPROVED BY: CSJ	STD. NO. T-4.08



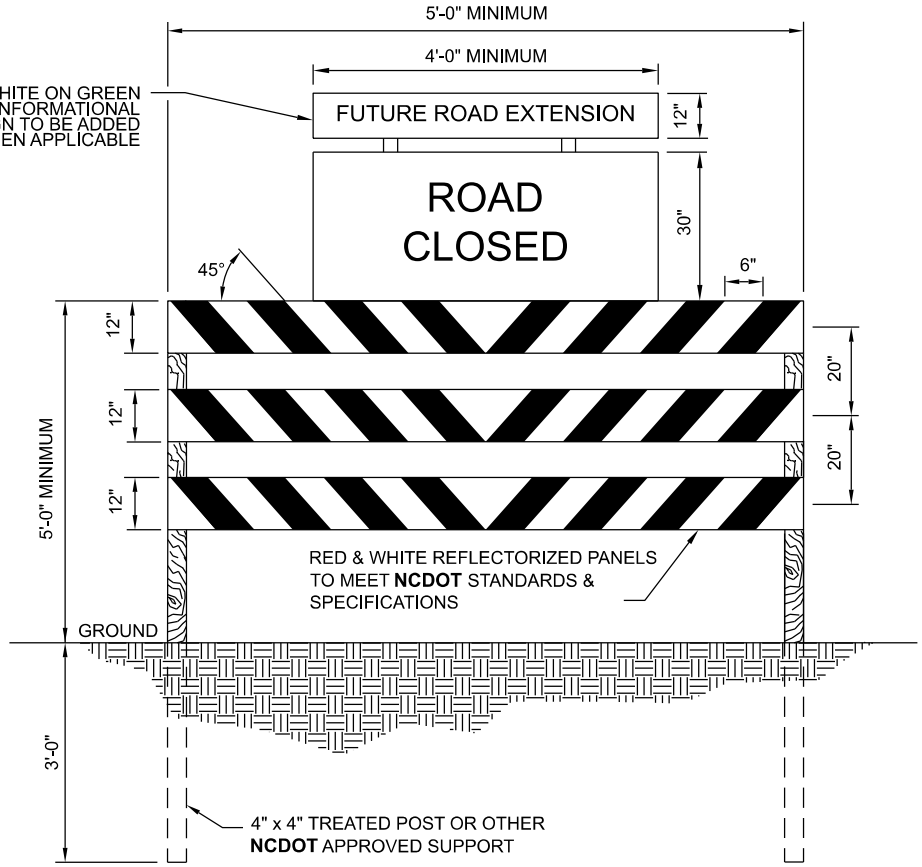
NOTE: A 30' RADIUS MAY BE USED ON CUL-DE-SAC STREETS LESS THAN 150' IN LENGTH.

RESIDENTIAL CUL-DE-SAC

TOWN OF GARNER, N.C.

DESIGNED BY:	REVISED
TOG	FEB. 2022
APPROVED BY:	STD. NO.
CSJ	T-5.01

MAJOR STREET

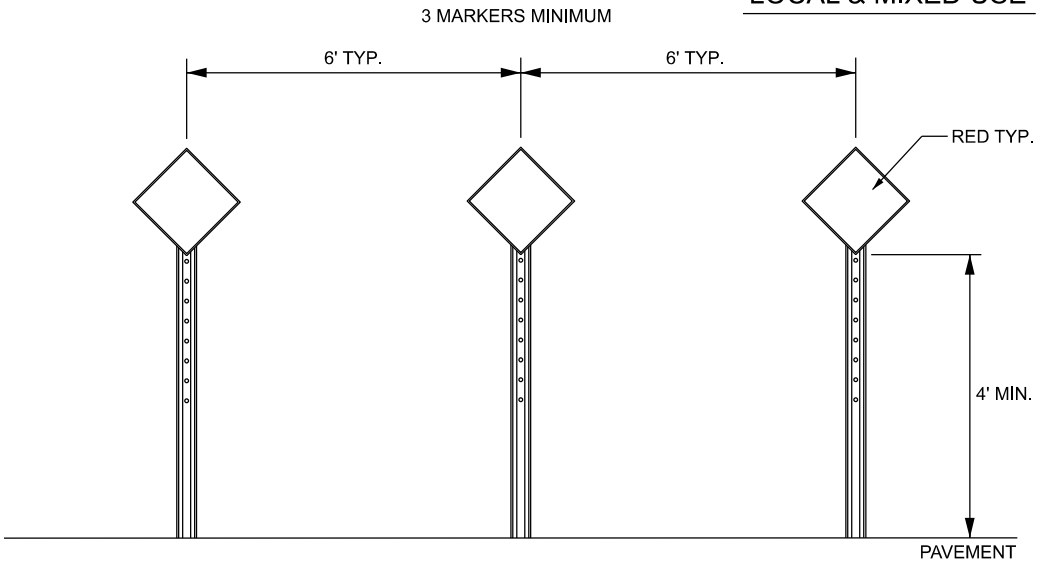


NOTES:

1. BARRICADE(S) TO BE ERECTED ACROSS ENTIRE ROADWAY INCLUDING CURB & GUTTER.
2. ADVANCE WARNING SIGN W14-1 (DEAD END) SHALL BE PLACED JUST AFTER LAST INTERSECTING STREET.
3. MARKINGS FOR BARRICADE RAILS SHALL BE REFLECTIVE AND ALTERNATE RED & WHITE STRIPS.
4. "ROAD CLOSED" SIGN SHALL MEET SPECIFICATIONS OF MU.T.C.D.R11-2 AND BE REQUIRED ATOP EACH BARRICADE USED.
5. CALL 811 FOR UNDERGROUND UTILITY LOCATE PRIOR TO INSTALLATION.

FOR USE AT FOUR LANE STREET AND ≥ 40 MPH, OTHERWISE THREE RED OBJECT MARKERS.

LOCAL & MIXED USE

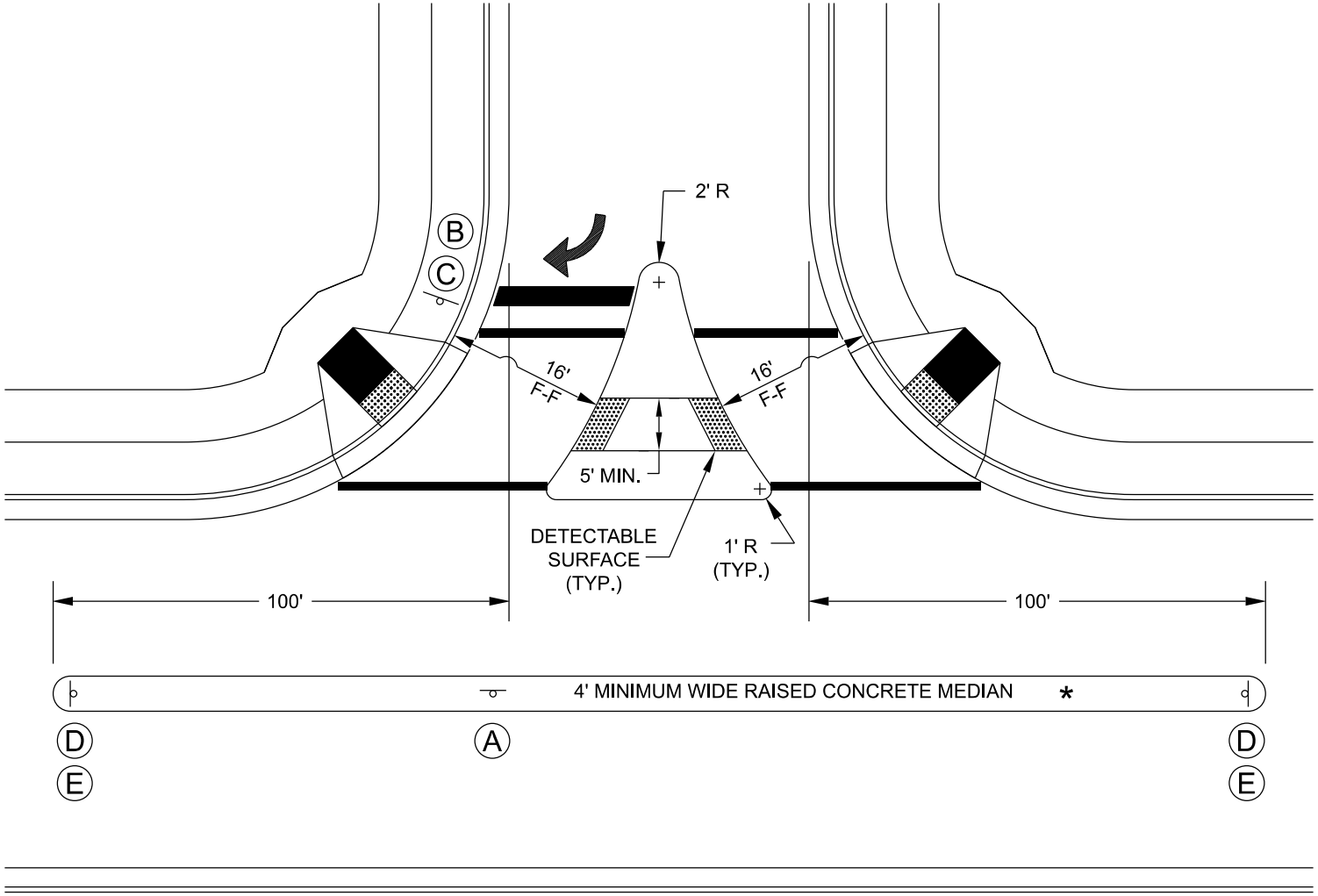


7' U - CHANNEL POSTS (1.12 LB/FT)

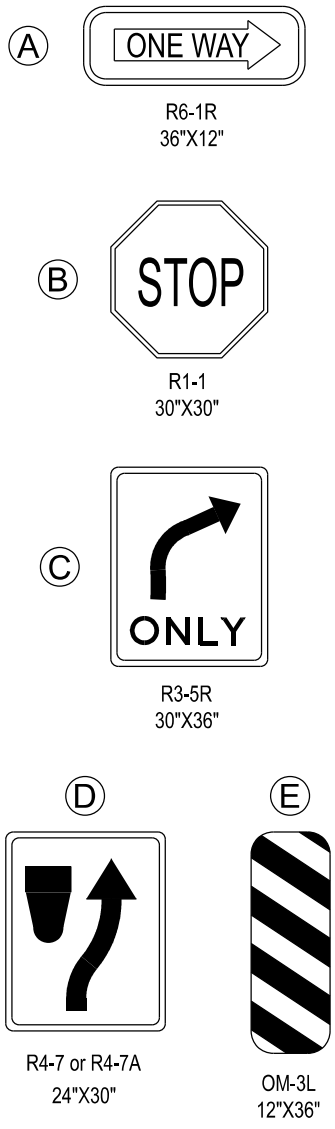
BARRICADE FOR DEAD END STREETS

TOWN OF GARNER, N.C.

DESIGNED BY:	REVISED
TOG	FEB. 2022
APPROVED BY:	STD. NO.
CSJ	T-5.02



SIGN LEGEND

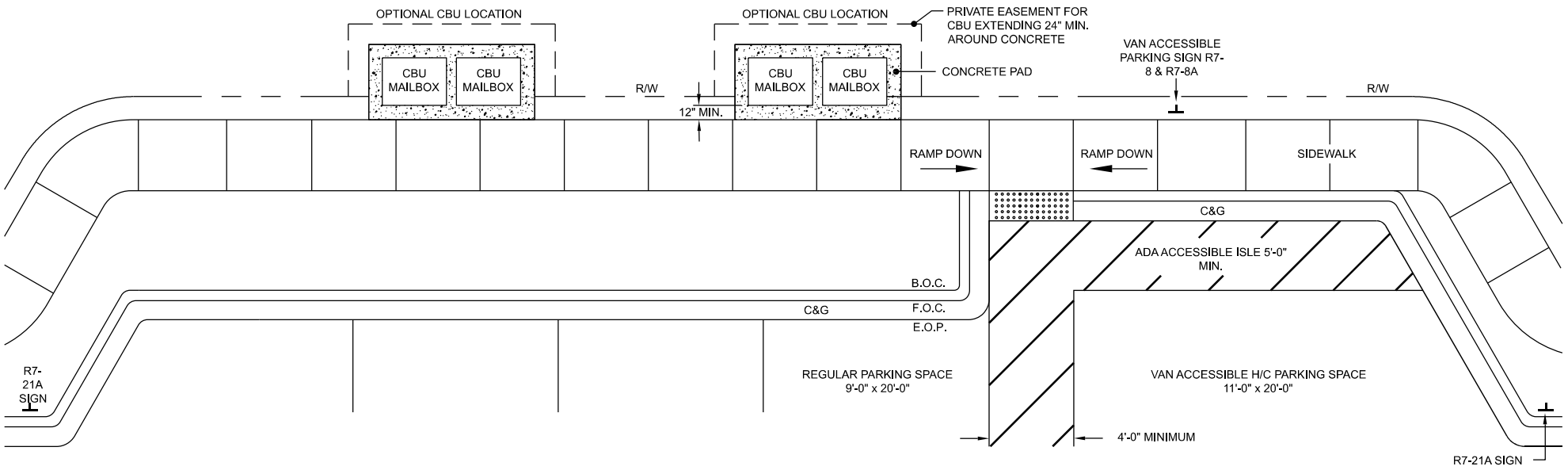


NOTES:

1. MOUNT SIGN B & C ON SAME POST WITH STOP SIGN ON TOP.
2. F-F = FACE OF CURB TO FACE OF CURB.

* MEDIAN USED ON UNDIVIDED ROADWAYS ONLY

TOWN OF GARNER, N.C.	STANDARD RIGHT IN/RIGHT OUT CHANNELIZATION (LIMITED FRONTAGE)	DESIGNED BY: TOG	REVISED FEB. 2022
		APPROVED BY: CSJ	STD. NO. T-5.03



C&G = CURB & GUTTER
B.O.C. = BACK OF CURB
E.O.P. = EDGE OF PAVEMENT
F.O.C. = FACE OF CURB
R/W = RIGHT-OF-WAY

NOTES:

1. THIS DETAIL IS ONLY INTENDED FOR USE IN RETROFIT LOCATIONS (EXISTING DEVELOPMENTS) AND/OR NEW SMALL-SCALE DEVELOPMENTS (TRACTS <1 ACRE IN SIZE). ALL OTHER CBU'S MUST BE INSTALLED OUTSIDE PUBLIC R/W WITH OFF-STREET PARKING LOTS.
2. CBU SHALL CONTAIN NO MORE THAN A TOTAL OF 26 MAIL RECEPTACLES.
3. LOCATE CBU ON PROPERTY LINE OR NEAR COMMON AREAS, IF POSSIBLE.
4. MAXIMUM HEIGHT OF CBU SHALL BE 62 INCHES.
5. CBU SHALL NOT BE LOCATED NEAR UTILITY LINES, WATER METERS, OR CLEANOUTS.
6. ACCESS TO CBU BY RESIDENCES SHALL BE BY SIDEWALK SIDE ONLY.
7. ACCESSIBLE SPACE SHALL HAVE LONGITUDINAL AND TRANSVERSE SLOPES NOT EXCEEDING 2%.
8. R7-21A SIGN SHALL READ "MAIL PARKING, 15 MINUTE LIMIT".

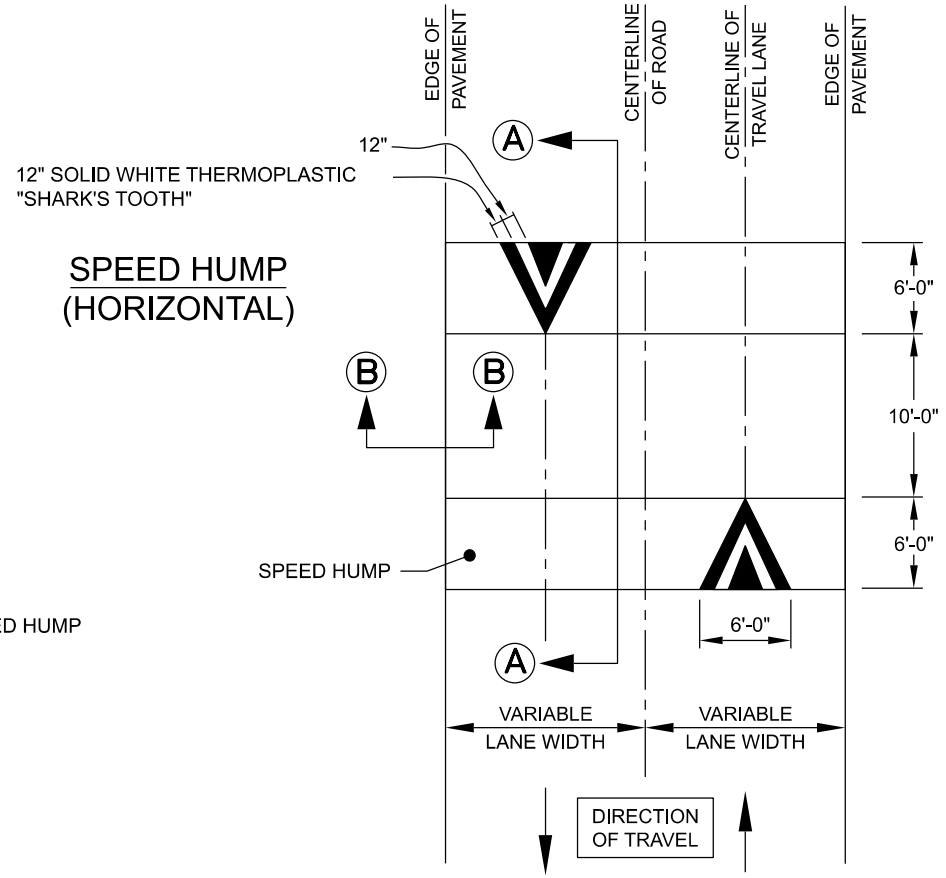
CLUSTER BOX UNIT (CBU) MAILBOX
(RETROFITS AND NEW DEVELOPMENTS LESS THAN 1 ACRE ONLY)

TOWN OF GARNER, N.C.

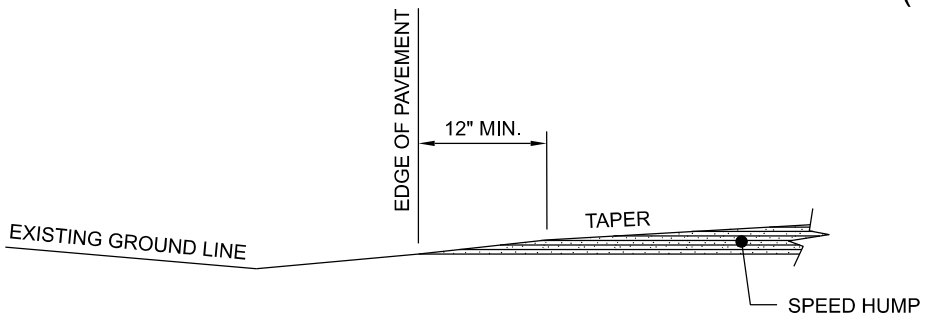
DESIGNED BY:	REVISED
TOG	FEB. 2022
APPROVED BY:	STD. NO.
CSJ	T-5.04

NOTE:

FLAT-TOP SPEED HUMPS ARE FOR USE ON PUBLIC AND PRIVATE STREETS.



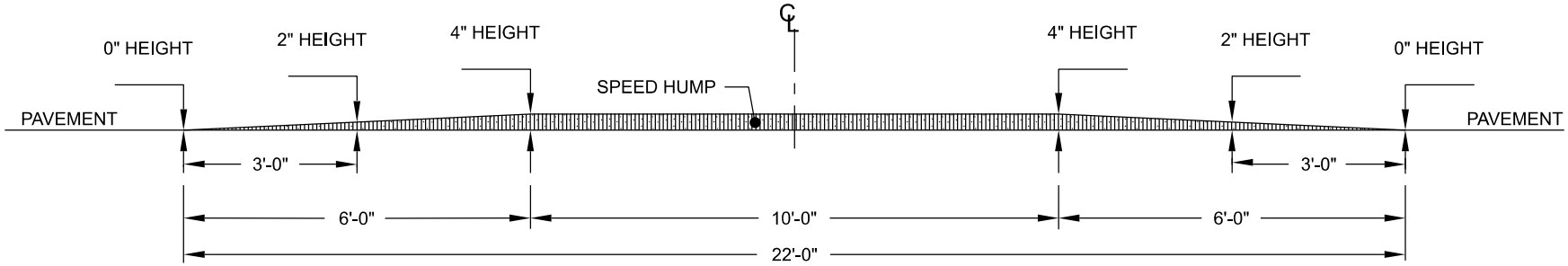
SPEED HUMP (HORIZONTAL)



SECTION B-B

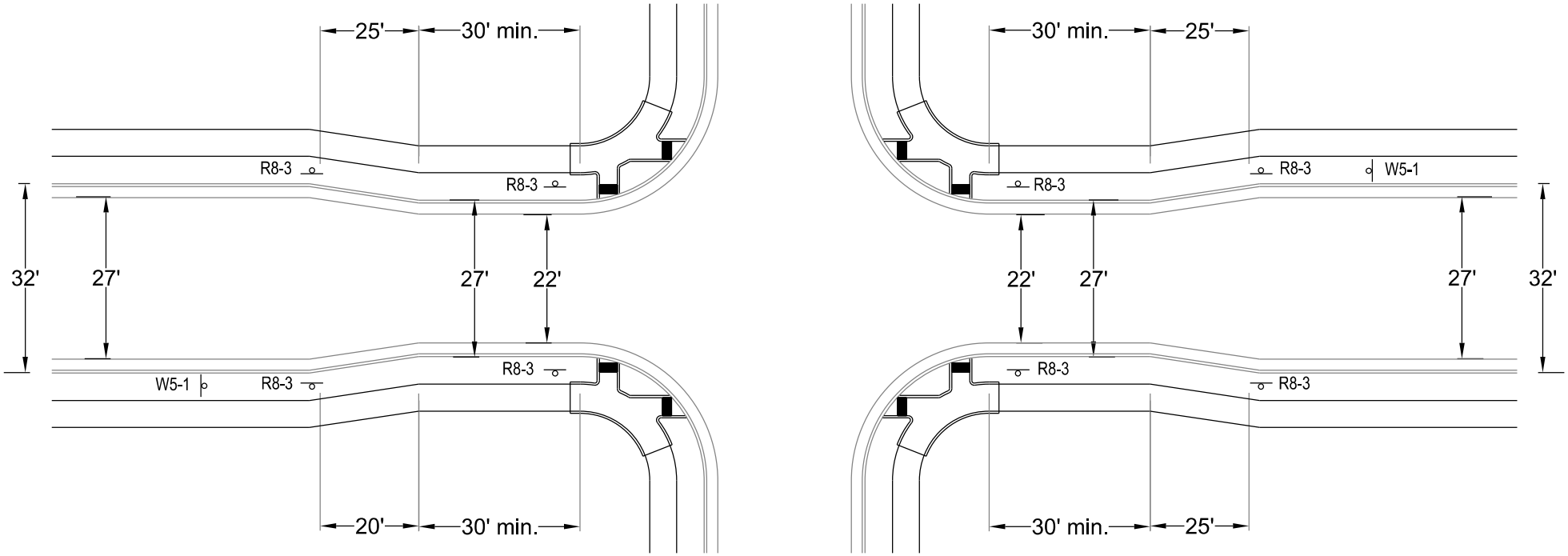
NOTE:

ALL VERTICAL MEASUREMENTS SHALL BE WITHIN A MAXIMUM OF 0.5" TOLERANCE, OTHERWISE, THE TOWN MAY REQUIRE REMOVAL/ REPLACEMENT.



SECTION A-A

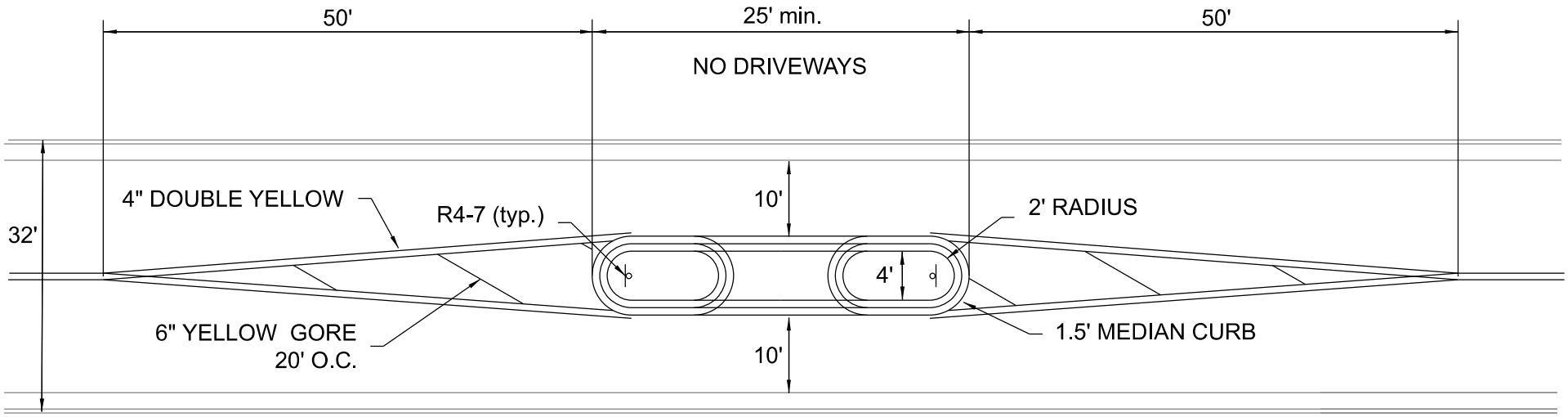
TOWN OF GARNER, N.C.	STANDARD PAVEMENT UNDULATION (FLAT TOP SPEED HUMP)	DESIGNED BY: TOG	REVISED FEB. 2022
		APPROVED BY: CSJ	STD. NO. T-5.05

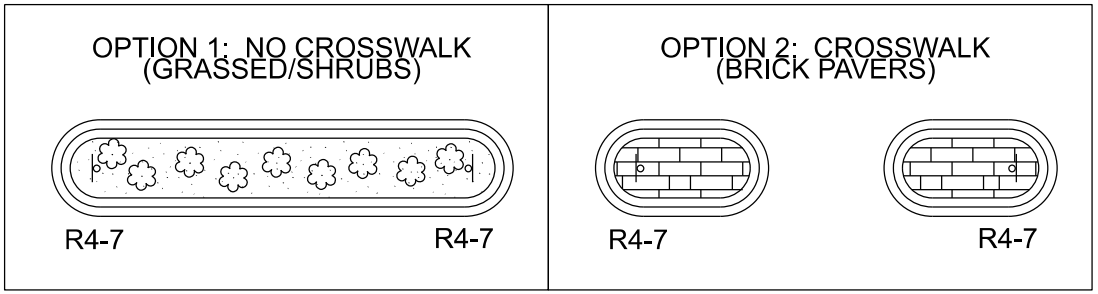


NOTES:

1. NO PARKING ALLOWED WITHIN THE TAPER AND NARROW LANE AREA.
2. W5-1 "ROAD NARROWS" TO BE INSTALLED 100' IN ADVANCE OF TAPER.
3. R8-3 "NO PARKING" TO BE INSTALLED ON BOTH SIDES OF STREET WITHIN NECKDOWN AND TAPER.
4. MAY BE USED TO REDUCE ENVIRONMENTAL IMPACTS OVER LONGER DISTANCES WHERE DRIVEWAYS ARE NOT PRESENT, INCLUDING STREAM OR WETLAND CROSSINGS.
5. DRIVEWAYS SHALL NOT BE LOCATED WITHIN THE LIMITS OF THE NECKDOWN DEVICE.

TOWN OF GARNER, N.C.	CURB EXTENSION (BULB-OUT) TRAFFIC CALMING DEVICE	DESIGNED BY: TOG	REVISED FEB. 2022
		APPROVED BY: CSJ	STD. NO. T-5.06





NOTES:

1. NOT FOR USE WITHIN 300' OF HORIZONTAL CURVES UNDER 300' RADIUS OR WITHIN 50' OF AN INTERSECTION.

2. PLACE R4-7 KEEP RIGHT SIGNS ON EACH END OF MEDIAN ISLAND.

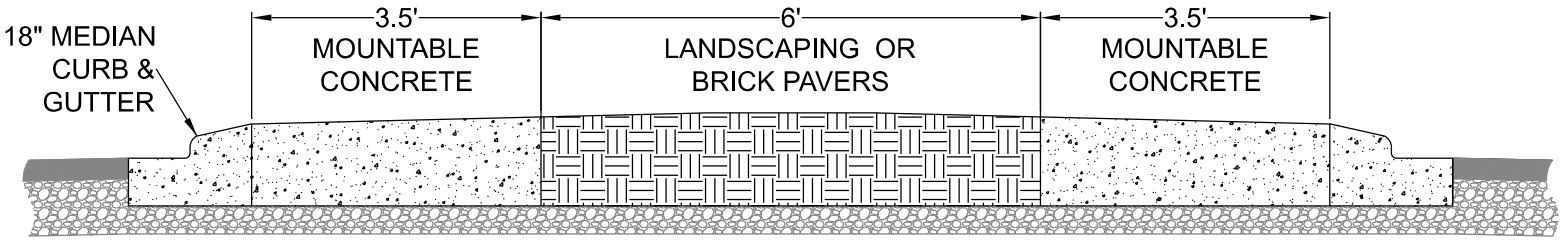
3. OPTIONAL: 10' BREAK (SHOWN ABOVE) FOR MID-BLOCK PEDESTRIAN CROSSING. MID-BLOCK CROSSINGS SHOULD BE MARKED WITH 24" THERMOPLASTIC HI-VISIBILTY BARS.

4. PLANTINGS MAY INCLUDE GRASS, FLOWERS, OR SHRUBS UNDER 30" MATURE HEIGHT IN OPTIONAL 2' PLANTING STRIP. MAINTENANCE OF ANY PLANTINGS IS THE RESPONSIBILTY OF THE HOA.

5. DRIVEWAYS SHALL NOT BE LOCATED WITHIN 25' OF THE MEDIAN.

TOWN OF GARNER, N.C.	MEDIAN ISLAND TRAFFIC CALMING DEVICE	DESIGNED BY: TOG	REVISED FEB. 2022
		APPROVED BY: CSJ	STD. NO. T-5.07

CROSS SECTION



NOTES:

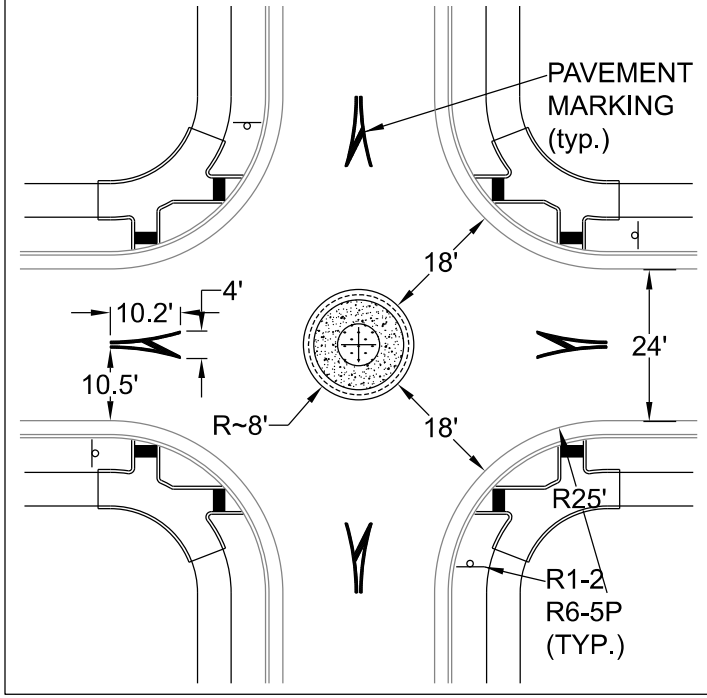
1. ROADWAY: MINIMUM STREET WIDTH IS 29' BACK-TO-BACK OR 24' EDGE-TO-EDGE; MAXIMUM CIRCULATING LANE WIDTH IS 18'; LANE WIDTH WILL VARY FOR SKEWED INTERSECTIONS AND INTERSECTIONS INVOLVING WIDER STREETS.

2. CENTER ISLAND TO BE HOA MAINTAINED; LARGE SHRUBS AND TREES ARE NOT PERMITTED. LANDSCAPING SUBJECT TO STAFF REVIEW AND APPROVAL.

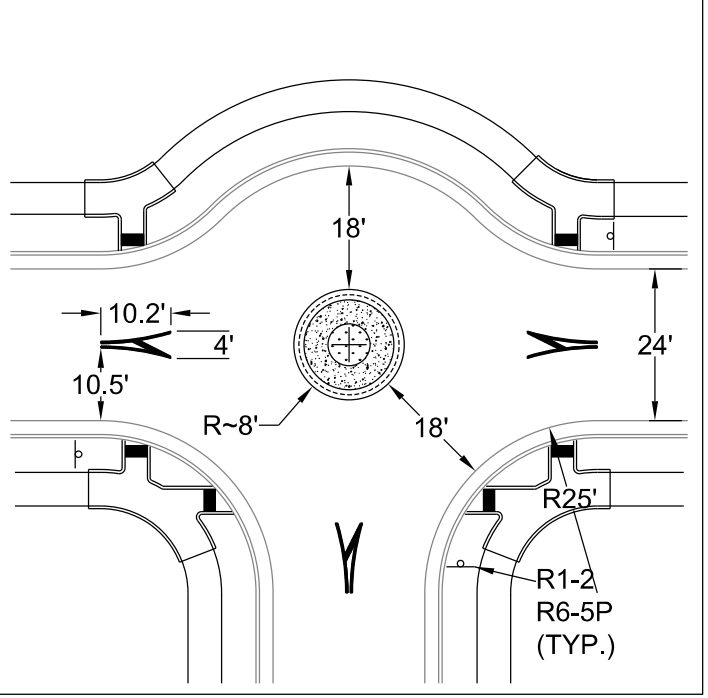
3. SIGNS: YIELD SIGN (R1-2) AND CIRCULAR INTERSECTION SIGN (R6-5P) ON EACH APPROACH AT CIRCLE.

4. PAVEMENT MARKING: PAINTED SPLITTER ISLANDS ARE 4" DOUBLE YELLOW WITH 8" ANGLE MARKING AT 2:1.

4-LEG PLAN VIEW



3-LEG PLAN VIEW

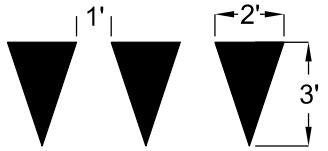


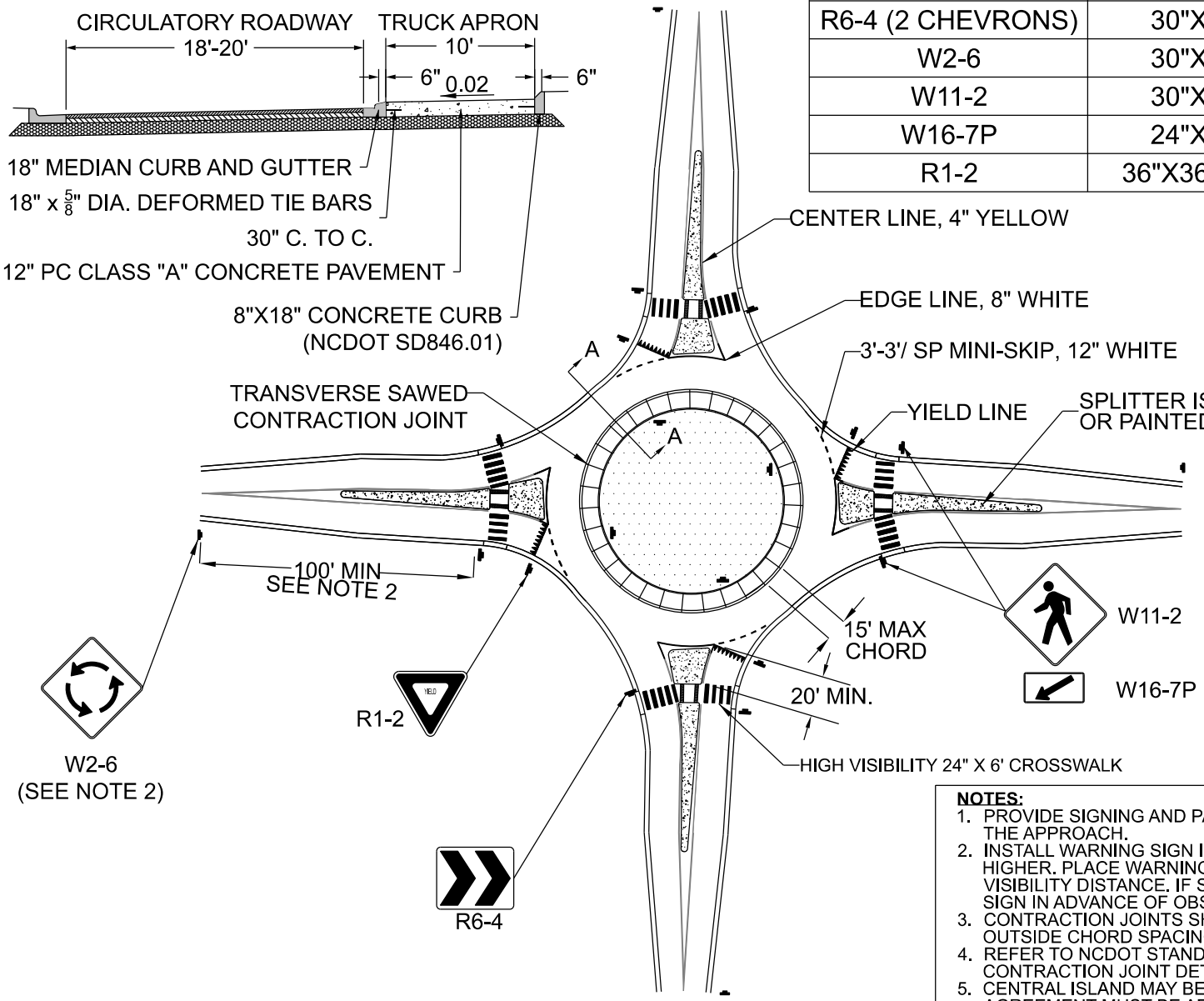
	NEIGHBORHOOD MINI-TRAFFIC CIRCLE	DESIGNED BY: TOG	REVISED FEB. 2022
	TOWN OF GARNER, N.C.	APPROVED BY: CSJ	STD. NO. T-5.08

SECTION A-A

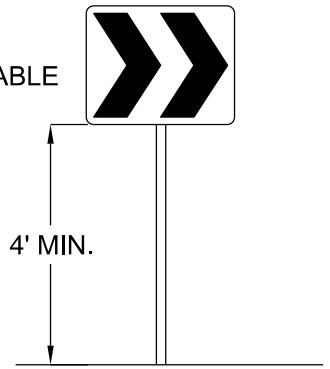
SIGN TYPE	SIGN SIZE
R6-4 (2 CHEVRONS)	30"X24"
W2-6	30"X30"
W11-2	30"X30"
W16-7P	24"X12"
R1-2	36"X36"X36"

YIELD LINE DETAIL





R6-4 DETAIL



NOTES:

1. PROVIDE SIGNING AND PAVEMENT MARKINGS ON EACH LEG OF THE APPROACH.
2. INSTALL WARNING SIGN IF POSTED SPEED LIMIT IS 40 MPH OR HIGHER. PLACE WARNING SIGN TO PROVIDE 180 FEET MINIMUM VISIBILITY DISTANCE. IF SIGN VISIBILITY IS OBSTRUCTED, PLACE SIGN IN ADVANCE OF OBSTRUCTION.
3. CONTRACTION JOINTS SHALL BE EQUALLY SPACED, WITH MAX OUTSIDE CHORD SPACING OF 15 FEET.
4. REFER TO NCDOT STANDARD DRAWINGS 700.01 FOR TRANSVERSE CONTRACTION JOINT DETAIL.
5. CENTRAL ISLAND MAY BE LANDSCAPED. A MAJOR ENCROACHMENT AGREEMENT MUST BE APPROVED BY TOWN OF GARNER AND VEGETATION MAINTAINED BY THE HOA.

TOWN OF GARNER, N.C.

SINGLE LANE ROUNDABOUT

DESIGNED BY:	REVISED
TOG	FEB. 2022
APPROVED BY:	STD. NO.
CSJ	T-5.09

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 TOWN ENGINEER
815.03	PIPE UNDERDRAIN AND BLIND DRAIN	
816.03	GEOCOMPOSITE SHOULDER 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
838.05	CONCRETE "L" ENDWALL FOR SINGLE PIPE CULVERTS 15" THRU 48" 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
838.15	BRICK "L" ENDWALL FOR SINGLE PIPE CULVERTS 15" THRU 48" PIPE	NOTE 1
838.21	REINFORCED CONCRETE ENDWALL FOR SINGLE 54" PIPE 90' SKEW	NOTE 1
838.22	REINFORCED CONCRETE ENDWALL FOR DOUBLE & TRIPLE 54" PIPE 90' SKEW	NOTE 1
838.27	REINFORCED CONCRETE ENDWALL FOR SINGLE 60" PIPE 90' SKEW	NOTE 1
838.28	REINFORCED CONCRETE ENDWALL FOR DOUBLE & TRIPLE 60" PIPE 90' SKEW	NOTE 1
838.33	REINFORCED CONCRETE ENDWALL FOR SINGLE 66" PIPE 90' SKEW	NOTE 1
838.34	REINFORCED CONCRETE ENDWALL FOR DOUBLE & TRIPLE 66" PIPE 90' SKEW	NOTE 1
838.39	REINFORCED CONCRETE ENDWALL FOR SINGLE 72" PIPE 90' SKEW	NOTE 1
838.40	REINFORCED CONCRETE ENDWALL FOR DOUBLE & TRIPLE 72" PIPE 90' SKEW	NOTE 1

NOTE 1: FOR ALL STRUCTURES - NCDOT REQUIRES CLASS B CONCRETE (2500PSI). THE TOWN REQUIRES 3600 PSI CONCRETE STRENGTH @ 28 DAYS. 3600 PSI CONCRETE SHALL BE USED IN ALL TOWN AND ETJ PROJECTS.

NCDOT STANDARDS APPROVED FOR USE IN THE TOWN OF GARNER

TOWN OF GARNER, N.C.

DRAWN BY: TOG

APPROVED BY: CSJ

REVISED FEB. 2022

STD. NO. SW-1.01.1

DWG	SHEET TITLE	SPECIAL REQUIREMENTS AND NOTES
838.45	NOTES FOR REINFORCED CONCRETE ENDWALL STANDARD DRAWINGS	NOTE 1
	838.21 THRU 838.40	NOTE 1
838.51	REINFORCED BRICK ENDWALL FOR SINGLE 54" PIPE 90' SKEW	NOTE 1
838.52	REINFORCED BRICK ENDWALL FOR DOUBLE & TRIPLE 54" PIPE 90'SKEW	NOTE 1
838.57	REINFORCED BRICK ENDWALL FOR SINGLE 60" PIPE 90' SKEW	NOTE 1
838.58	REINFORCED BRICK ENDWALL FOR DOUBLE & TRIPLE 60" PIPE 90' SKEW	NOTE 1
838.63	REINFORCED BRICK ENDWALL FOR SINGLE 66" PIPE 90' SKEW	NOTE 1
838.64	REINFORCED BRICK ENDWALL FOR DOUBLE & TRIPLE 66" PIPE 90' SKEW	NOTE 1
838.69	REINFORCED BRICK ENDWALL FOR SINGLE 72" PIPE 90' SKEW	NOTE 1
838.70	REINFORCED BRICK ENDWALL FOR DOUBLE & TRIPLE 72" PIPE 90' SKEW	NOTE 1
838.75	NOTES FOR REINFORCED BRICK ENDWALL STANDARD DRAWINGS 838.51 THRU 838.70	NOTE 1
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 TOWN 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 G4.20 & G4.21
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 G4.20 & G4.21
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 AREAS
840.22	FRAMES AND WIDE SLOT SAG GRATES	NOT FOR USE IN PEDESTRIAN 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	

NOTE 1: FOR ALL STRUCTURES - NCDOT REQUIRES CLASS B CONCRETE (2500PSI). THE TOWN REQUIRES 3600 PSI CONCRETE STRENGTH @ 28 DAYS. 3600 PSI CONCRETE SHALL BE USED IN ALL TOWN AND ETJ PROJECTS.

NCDOT STANDARDS APPROVED FOR USE IN THE TOWN OF GARNER

TOWN OF GARNER, N.C.

DRAWN BY: TOG	APPROVED BY: CSJ	REVISED FEB. 2022
		STD. NO. SW-1.01.2

DWG	SHEET TITLE	SPECIAL REQUIREMENTS AND NOTES
840.31	CONCRETE JUNCTION BOX (WITH OPTIONAL MANHOLE) 12" THRU 66" PIPE	NOTE 1; OPTIONAL MANHOLE IS REQUIRED
840.32	BRICK JUNCTION BOX 12" THRU 66" PIPE	NOTE 1; OPTIONAL MANHOLE IS REQUIRED
840.34	TRAFFIC BEARING JUNCTION BOX FOR USE WITH PIPES 42" AND UNDER	NOTE 1; OPTIONAL MANHOLE IS REQUIRED; AS MEASURED FROM BOTTOM OF TOP SLAB -- FOR JUNCTION BOX HEIGHT 0'-4'8" USE 8" THICK WALL, FROM 4'8" HEIGHT TO 10' HEIGHT, USE 12" THICK WALL. IF PROPOSED STRUCTURE EXCEEDS 12'-0" HEIGHT A SPECIAL DESIGN WILL BE REQUIRED
840.35	TRAFFIC BEARING DROP INLET FOR CAST IRON DOUBLE FRAME AND GRATES	
840.36	TRAFFIC BEARING DROP INLET FOR STEEL (840.37) DOUBLE FRAME AND GRATES	NOT FOR USE IN PEDESTRIAN AREAS
840.37	STEEL GRATE AND FRAME	NOT FOR USE IN PEDESTRIAN AREAS
840.41	SPRING BOX CONCRETE OR BRICK	
840.45	PRECAST DRAINAGE STRUCTURE (SOLID AND WAFFLE WALL)	OR MEDIANS. ALL OPENINGS SHALL BE PRE-CAST
840.46	TRAFFIC BEARING PRECAST DRAINAGE STRUCTURE	
840.51	BRICK MANHOLE 12" 36" PIPE	
840.52	PRECAST MANHOLE 4', 5' AND 6' DIAMETER 12" THRU 48" PIPE	IF USED AS A CATCH BASIN SUPPORTING NCDOT 840.03 FRAME, GRATE, AND HOOD - THE FLAT TOP SLAB ONLY ACCEPTABLE WHEN A 12" VERTICAL RISER CAN BE ACCOMMODATED ON TOP OF THE STRUCTURE (BETWEEN THE TOP OF FLAT TOP SLAB AND BOTTOM OF FRAME/GRATE)
840.53	PRECAST MANHOLE WITH MASONRY BASE 12" THRU 42" PIPE	IF USED AS A CATCH BASIN SUPPORTING NCDOT 840.03 FRAME, GRATE, AND HOOD - THE FLAT TOP SLAB ONLY ACCEPTABLE WHEN A 12" VERTICAL RISER CAN BE ACCOMMODATED ON TOP OF THE STRUCTURE (BETWEEN THE TOP OF FLAT TOP SLAB AND BOTTOM OF FRAME/GRATE)
840.54	MANHOLE FRAME AND COVER	ALL COVERS SHALL BE SUPPLIED WITH A MINIMUM OF TWO AND A MAXIMUM OF SIX 1-INCH DIAMETER VENT HOLES.
840.60	DRAINAGE STRUCTURE STEPS	
840.71	CONCRETE PAVED DITCHES	
840.72	PIPE COLLAR	
850.01	CONCRETE PAVED DITCHES	
852.05	MEDIAN CURB FOR CATCH BASIN (FOR USE WITH 1'-6" CURB AND GUTTER)	
852.06	METHOD OF PLACEMENT OF DROP INLETS IN CONCRETE ISLANDS	
876.01	RIP RAP IN CHANNELS	
876.03	DRAINAGE DITCHES WITH CLASS "A" RIP RAP	
876.04	DRAINAGE DITCHES WITH CLASS "B" RIP RAP	

NOTE 1: FOR ALL STRUCTURES - NCDOT REQUIRES CLASS B CONCRETE (2500PSI). THE CITY REQUIRES 3600 PSI CONCRETE STRENGTH @ 28 DAYS. 3600 PSI CONCRETE SHALL BE USED IN ALL CITY AND ETJ PROJECTS.

NCDOT STANDARDS APPROVED FOR USE IN THE TOWN OF GARNER

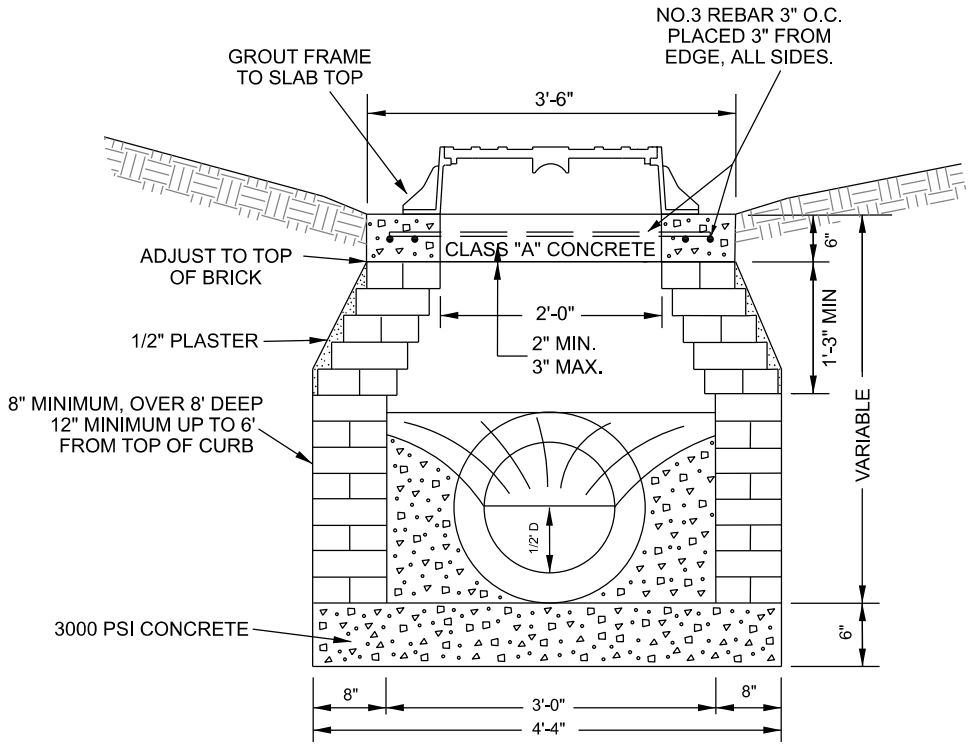
TOWN OF GARNER, N.C.

DRAWN BY: TOG

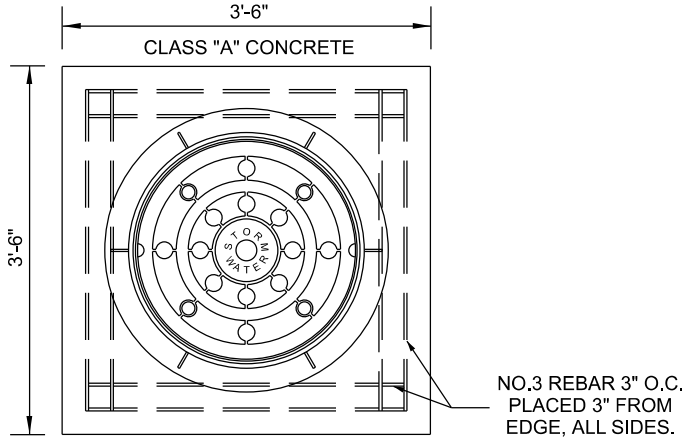
APPROVED BY: CSJ

REVISED FEB. 2022

STD. NO. SW-1.01.3

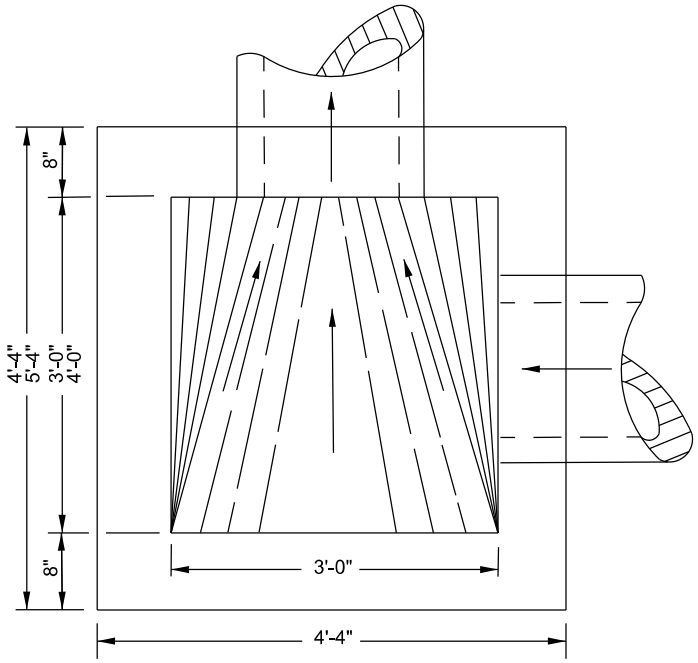


CONCRETE SLAB TOP



NOTES:

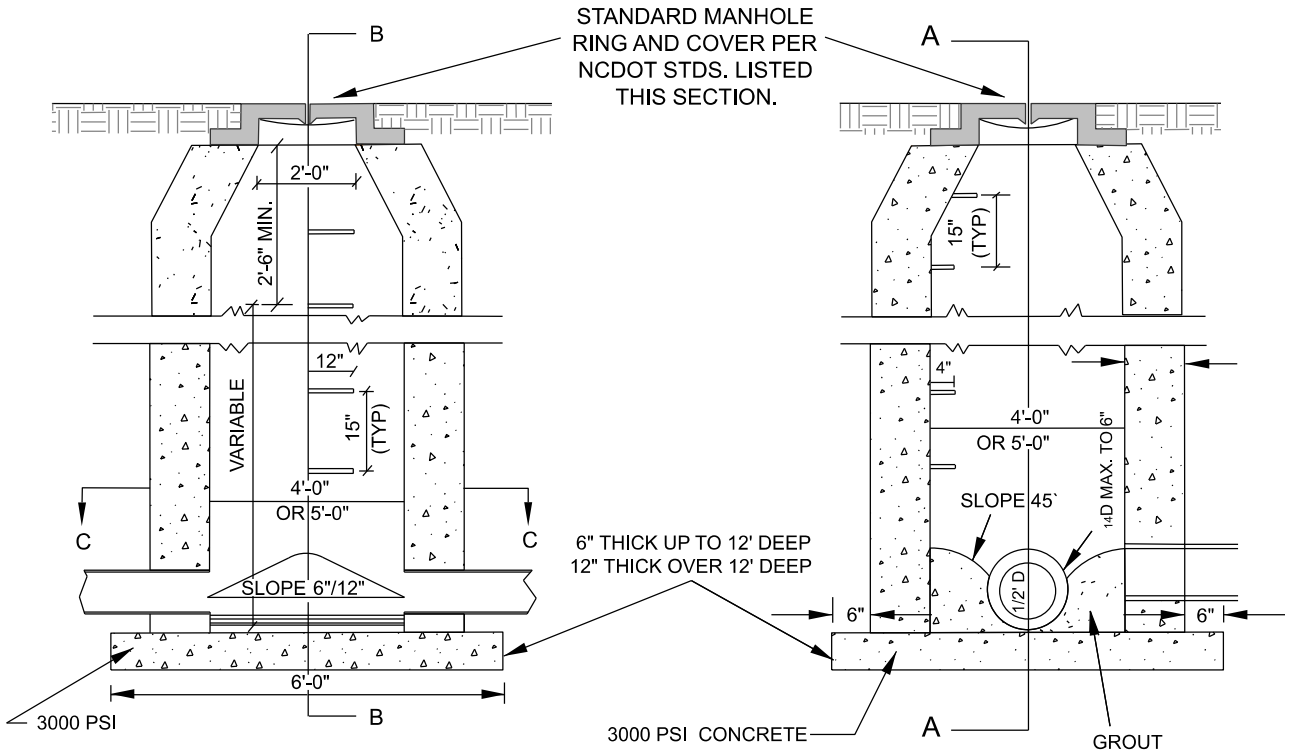
1. FOR 24" PIPE & LARGER USE PIPE DIAMETER PLUS 12" FOR MINIMUM INSIDE DIMENSION.
2. USE 4" X 4" X 8" OR 4" X 8" X 16" SOLID CONCRETE BLOCK. CAST IN PLACE OR PRECAST CONCRETE TO MEET NCDOT STANDARDS ACCEPTABLE.
3. STEPS SHALL BE INSTALLED IN JUNCTION BOXES OVER 3' IN DEPTH. DEPTH SHALL BE MEASURED FROM THE TOP OF GRATE TO THE INVERT OF THE JUNCTION BOX.



STANDARD JUNCTION BOX

TOWN OF GARNER, N.C.

DESIGNED BY:	REVISED
TOG	FEB. 2022
APPROVED BY:	STD. NO.
CSJ	SW-1.02

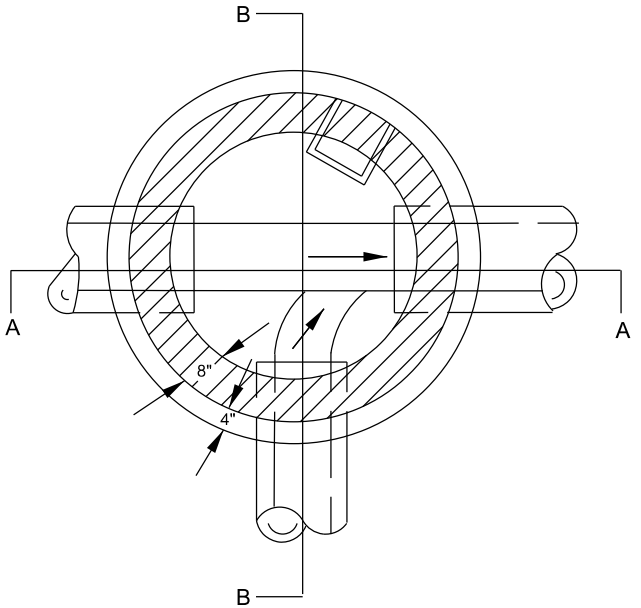


SECTION A-A

SECTION B-B

NOTES:

1. DEPTH MEASURED FROM TOP OF CASTING TO INVERT OF MANHOLE.
2. PRECAST MANHOLE COMPONENTS SHALL MEET ASTM-C-478 REQUIREMENTS.
3. DOMESTIC CASTINGS REQUIRED WITHIN STREET RIGHT-OF-WAY.



TYPE A
SECTION C-C

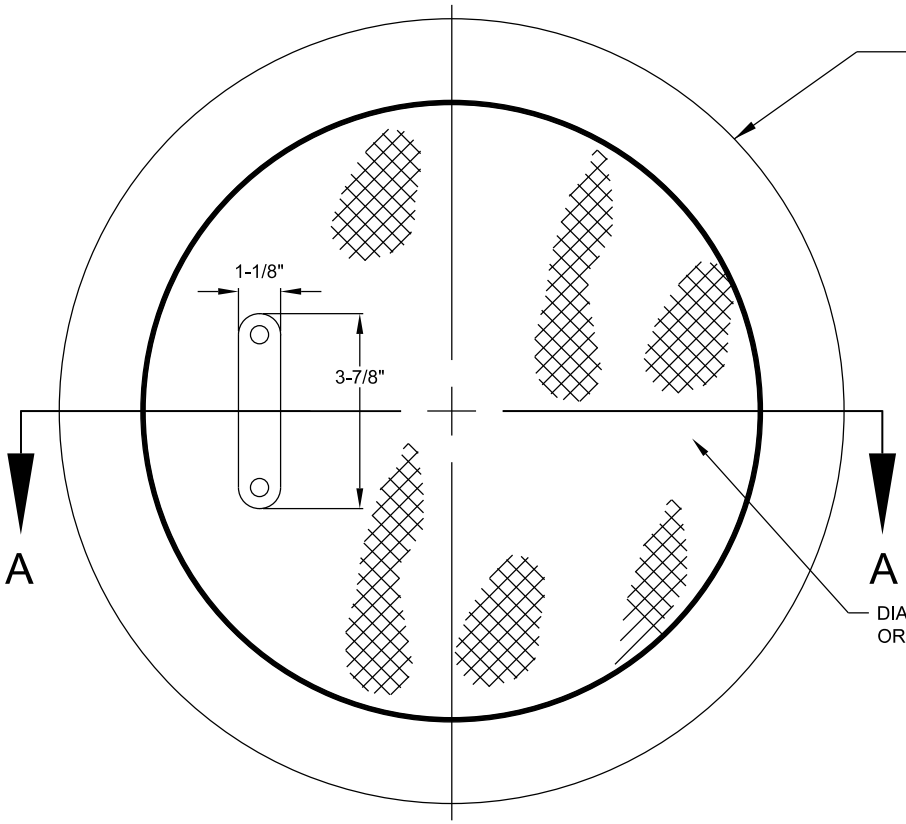
TYPICAL MH FOR STORM SEWER

PIPE SIZE	MH DIAMETER
12-24"	4'-0"
30-42"	5'-0"
48"	6'-0"
54"	8'-0"

TOWN OF GARNER, N.C.

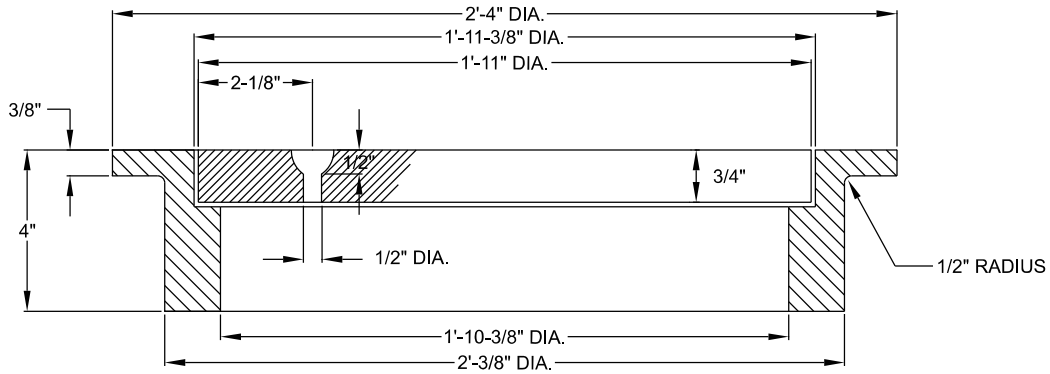
STANDARD CLASS "A" MANHOLE

DESIGNED BY:	REVISED
TOG	FEB. 2022
APPROVED BY:	STD. NO.
CSJ	SW-1.03



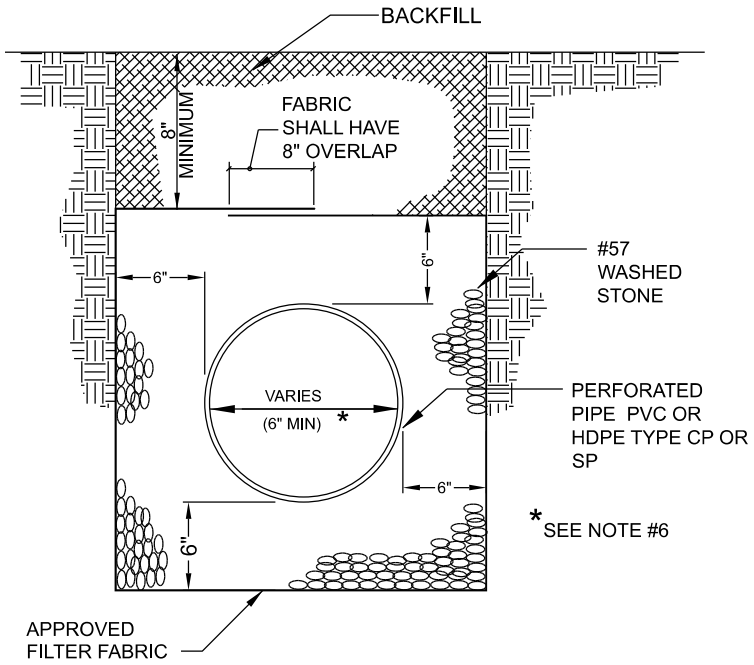
PLAN VIEW

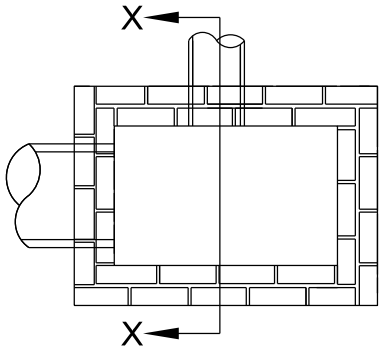
MINIMUM WEIGHT	
RING	96 LBS
COVER	86 LBS



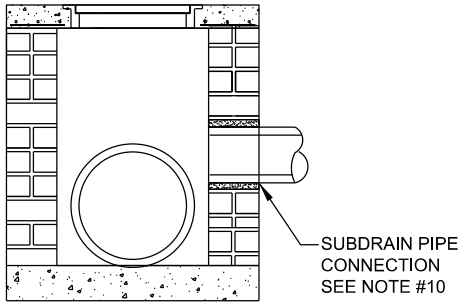
SECTION A-A

TOWN OF GARNER, N.C.	MANHOLE RING AND COVER FOR SLAB TYPE CATCH BASIN	DESIGNED BY: TOG	REVISED FEB. 2022
		APPROVED BY: CSJ	STD. NO. SW-1.04





PLAN VIEW



SECTION X-X

CONNECTION AT DRAINAGE STRUCTURE

NOTE: STRUCTURE SHOWN FOR REPRESENTATION PURPOSES ONLY.

NOTES:

1. A MINIMUM OF 6" FROM OUTSIDE DIAMETER OF PIPE TO SIDE OF TRENCH MUST BE ALLOWED FOR WASHED STONE. THE METHOD OF COMPACTING BACKFILL MATERIAL IS SUBJECT TO APPROVAL BY THE CITY ENGINEER. AN APPROVED FILTER FABRIC SHALL BE PLACED AROUND STONE AND OVERLAPPED 8" AT TOP WITHIN STREET RIGHT OF WAY.
2. SUBDRAIN IS TO BE A MINIMUM 6" DIAMETER PERFORATED PIPE; USE SCHEDULE 40 PVC PER ASTM D1785 OR HDPE PER AASHTO M252, TYPE CP (SINGLE-WALL, CORRUGATED) OR TYPE SP (DOUBLE-WALL, SMOOTH INTERIOR).
3. OUTLET PIPE FROM SUBDRAIN SHALL BE NON-PERFORATED UNDER PAVEMENT (INCLUDING SIDEWALKS AND DRIVEWAYS). SEE SITE PLAN FOR SLOPE OF SUBDRAIN AND TIE IN TO STORM DRAINAGE.
4. THE OUTLET PIPES SHALL BE SCHEDULE 40 (MIN.) PVC PER ASTM D2665 OR HDPE PER AASHTO M252, TYPE S (DOUBLE WALL, SMOOTH INTERIOR) UNDER ROADWAYS.
5. FILTER FABRIC SHALL BE AN APPROVED, TYPE 2 WATER PERMEABLE, SYNTHETIC FABRIC.
6. A MINIMUM 4" DIAMETER SUBDRAIN MAY BE USED IN PLANTING AREAS AS DESCRIBED IN THE CLDSM 4000 SERIES.
7. CLEAN-OUTS ARE RECOMMENDED AT ALL PIPE INTERSECTIONS AND AT A 100' MAXIMUM SEPARATION.
8. SUBDRAIN INVERTS AT CATCH BASINS SHOULD BE INSTALLED ABOVE THE BOTTOM TO AVOID SURCHARGE OF SUBDRAIN SYSTEM.
9. ALL SUBDRAINS WILL TIE INTO A STANDARD DRAINAGE STRUCTURE OR DAYLIGHT TO THE SURFACE WHERE APPROPRIATE, AND NOT DIRECTLY INTO A PIPE.
10. ONLY REMOVE NECESSARY MASONRY UNITS TO INSTALL PIPE INTO BASIN WALL. PRECAST STRUCTURES WILL BE CORE DRILLED 2 INCHES LARGER THAN PIPE DIAMETER TO PROVIDE FOR INSTALLATION OF PIPE IN WALL.
11. ALL PIPE IN STORM DRAIN STRUCTURE SHALL BE STRUCK EVEN WITH THE INSIDE WALL, GROUTED AND BRUSHED SMOOTH.
12. PIPE INSTALLATION PER SECTION 300 NCDOT STANDARD SPECIFICATIONS FOR ROADS AND STRUCTURES.
13. SUBDRAINS WILL BE INSTALLED AT A DRAINAGE STRUCTURE AND THIS CONNECTION WILL NEED TO BE INSPECTED BY CITY STAFF PRIOR TO BACKFILLING.
14. SCHEDULE 40 PVC (NON-PERFORATED) SHALL BE USED TO MAKE THE CONNECTION TO THE STORM DRAINAGE SYSTEM. CONNECTION WILL BE WITHIN THE RIGHT-OF-WAY UNLESS OTHERWISE APPROVED BY THE CITY ENGINEER.
15. PREFABRICATED DRAINAGE MAY BE USED WITH APPROVAL OF CITY ENGINEER
16. MAXIMUM OF TWO SUBDRAIN PENETRATIONS PER WALL OF DRAINAGE STRUCTURE.

TOWN OF GARNER, N.C.	SUBDRAIN DETAIL	DESIGNED BY: TOG	REVISED FEB. 2022
		APPROVED BY: CSJ	STD. NO. SW-1.05

1. THE PIPE SHALL BE CORRUGATED EXTERIOR/SMOOTH INTERIOR PIPE (TYPE S), CONFORMING TO THE REQUIREMENTS OF AASHTO SPECIFICATIONS M294 (LATEST EDITION) FOR CORRUGATED POLYETHYLENE PIPE.

2. BELL AND SPIGOT JOINTS SHALL BE REQUIRED ON ALL PIPE. BELLS SHALL COVER AT LEAST TWO FULL CORRUGATIONS ON EACH SECTION OF PIPE. THE BELL AND SPIGOT JOINT SHALL HAVE "O"-RING RUBBER GASKETS 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 HDPE PIPE INSTALLATION SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

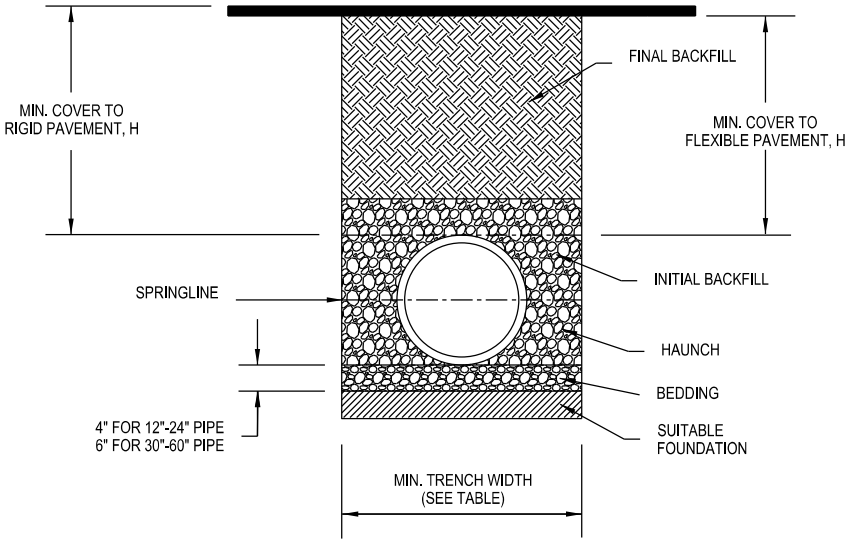
4. BACKFILL MATERIAL USED TO INSTALL HDPE PIPE SHALL BE SELECT MATERIAL, CLASS I-III, AS DEFINED BY ASTM D2321 (LATEST EDITION) OR AASHTO M145 GRANULAR MATERIALS):

   - A-1 AND A-3 AASHTO SOILS
   - A-2 AASHTO WITH THE EXCEPTION OF A-2-7
   - A-4 AND A-6 SOIL BASED ON GREATER THAN (>) 30% RETAINED ON THE NO. 200 SIEVE
   - UPON SUBMITTAL OF WRITTEN CERTIFICATION OF MATERIAL SUITABILITY BY A LICENSED GEOTECHNICAL ENGINEER, SELECT MATERIAL MAY BE USED. ALL BACKFILL SHALL BE APPROVED BY THE TOWN INSPECTOR PRIOR TO PLACEMENT.

5. NO HDPE END TREATMENTS ALLOWED. ALL END TREATMENTS SHOULD BE REINFORCED CONCRETE PIPE OR HEADWALLS. TRANSITIONS FROM HDPE TO CONCRETE PIPE SHALL BE MADE WITH THE APPROPRIATE ADAPTER.

6. MINIMUM BURY DEPTH OF 18" FROM THE OUTSIDE WILL OF THE PIPE AND MAXIMUM BURY DEPTH OF 20' UNLESS SPECIFIC APPROVAL IS OBTAINED FROM THE TOWN ENGINEER.

TOWN OF GARNER, N.C.	HDPE PIPE	DESIGNED BY: TOG	REVISED FEB. 2022
		APPROVED BY: CSJ	STD. NO. SW-2.01.1



RECOMMENDED MINIMUM TRENCH WIDTHS

PIPE DIAM.	MIN. TRENCH WIDTH
4" (100mm)	21" (533mm)
6" (150mm)	23" (584mm)
8" (200mm)	26" (660mm)
10" (250mm)	28" (711mm)
12" (300mm)	30" (762mm)
15" (375mm)	34" (864mm)
18" (450mm)	39" (991mm)
24" (600mm)	48" (1219mm)
30" (750mm)	56" (1422mm)
36" (900mm)	64" (1626mm)
42" (1050mm)	72" (1829mm)
48" (1200mm)	80" (2032mm)
60" (1500mm)	96" (2438mm)

MINIMUM RECOMMENDED COVER BASED ON VEHICLE LOADING CONDITIONS**

PIPE DIAM.	SURFACE LIVE LOADING CONDITION	
	H-25	HEAVY CONSTRUCTION (75T AXLE LAOD) *
12" - 48" (300mm - 1200mm)	12" (305mm)	48" (1219mm)
60" (1500mm)	24" (610mm)	60" (1524mm)

* VEHICLES IN EXCESS OF 75T MAY REQUIRE ADDITIONAL COVER
**SEE BACKFILL REQUIREMENTS IN NOTE 6.

MAXIMUM RECOMMENDED COVER BASED ON VECHICLE LOADING CONDITIONS

PIPE DIAM.	CLASS I		CLASS II		CLASS III
	COMPACTED	DUMPED	95%	90%	95%
4" (100mm)	37 (11.3m)	18 (5.5m)	25 (7.6m)	18 (5.5m)	18 (5.5m)
6" (150mm)	44 (13.4m)	20 (6.1m)	29 (8.8m)	20 (6.1m)	21 (6.4m)
8" (200mm)	32 (9.8m)	15 (4.6m)	22 (6.7m)	15 (4.6m)	16 (4.9m)
10" (250mm)	38 (11.6m)	18 (5.5m)	26 (7.9m)	18 (5.5m)	18 (5.5m)
12" (300mm)	35 (10.7m)	17 (5.2m)	24 (7.3m)	17 (5.2m)	17 (5.2m)
15" (375mm)	38 (11.6m)	17 (5.2m)	25 (7.6m)	17 (5.2m)	18 (5.5m)
18" (450mm)	36 (11.0m)	17 (5.2m)	24 (7.3m)	17 (5.2m)	17 (5.2m)
24" (600mm)	28 (8.5m)	13 (4.0m)	20 (6.1m)	13 (4.0m)	14 (4.3m)
30" (750mm)	28 (8.5m)	13 (4.0m)	20 (6.1m)	13 (4.0m)	14 (4.3m)
36" (900mm)	26 (7.9m)	12 (3.7m)	18 (5.5m)	13 (4.0m)	13 (4.0m)
42" (1050mm)	23 (7.0m)	11 (3.4m)	16 (4.9m)	11 (3.4m)	11 (3.4m)
48" (1200mm)	25 (7.6m)	11 (3.4m)	17 (5.2m)	11 (3.4m)	12 (3.7m)
60" (1500mm)	25 (7.6m)	11 (3.4m)	17 (5.2m)	11 (3.4m)	12 (3.7m)

FILL HEIGHT TABLE GENERATED USING AASHTO SECTION 12, LOAD RESISTANCE FACTOR DESIGN (LRFD) PROCEDURE WITH THE FOLLOWING ASSUMPTIONS:
NO HYDROSTATIC PRESSURE,
UNIT WEIGHT OF SOIL (Ys) = 120 PCF

NOTES:

1. ALL PIPE SYSTEMS SHALL BE INSTALLED IN ACCORDANCE WITH ASTM D2321, "STANDARD PRACTICE FOR UNDERGROUND INSTALLATION OF THERMOPLASTIC PIPE FOR SEWERS AND OTHER GRAVITY FLOW APPLICATIONS", LATEST ADDITION

2. MEASURES SHOULD BE TAKEN TO PREVENT MIGRATION OF NATIVE FINES INTO BACKFILL MATERIAL, WHEN REQUIRED.

3. FOUNDATION: WHERE THE TRENCH BOTTOM IS UNSTABLE, THE CONTRACTOR SHALL EXCAVATE TO A DEPTH REQUIRED BY THE ENGINEER AND REPLACE WITH SUITABLE MATERIAL AS SPECIFIED BY THE ENGINEER. AS AN ALTERNATIVE AND AT THE DISCRETION OF THE DESIGN ENGINEER, THE TRENCH BOTTOM MAY BE STABILIZED USING A GEOTEXTILE MATERIAL.

4. BEDDING: SUITABLE MATERIAL SHALL BE CLASS I, II OR III. THE CONTRACTOR SHALL PROVIDE DOCUMENTATION FOR MATERIAL SPECIFICATION TO ENGINEER. UNLESS OTHERWISE NOTED BY THE ENGINEER, MINIMUM BEDDING THICKNESS SHALL BE 4" (100mm) FOR 4"-24" (100mm-600mm); 6" (150mm) FOR 30"-60" (750mm-1500mm).

5. INITIAL BACKFILL: SUITABLE MATERIAL SHALL BE CLASS I, II OR III IN THE PIPE ZONE EXTENDING NOT LESS THAN 6" ABOVE CROWN OF PIPE. THE CONTRACTOR SHALL PROVIDE DOCUMENTATION FOR MATERIAL SPECIFICATION TO ENGINEER. MATERIAL SHALL BE INSTALLED AS REQUIRED IN ASTM D2321, LATEST EDITION.

6. MINIMUM COVER: MINIMUM COVER, H, IN NON-TRAFFIC APPLICATIONS (GRASS OR LANDSCAPE AREAS) IS 12" FROM THE TOP OF PIPE TO GROUND SURFACE. ADDITIONAL COVER MAY BE REQUIRED TO PREVENT FLOTATION. FOR TRAFFIC APPLICATIONS, MINIMUM COVER, H, IS 12" UP TO 48" DIAMETER PIPE AND 24" OF COVER FOR 60" DIAMETER PIPE, MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TO TOP OF RIGID PAVEMENT. FOR TRAFFIC APPLICATIONS WITH LESS THAN FOUR FEET OF COVER, EMBEDMENT OF THE PIPE SHALL BE USING ONLY A CLASS I OR CLASS II BACKFILL.

TRENCH INSTALLATION FOR HDPE (PER AASHTO)

TOWN OF GARNER, N.C.

DESIGNED BY: TOG

APPROVED BY: CSJ

REVISED FEB. 2022

STD. NO. SW-2.01.2

1. THE PIPE AND FITTINGS SHALL BE AN ANNULAR CORRUGATED WALL AND AN ESSENTIALLY SMOOTH INTERIOR WALL (DOUBLE WALL), OR AN ANNULAR CORRUGATED WALL AND AN ESSENTIALLY SMOOTH INTERIOR AND EXTERIOR WALL (TRIPLE WALL) CONFORMING TO THE REQUIREMENTS OF:

   - ASTM F2764 AND
   - AASHTO SPECIFICATIONS M330 (LATEST EDITION) FOR CORRUGATED POLYPROPYLENE PIPE.

2. BELL AND SPIGOT JOINTS SHALL BE REQUIRED ON ALL PIPE. BELLS SHALL COVER AT LEAST TWO FULL CORRUGATIONS ON EACH SECTION OF PIPE. THE BELL AND SPIGOT JOINT SHALL HAVE "O"-RING RUBBER GASKETS MEETING ASTM F477 WITH THE GASKET FACTORY INSTALLED, PLACED ON THE SPIGOT END OF THE PIPE. PIPE JOINTS SHALL MEET ALL REQUIREMENTS OF AASHTO M330.

3. ALL PP PIPE INSTALLATION SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.

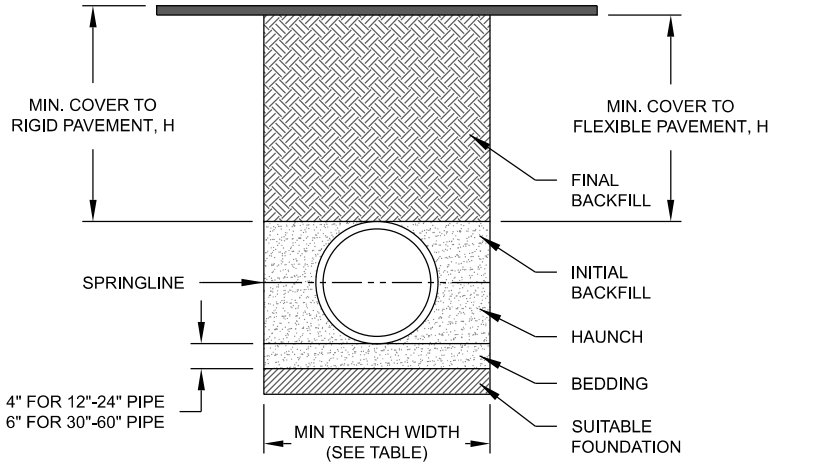
4. BACKFILL MATERIAL USED TO INSTALL PP PIPE SHALL BE SELECT MATERIAL, CLASS I-IV, AS DEFINED BY ASTM D2321 (LATEST EDITION) OR AASHTO M145 GRANULAR MATERIALS:

   - A-1 AND A-3 AASHTO SOILS (CLASS II)
   - A-2 AASHTO (CLASS III) WITH THE EXCEPTION OF A-2-7
   - A-4 AND A-6 SOIL BASED ON GREATER THAN (>) 30% RETAINED ON THE NO. 200 SIEVE (CLASS III)
   - A-2-7: A-4 AND A-6 SOIL BASED ON LESS THAN (<) 30% RETAINED ON THE NO. 200 SIEVE (CLASS IV)
   - UPON SUBMITTAL OF WRITTEN CERTIFICATION OF MATERIAL SUITABILITY BY A LICENSED GEOTECHNICAL ENGINEER, SELECT MATERIAL MAY BE USED. ALL BACKFILL SHALL BE APPROVED BY THE TOWN INSPECTOR PRIOR TO PLACEMENT.

5. NO PP END TREATMENTS ALLOWED. ALL END TREATMENTS SHOULD BE REINFORCED CONCRETE PIPE OR HEADWALLS. TRANSITIONS FROM PP TO CONCRETE PIPE SHALL BE MADE WITH THE APPROPRIATE ADAPTER.

6. MINIMUM BURY DEPTH OF 18" FROM THE OUTSIDE WALL OF THE PIPE AND MAXIMUM BURY DEPTH OF 25' UNLESS SPECIFIC APPROVAL IS OBTAINED FROM THE TOWN ENGINEER.

POLYPROPYLENE TRENCH INSTALLATION DETAIL



NOTES:

1. ALL PIPE SYSTEMS SHALL BE INSTALLED IN ACCORDANCE WITH ASTM D2321, "STANDARD PRACTICE FOR UNDERGROUND INSTALLATION OF THERMOPLASTIC PIPE FOR SEWERS AND OTHER GRAVITY FLOW APPLICATIONS", LATEST ADDITION, WITH THE EXCEPTION THAT THE INITIAL BACKFILL MAY EXTEND TO THE CROWN OF THE PIPE. SOIL CLASSIFICATIONS ARE PER THE LATEST VERSION OF ASTM D2321. CLASS IVB MATERIALS (MH, CH) AS DEFINED IN PREVIOUS VERSIONS OF ASTM D2321 ARE NOT APPROPRIATE BACKFILL MATERIALS.

2. MEASURES SHOULD BE TAKEN TO PREVENT MIGRATION OF NATIVE FINES INTO BACKFILL MATERIAL, WHEN REQUIRED.

3. FOUNDATION: WHERE THE TRENCH BOTTOM IS UNSTABLE, THE CONTRACTOR SHALL EXCAVATE TO A DEPTH REQUIRED BY THE ENGINEER AND REPLACE WITH SUITABLE MATERIAL AS SPECIFIED BY THE ENGINEER. AS AN ALTERNATIVE AND AT THE DISCRETION OF THE DESIGN ENGINEER, THE TRENCH BOTTOM MAY BE STABILIZED USING A GEOTEXTILE MATERIAL.

4. BEDDING: SUITABLE MATERIAL SHALL BE CLASS I, II, III, OR IV. THE CONTRACTOR SHALL PROVIDE DOCUMENTATION FOR MATERIAL SPECIFICATION TO ENGINEER. COMPACTION SHALL BE SPECIFIED BY THE ENGINEER IN ACCORDANCE WITH TABLE 3 FOR THE APPLICABLE FILL HEIGHTS LISTED. UNLESS OTHERWISE NOTED BY THE ENGINEER, MINIMUM BEDDING THICKNESS SHALL BE 4" (100mm) FOR 12"-24" (300mm-600mm) DIAMETER PIPE; 6" (150mm) FOR 30"-60" (750mm-1500mm) DIAMETER PIPE. THE MIDDLE 1/3 BENEATH THE PIPE INVERT SHALL BE LOOSELY PLACED. PLEASE NOTE, CLASS IV MATERIAL HAS LIMITED APPLICATION AND CAN BE DIFFICULT TO PLACE AND COMPACT; USE ONLY WITH THE APPROVAL OF A SOIL EXPERT.

5. INITIAL BACKFILL: SUITABLE MATERIAL SHALL BE CLASS I, II, III, OR IV IN THE PIPE ZONE EXTENDING TO THE CROWN OF THE PIPE. THE CONTRACTOR SHALL PROVIDE DOCUMENTATION FOR MATERIAL SPECIFICATION TO ENGINEER. MATERIAL SHALL BE INSTALLED AS REQUIRED IN ASTM D2321, LATEST EDITION. COMPACTION SHALL BE SPECIFIED BY THE ENGINEER IN ACCORDANCE WITH TABLE 3 FOR THE APPLICABLE FILL HEIGHTS LISTED. PLEASE NOTE, CLASS IV MATERIAL HAS LIMITED APPLICATION AND CAN BE DIFFICULT TO PLACE AND COMPACT; USE ONLY WITH THE APPROVAL OF A SOIL EXPERT.

6. MINIMUM COVER: MINIMUM COVER, H, IN NON-TRAFFIC APPLICATIONS (GRASS OR LANDSCAPE AREAS) IS 12" (300mm) FROM THE TOP OF PIPE TO GROUND SURFACE. ADDITIONAL COVER MAY BE REQUIRED TO PREVENT FLOTATION. FOR TRAFFIC APPLICATIONS; CLASS I OR II MATERIAL COMPACTED TO 90% SPD AND CLASS III COMPACTED TO 95% SPD IS REQUIRED. FOR TRAFFIC APPLICATIONS, MINIMUM COVER, H, IS 12" (300mm) UP TO 48" (1200mm) DIAMETER PIPE AND 24" (600mm) OF COVER FOR 60" (1500mm) DIAMETER PIPE, MEASURED FROM TOP OF PIPE TO BOTTOM OF FLEXIBLE PAVEMENT OR TO TOP OF RIGID PAVEMENT.

7. FOR ADDITIONAL INFORMATION SEE PRODUCT MANUFACTURERS TECHNICAL GUIDANCE.

TABLE 1, RECOMMENDED MINIMUM TRENCH WIDTHS

PIPE DIAM.	MIN. TRENCH WIDTH
12" (300mm)	30" (762mm)
15" (375mm)	34" (864mm)
18" (450mm)	39" (991mm)
24" (600mm)	48" (1219mm)
30" (750mm)	56" (1422mm)
36" (900mm)	64" (1626mm)
42" (1050mm)	72" (1829mm)
48" (1200mm)	80" (2032mm)
60" (1500mm)	96" (2438mm)

TABLE 2, MINIMUM RECOMMENDED COVER BASED ON VEHICLE LOADING CONDITIONS

	SURFACE LIVE LOADING CONDITION	
PIPE DIAM.	H-25	HEAVY CONSTRUCTION (75T AXLE LOAD) *
12" - 48" (300mm - 1200mm)	12" (305mm)	48" (1219mm)
60" (1500mm)	24" (610mm)	60" (1524mm)

* VEHICLES IN EXCESS OF 75T MAY REQUIRE ADDITIONAL COVER

TABLE 3, MAXIMUM COVER FOR ADS HP STORM PIPE, ft

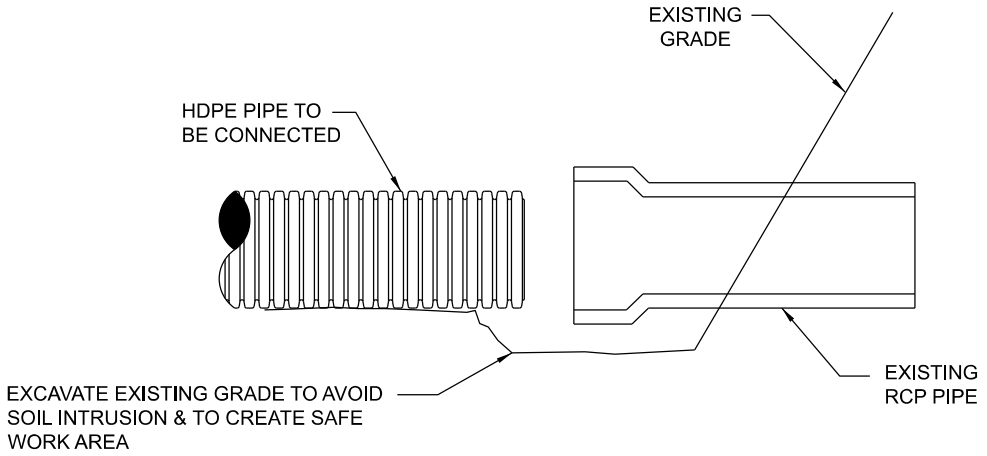
	CLASS I	CLASS II			CLASS III		CLASS IV
PIPE DIA	COMPACTED	95%	90%	85%	95%	90%	95%
12" (300mm)	41 (12.5m)	28 (8.5m)	21 (6.4m)	16 (4.9m)	20 (6.1m)	16 (4.9m)	16 (4.9m)
15" (375mm)	42 (12.8m)	29 (8.8m)	21 (6.4m)	16 (4.9m)	21 (6.4m)	16 (4.9m)	16 (4.9m)
18" (450mm)	44 (13.4m)	30 (9.1m)	21 (6.4m)	16 (4.9m)	22 (6.7m)	17 (5.2m)	16 (4.9m)
24" (600mm)	37 (11.3m)	26 (7.9m)	18 (5.5m)	14 (4.3m)	19 (5.8m)	14 (4.3m)	14 (4.3m)
30" (750mm)	39 (11.9m)	27 (8.2m)	19 (5.8m)	14 (4.3m)	19 (5.8m)	15 (4.6m)	14 (4.3m)
36" (900mm)	28 (8.5m)	20 (6.1m)	14 (4.3m)	10 (3.0m)	14 (4.3m)	11 (3.4m)	10 (3.0m)
42" (1050mm)	30 (9.1m)	21 (6.4m)	14 (4.3m)	10 (3.0m)	15 (4.6m)	11 (3.4m)	10 (3.0m)
48" (1200mm)	29 (8.8m)	20 (6.1m)	14 (4.3m)	9 (2.7m)	14 (4.3m)	10 (3.0m)	10 (3.0m)
60" (1500mm)	29 (8.8m)	20 (6.1m)	14 (4.3m)	9 (2.7m)	14 (4.3m)	10 (3.0m)	9 (2.7m)

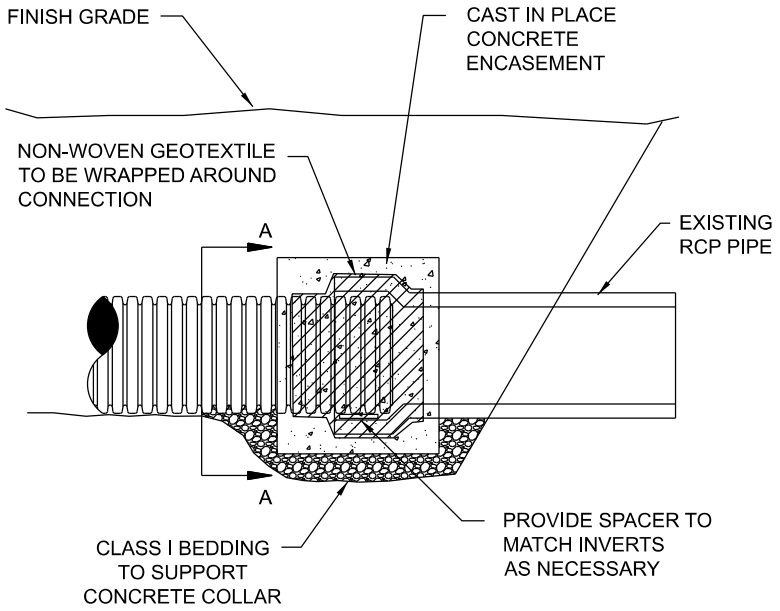
FILL HEIGHT TABLE GENERATED USING AASHTO SECTION 12, LOAD RESISTANCE FACTOR DESIGN (LRFD) PROCEDURE WITH THE FOLLOWING ASSUMPTIONS:
NO HYDROSTATIC PRESSURE
UNIT WEIGHT OF SOIL (γs) = 120 PCF

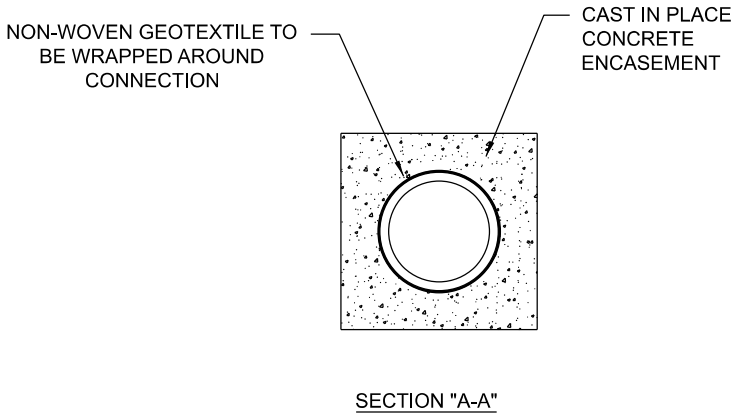
TOWN OF GARNER, N.C.	TRENCH INSTALLATION FOR POLYPROPYLENE	DESIGNED BY: TOG	REVISED FEB. 2022
		APPROVED BY: CSJ	STD. NO. SW-2.02.2

NOTES:

1. CONNECTION AND PIPE TO BE BACKFILLED PER ASTM D2321, LATEST EDITION.
2. IN LIEU OF AN INTERNAL CYLINDER, AN HDPE WATERTIGHT REPAIR COUPLER CAN BE USED.
3. INTERNAL CYLINDER ADAPTER IS NOT RECOMMENDED FOR DOWNSTREAM CONNECTIONS.

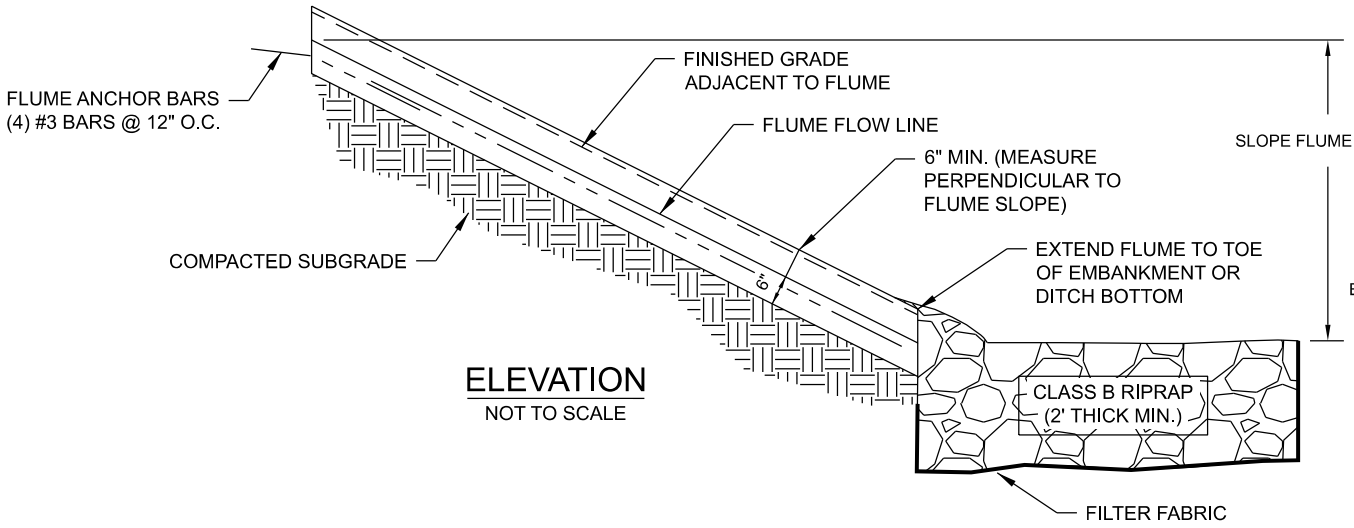




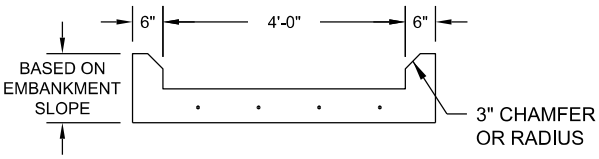


SECTION "A-A"

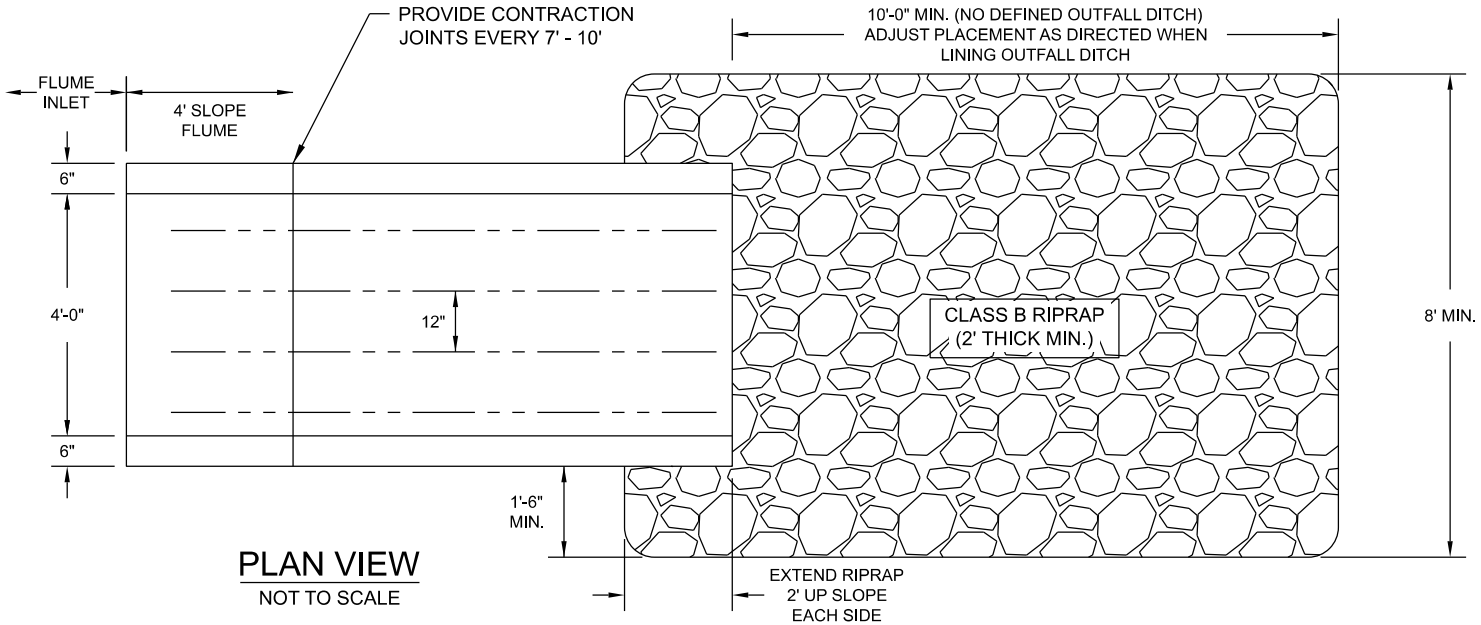
DISSIMILAR PIPE CONNECTIONS TO RCP	DESIGNED BY: TOG	REVISED FEB. 2022
TOWN OF GARNER, N.C.	APPROVED BY: CSJ	STD. NO. SW-2.03



ELEVATION
NOT TO SCALE



SECTION
NOT TO SCALE



PLAN VIEW
NOT TO SCALE

TOWN OF GARNER, N.C.

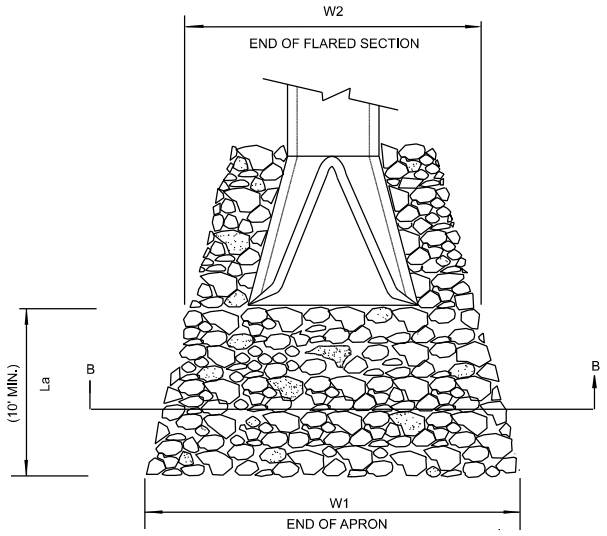
CONCRETE DRAINAGE FLUME

DESIGNED BY:	REVISED
TOG	FEB. 2022
APPROVED BY:	STD. NO.
CSJ	SW-3.01

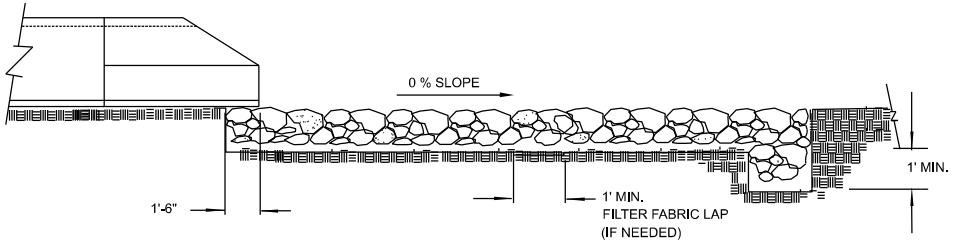
NOTES:

1. CLASS OR MEDIAN SIZE OF RIPRAP AND LENGTH, WIDTH AND DEPTH OF APRON TO BE DESIGNED BY THE ENGINEER.
2. REFER TO THE NC DEQ STORM WATER DESIGN MANUAL FOR RIPRAP APRON DESIGN STANDARDS.
3. RIPRAP SHOULD EXTEND UP BOTH SIDES OF THE APRON AND AROUND THE END OF THE PIPE OR CULVERT AT THE DISCHARGE OUTLET AT A MAXIMUM SLOPE OF 2:1 AND A HEIGHT NOT LESS THAN TWO THIRDS THE PIPE DIAMETER OR CULVERT HEIGHT.
4. THERE SHALL BE NO OVERFLOW FROM THE END OF THE APRON TO THE SURFACE OF THE RECEIVING CHANNEL. THE AREA TO BE PAVED OR RIPRAPPED SHALL BE UNDERCUT SO THAT THE INVERT OF THE APRON SHALL BE AT THE SAME GRADE (FLUSH) WITH THE SURFACE OF THE RECEIVING CHANNEL. THE APRON SHALL HAVE A CUTOFF OR TOE WALL AT THE DOWNSTREAM END.
5. THE WIDTH OF THE END OF THE APRON SHALL BE EQUAL TO THE BOTTOM WIDTH OF THE RECEIVING CHANNEL. MAXIMUM TAPER TO RECEIVING CHANNEL 5:1.
6. ALL SUBGRADE FOR STRUCTURE TO BE COMPACTED TO 95% OR GREATER.
7. THE PLACING OF FILL, EITHER LOOSE OR COMPACTED IN THE RECEIVING CHANNEL SHALL NOT BE ALLOWED.
8. NO BENDS OR CURVES IN THE HORIZONTAL ALIGNMENT OF THE APRON WILL BE PERMITTED.
9. FILTER FABRIC SHALL BE INSTALLED ON COMPACTED SUBGRADE PRIOR TO PLACEMENT OF RIP RAP.
10. ANY DISTURBED AREA FROM END OF APRON TO RECEIVING CHANNEL MUST BE STABILIZED.

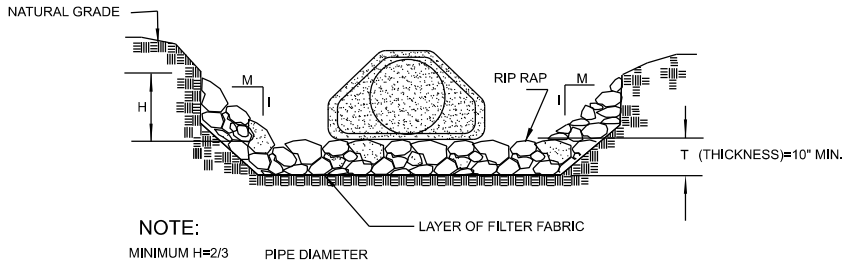
USE USDA NOMOGRAPH FROM NC SEDIMENT AND EROSION CONTROL MANUAL FOR DESIGN DATA.



PLAN

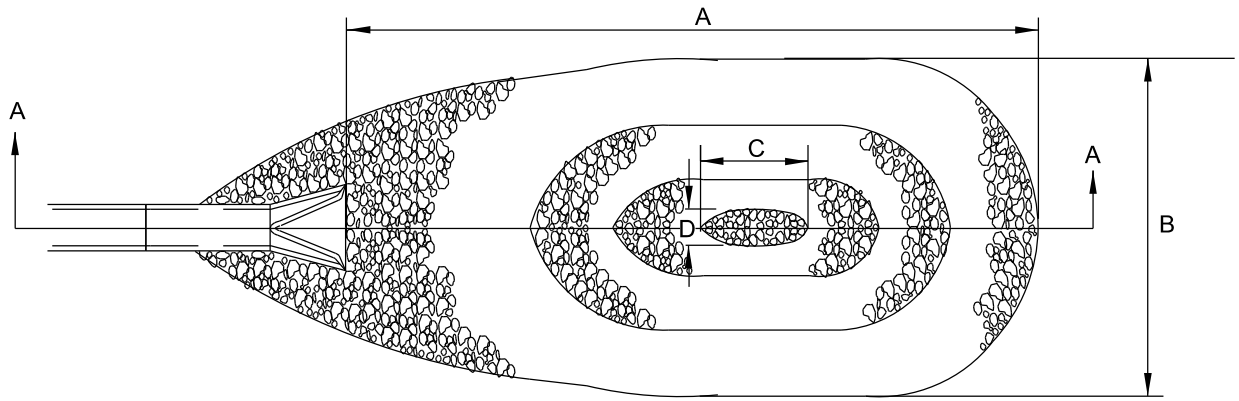


ELEVATION

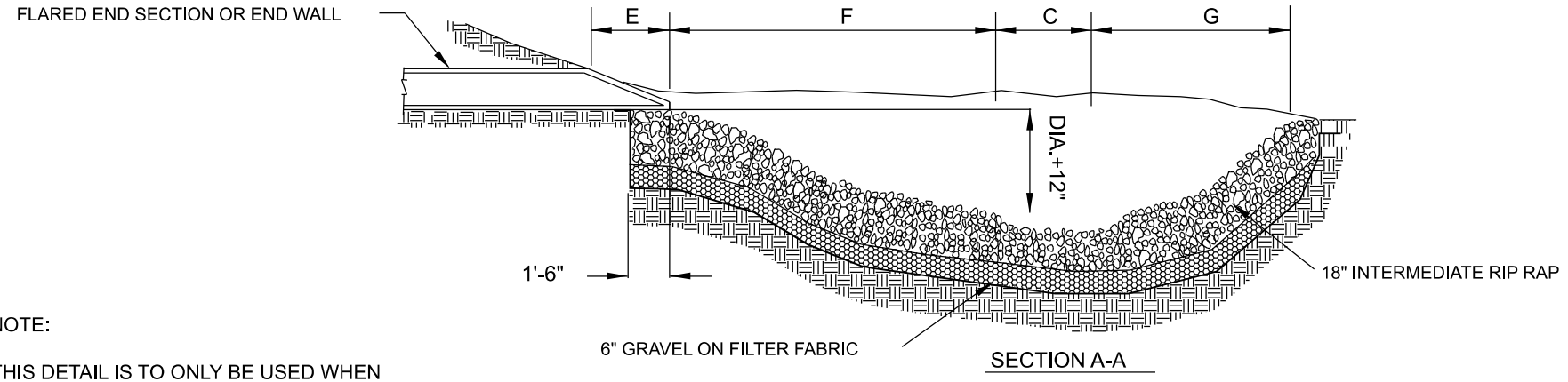


SECTION B-B

RIPRAP APRON AT PIPE OUTFALLS	DESIGNED BY: TOG	REVISED FEB. 2022
TOWN OF GARNER, N.C.	APPROVED BY: CSJ	STD. NO. SW-3.02



PLAN



SECTION A-A

NOTE:

THIS DETAIL IS TO ONLY BE USED WHEN OUTFALL HAS A CONTINUOUS FLOW OF WATER AND WITH PRIOR APPROVAL OF THE TOWN ENGINEER.

PIPE SIZE	A	B	C	D	E	F	G	WT. RIP RAP IN TONS
15"	10'	7'	1 1/2'	1'	1'	4 1/2'	3'	6
18"	12'	8'	2'	1'	1'	5'	4'	8
21"	15'	9'	2 1/2'	1 1/2'	1'	7'	4 1/2'	12
24"	17'	10'	2 1/2'	1 1/2'	1'	8'	5 1/2'	15
30"	20'	13'	3'	2'	2'	9'	6'	22
36"	24'	16'	3 1/2'	2'	2'	9 1/2'	7'	33

NOT TO SCALE

RIPRAP PLUNGE POOL

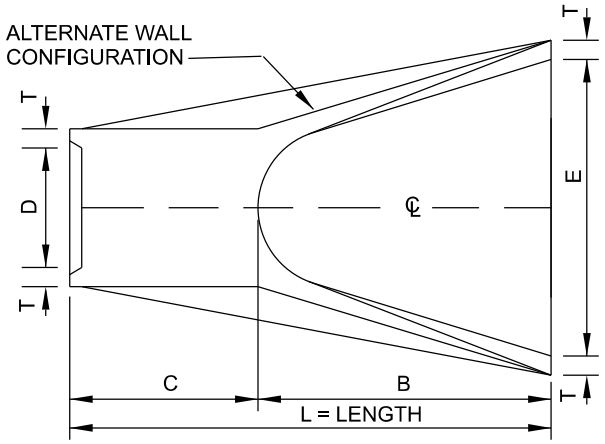
DESIGNED BY: TOG

REVISED FEB. 2022

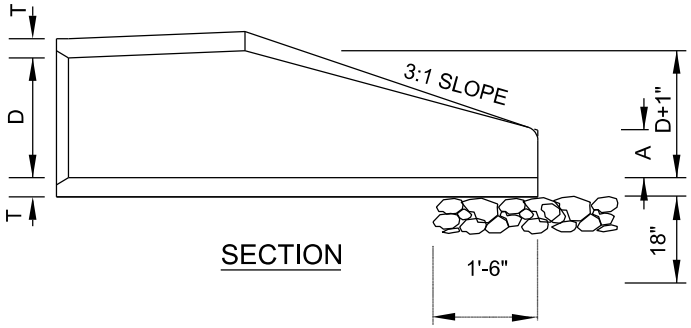
TOWN OF GARNER, N.C.

APPROVED BY: CSJ

STD. NO. SW-3.03

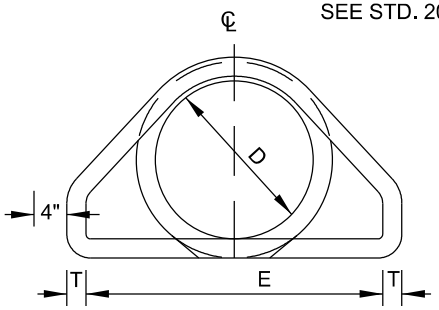


PLAN



SECTION

SEE STD. 20.23 AND 20.24



END VIEW

TABLE OF DIMENSIONS							
D	T	A	B	C	E	L	WT.
12"	2-1/4"	4"	2'-0"	4'-1"	2'-0"	6'-1"	730
15"	2-1/4"	6"	2'-3"	3'-10"	2'-0"	6'-1"	730
18"	2-1/2"	9"	2'-3"	3'-10"	3'-0"	6'-1"	1190
24"	3"	10"	3'-8"	2'-6"	4'-0"	6'-2"	1770
30"	3-1/2"	1'-0"	4'-6"	1'-8"	5'-0"	6'-2"	2380
36"	4"	1'-3"	5'-3"	2'-11"	6'-0"	8'-2"	5320
42"	4-1/2"	1'-9"	5'-3"	2'-11"	6'-6"	8'-2"	5920
48"	5"	2'-0"	6'-0"	2'-2"	7'-0"	8'-2"	7470
54"	5-1/2"	2'-3"	5'-6"	2'-10"	7'-6"	8'-4"	8810
60"	6"	2'-6"	5'-0"	3'-3"	8'-0"	8'-3"	11180
66"	6-1/2"	3'-0"	6'-0"	2'-3"	8'-6"	8'-3"	12530
72"	7"	3'-0"	6'-6"	1'-9"	9'-0"	8'-3"	13980

NOTES:

1. SEE FORMER NCDOT STANDARD 310.01 FOR DETAILS.
2. REINFORCEMENT SHALL CONFORM TO THE REQUIREMENTS OF REINFORCED CONCRETE PIPE OF LIKE DIAMETER PER AASHTO M170, TABLE 2, WALL B.
3. ALL CONCRETE TO BE 3600 PSI COMPRESSIVE STRENGTH.
4. PROVIDE TONGUE OR SPIGOT JOINT AT INLET END SECTION.
5. PROVIDE GROOVE OR BELL JOINT AT OUTLET END SECTION.
6. THE DIMENSIONS FOR END SECTIONS SHALL SUBSTANTIALLY AGREE WITH THE TABLE. MINOR VARIATIONS WILL BE PERMITTED BASED ON THE MANUFACTURER'S STANDARD FORMS AND TEMPLATES.
7. NOT TO BE USED IN NCDOT MAINTAINED RIGHT OF WAY.

NOT TO SCALE

FLARED END SECTION (12" THRU 72" PIPE)

TOWN OF GARNER, N.C.

DESIGNED BY: TOG

APPROVED BY: CSJ

REVISED FEB. 2022

STD. NO. SW-3.04

STORM DRAIN POLICY

1.0 POLICY PURPOSE

This policy has been formulated to provide proper and suitable guidelines as to a procedure for dealing with storm water drainage within the Town of Garner.

2.0 COVERAGE

This policy upon adoption by the Board of Aldermen, shall apply to existing and proposed storm drainage systems including, but not limited to, drainage pipe, head walls, stream beds and banks, until such time that the policy statement is altered, modified or rescinded by the Board.

3.0 POLICY

The Town policy is to assure the equitable and consistent maintenance of storm drainage structures, streams, or easements lying only within the Town of Garner right-of-way or traversing Town owned property. The property owner has the sole responsibility for off-street drainage easements traversing his property except as provided in the Section entitled PROCEDURES AND GUIDELINES.

4.0 PROCEDURES AND GUIDELINES

4.1 The Town of Garner will not maintain or correct any storm drainage or permanent drainage facilities unless it lies within the Town right-of-way or on Town owned property, or as set forth below.

4.2 If, in the opinion of the Town Engineer, there exists a problem on private property which is presenting a danger to the life or health of the neighborhood public, upon a property owner's request or upon an independent investigation by the Engineering Department, the Town Engineer shall make a recommendation to the Town Manager.

4.3 If there exists a drainage problem which is causing periodic flooding of the finished floor of a principal structure (house, business office, etc.) due to an inadequate street storm drainage system, the Town may upgrade the street storm drainage system to alleviate the flooding problem. Flooding would be considered periodic if the finished floor would flood during storm events of lesser magnitude than the theoretical fifty (50) year return frequency storm. Any upgrade to the street drainage system would be designed to accommodate the peak runoff from the fifty (50) year storm without causing finished floor flooding. Flooding of garages, outbuildings, crawl spaces, or yards does not qualify as finished floor flooding.

4.4 If there exists a drainage problem which involves frequent flooding of Town maintained streets due to an inadequate street drainage system the Town may upgrade the street storm drainage system to alleviate the flooding problem. Flooding would be considered frequent if the street would be flooded during storm events of lesser magnitude than the theoretical five (5) year return frequency storm. Any associated upgrades to the street drainage system would be designed to accommodate the peak runoff from the five (5) year storm. The Town may elect not to address the drainage problem if the street flooding does not result in significant inconvenience to the motoring public or does not cause significant safety concerns to the area residents.

4.5 Erosion of public or private property that is directly caused by street drainage systems may be stabilized by the Town. Such stabilization would be undertaken only in the area immediately upstream of the storm drain inlet and/or immediately downstream of the storm drain outlet. Erosion of stream banks in areas not immediately adjacent to storm drains is not eligible for stabilization by the Town.

4.6 In such situations where there is an emergency, the Town Manager has full authority to make a final decision as to how to proceed with the drainage problem. Emergency actions taken will be reported to the Public Works Committee as soon as feasible. When the Town Manager concludes that action would contravene or extend this policy, he shall seek the advice and concurrence of the Public Works Committee.

4.7 When, as determined by the Town Engineer, the Town has directly been the sole cause of a new downstream or upstream drainage problem, the Town will correct the problem at no cost to the property owner. However, if it is determined that the problem was caused by a property owner, the Town will not be responsible for the cost involved.

4.8 If the Public Works Committee deems it necessary for the Town of Garner to correct a problem on private property, the property owner(s) will be responsible for moving or removing all structures (i.e., fences, sheds) from the drainage easement from which the work is to be performed at no cost to the Town. In addition, the property owner will provide reasonable access to area to be repaired along with drainage and construction easements at no cost to the Town.

4.9 The Town of Garner will not install and/or maintain driveway culverts on public or private property.

EXHIBIT A:

TOWN OF GARNER OPERATIONS AND MAINTENANCE MANUAL FOR STORMWATER CONTROL MEAURES(S)

Project Name:	
Project Number:	
Project Address:	
PIN of Project:	
Property Owner/Responsible Party:	
Email Address:	
Prepared by:	
Date:	

The annual inspections and routine maintenance of any Stormwater Control Measure (SCM) installed to achieve nitrogen loading and/or flow attenuating requirements for a development shall be the responsibility of the property owner or other identified responsible party. In the case of residential or commercial subdivisions, Home Owners Associations or Merchants Associations must be established in order to identify the responsible party. Any sale of this property binds this agreement to the new property owner.

This manual establishes general procedures for maintenance and operation of the allowed SCM types in accordance with the Town of Garner Stormwater Program for Nitrogen Control and the North Carolina Division of Environmental Quality (NCDEQ) Stormwater Control Measures Design Manual. It is important to note that only general maintenance tasks are identified here. All devices shall be maintained to original design standards. This agreement shall be signed and notarized in conjunction with a Memorandum of Agreement by the responsible party to perform the tasks specified in the plan, including inspections, operation, and any needed maintenance activities.

I. Background

Identify the types of SCMs located on the site and give a brief description on their design. If you need additional space please attach separate pages to this document.

_____

_____

_____

_____

_____

_____

_____

II. Annual Inspections and Certification and Maintenance Requirements

All property owners are required to perform an inspection of their owned and maintained SCMs on an annual basis based on the fiscal calendar that begins July 1 and ends June 30 of the following year. This inspection should be completed and certified by a qualified professional. Private property owners shall provide to the Town of Garner Engineering Department staff annually: a maintenance report along with detailed findings for the inspection, a certification letter sealed by a qualified professional that the SCM system(s) are functioning as originally designed or if not, a list of any required deficiencies or repairs to be completed along with a projected maintenance timeline.

The property owner/responsible party will have 90 days to correct all deficiencies and make all repairs to the satisfaction of the Town Engineer. Once repairs have been completed, the property owner shall resubmit a certification letter with an updated maintenance report to the Town of Garner Engineering Department staff for review and sign off. Failure to provide a certification letter that the SCM is functioning as originally designed or failure to satisfactorily complete the required repairs within the 90 days shall be constitute that the SCM is operating improperly and will cause the SCM to be declared a nuisance as provided for in Section 6-17 of the Garner Town Code and shall also constitute a violation of the Town's Unified Development Ordinance (UDO) subject to the issuance of civil penalties and other remedies. Abatement of the nuisance may proceed as provided for in Chapter 6, Article II of the Garner Town Code or as provided for in the UDO.

All property owners shall retain a copy of any and all documentation that pertains to inspections, maintenance and certifications performed for their individual SCM(s) for a five (5) year period and make those records available to Town of Garner Engineering Department staff upon request.

III. Maintenance of SCMs

A. Riparian Buffers – Extra land in addition to required riparian buffers that is used for nitrogen reduction should be left in an undisturbed condition. Only maintenance activities allowed by the buffer rules would be allowed. Any level spreaders used to diffuse flow into the buffer should be maintained as required in section II.B.2.

B. Vegetated Filter Strips with Level Spreaders – Maintenance requirements are as follows:

1. At least once annually, remove deposited sediment, especially from the upstream edge, to maintain original contours and grading.
2. Repair channels that form and regrade the filter strip to ensure that the runoff flows evenly in a thin sheet over the filter strip.
3. Repair level spreader whose disrepair can cause the formation of channels in the filter strip.
4. Reseed and regrade the filter strip to maintain a dense growth of vegetation, especially if the strip has been used for sediment control.
5. Grassed filter strips shall be mowed at least twice annually to a minimum height of six inches.

C. Open Channel Practices – Maintenance shall be performed as follows:

1. At least once annually, remove excess sediment, especially from the upstream edge, to maintain original contours and grading.

2. At least once annually, repair any erosion and regrade the swale to ensure that the runoff flows evenly in a thin sheet through the swale.
3. At least once annually, inspect vegetation and revegetate the swale to maintain a dense growth of vegetation.
4. Grassed swales shall be mowed at least twice annually to a minimum height of six inches.

D. Bioretention – Ongoing monitoring and maintenance is vital to the overall success of bioretention areas. Annual maintenance will be required for plant material, mulch layer, and soil layer. A maintenance schedule should include all of the main considerations discussed below:

1. Soil and mulch layer maintenance will most likely be limited to correcting areas of erosion.
2. Replacement of mulch layers may be necessary every two or three years.
3. Mulch should be replaced in the spring.
4. When the mulch layer is replaced, the previous layer should be removed first.
5. Plant material upkeep will include addressing problems associated with disease or insect infestations, replacing dead plant material, and any necessary pruning.
6. Mowing on a quarter basis for all grassed systems.

E. Constructed Wetlands – Wetlands will tend to collect debris, and it should be removed whenever it accumulates, or at least twice annually. Wetlands should be inspected annually after a rain even to ensure that the basin is operating as designed. At a minimum, items that should be included in the inspection are:

1. Clogging of the outlet or too rapid a release.
2. Erosion on the banks.
3. Erosion at the inlet and outlet.
4. Sediment accumulation and the need for removal.
5. Condition of the emergency spillway.
6. Woody vegetation in the embankment.

F. Sand Filters – Maintenance requirements are as follows:

1. Sand filters should be inspected at least once per month and after any large rain event to check for damages.
2. Sediment should be cleaned out of the forebay/sedimentation chamber when it accumulates to a depth of more than six (6) inches.
3. Any structures (outlets, flow diversions, embankments, etc.) should be checked at least annually for damage or degradation.
4. Once a year, the sand media will be skimmed.
5. Once a year the sand filter media will be replaced whenever it fails to function properly after vacuuming.
6. The sand filter will be inspected quarterly and within 24 hours after every storm event greater than 1.0 inches.

G. Wet Retention Ponds – Maintenance requirements are as follows:

1. Debris and litter control checks for inlet, outlet, and orifice obstruction after every storm producing runoff.
2. Provisions for routine vegetation management/mowing and a schedule for these activities.
3. Checks every 6 months, or more frequently, for:

    a. Sediment buildup and the need for removal.
    b. Erosion along the bank and the need for reseeding or stabilization and, if reseeding is necessary, a reseeding schedule.
    c. Erosion at the inlet and outlet and methods of stabilization.
    d. Seepage through the dam.
    e. Operation of any valves or mechanical components.

H. Dry Detention Ponds - Maintenance requirements are as follows:

1. All grassed areas of an extended dry detention basin should be mowed to a maximum height of six inches.
2. Reseeding of any areas not germinating with ground cover. Periodic reseeding may be required to establish grass on areas where seed did not take or has been destroyed. Before seeding, fertilizer (12-12-12) shall be applied at a minimum rate of 12 to 15 pounds per 1000 square feet. The seed should be covered with soil to a depth of approximately ¼ of an inch. Immediately following the planting, the area should be mulched with straw. At a minimum, semi-annual maintenance should include seeding and fertilizing of the dry detention basin which shall be performed by the grounds keeping contractor or individual otherwise noted.
3. Extended dry detention basins will tend to collect debris. It should be removed whenever it accumulates, or at least quarterly.
4. The basin should be inspected annually and after a rain event of more than one inch to ensure that it is operating as designed and that debris is removed from inlets and outlets and the crest of the spillway.
5. At a minimum, items that should be included in the annual inspection and addressed are:

    1. Clogging of the outlet or too rapid a release
    2. Erosion on the banks
    3. Erosion at the inlet and outlet
    4. Sediment accumulation and the need for removal
    5. Condition of the emergency spillway
    6. Woody vegetation in the embankment and condition of embankment. Embankments shall be kept clear of any woody vegetation. Rip rap pads, channels and slope protection shall be repaired or replaced, as needed.

I. Proprietary SCMs – Maintenance requirements will be based on the approved plans per manufacturer subject to DEQ approval.

J. Other SCMs – Maintenance requirements will be based on the approved plans subject to DEQ approval.

TOWN OF GARNER STORMWATER CONTROL MEASURE ANNUAL INSPECTION REPORT

This completed certification and accompanying materials are to be submitted to the Stormwater Program Administrator each year on or before June 30, for stormwater facilities. All stormwater facilities shall be maintained in accordance with instructions for the specific type of facilities, as described in Stormwater Best Management Practices ("Design Manual"), NC Department of Environment and Natural Resources, Division of Water Quality, Water Quality Section, 2017, including any and all subsequent revisions. At minimum, maintenance activities shall conform to the guidelines contained therein, and shall maintain the Facility as designed for optimal functioning.

Project Information:	
Project Name:	
Property Address:	
Property Owner:	
Property Owner Address:	
Property Owner Email:	Telephone:
Wake County PIN:	Date of Inspection:
Recorded Book and Page Number for each required storm water control facility:	Book/Page:

Use ONE SCM checklist sheet for each specific type of SCM device found at each SCM site location. As an example if a given site has four dry ponds and four level spreaders, you need to submit <u>one standard form</u> (i.e., this 2-page form) along with four Dry Pond sheets and four Level Spreader sheets. Fill-in the actual number of SCM devices on the table below that exist at a given site. Attach digital low-res digital color photos as appropriate, to show areas of interest or areas that need attention.

Device Type	Number of SCM's per Site	Describe (only if needed)
Bioretention Areas		
Constructed Wetlands		
Dry Ponds		
Grass Swales		
Level Spreaders		
Proprietary Device (*Must receive DWQ/TOC advance approval)		
Riparian Buffers		
Sand Filter		
Underground Detention/Storage		
Wet Ponds		
Other (Ex: Rain Garden, Green Roofs, Infiltration Basins, Cisterns, Permeable Pavement (Describe)		

The results of this inspection are as follows:

☐ **NON-COMPLIANT**

VISUAL INSPECTION FOUND APPARENT ISSUES WHICH NEED IMMEDIATE ATTENTION. COMPLETE THE REPAIR ITEMS INDICATED ON THE ATTACHED CHECKLISTS WITHIN 60-DAYS OF THE DATE OF THIS REPORT. RE-INSPECTION AND CERTIFICATION PRIOR TO OR AT THE 60-DAY INTERVAL WILL FOLLOW SATISFACTORY COMPLETION OF ALL REPAIRS. REPORTS NOT RECEIVED WITHIN 60-DAYS WILL LEAD INTO ENFORCEMENT ACTIONS. SEE ITEM "D" BELOW REGARDING ENFORCEMENT.

☐ **COMPLIANT WITH MAINTENANCE**

VISUAL INSPECTION FOUND DEFICIENCIES THAT NEED ATTENTION. COMPLETE THE MAINTENANCE ITEMS INDICATED ON THE ATTACHED CHECKLISTS WITHIN 30-DAYS OF THE DATE OF THIS REPORT. THE TOWN SHALL BE NOTIFIED OF THE REPAIRS HAVE BEEN PERFORMED WITH PHOTOS OF MAINTENANCE PERFORMED. IF NOTIFICATION HAS NOT BEEN RECEIVED WITHIN 30-DAYS THIS WILL BE CONSIDERED A VIOLATION. SEE ITEM "D" BELOW.

☐ **COMPLIANT** **(CHECK HERE IF INITIAL INSPECTION WAS NON COMPLIANT AND THIS IS A RE-INSPECTION)**

VISUAL INSPECTION FOUND NO APPARENT ISSUES, (CERTIFICATION BELOW; SEE ITEM "E").

Information for All SCMs:

Additional pages are required to complete this Stormwater Control Measure Annual Inspection Report. A narrative for each SCM is to be provided that details the current condition. Photographs are to be included to document sufficiently the current condition of all structures and features.

Engineer Certification:

As a duly registered professional engineer in the State of North Carolina, I hereby attest that all required stormwater control facilities for the above referenced project were thoroughly inspected under my responsible charge, were found to be performing properly and were in compliance with any approved stormwater management plan, applicable operation and maintenance agreements, and the Town of Garner and NCDEQ standards and regulations.

Certifier's Name	License Number:
Title:	Company Name:
Address:	City/State/Zip
Telephone:	Email:

Seal/Signature/Date

Submittal Requirements:

1) **SUBMITTAL TIMELINE**. All inspections must be submitted to the Town of Garner electronically (pdf file) within the fiscal year that begins July 1 and ends June 30 and subsequently every year at the end of the month in which it was initially submitted.

2) **ELECTRONIC PDF SUBMITTALS**. Submittals shall be in the form of an electronic copy sent via email as a pdf file. The Town of Garner's standard *STORMWATER SCM ANNUAL MAINTENANCE INSPECTION REPORT* form shall be submitted with as many applicable SCM attachment check-off sheets as necessary based upon actual numbers of SCM's at a site. As an example if a given site has four **dry ponds** and four **level spreaders connected to the ponds**, you need to submit one standard form (i.e., the 2-page form) along with four 'dry pond checklist attachments and four 'level spreader checklist attachment sheets. Additionally, color digital photographs of the SCM features and areas of interest/concern shall be submitted as well. ALL of the above shall be submitted as ONE pdf – preferably no more than (5) megabytes in size. Do **NOT** submit separate digital photos as a pdf, separate attachment sheets as a pdf – make it all one pdf submittal. If you need to shrink or reduce the size of the electronic file – use low resolution scanning and put approximately 3-4 pictures on one page. Full size page pictures are not needed or desired. Text book quality digital pictures likewise are not needed. However, all pictures shall be submitted in COLOR – no black and white pictures are desired. We need pictures of the overall SCM, berms, riser structure, outfall looking up into the riser to see the flow path, and dissipators at a minimum.

3) **PDF FILE NAMING**. For simplicity, create the pdf file name with an equivalent site name as identified by the Town of Garner's site name for the SCM followed by the year of inspection. ***Example: Mayflower Subdivision 2021.*** If the site fails – give it the following name – ***Mayflower Subdivision 2021 FAIL.***

4) **PAPER COPIES.** Paper copy submittals are no longer required or desired. All submittals should be submitted electronically to the Stormwater Program Administrator: Jaclyn Stannard at the following email address: jstannard@garnernc.gov Additional submittal questions may be answered by the Stormwater Program Administrator via telephone at: (919) 773-4421.

Note #1: Inspections that are NOT IN COMPLIANCE
The "NON COMPLIANT" box should be checked under item "C". The failed inspection form along with the specific SCM check-off attachments summarizing required repairs must be submitted to the TOG within one week following the inspection. Re-inspection and certification will be required after the repairs. The Owner has a maximum of 90-days from the date of the preliminary inspection to make all repairs, correct all deficiencies, and submit a certification to the TOG in order to avoid enforcement actions.

Note #2 Inspections with Minor Maintenance The "Compliant with Maintenance" box should be checked. The inspection forms along with specific SCM check-off attachments summarizing the maintenance need to be submitted to the town. Maintenance should be performed and a follow-up notification (email with pictures) sent to the town.

Note #3: Inspections With No Deficiencies – "The "COMPLIANT" box should be checked under item "C". The inspection form should be signed, stamped, and sealed by the appropriate professional and submitted to the TOG within the same month of, on or before the established inspection due date. Attach the applicable SCM check-off sheets and confirmatory digital photographs accordingly.

Underground Detention Checklist for Annual SCM Report

Town of Garner, North Carolina

SCM Site Name _____ Date_____

Item-by-Item Code Key:

C	**Compliant (No Repairs Needed) = Passes Inspection**
C/M	**Compliant with minor maintenance (repairs and notification within 30 days)**
NC	**Not Compliant (Repairs and re-inspection within 60 days)**
N/A	**Not Applicable**

INFLOW POINTS

Assessment	Code Status	Comments
Obstruction: debris/sediment		
Structural Condition		
Other (Describe)		

UNDERGROUND VAULT*

Assessment	Code Status	Comments
Sediment/debris accumulation		
Vault structural condition		
Baffles and/or weir condition		
Access ladder/steps condition		
Proper drainage		
Other (Describe)		

* All applicable OSHA requirements should be followed during an underground detention inspections.

OUTLET DEVICE

Assessment	Code Status	Comments
Erosion/Undercutting		
Joint Failure/Loss of grout		
Leaking Device		
Emergency By-pass Condition		
Rip-Rap: Size, Quantity, Underlying Fabric?		
Other (Describe)		

MISCELLANEOUS

Assessment	Code Status	Comments
Trash/debris		
Other (Describe)		

PHOTOGRAPHS

Attach low-resolution, digital color photographs of the site and SCM features (*2-4 per page- no more, no less on any one page*). Include captions describing the photographs.

ADDITIONAL COMMENTS

_____
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Level Spreader Checklist for Annual SCM Report

Town of Garner, North Carolina

SCM Site Name _____ Date_____

Item-by-Item Code Key:

C	**Compliant (No Repairs Needed) = Passes Inspection**
C/M	**Compliant with minor maintenance (repairs and notification within 30 days)**
NC	**Not Compliant (Repairs and re-inspection within 60 days)**
N/A	**Not Applicable**

INLET/FLOW SPLITTER DEVICE

Assessment	Code Status	Comments
Debris/Sediment		
Rip Rap Displacement /Sedimentation		
Structural Condition		
Other (Describe)		

POOLING AREA AND LEVEL LIP

Assessment	Code Status	Comments
Sediment/debris accumulation		
Level lip is cracked , settled, undercut or eroded		
Stormwater is by-passing level spreader		
Woody Vegetation growth in pooling area or on level lip		

Grass is maintained as mowed		
Other (Describe)		

BYPASS CHANNEL

Assessment	Code Status	Comments
Bare soil/erosive gullies		
Turf Reinforcement/Pipe condition		
Displacement of rip-rap		
Other (Describe)		

FILTER STRIP

Assessment	Code Status	Comments
Grass length: (too short/too long)		
Bare soil/erosive gullies		
Sediment accumulation		
Nuisance vegetation is present		
Other (Describe)		

MISCELLANEOUS

Assessment	Code Status	Comments
Trash/debris		
Access		
Evidence of routine maintenance being performed?		
Other (Describe)		

PHOTOGRAPHS

Attach low-resolution, digital color photographs of the site and SCM features (*2-3 per page- no more, no less on any one page*). Include captions describing the photographs.

ADDITIONAL COMMENTS

_____
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Grass Swale Checklist for Annual SCM Report

Town of Garner, North Carolina

SCM Site Name _____ Date_____

Item-by-Item Code Key:

C	**Compliant (No Repairs Needed) = Passes Inspection**
C/M	**Compliant with minor maintenance (repairs and notification within 30 days)**
NC	**Not Compliant (Repairs and re-inspection within 60 days)**
N/A	**Not Applicable**

INFLOW POINTS

Assessment	Code Status	Comments
Debris		
Erosion/undercutting		
Displacement/sedimentation of fabric or rip-rap		
Outlet Pipe condition		
Other (Describe)		

ENTIRE LENGTH OF SWALE

Assessment	Code Status	Comments
Trash debris		
Bare soil/erosive gullies		
Sediment accumulation		
Vegetation length: (too short/too long)		

Invasive vegetation		
Erosion/Damage to outlet		
Other (Describe)		

PHOTOGRAPHS

Attach low-resolution, digital color photographs of the site and SCM features (*2-3 per page- no more, no less on any one page*). Include captions describing the photographs.

ADDITIONAL COMMENTS

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Dry Pond Checklist for Annual SCM Report

Town of Garner, North Carolina

SCM Site Name _____ Date_____

Item-by-Item Code Key:

C	**Compliant (No Repairs Needed) = Passes Inspection**
C/M	**Compliant with minor maintenance (repairs and notification within 30 days)**
NC	**Not Compliant (Repairs and re-inspection within 60 days)**
N/A	**Not Applicable**

INFLOW POINTS

Assessment	Code Status	Comments
Debris/Sediment		
Erosion/undercutting		
Displacement/sedimentation of rip-rap		
Pipe condition		
Other (Describe)		

FOREBAY (AS APPLICABLE)

Assessment	Code Status	Comments
Sediment/debris accumulation		
Bare soil/erosion on side slopes		
Invasive vegetation		
Other (Describe)		

MAIN TREATMENT AREA

Assessment	Code Status	Comments
Sediment/debris accumulation		
Bare soil/erosion on side slopes		
Invasive vegetation		
Side slopes maintained as mowed/covered		
Emergency spillway properly armored and free of woody vegetation		
Other (Describe)		

EMBANKMENT

Assessment	Code Status	Comments
Bare soil, erosion, loss of dam material		
Shrubs/trees present (>3'tall)		
Animal burrows		
Grass cover is eroding/unhealthy		
Signs of seepage on downstream face		
Other (Describe)		

**** Note" It is recommended that shrubs/trees if present on the embankment be removed if greater than 3' tall***

OUTLET DEVICE

Assessment	Code Status	Comments
Obstructed pipe, trash rack, or draw-down orifice		
Erosion/undercutting		
Joint failure/loss of grout material, soil piping		
Overall structural condition		
Sediment in Pipe		
Displacement of fabric/rip-rap		

**** Note: It is recommended that the pond drain be exercised twice a year to prevent freezing***

MISCELLANEOUS

Assessment	Code Status	Comments
Trash/debris		
Access		
Evidence of routine maintenance being performed?		
Other (Describe)		

PHOTOGRAPHS

Attach low-resolution, digital color photographs of the site and SCM features (*2-3 per page- no more, no less on any one page*). Include captions describing the photographs.

ADDITIONAL COMMENTS

_____
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Wet Pond Checklist for Annual SCM Report

Town of Garner, North Carolina

SCM Site Name _____ Date_____

Item-by-Item Code Key:

C	**Compliant (No Repairs Needed) = Passes Inspection**
C/M	**Compliant with minor maintenance (repairs and notification within 30 days)**
NC	**Not Compliant (Repairs and re-inspection within 60 days)**
N/A	**Not Applicable**

INFLOW POINTS

Assessment	Code Status	Comments
Debris/Sediment		
Erosion/undercutting		
Displacement/sedimentation of fabric or rip-rap		
Pipe condition		
Other (Describe)		

FOREBAY (AS APPLICABLE)

Assessment	Code Status	Comments
Sediment/debris accumulation		
Bare soil/erosion on side slopes		
Invasive vegetation		
Other (Describe)		

MAIN POND POOL AREA

Assessment	Code Status	Comments
Visible pollution/muddiness of water quality,		
Sediment accumulation		
Trash accumulation		
Is litoral shelf thriving? *		
Invasive vegetation (%) *		
Algae cover (%)		
Bare soil/erosion on side slopes		
Side slopes maintained with vegetation		
Emergency spillway properly armored and free of woody vegetation		
Water level returns to water quality elevation (>5-days after rainfall event)		
Other (Describe)		

**** Note: Replace such plants as necessary per original approved construction plans***

**** Invasive vegetation should be no greater than 5% of surface area***

EMBANKMENT

Assessment	Code Status	Comments
Bare soil, erosion, loss of dam material		
Shrubs/trees present (>3'tall)		
Animal burrows		
Grass cover is eroding/unhealthy		

Signs of seepage on downstream face		
Removal of all woody vegetation on the dam		
Signs of structural failure: i.e., horizontal/vertical cracks		
Upslope, top, and downslope maintained as mowed		
Condition of soil on dam: bare spots or loss of dam material?		
Other (Describe)		

OUTLET DEVICE

Assessment	Code Status	Comments
Obstructed pipe, trash rack, or draw-down orifice		
Erosion/undercutting		
Joint failure/loss of grout material, soil piping		
Overall structural condition		
Leaking devices		
Sediment in Pipe		
Displacement of fabric/rip-rap		
Other (Describe)		

**** Note: It is recommended that the pond drain be exercised twice a year to prevent freezing***

MISCELLANEOUS

Assessment	Code Status	Comments
Trash/debris		
Access		
Evidence of routine maintenance being performed?		
Other (Describe)		

PHOTOGRAPHS

Attach low-resolution, digital color photographs of the site and SCM features (*2-3 per page- no more, no less on any one page*). Include captions describing the photographs.

ADDITIONAL COMMENTS

_____
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Constructed Wetland Checklist for Annual SCM Report

Town of Garner, North Carolina

SCM Site Name _____ Date_____

Item-by-Item Code Key:

C	**Compliant (No Repairs Needed) = Passes Inspection**
C/M	**Compliant with minor maintenance (repairs and notification within 30 days)**
NC	**Not Compliant (Repairs and re-inspection within 60 days)**
N/A	**Not Applicable**

INFLOW POINTS

Assessment	Code Status	Comments
Obstruction: vegetation/debris/sediment		
Erosion/undercutting		
Displacement of dissipator		
Pipe condition		
Other (Describe)		

FOREBAY/DEEP POOL AT INLET STRUCTURE

Assessment	Code Status	Comments
Sediment/debris accumulation		
Bare soil/erosion on side slopes		
Invasive Vegetation		
Side slopes maintained/mowed		
Other (Describe)		

MAIN TREATMENT AREA

Assessment	Code Status	Comments
Returns to permanent pool elevation (>5-days after storm)		
Sediment/debris accumulation		
Plants are dead, diseased, or dying (*Replace such plants as necessary per original approved construction plans*)		
Side slopes maintained as mowed		
Bare soil/erosion on side slopes		
Invasive vegetation (%)		
Algae cover (%)		
Emergency spillway properly armored and free of woody vegetation		
Deep pool at outlet		
Other (Describe)		

EMBANKMENT

Assessment	Code Status	Comments
Bare soil/erosion/loss of dam material		
Shrubs/trees present		
Animal burrows		
Signs of structural failure: i.e., horizontal or vertical cracks		
Upslope, top, and downslope maintained as mowed		
Other (Describe)		

OUTLET DEVICE

Assessment	Code Status	Comments
Obstruction: vegetation/debris/sediment		
Erosion/undercutting		
Joint failure/loss of grout material/soil piping		
Leaking device		
Structural Condition		
Sediment in Pipe		
Displacement of fabric/rip-rap		
Other (Describe)		

* *= It is recommended that the pond drain be exercised twice a year to prevent freezing*

MISCELLANEOUS

Assessment	Code Status	Comments
Trash/debris		
Access		
Evidence of routine maintenance being performed?		
Other (Describe)		

PHOTOGRAPHS

Attach low-resolution, digital color photographs of the site and SCM features (*2-3 per page- no more, no less on any one page*). Include captions describing the photographs.

ADDITIONAL COMMENTS

_____

_____

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Bioretention Area Checklist for Annual SCM Report

Town of Garner, North Carolina

SCM Site Name _____ Date_____

Item-by-Item Code Key:

C	**Compliant (No Repairs Needed) = Passes Inspection**
C/M	**Compliant with minor maintenance (repairs and notification within 30 days)**
NC	**Not Compliant (Repairs and re-inspection within 60 days)**
N/A	**Not Applicable**

INFLOW POINTS

Assessment	Code Status	Comments
Erosion/undercutting		
Structural condition		
Displacement /sedimentation of fabric/rip-rap		
Other (Describe)		

PERIMETER/SIDE SLOPES/EMBANKMENT

Assessment	Code Status	Comments
Bare soil/erosion		
Woody vegetation		
Other (Describe)		

PRE-TREATMENT AREA (Forebay, grass swales, & verges, gravel)

Assessment	Code Status	Comments
Sediment/debris accumulation		
Erosion/gullies present		
Invasive vegetation		
Other (Describe)		

BIORETENTION CELL

Assessment	Code Status	Comments
Overgrown vegetation (requires pruning)		
Plants are dead, diseased, or dying (*Replace such plants as necessary per original approved construction plans*)		
Mulch is decomposed or displaced		
Soils/mulch clogged with sediment		
Evidence of lack of proper drainage (i.e., dead plants, or successional wetland vegetation)		
Bare or eroded areas in grass cells		
Other (Describe)		

OUTLET DEVICE

Assessment	Code Status	Comments
Riser structure has 9-12 inches of pooling		
Erosion/undercutting		
Structural condition		
Sediment in pipe		
Joint failure/loss of grout material/soil piping		
Displacement of fabric/rip-rap		
Other (Describe)		

MISCELLANEOUS

Assessment	Code Status	Comments
Trash/debris		
Access		
Evidence of routine maintenance being performed?		
Other (Describe)		

PHOTOGRAPHS

Attach low-resolution, digital color photographs of the site and SCM features (*2-3 per page- no more, no less on any one page*). Include captions describing the photographs.

ADDITIONAL COMMENTS

_____
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Sand Filter Checklist for Annual SCM Report

Town of Garner, North Carolina

SCM Site Name _____ Date_____

Item-by-Item Code Key:

C	**Compliant (No Repairs Needed) = Passes Inspection**
C/M	**Compliant with minor maintenance (repairs and notification within 30 days)**
NC	**Not Compliant (Repairs and re-inspection within 60 days)**
N/A	**Not Applicable**

INFLOW POINTS

Assessment	Code Status	Comments
Obstruction: debris/sediment		
Structural condition of grates & covers		
Trash/debris covering		
Other (Describe)		

SEDIMENT CHAMBER * * *= All applicable OSHA requirements should be followed during inspection*

Assessment	Code Status	Comments
Sediment exceeds O&M manual tolerance		
Vault/pipe structural condition		
Baffles and/or weir condition		
Access ladder/steps condition		
Proper Drainage		
Trash/Debris		

SAND CHAMBER * ** = All applicable OSHA requirements should be followed during inspection*

Assessment	Code Status	Comments
Standing water >24-hours after rain event		
Sand bed has been silted-in (silt/clay and contaminated sand should be removed and replaced with clean sand)		
Sand bed color profile (if discolored >3" deep, remove and replace with clean sand)		
Sand bed has been eroded or displaced (rake to level)		
Vault/pipe structural condition		
Access ladder/step condition		
Trash/debris		
Other (Describe)		

OUTLET DEVICE

Assessment	Code Status	Comments
Obstructions		
Erosion/undercutting		
Joint failure/loss of grout material		
Emergency by-pass condition		
Other (Describe)		

MISCELLANEOUS

Assessment	Code Status	Comments
Access		
Other (Describe)		

PHOTOGRAPHS

Attach low-resolution, digital color photographs of the site and SCM features (*2-3 per page- no more, no less on any one page*). Include captions describing the photographs.

ADDITIONAL COMMENTS

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Other SCM Type Checklist for Annual SCM Report

Town of Garner, North Carolina

SCM Site Name _____ Date_____

Item-by-Item Code Key:

C	**Compliant (No Repairs Needed) = Passes Inspection**
C/M	**Compliant with minor maintenance (repairs and notification within 30 days)**
NC	**Not Compliant (Repairs and re-inspection within 60 days)**
N/A	**Not Applicable**

FEATURES

Assessment	Code Status	Comments

PHOTOGRAPHS

Attach low-resolution, digital color photographs of the site and SCM features (*2-3 per page- no more, no less on any one page*). Include captions describing the photographs.

ADDITIONAL COMMENTS

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Town of Garner
Engineering Department
900 7th Avenue, Garner, NC 27529
Telephone: 919-773-4425

Major Encroachment Application

Submit to: ROWencroachments@garnernc.gov

FOR OFFICE USE ONLY	RECEIVED DATE	PERMIT NO.

APPLICANT INFORMATION		
Applicant:		**Submittal Date:**
Mailing Address:		**Zip Code:**
Project Contact Person:		**Work Phone:**
Email:		
Start Date:	**Proposed Work Duration:**	**Cell Phone:**

Description of work to be done:

Located on: _____ **Between:** _____ **And:** _____

ENCROACHMENT INFORMATION			
Type of Encroachment (check all that apply)			
Building Elements (Examples: Balconies, Doors, Stairs, Landings, Ramps)	☐	**Telecommunication Devices** (Examples: Aerial and Underground lines, Towers)	☐
Streetscape Furnishings (Examples: Permanent furniture, Benches, Bike racks)	☐	**Miscellaneous**	☐
Landscaping (Examples: Right-of-way plantings)	☐	**Legalize an Existing Encroachment**	☐
Utilities and Irrigation (Examples: Stormwater, Wells, Grease Traps, Monitoring Wells)	☐		
Hardscape (Examples: Pavers, Fences, Retaining Walls)	☐		

Street Closure Required? **Yes**_____ **No**_____
(If yes, attach proposed detour plan, including detour routes and detour signage.)

Description of proposed encroachment (including duration):

If this is a linear project, provide total distance of installation (in linear feet):

The following items are required to process Major Encroachment Application:	COMPLETED BY TOWN STAFF		
	YES	NO	N/A
Completed Encroachment Application			
Completed and signed Encroachment Agreement			
Certificate of Insurance			
Permit Fee ($150.00)			
Scaled sketch or Plans of Encroachment (pdf)			
Photos, a brochure, or architectural drawing of proposed furniture (if applicable)			

Town of Garner
Engineering Department
900 7th Avenue, Garner, NC 27529
Telephone: 919-773-4425

Unless special notice has been given at issuance of the permit, the permittee certifies that there will be no danger of collapse, explosion, or underground damage during the course of the project.

The Engineering Department shall be contacted at ROWencroachment@garnernc.gov between 8:00am - 4:00pm Monday through Friday prior to and at the conclusion of any construction.

Town of Garner Ordinance No. (2007) 3470 pertaining to traffic controls for construction/maintenance and regulations for working within the street will be strictly enforced. Failure to comply with such regulations shall constitute a misdemeanor violation.

Note that additional permits may be required by the Town upon approval of encroachment.

In emergency situations the permittee shall immediately notify the Town Manager and the Fire or Police Chief of the emergency event. The permittee may proceed to take whatever actions are necessary to immediately respond to the emergency. Within two (2) business days after the occurrence of the emergency the permittee shall apply for the Permit to Work on Town Right-Of-Way.

If encroachment onto private property is necessary for construction, staging, vehicle/equipment storage, etc. then the permittee is directed to contact and obtain permission from said property owners for such encroachment.

A COPY OF A VALID PERMIT MUST BE ON THE SITE AT ALL TIMES.

APPROVED BY TOWN OFFICIAL:

PRINTED NAME	**TITLE**
SIGNATURE	**DATE**

Town of Garner
Engineering Department
900 7th Avenue, Garner, NC 27529
Telephone: 919-773-4425

Minor Encroachment Application

Submit to: **ROWencroachments@garnernc.gov**

FOR OFFICE USE ONLY	RECEIVED DATE	PERMIT NO.

APPLICANT INFORMATION		
Applicant:		**Submittal Date:**
Mailing Address:		**Zip Code:**
Project Contact Person:		**Work Phone:**
Email:		
Start Date:	**Proposed Work Duration:**	**Cell Phone:**

Description of work to be done:

Located on: _____ **Between:** _____ **And:** _____

ENCROACHMENT INFORMATION			
Type of Minor Encroachment (check all that apply)			
Outdoor Merchandise (Requires annual permit renewal)	☐	**Overhead Signage**	☐
Temporary Structures	☐	**A-Frame Signage**	☐
Street Furniture (movable)	☐	**Point of Sale Vending**	☐
Awnings	☐	**Miscellaneous**	☐
Exterior Building and Accent Lighting	☐	**Legalize an Existing Encroachment**	☐

Description of proposed encroachment (including duration):

If this is a linear project, provide total distance of installation (in linear feet):

The following items are required to process Minor Encroachment Application:	COMPLETED BY TOWN STAFF		
	YES	NO	N/A
Completed Encroachment Application			
Completed and signed Encroachment Agreement			
Permit Fee ($75.00)			
Scaled sketch or Plans of Encroachment (pdf)			
Photos, a brochure, or architectural drawing of proposed furniture (if applicable)			

Town of Garner
Engineering Department
900 7th Avenue, Garner, NC 27529
Telephone: 919-773-4425

Unless special notice has been given at issuance of the permit, the permittee certifies that there will be no danger of collapse, explosion, or underground damage during the course of the project.

Town of Garner Ordinance No. (2007) 3470 pertaining to traffic controls for construction/maintenance and regulations for working within the street will be strictly enforced. Failure to comply with such regulations shall constitute a misdemeanor violation.

Note that additional permits may be required by the Town upon approval of encroachment.

In emergency situations the permittee shall immediately notify the Town Manager and the Fire or Police Chief of the emergency event. The permittee may proceed to take whatever actions are necessary to immediately respond to the emergency. Within two (2) business days after the occurrence of the emergency the permittee shall apply for the Permit to Work on Town Right-Of-Way.

If encroachment onto private property is necessary for construction, staging, vehicle/equipment storage, etc. then the permittee is directed to contact and obtain permission from said property owners for such encroachment.

A COPY OF A VALID PERMIT MUST BE ON THE SITE AT ALL TIMES. PERMIT IS VALID FOR ONE YEAR FROM DATE OF APPROVAL.

APPROVED BY TOWN OFFICIAL:

PRINTED NAME	**TITLE**
SIGNATURE	**DATE**

STATE OF NORTH CAROLINA
COUNTY OF WAKE

RIGHT-OF-WAY ENCROACHMENT AGREEMENT

☐ *Major Encroachment* ☐ *Minor Encroachment*

THIS AGREEMENT ("Agreement") is made this ___day of_____, 20____ by and between THE TOWN OF GARNER, a municipal corporation existing under the laws of the State of North Carolina (the "Town"), and _____, hereinafter known as the "Applicant."

W I T N E S S E T H:

WHEREAS, the Town maintains the public street right-of-way located at -
_____

and known as_____ (referred herein as "the Property" or "Town right-of way").

WHEREAS, the Applicant desires, for its sole interest and convenience, to encroach within the above-referenced Property to construct, erect, install, put into place, maintain, and/or repair (such activities within the public street right-of-way hereinafter individually and collectively referred to herein as "Work") the improvements and/or infrastructure more particularly described in the approved permit numbered _____.

WHEREAS, the Town under the terms and conditions herein set forth, is willing to allow the above-described Work to be performed, and allow the Applicant to encroach upon the above-referenced Property as provided herein.

NOW, THEREFORE, in consideration of the premises, and payment of any and all required fees, in hand paid receipt of which is hereby acknowledged and other consideration, the Applicant hereby covenants and agrees that:

The above-stated recitals are intended to be integral to this Agreement and are incorporated herein by reference as though fully set forth herein;

1) For purposes of this Agreement, the term "encroachment" refers to (i) said Work, (ii) the improvements and/or infrastructure permitted to be located within the Town's right-of-way referenced herein, and (iii) the use of said encroaching improvements and/or infrastructure.

2) The Applicant is responsible for any and all expenditure of labor and materials required for any said Work and encroachment.

3) The Applicant is responsible for any and all labor and expenses which result from any and all future maintenance, repair, removal, or dismantling of said encroachment as required by the Town in its sole discretion.

4) The Town hereby grants the Applicant the Permission at the locations described in the approved Town permit applications. Such Permission to encroach is for the purpose of construction and/or erection, and maintenance, more particularly described in the approved permit applications. The installation, operation, and maintenance are referred to herein as "the Work." Applicant understands and agrees that, notwithstanding any language in this Agreement to the contrary, Town grants Permission only to the extent authorized by law and the terms of the conveyance of the right-of-way, fee, easement, or other property interest to Town in the Property. Nothing in this Agreement shall constitute or create an assignment to Applicant by Town of any easement or license held by Town or of any rights under any easement or license held by Town. Nothing herein contained shall be construed to confer on Applicant an exclusive right to encroach on Public Streets or confer any rights to any third party not specifically identified herein by name. If the Town determines that suspension of this Agreement is warranted to protect the public health or safety, Town may suspend this Agreement, in whole or in part, immediately upon notice to Applicant and for such length of time as deemed necessary by the Town to protect the public health or safety. Approved permit application shall be added as Exhibit A to, and shall be governed by, this Agreement.

5) Applicant's Obligation . The Applicant is fully responsible for any and all property damage or injury to or death of any person which results from any and all negligence, omission, defect in design, maintenance, or workmanship created by the Applicant, its agents, employees, contractors or subcontractors, and any cause of action arising out of the aforesaid Work, any encroachment, and the location of any such encroachment within the Town right-of-way referenced herein;

   a) The Applicant agrees to hold the Town, its officers, councilors, and employees harmless from any and all liability arising out of such negligence, omission, defect, or other cause of action; that it will defend the Town, its officers, councilors and employees and pay all attorney's fees in any and all actions brought as a result of such; and that it will indemnify the Town, its officers, councilors, and employees against any and all loss sustained by reason of such negligence, omission, defect, or other cause of action arising out of the aforesaid Work, any encroachment, and the location of any such encroachment within the Town right-of-way referenced herein;

   b) The Applicant will promptly repair any damage to the Public ROW, Town property, or private property if such damage is directly caused by Applicant's Work and no other Person is responsible for the damage (e.g., where a Person other than Applicant fails to accurately or timely locate its underground facilities as required by applicable law). Applicant will repair the damaged property to a condition equal to or better than that which existed prior to the damage. Applicant's obligation will be limited by, and consistent with, any applicable seasonal or other restrictions on construction or restoration work. Should the Applicant fail to repair damages within seven (7) days of notice by the Town, the Town has the right to perform the repair and obtain reimbursement from the Applicant. The Applicant shall reimburse the Town for any actual, reasonable, and documented costs or expenses incurred for such repairs, following receipt of invoices form the Town detailing those costs.

   c) Damages. Applicant understands and agrees that damage or destruction may occur to facilities of Permittee in the course of the Town's operations and that the Town has no obligation to protect Applicant, Applicant's property or Facilities to minimize, mitigate, or avoid any such damage, except to the extent caused by the gross negligence or willful misconduct of the Town.

   d) Third Party Encroachments. Applicant releases, waives, and discharges any legal rights to seek payment or relief of any kind from the Town, its officers, boards, commissions, and employees, for any damages resulting from Third Party Encroachments.

6) Insurance. For a major encroachment, the Applicant, during the life of this Agreement, agrees to procure or cause to be procured from a responsible insurance carrier or carriers, authorized under the laws of the State of North Carolina, in the amount of:

Coverage	**Minimum Limits**
Workers' Compensation	Statutory Limits
Employers' Liability	$500,000
General Liability	$1,000,000 per occurrence ($2,000,000 aggregate)
Automobile Liability	$1,000,000
Professional Liability	$1,000,000 per occurrence ($2,000,000 aggregate)

Certificates of Insurance acceptable to the Town shall be filed with the Town prior to commencement of any work. Coverage afforded under the policies will not be canceled, if not renewed, until at least thirty (30) days prior written notice has been given to the Town. The insurance carrier (s) shall be licensed, authorized, or permitted, and admitted to do business in the state of North Carolina.

Insurance will not be required for a minor encroachment unless otherwise determined by the Town of Garner and defined herein.

7) The Applicant agrees to abide by all applicable regulations, statutes, laws, and ordinances.

8) This Agreement shall not divest the Town of any rights or interest in said right-of-way.

9) This Agreement shall be revocable at will by the Town of Garner. The Town may terminate this Agreement by giving applicant thirty (30) days written notice, unless an emergency or other situation requires less notice. Prior to the termination date, the Applicant shall remove or relocate, at its own expense, all or part of the encroaching improvements as specified by the Town, and shall restore the Property at Applicant's sole cost and expense, to the condition as existing prior to the installation of the encroaching improvements or to be in compliance with applicable laws as may be determined ty the Town in its sole discretion.

10) In the event that the Town or its contractor need to perform work within the public street right-of-way referenced herein and the encroaching improvement(s) are in conflict with such work, the Town shall deliver written notice to Applicant describing the nature of the conflict, and Applicant shall, within fifteen (15) days of receipt of the notice, meet with representatives of the Town to determine a plan of action to remove or alter its encroaching improvement(s). Work in accordance with the relocation and/or removal plan addressing the conflict shall be completed within a commercially reasonable time as determined by the Town, and all work will be done at the Applicant's own cost unless applicable law provides otherwise.

11) The Applicant shall obtain all required permits from the Town and any other governmental authorities prior to performing any said Work.

12) If applicable, Applicant shall contact "NC 811" forty-eight (48) hours prior to excavation and shall ensure that the encroachment remains ten feet (10') from existing utilities.

13) Proper Signage. Applicant will provide proper signs, signal lights, flagman, and other warning devices for the protection of traffic in conformance with the latest Manual on Uniform Traffic Control for Streets and Highways (MUTCD) and amendments or supplements thereto, during any installation and maintenance of the facilities Applicant places in the

Public ROW pursuant to this Agreement. Provide at least three (3) days' notice to the Town of any work which will require lane closure or traffic control measures lasting more than twenty-four (24) hours; and ensure that temporary pedestrian accessibility is provided in accordance with Americans with Disabilities Act Accessibility Guidelines and MUTCD.

14) This Agreement shall be binding upon and inure to the benefit of all the parties hereto, their heirs, personal representatives, grantees, successors, and assigns.

15) All matters relating to this Agreement shall be governed by the laws of the State of North Carolina, without regard to its choice of law provisions, and venue for any action related to the Agreement shall be Wake County Superior Court or the United States District Court for the Eastern District of North Carolina, Western Division.

IN WITNESS WHEREOF, each of the parties to this agreement has caused the same to be executed in the day and year first above written.

NAME OF APPLICANT:

_____

By:_____
Signature

_____
Name and Title, if Applicable (Please Print)

_____
Address

_____
City, State, Zip

NOTARY OR CORPORATE SEAL
ATTEST OR WITNESS:
NORTH CAROLINA
COUNTY OF _____

I, _____, a notary public, do certify that _____ personally appeared before me this day and acknowledged the due execution of the foregoing agreement. Witness my hand and notarial seal this _____ day of _____, 20__.

_____
Notary Public
My commission
expires:_____

TOWN OF GARNER APPROVAL

So Agreed By: _____ DATE_____

Name and Title: _____

Project Name: _____
Town Site Plan Number: _____

CONSTRUCTION DRAWING SUBMITTAL CHECKLIST

Town of Garner
Engineering Department

900 Seventh Avenue, Garner, NC 27529
Telephone: (919) 773-4423

Section A. *DATA TO BE SHOWN ON PLANS*

(a) Overall Submission requirements

- ❑ 1. The site plan drawings shall be drawn on a standard sheet size of either twenty-four (24) by thirty-six (36) inches or thirty (30) by forty-two (42) inches when included in an architectural submittal;
- ❑ 2. True north arrow, with north being at the top of the map;
- ❑ 3. Scale of the map using engineer's scale (1"=10', 1"=50', etc.) both graphic and numeric and date of preparation, including all revision dates;
- ❑ 4. Each plan sheet shall be signed AND sealed by a NC registered Professional Engineer;
- ❑ 5. A legend and notes sheet shall be included with all line types and symbols clearly shown for interpretation;
- ❑ 6. Add Town of Garner Approval stamp to each sheet of plans, preferably at lower or middle right side of page.
- ❑ 7. **Submit 3 sets of plans** in the order shown below:
  - ❑ Cover Sheet
  - ❑ Existing Conditions Plan
  - ❑ Site Plan
  - ❑ Utility Plan
  - ❑ Storm Drainage/Grading Plan
  - ❑ Erosion Control Plan
  - ❑ Stormwater Management Details (SCM plan/profile/cross sections/details)
  - ❑ Street Plans/Profiles, including property frontage road widening(s), as applicable;
  - ❑ Landscape Plan (including sight distance triangles on plans)
  - ❑ Lighting Plan
  - ❑ Standard Detail Sheets
  - ❑ Building Elevations (if applicable)
- ❑ 8. **Submit 2 sets of stormwater management calculations**, including all the following items:
  - ❑ Inlet gutter spread calculations (2-year storm)
  - ❑ Pipe HGL calculations (10-year storm)
  - ❑ Stormwater management calculations
    - ❑ Pre/post for 1-yr, 10-yr, and 25-yr storms
    - ❑ TSS calculations for Watershed Development Permit (Swift Creek watershed only)
    - ❑ Nitrogen calculations
    - ❑ Anti-buoyancy calculations for riser foundations
  - ❑ Outlet Dissipators (10 year)
  - ❑ Channels/Swales (2-year temp, 10-year permanent), including shear stress calcs for linings.
- ❑ 9. **Submit 1 signed copy of this Construction Drawing and Site Plan Review Checklist**.
- ❑ 10. For resubmittals, **submit 3 letters responding to each comment received on previous submittal.**
- ❑ 11. Submittals for **water/sewer permits** should be delivered directly by the applicant to City of Raleigh Public Utilities Department, located at One Exchange Plaza, Suite 620, Raleigh, NC 27602.
- ❑ 12. Submittal for **erosion control permit** should be submitted directly by the applicant to Wake County Environmental Services, 336 Fayetteville Street, Raleigh, NC 27602.
- ❑ 13. Submittals for **driveway permit and/or encroachment agreements** should be submitted directly by the applicant to the NCDOT District Office, located at 4009 District Office, Raleigh, NC 27607. Driveway permit must be signed by Town Engineer prior to submittal to NCDOT.

Note: ***Town of Garner will not sign construction drawings until all other agencies have approved plans and verification provided to the Town.***

(b) Title Sheet

- ❑ 1. The name of the development and primary owner agent, including name, address, email, and telephone number.
- ❑ 2. The name of the design consultant and primary agent, including name, address, email, and telephone number.
- ❑ 3. Project address, PIN number, and project name;
- ❑ 4. A vicinity sketch or key map at a scale of not more than one thousand (1000) feet to the inch (1"=200' is preferred on cover sheet), showing the position of the proposed project with its relation to surrounding streets and properties, and oriented in the same direction as the site plan;
- ❑ 5. Site information including total acreage, disturbed area, existing impervious area, proposed impervious area with percentage, future impervious (where applicable);
- ❑ 6. For residential developments – Planned number of units, along with their size (in terms of bedrooms);
- ❑ 7 For commercial developments – Proposed square footage of building space;
- ❑ 8. Add note - "Contact the North Carolina One Call Center prior to doing any digging. 1-800-632-4949";
- ❑ 9. Add note – "Please contact Town of Garner Engineering inspector at Eng-inspections@garnernc.gov to schedule a pre-construction meeting prior to obtaining building permits for this plan";
- ❑ 10. Add revision block with dates and description for each submittal.
- ❑ 11. Include **Infrastructure Inspection Table(s)** including all the following items (even if zero quantity).

  Garner Engineering

  - ❑ Linear footage of Public Streets
  - ❑ Linear footage of Public Sidewalks
  - ❑ Number of Stormwater Control Measures (SCM's)

  City of Raleigh Public Utilities

  - ❑ Linear footage of Public Watermain (by size)
  - ❑ Linear footage of Public Sewermain (by size)
  - ❑ Linear footage of Private Watermain (by size)
  - ❑ Linear footage of Private Sewermain (by size)
  - ❑ Number of Water Stubs/Ties (includes all new taps, new water service stubs, and hydrant stubs on existing watermains)
  - ❑ Number of Water Meter(s) for Domestic (by size)
  - ❑ Number of Water Meter(s) for Irrigation (by size)
  - ❑ Number of Sewer Services (by size)
- ❑ 12. Include general note "All construction shall be in accordance with Town of Garner, City of Raleigh, and/or NCDOT standards and specifications as applicable."

(c) General Site Plan Information

- ❑ 1. An accurate and complete legend is required on each plan sheet (detail sheets do not require a legend);
- ❑ 2. Names of property owners of adjacent properties or subdivisions of record;
- ❑ 3. Proposed streets, existing and platted streets on adjoining properties and in the proposed development with right-of-way widths (and NCDOT SR numbers if applicable);
- ❑ 4. Existing and proposed topographical information, along with proposed finished floor elevations for structures, and spot elevations for all roadways and parking areas;
- ❑ 5. Existing or proposed sidewalks, both on public rights-of-way and on-site; labeled accordingly.
- ❑ 6. All proposed and existing easements, widths, purposes noted, public or private and book and page numbers;
- ❑ 7. Location, material, and size of any existing utilities (water, sanitary sewer, septic, storm water, etc.) along with their owners' names, and inverts on all sanitary sewer and storm water facilities;
- ❑ 8. Street centerline stations are shown for reference on all plan views and correspond to plan and profile sheets;
- ❑ 9. All curb ramps are drawn and labeled (by type) according to Town of Garner standard details.
- ❑ 10. All temporary road stubs include temporary turnarounds per Town of Garner details.
- ❑ 11. All permanent road stubs include signage/barricades per Town of Garner details.
- ❑ 12. Sight distances calculated at each intersection and easements provided for all applicable areas. Vegetation within sight distance easements shall be clear between 2' and 8' height for maximum visibility.

- ❑ 13. Add following note to site plan. "The Town will be responsible for payment of the monthly costs for public street lighting and the developer will be responsible for all initial fees charged with the light installation. All installation fees are required to be paid up front at the time of installation."
- ❑ 14. Add note: Mail kiosk parking inside public rights of way are not maintained by the Town of Garner. Any parking spaces along a public street shall be separated by a 2' wide x 8" deep concrete band to separate public street from private parking maintenance.
- ❑ 15. Parking spaces adjacent to sidewalk without curb and gutter are required to have curb stops to maintain sidewalk clearance from vehicle overhangs.
- ❑ 16. Add a note to contact the Town of Garner Engineering Department prior to conversion of any SCM onsite from an erosion control device to a stormwater control measure.
- ❑ 17. If project is phased, ensure delineation lines are clearly noted on the plan. Also, ensure the first proposed phase has appropriate fire truck turnaround that is not dependent on other phases.
- ❑ 18. If greenway paths are included, denote clearly on plan if proposed as public or private.
- ❑ 19. For access easements to stormwater or utility infrastructure (such as pump stations), include the following note "Contractor to ensure access easements and associated streets are fully maintained for reasonable access by maintenance personnel."

(d) Environmental Requirements (where applicable)

- ❑ 1. Floodplain information, including base flood elevation, 100-year flood boundary, floodway and floodway fringe areas, indicating source of information;
- ❑ 2. Riparian buffer information, including labels of both Zone 1 (inner 30') and Zone 2 (outer 20');
- ❑ 3. Include copy of NCDEQ buffer determination letter.
- ❑ 4. State and federal wetlands are shown on the site; with
- ❑ 5. Blue-line streams and other existing water features on the site, or are adjacent to the site and impact the site through previously mentioned buffers;
- ❑ 6. Drainage basin maps showing existing drainage basins with area and impervious broken down, and proposed drainage basin maps showing areas broken down by their destination (i.e. Pond #1, Bio-retention #4, Bypass area, etc.);

(e) Storm Drainage and Grading Plans

- ❑ 1. All existing and proposed contours shall be drawn at 1' or 2' intervals with major contours labeled;
- ❑ 2. Retaining walls shall be clearly drawn, labeled, including top and bottom of wall spot elevations; Retaining wall detail should be provided. **A Town building permit is required when 1) When adjacent to a structure, any retaining wall less than 5' in cumulative vertical relief and located closer to structure than the vertical relief, or 2) Any retaining walls providing cumulative vertical relief greater than 5' within a horizontal separation distance of 50' or less. Walls requiring a building permit shall be designed under the responsible charge of a registered design professional per the North Carolina Building Code, Section 1807.2.**
- ❑ 3. Ensure all existing and proposed storm drainage inlets and pipes are labeled with pipe sizes accordingly.
- ❑ 4. Include design chart/tables for all drainage inlets, pipe schedule, channel/swales, and dissipators.
- ❑ 5. Clearly label each outfall location and proposed outlet protection controls.
- ❑ 6. Add note that "All slopes to be vegetated with grass shall be a maximum of 3:1."

(f) General Storm Water Information Requirements (where applicable)

- ❑ 1. The overall storm water plan demonstrates the ability to treat for the site and location;
- ❑ 2. All existing and proposed storm water piping shown as well as their sizes and material type, and details on how they are to be constructed;
- ❑ 3. All existing and proposed storm water structures (curb inlets, drop inlets, manholes, and outlets) with their size, rim elevation, invert elevations, and labeling to correspond to calculations and details to show how they are to be constructed;
- ❑ 4. All existing and proposed swales for conveyance or treatment shown as well as spot elevations at the top and bottom of the swale and the linear footage of the swale (i.e. "335 LF grassed swale No. 1"), and details;
- ❑ 5. All proposed storm water BMP's or SCM's comply with the NCDEQ Minimum Design Criteria;
- ❑ 6. All BMP details are included for construction including a cross-sectional detail of each proposed BMP, and all elevations on plan and details match those in routing calculations of storm water narrative;
- ❑ 7. All outlet protection, rip-rap energy dissipaters, and their associated sizing calculations and details;
- ❑ 8. Add note on plans – "All roof drains shall be directed to the storm drain system";

- ❑ 9. Add note – "At the conclusion of the project all SCMs installed on-site must be certified by a design professional and the Town of Garner Engineering Department must receive all as-built drawings prior to receiving the certificate of occupancy."
- ❑ 10. SCM Sheets shall include the following information.
  - Plan view of SCM, including existing/proposed contours, riser, pipes, spillway location, and outfall measures;
  - Profile/cross section showing inlet/forebay, SCM, and outfall infrastructure;
  - Risers (4'x 4' minimum), including rim/invert elevations, drawdown orifice size/elevations, foundation design, and riser steps @ 16" o.c.;
  - Draw/label water elevations for normal pool, Q1, Q10, Q25, and Q100;
  - Trash rack detail, including access hatch location/details;
  - Drain valve/handwheels, if applicable, should be located inside riser;
  - All proposed SCM landscaping, special media mix details, and installation requirements;
  - Spillway detail, including lining details, and spillway elevation;
  - Anti-seep collars and/or filter diaphragm, for any dam outfalls;

(g) General Transportation & Roadway Information Requirements (where applicable)

- ❑ 1. Site plan demonstrates conformance with Garner Transportation Plan (rights-of-way are dedicated, street sections match, sidewalk is in correct locations, etc.);
- ❑ 2. Connectivity to surrounding vacant parcels or existing streets is provided;
- ❑ 3. Street cross-sections match Town of Garner standards for the type of street;
- ❑ 4. Proposed curb and gutter types match the Town of Garner standards and are applicable for the area of the project;
- ❑ 5. Street details meet minimum design standards for Town of Garner;
- ❑ 6. Proposed cul-de-sacs meet Town of Garner minimum radii per standard details.
- ❑ 7. Plan/profiles provided for all public streets with K-values that meet rolling terrain in NCDOT Subdivision Manual for each street type.
- ❑ 8. Stop controlled intersections have a maximum rollover of 6%, or contain vertical curve to minimize transitions.
- ❑ 9. Plan/profiles include all applicable utility infrastructure for the street, including, but not limited to:
  - ❑ Watermain, hydrants, bends, ARV's, taps, reducers, clearances per COR handbook;
  - ❑ Sanitary sewer rims/inverts, pipe length/slope, clearances per CORPUD handbook;
  - ❑ Storm sewer rims/inverts, pipe length/slopes;
  - ❑ Private communication, gas, or other utility lines applicable or in conflict with the proposed improvements.
- ❑ 10. All driveways clear of drainage inlets and meet vertical design requirements in Town of Garner standard details
- ❑ 11. All proposed pavement markings to be shown and labeled for clarity. Add general note: "All pavement markings to be thermoplastic"

(h) General Water & Sewer Information Requirements (where applicable)

- ❑ 1. Utilize City of Raleigh Public Utilities Handbook for all design requirements of water and sewer utility plans.
- ❑ 2. Tie-ins and extension locations for connectivity to neighboring parcels is provided (either through construction or easements);
- ❑ 3. Add City of Raleigh Public utility details for all water/sewer infrastructure, as applicable.
- ❑ 4. Add City of Raleigh water/sewer approval blocks to utility plans for signature.

(i) Lighting Plans

- ❑ 1. Include street lighting for all public streets according to Town of Garner standards;
  - o Local and collector streets - 25' fiberglass poles (50W or 75W LED fixtures). Town approves lighting plan.
  - o Thoroughfare Streets – 30' fiberglass poles (105, 150, or 215 W LED fixtures), located behind sidewalk with appropriate clearance for non-breakaway poles. Town and NCDOT approve lighting plan.
- ❑ 2. Include private street lighting for all parking areas according to Town of Garner standards;

Section B. *DATA TO BE SHOWN IN NARRATIVE AND CALCULATIONS*

- ❑ 1. Storm water narrative demonstrates how site will be developed and how storm water runoff will be captured and treated to meet Town of Garner storm water ordinance and NCDEQ MDC;
- ❑ 2. Storm water narrative also includes all details about the storm water on the site, how it drains prior to the proposed development, how it will drain after the proposed development, and if any off-site drainage is being captured or if any on-site drainage is being bypassed and how the treatment over-detains to compensate;
- ❑ 3. Pipe/swale calculations included either on plans or in narrative package to justify sizing;
- ❑ 4. Basin maps show pre-developed condition and post-developed condition with clear delineation on treatment areas;
- ❑ 5. Storm water routing calculations provide clear justification for sizing of SCM's and outlet elevations;
- ❑ 6. Routing calculations provide 1-year, 10-year, and 25-year pre vs. post compliance (Post < Pre) and 100-year emergency sizing;
- ❑ 7. Nitrogen calculations on Town of Garner form;
- ❑ 8. Please enclose an O&M Agreement for any proposed water quality or water quantity SCMs, which will also require a Memorandum of Agreement at time of completion.

By signing below, I acknowledge that I have reviewed every requirement listed in this checklist and have addressed all items accordingly, or provided specific information to support which requirements may not be applicable to this project submittal.

_____
Printed Name

_____
Signature

_____
Date

Project Name: _____
Town Site Plan Number: _____

Plan Sheet Standard Approval Blocks

All Plan Sheets

Town of Garner
Engineering Department

APPROVED

SIGNED DATE

**Dimension ~ 2.5" Wide by 2" Tall

Title Sheet Only

ATTENTION CONTRACTORS

The ***Construction Contractor*** responsible for the extension of water, sewer, and/or reuse, as approved in these plans, is responsible for ***contacting*** the ***Public Utilities Department*** at ***(919) 996-4540*** at least ***twenty four hours*** prior to beginning any of their construction.

Failure to notify both ***City Departments*** in advance of beginning construction, will result in the issuance of ***monetary fines***, and require reinstallation of any water or sewer facilities not inspected as a result of this notification failure.

Failure to call for ***Inspection***, ***Install a Downstream Plug***, have ***Permitted Plans*** on the ***Jobsite***, or any other ***Violation*** of ***City of Raleigh Standards*** will result in a ***Fine and Possible Exclusion*** from future work in the ***City of Raleigh***.

Utility Plans Only (as applicable)

Public
Water Distribution / Extension System

The City of Raleigh consents to the connection and extension of the City's public water system as shown on this plan. The material and Construction methods used for this project shall conform to the standards and specifications of the City's Public Utilities Handbook.

City of Raleigh
Public Utilities Department Permit # _____

Authorization to Construct _____

Date _____

Private
Water Distribution / Extension System

The City of Raleigh consents to the connection to its public water system and extension of the private water distribution system as shown on this plan. The material and constructions methods used for this project shall conform to the standards and specifications of the City's Public Utilities Handbook.

City of Raleigh
Public Utilities Department Permit # _____

Authorization to Construct _____

Date _____

Public
Sewer Collection / Extension System

The City of Raleigh consents to the connection and extension of the City's public sewer system as shown on this plan. The material and Construction methods used for this project shall conform to the standards and specifications of the City's Public Utilities Handbook.

City of Raleigh
Public Utilities Department Permit # _____

Authorization to Construct _____

Date _____

Private
Sewer Collection / Extension System

The City of Raleigh consents to the connection to its public sewer system and extension of the private sewer collection system as shown on this plan. The material and constructions methods used for this project shall conform to the standards and specifications of the City's Public Utilities Handbook.

City of Raleigh
Public Utilities Department Permit # _____

Authorization to Construct _____

Date _____

Public
Reuse Distribution / Extension System

The City of Raleigh consents to the connection and extension of the City's public reuse system as shown on this plan. The material and Construction methods used for this project shall conform to the standards and specifications of the City's Public Utilities Handbook.

City of Raleigh
Public Utilities Department Permit # _____

Authorization to Construct _____

Date _____

As-Built Submittal Checklist

Please submit (1) hard copy of all documents to the Engineering Department and an electronic copy of all documents to **asbuilts@garnernc.gov**. Plans considered incomplete or not meeting Town standards will be returned with written comments to be addressed. Any minor comments shall be addressed in final submittal for engineering approval. ***Do not resubmit unless all comments have been fully addressed.***

The following fees are due at the time of submittal:

- $ 150.00 (fee includes 1st and 2nd Review)
- $ 75.00 (collected at 3rd, 5th, 7th Review)

General Notes

1. Plans must be submitted on 24" X 36" sheets.
2. Provide a north arrow on each plan sheet.
3. Provide scale of drawings and bar scale on each plan sheet.
4. Horizontal tie to North American Datum (NAD83/Suffix year). Datum to be consistent with approved plans.
5. Vertical tie to North American Vertical Datum of 1988 (NAVD88).
6. Submittals must include an electronic copy of as-built drawings in PDF format.
7. On each page, include the text "As-Built" in large, bold font.
8. On each page, add the provided certification block in accordance with 21 NCAC 56.16.00, completed, signed, and sealed by a NC registered PLS responsible for the as-built survey.

AS-BUILT CERTIFICATION

Firm Name: _____

Address: _____

Name/Date: _____

Signature: _____

SEAL

I hereby certify to the best of my knowledge and belief that this recorded As-Built is based on actual field survey information provided by _____dated _____ and accurately represents the final conditions of this project. The constructed improvements have been field verified and conform to all the provisions of the Town of Garner.

9. As-Built drawings should conform to the approved construction plans and include any field modifications or other changes to the approved construction plans.

Cover Sheet

10. Ensure that the cover sheet includes:
    - project name
    - vicinity map
    - parcel identification number
    - project address
    - date of survey
11. On Cover Sheet provide an As-Built Quantity Table indicating, at a minimum, the following information:
    - Streets (List lengths individually: Public, Private and/or Fire Lane)
    - Water mains (Identify diameter, material (including wrapping and/or coating (if applicable), pressure class and length)
    - Sewer mains (Identify diameter, material (including wrapping and/or coating (if applicable), pressure class and length)
    - Storm pipe (Identify diameter, material and length)
    - Reclaimed water mains (Identify diameter, material, pressure class, and length)
    - Number of and manufacturer of valves (For each size)
    - Number of and manufacturer of fire hydrants (per each)
    - Number of and manufacturer of manholes (per each)
    - Other (Any additional appurtenances)
    - Number of stop signs
    - Sidewalks (Identify width and length, measured in feet)
    - Greenways & multi-use trails (Identify width and length, measured in feet)
    - Greenway structures (bridges & culverts) (Identify width and length, measured in feet)
    - Greenway signs, benches & trashcan (per each)

Stormwater Conveyance

12. Show/label outline of FEMA 100-year floodplain (with base flood elevations) and Town of Garner Conservation Buffer.
13. Show/label outline of any jurisdictional wetlands and/or applicable zones of Neuse River buffers.
14. Label structure invert and top elevations.
15. Label all pipes with length, size, and material.
16. Provide as-built pipe schedule. For any pipes with slope less than 0.5% or with greater than 10% variance from design slope, provide as-built capacity calculations.
17. Provide size of riprap dissipation pad.
18. Provide statement of stormwater velocity at all outlets.
19. Include maintenance agreement responsibility statement.
20. Show/label permanent stormwater SCMs with locations and associated drainage inlets where required on site plan/construction drawings.
21. Spatial data shall be submitted to the Town of Garner following approval of as-builts. Provide Survey Point File - SHP (preferred), DWG, or DGN file of all NCPLS certified post-construction survey information with the following columns (as applicable):

a. Feature Type – Descriptions used shall be common industry standard abbreviated terms (MH, CB, DI, JB, FH, WV, WM, CO, SCM, etc.)
b. Northing
c. Easting
d. Elevation
e. Description

22. Spatial data shall be submitted to the Town of Garner following approval of as-builts. Provide Survey Lines file - SHP (preferred), DWG, or DGN file of all NCPLS certified post-construction survey information with following layer names.
    a. Storm Pipes (including attribute table or labels for pipe size, pipe type, pipe slope, invert upstream, invert downstream)
    b. Roadway Centerline
    c. Edge of Pavement
    d. Back of Curb
    e. Sidewalk
    f. Right of Way

Stormwater Control Measures

23. Provide narrative summary of site SCMs and any deviations from approved plans.
24. Provide as-built surveyed elevation spot shots to confirm as-built elevations in comparison to design contours, including slopes, top of dam, exterior slopes, and emergency spillway. Provide SCM as-built storage capacity/volume.
25. Provide as-built impervious and pervious surface areas in tabular form.
26. Provide approved elevations versus built elevations for any differences on the SCM cross-section.
27. Recorded Memorandum of Agreement along with SCM Operations and Maintenance Agreement is required prior to approval of as-builts.
28. Media/materials certification (for filtration systems [ex: sand filter, bioretention areas, etc.])
29. For vegetation to be planted within an SCM, provide a landscape planting list to verify conformance with approved plan or any substitutions made.
30. Ensure slopes of the stormwater device and berm are stable and not steeper than 3:1.
31. Removal of any silt fence or tree protection fence material is required prior to as-built approval.
32. Licensed Professional Certification of Engineering Stormwater Control Measure (attached) is required prior to as-built approval.

LICENSED PROFESSIONAL CERTIFICATION OF ENGINEERED STORMWATER CONTROL MEASURE

Specific type of Engineered Stormwater Measure(s):

_____

I_____as a duly licensed Professional, do hereby certify that the Engineered Stormwater Control Measure for the project entitled:

_____

with the Town of Garner Site/Subdivision #:_____has been constructed within substantial compliance and intent of approved construction plans, drawings, and specifications and that the associated infrastructure has been installed in compliance with the approved construction plans, drawings, and specifications. This statement is based upon referemce and reviews of the record drawings prepared for this site and upon periodic field inspections and project reviews completed during the construction of the referenced Engineered Stormwater Control Measure, including a final inspection of the stormwater control measure made within 30-days prior to the signature date outlined below.

_____ _____

Signature Date

(seal)

Engineering Bond Requirements

General Information

- An engineer's sealed estimate for outstanding items must be submitted, reviewed and approved by the Engineering Department. **All public infrastructure must be installed or a bond received prior to final plat approval**. Provide this information to Leah Harrison, Assistant Town Engineer - lharrison@garnernc.gov
- Engineer's estimate shall include a calculated total at 125% of estimated value.
- Engineer's estimate shall include a table with categories such as: Item #, Item Description, Quantity, Unit Rate, Totals.
- Listed below are items related to Engineering Department bonds only. All Planning Department related bondable items must be separate and coordinated with the Planning Department.
- Please note this document is not a comprehensive list of all items that could be encountered on all projects. This serves to identify the most commonly encountered items. Please use judgment in assessing your individual project for unique features needing included within the estimate. If you have any questions and need clarification on individual items, please feel free to contact us.

Common Items to Include in Estimate

Drainage Infrastructure Work

- Quantify all FES and YI frame/grates as EA.
- Quantify as-builts as LS.

Water and Sewer Work

- Quantify all utility adjustments of manholes and water valves as EA.

Sidewalks & HC Ramps

- Quantify all sidewalk in SYD within public right of ways or in public easements. Please note, installation of all sidewalk on project or phase must be installed by end of the 1 year warranty period and prior to acceptance of roadway.
- Quantify all HC ramps as EA.

Roadway

- Quantify all top lift asphalt within public right of way. Please note, installation of this item can only be deferred until 1st home CO is requested. All top lift asphalt must be in place for 1st

home CO to be issued.

- Quantify all pavement markings by EA and LF.
- Quantify monolithic islands in SYD or EA.

Street Lighting

- Quantify all street lighting within public right of ways or easements as EA.

Stormwater Control Measures

- Quantify conversion and or construction of all stormwater ponds that are within the phase being platted as well as any ponds that receive stormwater infrastructure from the phase requesting the final plat.
- Provide this information in an itemized breakout to include survey & as-builts (LS), grading (CYD), landscaping plants by species/sizes (EA), Fence (LF), Grass/Stabilization (SYD), Etc. Note that all plantings within the SCM are part of the Engineering Department bond. All other plantings fall under a separate bond with Planning Department.

Erosion Control

- Quantify all areas needing stabilized by SY.

Example Engineer's Estimate

See example shown on page 3 and 4.

Project Name

Engineer's Seal

Infrastructure Bond

Garner, NC

DATE:

Item	Description	Quantity	Unit	Unit Price	Total Price
A. Phase 1A Infrastructure					
1.	1" Asphalt Lift	2846	SYD		
2.	Concrete Sidewalk	6606	SF		
3.	ADA Sidewalk Ramps	11	EA		
4.	Pavement Markings	1	LS		
5.	Street Signage	8	EA		
6.	Concrete Bands	65	LF		
7.	Street Lights	7	EA		
				Total Phase 1A	
TOTAL A					

Item	Description	Quantity	Unit	Unit Price	Total Price
B. Offsite Town Street Improvements					
1.	10" ABC	116	SY		
2.	4" I19.0C	116	SY		
3.	1.5" S9.5B	116	SY		
4.	1.5'x1.5" Milled Lap Joint	122	LF		
5.	30" Standard Curb	105	LF		
6.	5" B25.0C Under Curb	105	LF		
7.	Grade for Widening & Sidewalk	1	LS		
8.	Fine Grade For Widening	1	LS		
9.	4" Sidewalk	660	SF		
10.	Striping	1	LS		
8.	18" Median Curb Work	35	LF		
9.	Demo & Haul Off Curb	83	LF		
		Total			
TOTAL B					

Item	Description	Quantity	Unit	Unit Price	Total Price
D. Pond Conversion - Wet Detention Pond					
1.	Build model / Intital surveying	1	LS		
2.	Dewater pond - Labor (Set up pumps, Siphon, fuel pumps etc. throughout conversion)	30	HR		
3.	Dewater Pond - pumps	15	HR		

4.	Muck out Pond (Based on 1 ft average of mud export to landfill off site)	180	CY		
5.	Landfill fees & trucking	15	LDS		
6.	Import & place Topsoil for fine grading & planting	275	CY		
7.	Fine grade slopes around Pond including dam per plan	41350	SF		
8.	Riser work- remove skimmer, install drawdown, etc.	1	LS		
9.	Touch up RipRap Flumes & dissapater pad	45	TN		
10.	Sweetflag - 4" pot	72	EA		
11.	Pickerelweed - 4" Pot	74	EA		
12.	Blue Flag Iris	68	EA		
13.	Soft Rush	71	EA		
14.	Three Square Bulrush - 4" pot	70	EA		
15.	Swamp Milkweed - 4" Pot	75	EA		
16.	Cardinal Flower - 4" Pot	72	EA		
17.	Scarlet Rose Mallow - 4" Pot	74	EA		
18.	Dwarf Joe Pye Weed - 4" Pot	75	EA		
19.	Spotted Trumpetweed - 4 " Pot	76	EA		
20.	Seed & Straw all disturbed slopes around Pond & dam	27480	SF		
21.	Survey - As-Built (allowance)	1	LS		
			Total Stormwater Pond		
TOTAL D					

Total	
Total for Bond (125% of Estimate)	

NOTES: