

*Town of Zebulon*  
*Public Works Department*

450 E. Horton St.  
Zebulon, NC 27597  
(919) 269-5285



**STREET AND STORM DRAINAGE  
STANDARDS & SPECIFICATIONS  
MANUAL**



**February 7, 2011**

# INTRODUCTION to SPECIFICATIONS

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The following specifications and details have been established to assist developers and engineers with the design, construction of stormwater, streets or roadway, sidewalk or other public infrastructure within the jurisdiction of the Town of Zebulon. The methods, procedures, design factors, formulas, graphs and tables presented in the standard specifications as well as the information presented in the various other sections herein are intended to establish minimal guidelines for residential, commercial and industrial design. The Town of Zebulon believes that the following criteria are sufficient to insure the welfare and safety of the general public and to protect the economic investment of the citizens of our Town.

Alternative design methods may be considered by the Public Works Director on a case-by-case basis; however, there should not be extensive variations from the criteria and procedures within this division without the expressed approval of the Town of Zebulon.

Although this document has been created to provide minimum criteria for the design and construction of new infrastructure within the Town it is recognized that changes to the standards and design criteria are some times necessary to insure the welfare and safety of the general public and balance the needs, rights, and expectations of private property owners and citizens of the Town. Therefore, the Town may periodically revise these standards and criteria. It will be the responsibility of the design professional to verify and obtain any periodic updates and reference the latest edition of this manual.

## **TOWN OF ZEBULON**

The Town of Zebulon Public Works Director shall be responsible for interpretation and implementation of the Standard Specifications design criteria for the Town of Zebulon. Approval from other applicable agencies may be required. If the detail is not included in this document, the NCDOT Roadway Standard Drawings and Details shall apply. All construction shall conform to Town of Zebulon specifications, or to the latest edition of the NCDOT Standards Specifications for roads and structures.

## **TOWN OF ZEBULON SUBMITTAL POLICY**

It is the policy of the Town of Zebulon that all developers or its engineers will submit eleven (11) copies of plans for review. Each developer will find attached a copy of the Construction Drawings Checklist and Guideline to follow for each category. All engineers and developers are encouraged to take these specifications into consideration in the preliminary layout of the project so changes can be held to a minimum when construction drawings are being reviewed.

The standard specifications with this manual may be downloaded from the Town website at: [www.townofzebulon.org](http://www.townofzebulon.org) or copies can be obtained at the Public Works Department, 450 East Horton Street, Zebulon, NC 27597.

The Town of Zebulon will require each developer or its engineer to provide the following at final acceptance:

1. One (1) copy of As-built Drawings on bond media.
2. One (1) copy of As-built Drawings on mylar.
3. Two (2) electronic files on compact disc of As-built Drawings (PDF not geo-referenced and DWG geo-referenced to State plane NAD 83 ft, NFIPS 3200 NC versions).
4. Roadway/Stormwater infrastructure – Engineer Certification
5. Summary of all Geotechnical report (sub-grade, asphalt, concrete)
6. Certification of values of dedicated infrastructure
7. Site Plan/performance Bond for the remaining work (i.e. Overlays)
8. One Year Warranty for all Infrastructures

Once the Town of Zebulon has been provided the as-built drawings, the referenced project will be accepted into their system and the one year warranty will start.



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## CONSTRUCTION DRAWINGS CHECKLIST & GUIDELINES

### Transportation Services

- All sheets 24" X 36"
- Vicinity Map no smaller 1" = 500' with north arrow
- Cover sheet includes general notes, owner's name, telephone number, and mailing address
- Cover sheet includes developer's name, telephone number, and mailing address
- Cover sheet includes subdivision, site plan, or group housing case number (e.g. S-I-05)
- North arrow on all applicable sheets
- Public improvement quantities on front cover sheet
- Title blocks on all sheets
- Sealed by professional engineer, landscape architect, or surveyor as needed
- Show and locate all sidewalks & opposing driveways surrounding the site
- Right of way & pavement widths, street widths, sidewalk, curb & gutter, medians, median openings, curb radii labeled and dimensioned
- Existing property irons labeled "EIP"
- Centerline profile for existing streets shown for a minimum of 300 feet from the end of proposed streets, or as needed to establish adequate sight distance triangles
- Lot numbers, driveways, and parking lots shown on plan view
- Plan view shows all actual street names if known. State road number shall be shown, if applicable
- Plan view indicates whether existing streets are asphalt, concrete, gravel or dirt
- Stations beginning 0+00 labeled every 100' feet on plan and profile view
- Match lines between sheets should be shown
- Complete street curve data shall be shown on plan & profile sheet to include VPC sta., VPI sta., VPT sta., VPC elv., VPI elv., VPT elv., L, K, A, PC sta., PT sta., L, R, Delta, Chord Distance, & Chord Bearing
- Driveway permit from NCDOT, if access is on a State maintained road
- Proper location of sidewalk (BOC to right of way < 12.5' sidewalk located 1.0' inside right of way, BOC to right of way > 12.5' sidewalk located 4.0' inside right of way)
- All handicap ramps shown and labeled and are in proper place as shown on Standard Detail
- Typical sections are shown with pavement designs for all proposed residential, collector, & commercial streets
- Driveways and parking lots shall be shown on plan view.
- Plan view show proposed and existing curb and gutter, storm sewers, drainage structures, driveway pipes, water mains, sanitary sewer mains, etc.

### **Transportation Services (Continued)**

- Street lighting photometric design and layout including type of poles and fixtures
- Profile view shall show existing right and left right of way and centerline elevations as well as proposed centerline.
- Plans shall bear the note: "All construction to be in accordance with all Town of Zebulon standards and specifications and NCDOT if applicable."
- Construction plans show location of proposed street signage
- Provide all construction details where applicable.
- Provide any required traffic signage, lane striping or other traffic control devices.
- Phasing plan matches approved preliminary plan. Any other information required by the Public Works Director to determine the safety and effectiveness of improvements made in the public rights of way and easements.
- Centerline profile shown for a minimum of 100 feet from the end of proposed streets.
- 1/4 inch slope across entire sidewalk and planting strip area.
- Stone under curb and gutter when depth of stone and asphalt is 10" or greater for all public streets
- Private streets are labeled and include private street inspection statement and any necessary access easements
- Slope easements shown, labeled, and dimensioned
- Cul-de-sacs are dimensioned. (Back of curb radius & r/w radius)
- Existing and proposed right of way dimensioned & labeled
- Sight triangles to be shown and labeled including any structures within them. Add note: "Within the sight triangles shown on this plan, no obstruction between two (2) feet and eight (8) feet in height above the curb line elevation or the nearest traveled way if no curbing exists."
- Existing and proposed parking areas, bay dimensions aisle dimensions.
- Vehicular stacking space areas, length of queue, storage space required per stacked vehicle including aisle width, stall depth, stall width
- Adequate sight distance is demonstrated at intersections and dimensioned on plans.

### **Stormwater**

- Two copies of complete drainage calculations including one copy of the drainage area map and catch basin/gutter flow calculations
- 100-year floodplain boundaries and elevations shown on all plans at profiles where applicable.
- Class and location of rip-rap and all creek location/relocation shown on plan view.
- Dimensions and locations of all permanent erosion control measures shown on all applicable plan view sheets.
- All existing and proposed private drainage easements shown on all applicable sheets.
- All single pipes equal to or larger than 48" diameter and all multiple pipes have headwalls shown and labeled on upstream end and a headwall or FES on the downstream end.
- Existing and proposed contours of intervals at two feet or less, referred to sea level datum.
- Label and show drainage swales, ditches, channels and water courses, and direction of flow.
- Label and show spot elevations at proposed drainage swales, ditches, channels and water courses.
- Impoundment or retention/detention structures for stormwater if required.
- Show location of discharge points, velocity dissipation measures.
- Show location of existing and proposed storm sewer and inlet structures and culverts.
- Show floodway and floodway fringe areas. Flood hazard soil boundaries, flood storage area easements and regulatory flood protection elevations.
- Provide summary of water quality/quantity calculations.
- Affix completed financial responsibility form
- Show existing/proposed topography.
- Show all floodplains, wetlands, FEMA and alluvial soils, Neuse buffer, indicate FEMA/Firm (flood insurance rate map) map number, effective date of map and flood study numbers.
- Show backwater elevations for new stream crossings.
- Show stormwater network, including inlets, culverts, swales, ditches and channels (top elevation, invert elevation, pipes size and slope).
- Stream crossings have been approved by the required agency.

### **Public Utilities**

- All elevations shall be shown of the profile view as it relates to water main, sanitary sewer mains, etc.
- Existing utility lines shall be shown and labeled on plan view by dashed lines.
- Proposed utility lines shall be shown by solid lines.
- Plans show final proposed locations and dimensions of all water and sanitary sewer lines.
- Include stubs to each property line for water and sanitary sewer.
- Invert elevations for all manholes and profiles of sanitary sewer lines.
- Plan view shows all existing and proposed underground utility layout, including fiber optic, electric, gas and cablevision facilities located on the right of way.
- Existing water meter boxes and sewer cleanouts shown and labeled as "exist w. conn." and "exist s. conn."
- Connection number should be given for existing water connections.
- Existing paved roads shall be bored if possible.
- Smooth steel encasement pipe shall be shown on the plan view and profile view including size and wall thickness. 04", 6", and 8" water lines shall be bored under driveways when possible
- All existing and proposed sanitary sewer easements shown on all applicable sheets.



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**STREET AND STORM DRAINAGE  
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AMENDMENTS**

1. SECTION 2, STREET/SUBDIVISION DESIGN/CONSTRUCTION/INSPECTION  
Chapter 2.6, H – Addition of “not” to sixth line to read “The results of the samples will not be averaged and used to ....” (Amended August 31, 2011)
2. SECTION 3, RESIDENTIAL & COMMERCIAL LIGHTING STANDARDS  
Chapter 3.0, F – Addition to end of paragraph to read “As of June 2013, Duke Progress Energy charges a onetime fee per pole for installation. On November 25, 2013, the fee is \$563.63 per pole. The property owner/developer/contractor is responsible for payment of the fee.” (Amended November 25, 2013)
3. SECTION 8, GREENWAY DESIGN STANDARDS  
Addition of greenway design standards to standards and specifications manual. (Amended June 1, 2021)

## **SECTION 1**

# **INTRODUCTION TO STREETS & STANDARDS**

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The following division has been established to assist developers and engineers with the design of public streets within the jurisdiction of the Town of Zebulon. The methods, procedures, design factors, formulas, graphs, and tables presented in this division are intended to establish minimal guidelines for residential and commercial design of public streets. The Town of Zebulon believes that the following design criteria are sufficient to insure the welfare and safety of the general public and to protect the economic investment of the citizens of our Town.

Alternative design methods may be considered by the Public Works Director on a case-by-case basis; however, there should not be extensive variations from the criteria and procedures within this division without the expressed approval of the Town of Zebulon.

### **1.0 TOWN OF ZEBULON PUBLIC WORKS DIRECTOR**

The Town of Zebulon Public Works Director shall be responsible for interpretation and implementation of the pavement design criteria for the Town of Zebulon.

### **1.1 TOWN OF ZEBULON PAVEMENT POLICY**

It is the policy of the Town of Zebulon that all developed land within the Town Limits has adequate streets and parking lots. The Town may accept roadway systems for maintenance if the system provides pavement sections that have been accepted for maintenance by the Town Board of Commissioners and have been designed and constructed in accordance with the provisions of the Town and this division.

### **1.2 ACKNOWLEDGEMENTS**

This division has been prepared by the Zebulon Public Works Department, in cooperation with the Zebulon Planning Department. However, the content of this division is largely derived from the NCDOT Superpave 2009 (Hot Mix Asphalt/Quality Management System), NCDOT Standard Specifications for Road and Structure, and standards and specifications for the Town of Wake Forest and the City of Raleigh. These manuals, standards and specifications were particularly important because of their format, quality, completeness, and because they represented accepted criteria applied in the area of the Town of Zebulon.

### **1.3 GENERAL REQUIREMENTS:**

- 1.3.1 Prior to commencing construction, all approvals including plan approval and all permits and encroachments shall be obtained. Site grading only may be performed upon issuance of a grading permit from Wake County. All other construction must await the issuance of all remaining permits. A preconstruction conference must also be held prior to commencing any construction.
- 1.3.2 Prior to the issuance of a certificate of occupancy for any dwelling, an engineer's certification must be received by City of Raleigh for both water and sewer extensions.



- 1.3.3 The developer is responsible for the maintenance and repair of streets for twelve (12) months after acceptance by the Town for warranty. At the end of twelve (12) months the Town of Zebulon will accept permanent responsibility. If a significant failure occurs, requiring extensive maintenance during the first year of service, the Town of Zebulon shall suspend the twelve (12) month warranty until the failure is repaired to an acceptable condition.
- 1.3.4 The developer is responsible for the maintenance and repair of all paved areas other than streets.
- 1.3.5 No contractor shall permit mud or construction debris to accumulate in any paved street which is maintained or is proposed to be maintained by the Town of Zebulon.

## **1.4 INSPECTIONS**

- 1.4.1 Upon completion of construction, the developer shall request a final inspection. Upon completion of all punch list items, the provision of a set of acceptable record drawings, and the submission of engineer's certifications, a one-year warranty period shall commence.
- 1.4.2 During the one-year warranty period the developer shall repair any latent defects which occur. At the end of the one-year warranty period, the developer shall request a warranty inspection. Upon successful completion of all warranty items the developer shall be released from maintenance responsibilities for the warranted construction.
- 1.4.3 All inspections must be scheduled the day prior to when needed. Inspections will be performed in the order received. Every effort will be made to accommodate the time of request; however, this cannot be guaranteed.
- 1.4.4 All inspections, which fail, are not subject to a re-inspection fee. Inspections fee covers initial and second inspections. Additional inspections require fees based upon Town Inspections hourly rates.

## **1.5 MAINTENANCE**

### **1.5.1 EXISTING TOWN OF ZEBULON STREETS**

The Town will assume all maintenance responsibility on all existing paved streets. If an individual owner wishes to pipe an existing roadside ditch and/or install curb and gutter in front of their property, the Town of Zebulon shall make a determination whether it is favorable to do so. The Town, Town's contractor, or licensed utility contractor will install these improvements. If the Town installs these improvements, the Town shall require the owner to pay the full cost of the materials, labor, design, permitting and equipment. All construction will be dedicated to Town of Zebulon by property owner for ownership and future maintenance.

#### **A. Existing Non-Curb and Gutter Streets**

The Town shall maintain existing non-curb and gutter streets in the following manner:

- a. Streets that have an adequate roadway base and inadequate roadside drainage system shall be resurfaced as required. The inadequate roadside drainage will be scheduled and repaired by Town staff as staffing and funding permits. This maintenance shall be at the sole cost and expense of the Town.

- b. Streets that have an inadequate roadway base, but an adequate roadside drainage system shall have the inadequate base replaced and shall be resurfaced as required. If in the judgment of the Town of Zebulon Public Works Director, more than one-half of the street surface needs its base replaced, the Town of Zebulon may recommend that the street be rebuilt with curb, gutter, and paving to standard Town specifications. Property owners may be assessed for curb and gutter improvements based on the road frontage of their property. The Board of Commissioners will make the final determination as to whether the street is to be rebuilt with curb and gutter and whether assessments will be required of the property owner.
- c. Streets that have inadequate roadway base and/or inadequate roadside drainage will be resurfaced and drained as required. If, in the judgment of the Town of Zebulon Public Works Director, one-half of the street surface needs its base replaced or if adequate roadside drainage cannot be obtained without extensive work, the Town of Zebulon may recommend that the street be rebuilt with curb, gutter and paving to standard Town specifications. Property owners may be assessed for curb and gutter improvements based on the road frontage of their property. The Board of Commissioners will make the final determination as to whether the street is to be rebuilt with curb and gutter and whether assessments will be required of the property owner.
- d. If a new roadside ditch is required and its invert elevation is more than 30” below the elevation of the edge of the finished asphalt surface, options include:

Elect to have the ditch remain open, or

Elect to have the ditch piped with the total cost of the piping and appurtenances being assessed against the property in a manner consistent with other street improvement assessments, or

Elect to have curb and gutter and pavement widening installed in accordance with existing assessment policies.

The Town of Zebulon Public Works Director will make the final recommendation to the Board of Commissioners which option best meets the interest of the Town and parties involved.

- e. Streets that intersect streets that have been petitioned for curb and gutter that also need curb and gutter to adequately drain into the street to be improved shall have curb and gutter installed upon recommendation and approval of the Town of Zebulon Board of Commissioners.

## B. Existing Curb & Gutter Streets

All existing Town of Zebulon streets that have curb, gutter and paving shall be maintained as required at the sole cost and expense of the Town. Town of Zebulon does not maintain NCDOT streets within the town limits or private streets.

### C. Existing Dirt Streets

All dirt streets are to be improved at the expense of the abutting property owners or developer. These improvements can be caused by petition, Board of Commissioners order or as a requirement to obtain subdivision approval. Once approved, the Town will thereafter maintain the street at its sole cost and expense.

Existing dirt streets accepted by the Town prior to adoption of this policy shall be maintained as a dirt street at the sole expense of the Town.

### 1.5.2 NEW STREETS

All streets constructed as part of a new subdivision or other development shall be constructed at the sole expense of the developer.

#### A. Warranty/Repairs Performance Guarantee

Upon completion of construction of new streets, the developer shall request a warranty inspection. Upon completion of all punch list items, the developer shall submit to the Town of Zebulon a set of acceptable record drawings. Upon approval of these materials by the Town Board, a one-year warranty period shall commence.

During the one-year warranty period, the developer shall repair any latent defects that occur. At the end of the one-year warranty period, the developer shall request a final inspection. Upon successful completion of all warranty items, the developer shall be released from maintenance responsibilities for the warranted construction.

Warranty repairs to the following common problems shall be as follows:

- a. Trench failures in pavement shall be repaired in accordance with these Standards and Specifications.
- b. The Town of Zebulon may require a 1-inch overlay over any segment of street in which there are 3 or more trench failures per 800 longitudinal feet of street. A trench failure shall be defined as a depression of 1/2 inch or greater at the deepest point over a trench width. Extent of resurfacing shall be as determined by the Town of Zebulon.
- c. Cracks in sidewalk and/or curb and gutter shall be repaired by removing and re-pouring such sections as necessary; All repairs will be made to nearest control joint or expansion joint.
- d. Pavement, sidewalk or curb and gutter failures caused by latent subsurface problems shall be repaired in accordance with the recommendations of an approved Geotechnical Engineer.
- e. All storm sewer systems, ditches and streets shall be free of debris, dirt or silt.
- f. All storm sewer, drainage and street appurtenances shall be in perfect condition and properly exposed.
- g. All other defects shall be corrected in accordance with the recommendations of the Public Works Director.

If a developer fails to complete warranty items, future projects of the developer shall not be reviewed by the Department of Public Works. In addition, the Town may take legal action against the developer.

## B. Performance Guarantee

Following installation of erosion controls, the developer may proceed with preparation of the final plat and installation of all required improvements in accordance with the approved construction plat and the regulations of this ordinance. In lieu of installation of such improvements, the subdivider shall provide sufficient guarantee that such improvements will be installed as follows:

- a. Performance Guarantee. In lieu of prior construction of the improvements required by this ordinance, the subdivider shall guarantee that such improvements will be carried out according to the Town of Zebulon's specifications at his expense. Such guarantee may be in the form of a surety bond made by a surety company licensed to do business in North Carolina or certified check drawn in favor of the Town of Zebulon, or cash deposited with the Town of Zebulon, or a letter of credit from a local bank for the amount of the improvements to be installed. Such guarantees shall be in an amount of not less than one hundred (100) percent nor more than one hundred twenty-five (125) percent of the estimated cost of the construction of the required improvements. This amount shall be determined by Director of Public Works and Utilities. Improvements must be completed by the developer within one (1) year of the approval of the performance guarantee.
- b. Warranty and Defects Guarantee: Upon the acceptance of facilities, utilities or streets for permanent maintenance, a one-year warranty for all improvements shall become effective. This warranty must be satisfactory to the Town of Zebulon.

For the purposes of this section, the term "defects" refers to any condition in publicly dedicated facilities, utilities or streets that requires the Town to make repairs to such improvements over and above the normal amount of maintenance that they would require. If such defects appear, the warranty may be enforced regardless of whether the facilities, utilities or streets were constructed in accordance with the requirements of this ordinance.

## 1.6 UTILITY CUTS

A permit will be required for any utility company wishing to excavate or place utilities in the Town right-of-way. Pavement cuts in streets made by the utility company or the Town shall be repaired in either of the following ways:

- A. No. 57 stone shall be placed and vibrated on top of pipe to within 8-inches of the pavement surface after which 6-inches of H Binder and 2-inches of SF 9.5 asphalt is placed. All edges shall be over-excavated by 12-inches on each side of the cut and a 2-inch depth of SF 9.5 asphalt and 6-inches of H binder shall be placed in the remaining cut area. All pavement joints shall be tacked and sealed with an approved sealer. See Standard Detail.
- B. Electric service will not go in until street section is graded at final and approved.

## **1.7 USE OF EASEMENTS - HARD IMPROVEMENTS**

All public easements including sewer, water, storm sewer and electric are to remain clear of obstructions. No buildings, fences, trees, shrubs or other obstructions shall be placed in any easement. However, fences may be allowed transversely but not longitudinally across utility easement with an approved encroachment permit. Fences across utility easements shall be required to provide a 12 foot vehicular gate. Driveways, walkways, asphalt and parking lots may be permitted in easements; however, the Town reserves the right to remove such asphalt, concrete, base course and sod as necessary to access its facility in the case of emergency. Pavement or concrete will be replaced with a patch. Sod will be replaced with fescue or rye seeding. The Town will not be responsible for replacing a property owner's sod after repairing a utility line.

## **SECTION 2 STREET/SUBDIVISION DESIGN/CONSTRUCTION/INSPECTION**

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The purpose of this division is to define the policy of the Town of Zebulon with respect to the design, construction and maintenance of public streets within the Town. The following shall be considered the minimum standards of design for public infrastructure of streets within the Town of Zebulon. These systems include streets, sidewalks, greenways, and other ancillary systems.

All streets within the Town of Zebulon shall meet all the requirements of the Town of Zebulon, latest revision. The latest edition of the NCDOT “Standard Specifications for Roads and Structures” shall apply unless otherwise stated herein. The following substitutions shall be read into the aforementioned specifications:

- “State” or “Commission” shall be replaced by “Town of Zebulon”.
- “Resident Engineer” shall be replaced by “Town Engineer” or its authorized representative.
- “Sampling and Testing by Commission” shall be replaced by “sampling and testing by the Town or its duly authorized testing agent.”
- “Inspection by Commission” shall be replaced by “Inspection by Town or its duly authorized representative.”

NCDOT standards shall be applicable on all state maintained roads.

### **2.0 SUBDIVISION STREETS**

All public streets of any type constructed within the Town of Zebulon shall be designed to include the following minimum improvements: adequate grading, underground drainage, curb and gutter, public water and public sanitary sewer, paved streets, 5 ft wide sidewalks, street lights, street trees, underground wiring, and recreational areas.

In every new subdivision or development, the street system shall conform to the Town of Zebulon Multi-Modal Transportation Plan, April 2001 or as revised. In addition to the requirements of the Zebulon Multi-Modal Transportation Plan, the recommendations generated as a result of a Traffic Impact Analysis (TIA) or a Town-approved thoroughfare or corridor study will be considered in the design of street locations, design and types. The specific design elements and features will be considered in conjunction with the higher functions associated within the Zebulon Multi-Modal Transportation Plan. Refer to Town Ordinance 2010-13 for TIA requirements.

Right-of-way and pavement widths shall be in accordance with the Town of Zebulon Multi-Modal Transportation Plan and Table 1.

**Table 1 Minimum Right-of-Way and Pavement Width**

<b>Type of Street</b>	<b>Min. Right of Way Width Curb and Gutter (Back to Back)</b>	<b>Min. Pavement Width Curb and Gutter (Back to Back)</b>
Major Thoroughfare	Per Thoroughfare Plan	Varies, 52' min.
Minor Thoroughfare	Per Thoroughfare Plan	Varies, 45' min.
Residential Collector	60'	35'
Local Street	50'	26'
Cul-de-Sac	53' R	48' R
Frontage Road	60'	27'

### 2.0.1 Street Classifications/Definitions

- A. Major Thoroughfare: As identified on the officially adopted by the Town of Zebulon. Multi-Modal Transportation Plan, April 2001 or latest revision.
- B. Minor Thoroughfare: As identified on the officially adopted by the Town of Zebulon Multi-Modal Transportation Plan, April 2001 or latest revision.
- C. Residential Collector Street: A local access street that serves as a connector between local streets and the thoroughfare system, collecting traffic from 100 to 400 dwelling units.
- D. Local Street: Defined as being either cul-de-sacs, loop streets less than 2,500 feet in length, streets less than one mile in length that do not connect thoroughfares or serve major traffic generators and do not collect traffic from more than one hundred (100) dwelling units and whose function is to provide access to adjacent properties.
- E. Cul-De-Sac: A short local street, no more than 1,000 feet in length, having one open end to traffic and the other terminated by a vehicular turn-around.
- F. Frontage Road: A street parallel and adjacent to a major thoroughfare or railroad, which provides access to abutting properties, protection from through traffic and control of access to the major thoroughfare. Where a tract of land to be subdivided adjoins a Major thoroughfare, the Planning and Zoning Board shall, wherever possible, require that lots, which would otherwise abut the thoroughfare, be provided with frontage on a frontage road.

### 2.0.2 Widening of Existing Streets

New subdivisions or developments along existing streets of inadequate right-of-way shall provide and dedicate additional right-of-way and street paving improvements to meet the minimum widths specified above. The entire right-of-way shall be provided and dedicated where any part of a new subdivision is on both sides of an existing street. Minimum pavement section shall be as required by a Traffic Impact Analysis or 2 lanes minimum. One-half the required right-of-way and required street improvement (1/2-ultimate section) measured from the centerline of the existing street shall be provided where a new subdivision or development is located only on one side of an existing street.

Widening of streets in existing neighborhoods will be considered on a case-by-case, taking into consideration the effects on the neighborhood and the traffic and parking requirements.

**2.0.3 Paving**

In all cases, the subdivider shall be responsible for the cost and installation of the street foundation and paving of all streets on the approval of the final plat in accordance with the *Town of Zebulon Street and Storm Drainage Standards & Specifications Manual*, latest revision, and the North Carolina Department of Transportation.

**2.0.4 Pavement Design**

Pavement must be designed in accordance with the table below:

**Table 2**

Roadway Type	
Major and Minor Thoroughfare	See NCDOT Standards
Residential Collector	1.5” SF 9.5A + 2.5” SF 9.5B Asphalt over 8” CABC
Local Streets	1.5” SF 9.5A +1.5” SF 9.5B Asphalt over 8” CABC
Cul-de-sac	1.5” SF 9.5A +1.5” SF 9.5B Asphalt over 8” CABC

1. Pavement Design Life: All pavement structures for the Town of Zebulon shall be designed with a pavement design life of 20 years. With over 20 miles of local streets within the Town of Zebulon, it has been necessary to establish a routine maintenance and resurfacing program. Assuming that 1 mile of street can be resurfaced once a year, it would take approximately 20 years for each street to receive its proportion of refurbishment. The Town of Zebulon, therefore, feels that it would be cost prohibitive to permit streets to be constructed within the Town with a design life of less than 20 years, and therefore, will require all future streets in the Town's jurisdiction be constructed with a 20-year design life.
2. Pavement design standard: All pavement structures must meet the minimum design standards provided in Table 2 above. A geotechnical report shall be furnished to the Town to confirm that the minimum pavement schedule provided in Table 2 is adequate for the site conditions, or provide recommendations for an alternate pavement schedule where site conditions warrant a more stringent standard.

**2.0.5 Vertical Alignment**

A. Grades

Unless necessitated by exceptional topography and subject to the approval of the Town of Zebulon Public Works Director, street grades shall not exceed eight (7%) percent. Streets to be maintained by the North Carolina Department of Transportation shall not exceed seven (7%) percent. In all cases, street grades shall not be less than one (1 %) percent.

Grades approaching intersections shall not exceed five (5%) percent for a distance of at least one hundred (100) feet from the centerline of the intersection.

B. Vertical Curves

All changes in street grade shall be connected by a vertical curve having a length of at least 100 feet, or the equivalent in feet, rounded upward to even multiples of 50, of the value of K (given in Table 3) times the absolute value of arithmetic difference of the two grades in percent, whichever is greater.



**Table 3 Minimum K Values**

<b>Street Type</b>	<b>Sag</b>	<b>Crest</b>
Major Thoroughfare	140 K	240 K
Minor Thoroughfare	100 K	150 K
Residential Collector	28 K	28 K
Local and Cul-de-sac	18 K	18 K
Frontage Road	18 K	18 K

**C. Super-elevation**

Super-elevation shall only be utilized on major thoroughfares except when widening NCDOT streets. Super-elevation for shoulder sections shall not exceed 0.08 feet/foot of width. For curb and gutter sections, super-elevation shall not be less than 0.02 feet/foot of width or more than 0.06 feet/foot of width.

**D. Grading**

Grading and filling shall be undertaken to insure that:

- a. The street is centered in the right-of-way.
- b. Adequate shoulders and space for future sidewalks are provided.
- c. Allowance is made for roadside ditches, curbs and gutters, and storm sewers for street drainage.
- d. Street grades shall be established wherever practicable in such a manner as to avoid excessive grading, the promiscuous removal of ground cover, tree growth and the general leveling of the topography.

**2.0.6 Horizontal Alignment****A. Curves**

Where a street centerline deflection of five (5) or more degrees occurs a curve shall be introduced having a radius of curvature of not less than the following:

**Table 4 Minimum Horizontal Curve Radii**

<b>Street Type</b>	<b>Minimum Radius</b>
Major Thoroughfare	850
Minor Thoroughfare	500
Residential Collector	300
Local Street	200
Cul-de-sac	150
Frontage Road	150

A tangent of not less than one hundred (100) feet shall be provided between reverse curves on all streets.

## B. Intersections

Street intersections shall be designed in the following manner:

- a. No more than two streets shall intersect at one point.
- b. Streets shall intersect as nearly as possible at right angles, and no street shall intersect any other street at an angle of less than sixty (60) degrees.
- c. Intersections with major thoroughfares shall be at least eight hundred (800) feet apart, measured from centerline to centerline. The Planning Board may waive this requirement if such requirement would prevent a property owner fronting on a major thoroughfare from having access to such a facility.
- d. For divided thoroughfares desirable spacing for median breaks is 1,000 feet, with the minimum allowable spacing provided at 500 foot intervals.
- e. Street jogs with centerline offsets of less than 150 feet are prohibited.
- f. Property lines at street intersections shall be rounded with a minimum radius of twenty (20) feet.
- g. Residential driveways shall be located a minimum of 20 feet from the point of tangency of curb radii of street intersections.
- h. Intersection Sight Distance is required at the intersection of two streets or intersection of a street and driveway. The Town shall review all proposed development plans and landscape planting plans for compliance with the latest edition of the American Association of State Highway Transportation Officials (AASHTO) "Policy on Geometric Design of Highways and Streets" for sight distance. Plans must demonstrate design of adequate sight distance to allow passage of a motorist on a minor street having stop control to safely react and cross or join traffic on a major street (whose approach may not be controlled) while not requiring traffic on the major street to reduce its speed or alter its path. The amount sight distance required at an intersection is dependent upon the type of traffic control at the intersection, design speed of the vehicle, and turning maneuver(s). Intersection sight distance is measured in the horizontal (plan) and vertical (profile) planes and is a visual line connecting the driver's eye and the approaching vehicle (both located within the centerline of the travel way). The vertical line of sight is a visual line connecting the driver's eye, which is located 3.5 feet above the roadway surface, with the approaching vehicle, which located 4.25 feet above the roadway surface. A driver must be offered an unobstructed line of sight (in both planes) to the roadway they wish to cross or join. If this line of sight is impeded by any obstructions, either the obstruction should be moved or the alignment adjusted.

All proposed connections to NCDOT roads shall meet the criteria given in Details, as well as the applicable criteria of the NCDOT "Subdivision Roads Minimum Construction Standards," latest revision, and the "Policy on Street and Driveway Access to North Carolina Highways," latest revision.

## C. Cul-de-Sacs

Permanent dead-end streets or cul-de-sacs shall be no longer than one thousand (1000) feet. In general, streets with one end permanently closed shall be avoided unless the design of the subdivision and the existing or proposed street system in the surrounding area clearly indicates that a through street is not essential in the location of the proposed cul-de-sac.

#### D. Alleys

The Board of Commissioners may require the subdivider or developer to construct alleys. When required or proposed by the subdivider or developer, alleys shall have a minimum right-of-way of 20 feet and generally conform to Standard Details.

#### E. Blocks

- a. Proposed Use: Blocks shall be laid out with special consideration given to the type of land use proposed within the block.
- b. Length: Blocks shall not exceed 1,000 feet in length nor shall they be less than 400 feet in length, as measured from centerline to centerline.
- c. Width: Blocks shall have sufficient width to provide for two (2) tiers of lots of appropriate depth except where otherwise required to separate residential development from through traffic.
- d. Crosswalk: A pedestrian crosswalk not less than 10 feet in width may be required near the center and entirely across any block 900 feet or more in length where deemed essential to provide adequate access to schools.

### 2.0.7 Stopping Sight Distance

- A. Safe Stopping Sight Distance is required for both level and graded conditions. Plans must demonstrate design of safe stopping sight distance in accordance to the latest edition of the AASHTO "Policy on Geometric Design of Highways and Streets."
- B. Stopping sight distance is the distance required of a driver to perceive, react, brake, and stop before reaching a conflicting object in its path. The required stopping sight distance is dependent upon the reaction time of the driver, the design speed of the vehicle, and the grade of the roadway.
- C. Stopping sight distance is measured in both horizontal (plan) and vertical (profile) planes. In both planes, a driver must be offered an unobstructed line of sight to the roadway in front of them.
- D. Horizontal and Vertical stopping sight distance is a straight line measured along the centerline of the lane of travel from driver's eye, which is located 3.5 feet above the roadway surface to an object located within the roadway 0.5 feet above the roadway surface. If this line of sight is impeded by any obstructions, either the obstruction should be moved or alignments adjusted.

### 2.0.8 Drainage

- E. Inlet design shall be based upon a minimum spacing of 300 feet between inlets.
- F. Streets shall be designed so as not to permit storm runoff to cross intersections. Storm drainage structures should be used to avoid storm runoff crossing intersections. Directional arrows must be shown on plans to reflect surface drainage flow. This is particularly important around curb returns.

- G. Gutter slope at intersections shall be indicated on plans and spot elevations called out at tangents of all curb returns and high points set along the curb as needed to ensure adequate drainage. At a minimum gutter slope shall exceed 0.70 percent unless an exception is presented subject to the approval of the Town of Zebulon Public Works Director.
- H. Penetration of the back of the curb and gutter is permitted in accordance with §151.29 ILLICIT DISCHARGES AND CONNECTIONS of Ordinance 2010-27 (ARTICLE VI).
- I. The minimum pipe culvert diameter shall be 15 inches (15") to minimize clogging and maintenance for all pipe culverts within Town of Zebulon right-of-ways and easements. All pipe culverts to be a minimum class III reinforced concrete with a minimum pipe cover equal to 2 feet measured from the proposed finished grade to the top of the pipe.
- J. Curb inlets shall be located to prevent flow around intersections corners where such flow would conflict with pedestrian paths/crossing. Inlet shall be spaced to prevent spread of flow in the street to seven feet (7') or less. See Town of Zebulon Standard Details for specifics on the design of Curb inlets. Gutter spread calculations shall be based upon a 4 inch per hour rainfall intensity storm and must be provided with construction plans.
- K. Pipe Culverts shall be aligned parallel to the longitudinal axis of the channel, as much as possible to insure maximum hydraulic efficiency and to minimize erosion. In areas where a change in alignment is necessary, the change shall be accomplished upstream of the culvert in the open channel. Appropriate erosion protection shall be provided.
- L. Inlet and/or outlet protection is necessary to insure those channels upstream and downstream of pipe culverts maintain stability and avoid excessive transport and deposition of eroded material.
- M. Pipe culverts crossings beneath the roadway shall be designed to span from ditch line to ditch line. All pipe culverts are required to have Flared End Sections or Headwall/Endwalls.
- N. The introduction of impervious cover and improved runoff conveyance typically increases peak floods over those for existing conditions. Where physical, topographic and economic conditions permit, channel improvements downstream of the development are used to prevent increased flooding. When this is not feasible, runoff detention or retention is required in which the storm runoff is detained and released at an acceptable rate through flow limiting outlet structure, thus controlling peak downstream flow.
- O. All detention/retention facilities in the Town of Zebulon shall be designed to attenuate development condition peak discharges to the existing conditions for the given storm event and be designed in accordance with Ordinance 2010-27 as amended or revised.
- P. Basins which measure greater than fifteen feet (15') in height and have an impoundment capacity greater than 10-acre feet are subject to the dam safety regulations set forth in the North Carolina Administrative Code, Title 15A, Subchapter 2K, latest revision.
- Q. It is recommended that stormwater detention/retention facilities be located on the site from which the runoff to be controlled is generated. However, off site facilities are acceptable provided the land area involved with the facility is delineated and officially recorded at the Wake County Register of Deeds as a permanent "Stormwater Detention/Retention Easement." The property owner on which the facility is located will also be required to submit to the Town a letter of commitment to maintenance of the facility.

- R. In no case shall a habitable structure be located within the detention/retention area of any stormwater facility. No utilities (water, sewer, reclaimed, power or etc) shall be located within or immediately around detention/retention facilities.
- S. Adequate safety measures such as warning signs, embankment slopes, fences, grates, and other features should be incorporated into the design of the facility whenever appropriate,
- T. The Town of Zebulon will not be responsible for maintenance of stormwater detention or retention facilities. Responsibility for maintenance shall be the sole responsibility of the property owner or homeowner association. The Town will not be responsible for any damage that may occur resulting from flooding of the facility or surrounding areas.

## **2.1 STREET SECTION TYPES**

### **2.1.1 Curb and Gutter**

- A. All curb and gutter shall be constructed according to Standard Details of the *Town of Zebulon Street and Storm Drainage Standards & Specifications Manual*. Allowable sections shall be the standard 30" curb and gutter (preferred) and the 30" valley gutter type. Concrete valley gutter type is allowed only on local and cul-de-sac streets.
- B. All curb and gutter requires concrete testing for the following requirements
  - a. 4" concrete slump
  - b. Temperature - 50° and 90°F
  - c. Air mixture range 3.5% to 6.5%
  - d. Structural Strength – Lab Break Test – 7, 14, 28 days – 3000 PSI at 28 days
  - e. Samples every 1000' LF of curb and gutter to ensure quality.
  - f. Max water-cement ratio by weight: 0.594
  - g. Minimum cement content (lbs/cy): 602
- C. Concrete test and cylinders shall be taken by third party NCDOT certified technicians/firms and all cost associated with samples shall be the responsibility of the owner/developer or contractor. Curb and gutter that fails to meet testing requirements shall be replaced by developer/owner/contractor at no cost to the Town of Zebulon.
- D. Concrete shall not be placed during rainy weather when subgrade is frozen. Concrete shall be placed when air temperature in the shade away from artificial heat is above 40° and rising. The installation surface area must be a minimum of 50°.

## **2.2 SIDEWALKS AND DRIVEWAYS**

### **2.2.1 Sidewalks - General**

- A. Sidewalk shall be a minimum of five (5) feet wide and shall be placed as described in the Town of Zebulon Manual of Specifications.
- B. Sidewalks shall be constructed on the street right of way in accordance with the following table. (See Table 5).
- C. Sidewalk connections that cannot be constructed within the public right of way shall be constructed within a dedicated sidewalk easement in accordance with Town Standards.

- D. Sidewalks shall be included as a part of the construction of all streets. Sidewalks should link residential areas with employment, commercial and public areas.
- E. Multi-family and planned developments shall provide sidewalks for interior movement of pedestrians and for interior to connect to public sidewalk system.

**Table 5**

<b>Roadway Type</b>	<b>One side of Street</b>	<b>Both sides of street</b>
Major Thoroughfare		X
Minor Thoroughfare		X
Residential Collector	X	
Local Street	X	
Cul-de-sac over 250'	X	

- F. The Town of Zebulon shall determine on which side of the local and cul-de-sac Street the sidewalk will be constructed. The subdivider shall bear the expense of construction.
- G. For applicable construction details, see Standard Details section. Construction shall meet the applicable ADA provisions as well. All sidewalks should be constructed of 3000 PSI concrete at 28 days and have a 4-inch minimum thickness, unless otherwise specified.

**2.2.2 Sidewalk/Driveway inspections:**

Sidewalk inspections are required to check form grades, locations, widths and sub-grades. The construction inspection will ensure:

- A. Sidewalk slopes shall not exceed 5% unless local site topography makes it impracticable. Slopes greater than 5% require approval by the Public Works Director. Handicap ramps slopes must be less than 8% and first two feet shall handicap detectable warning tiles/panels. The remaining four feet of handicap ramp shall be dyed concrete with 70% contrast to other concrete sidewalk. Handicap detectable warning tiles shall be black or dark grey unless approved by the Public Works Director. Stamped concrete is not allowed.
- B. Sub-grade compaction is required for construction of sidewalks. Geo-technical density testing is not required unless the construction inspector determines that there are unsuitable soils for installation of sidewalks. To determine sub-grade compaction, construction inspector will use industry standards and probing rod to determine compaction. If geotechnical testing is required by the inspector, the developer/owner/contractor are responsible for all cost associated with the testing process. The third party geotechnical engineer must be certified by NCDOT to perform such test.
- C. All driveway entrances shall comply with Town of Zebulon details. Driveway and sidewalk construction must be a minimum of 6" inches thick and 3000 PSI at 28 days to property line. Residential driveways shall be 12' to 24' in width dependent upon subdivision requirements. Commercial and industrial driveways may be a maximum of 36' feet wide.
- D. Sidewalks may be narrowed down to avoid obstacles such as fire hydrants, telephone poles, etc. upon approval of the construction inspector. In no case shall the sidewalk be narrowed down less than 4 feet in width.

- E. Concrete sidewalk testing is not required, unless construction inspection determines that quality is inferior and does not meet industry standards. Contractor must maintain a 4" concrete slump for all sidewalk work. Air temperatures at placement must be 40° and rising. Surface temperature shall be 50° or greater.

### **2.2.3 Brick/Paver Sidewalks**

- A. Allowable Locations and Installation: Installation and maintenance of brick/paver sidewalks shall be permitted only:

- a. Where an existing sidewalk is brick/paver and is being replaced or repaired; or
- b. In an area designated as an historic district; or
- c. Adjacent to an historic property; or
- d. Where proposed for an entire block and all property owners agree to brick installation; or
- e. Where a streetscape plan has been approved by the Town of Zebulon specifying brick/paver sidewalk. In such areas, brick/paver sidewalk may be installed on a lot by lot basis.

- B. Construction Methods for Brick Sidewalks

- a. Sub grade Preparation: The sub grade for sidewalks shall be shaped to the proper cross-section and thoroughly compacted by rolling or tamping. Tree roots shall be removed to a depth of 12-inches below sub grade for the full width of the walk. All soft and spongy material shall be removed and replaced with suitable material that shall be compacted in layers not exceeding 6-inches in thickness.
- b. Base: The base shall consist of four (4) inches thick of CABC stone, well compacted and properly graded. Then four (4) inches thick concrete base rated at 3000 PSI with wire mesh reinforcement. When concrete has properly cured, a one (1) inch layer of bedding sand will be installed for brick pavers. Installation shall be graded for proper drainage and per Town of Zebulon specifications. Where the sidewalk is crossed by a driveway, the concrete base shall be increased to 6 inches.
- c. Sidewalk Width & Material: Except when repairing a non-conforming brick sidewalk, a 5-foot wide sidewalk of paving brick (conforming to ASTM C902) shall be laid to grade with a smooth uniform surface with a slope of 1/4-inch per foot toward the street.
- d. Filling Voids: The voids between the brick shall be filled with a mixture of sand and cement broomed into the voids. The sand-cement ratio shall be 1/3 cement and 2/3 sand well mixed before brooming into the voids. After the voids are well filled, the brick surface shall be cleaned of all excess sand and cement.

### **2.2.4 Pedestrian Easements or Walkways**

Pedestrian easements or walkways may be provided through the interior of blocks. Pedestrian easements shall be at least 10 feet wide and shall be laid out along front, side or rear property lines.

### **2.3 GREENWAYS & BIKEWAYS**

- A. Greenways: When required, Greenways shall be provided with a minimum of a 20' right-of-way/easement. The greenway shall be designed in accordance with design standards for off-road trails and greenway facilities, as defined by the American Association of State Highway Transportation Officials (AASHTO), the American with Disabilities Act, Designing Sidewalks and Trails for Access: Part 2 and the Manual on Uniform Traffic Control Devices.
- B. Bikeways: When required, the bikeways shall be provided with a minimum 20' right of way/easement. The bikeway shall be designed in accordance with the NCDOT's North Carolina Bicycle Facilities Planning and Design Guidelines, latest revision. Refer to standard detail for typical section and tie-in detail at roadways/streets.

### **2.4 UTILITY EASEMENT CURB CUT-DOWN**

A 10 foot wide curb cut-down shall be provided at all locations where utilities cross curb and gutter to run into off-site easements. The purpose for the cut-down is to provide equipment access to easements without "hopping" over the curb. See Standard Detail.

### **2.5 ROADWAY SUB-GRADE AND ROADWAY ABC**

The purpose of this section is to provide a guide for the roadway sub-grade and roadway stone in preparation for paved areas within the Town of Zebulon.

#### **2.5.1 Definitions:**

Roadway Sub-Grade: The base soil elevation determined by approved engineered drawings prior to placement of roadway ABC and Asphalt.

Roadway Stone Grade: The approved compacted roadway sub-grade plus the compacted stone grade prior to placement of asphalt.

- A. In all cases, the roadway sub-grade must pass a proof-roll test before placement of stone. The developer/owner/contractor should provide third party NCDOT certified geotechnical firm to perform density testing of sub-grade every 300 feet and roadway ABC every 150 feet via a nuclear gauge. The Town of Zebulon construction inspector will select various locations of the density testing. It is recommended that testing be performed at fill locations or utility cuts. A Town of Zebulon construction inspector must be present during all testing. All test results shall be submitted to and approved by the Town of Zebulon Public Works Director before roadway stone is installed.
- B. On roadways designed for Local, Cul-de-sacs, and Residential Collectors areas must meet all the following requirements:
  - a. Proof Roll Standard- A fully loaded tandem dump truck/Motor Grader that has a minimum gross weight of at least 20,000 pounds (10 tons) under the observation of the Town of Zebulon representative. No other method will be accepted. All areas of the roadway sub-grade or roadway stone shall be covered by the wheels of the proof-roller operating at walking speed (two to three miles per hour) or 225 to 300 feet per minute.



- b. It is the contractor responsibility to protect all structural facilities on the project such as bridges, box culverts, pipe culverts, and utilities from damage from proof rolling equipment.
- c. Proof Rolls are required at the roadway sub-grade construction phase and roadway stone construction phase.
- d. Any and all areas, which rut or pump excessively under the wheels of the proof-roller shall be repaired by the developer/contractor before roadway stone or asphalt is installed
- e. Proof roll areas again following the completion of the necessary corrections. All cost associated with the proof rolling process is the responsibility of developer/owner or contractor.

### 2.5.2 Roadway Subgrade Testing/Installation Requirements

- A. Requirements: 98% Standard proctor on all soils every 300'. All locations tested shall meet the 98% testing requirements. Averaging of density scores to meet standard is not allowed.

Successful proof-rolls required for all sub-grade soils

- B. Failure of Proof Roll Test or Density Test at Roadway Sub-grade:

All roadway sub-grade must pass a proof-roll test (No Exceptions).

Roadway sub grade that does not pass the proof roll test or density test will require remedial repairs. Repair recommendations from geo-technical firm can be made by using several methods including the use of Geo-grid/stabilization fabric and additional ABC stone, cement stabilization, lime stabilization or replacement of unsuitable soils with drier/more suitable soils. Regardless of the method chosen by the contractor, developer or owner for remedial repairs; a successful proof-roll must be obtained prior to placement of ABC stone can begin.

- C. Successful Proof Roll Test at Road-way sub-grade:

If repairs were made to the roadway sub grade involve using Geo-grid/stabilization fabric and additional stone; no density additional testing is required. If repairs to the roadway sub grade involve undercutting unsuitable soils and replacement with other more suitable soils then density testing is required to verify compliance of 98% compaction requirement. The contractor/geo-technical firm must provide the Town of Zebulon inspector with density test results prior to placement of ABC Stone were required. All cost of density testing shall be by the developer or owner.

**Note:** If the roadway sub-grade is exposed to precipitation (rain, snow, ice, etc.) before it is covered with ABC stone, the exposed sub-grade must pass an additional proof-roll. Additional density testing is not required under these conditions.

### 2.5.3 Roadway ABC Stone Testing/Installation Requirements

- A. Requirements: 98% Standard proctor on all Roadway ABC every 150'. All locations tested shall meet the 98% testing requirements. Averaging of density scores to meet standard is not allowed.

Successful proof-rolls required for all Roadway ABC Stone.

- B. Roadway ABC stone must be installed per Town of Zebulon minimum requirements and/or approved engineering roadway drawings. Roadway ABC stone shall be installed in compacted lifts per manufacture equipment recommendations. A minimum of six inches of compacted ABC stone shall be installed under Curb and Gutter. All roadways will have a minimum of eight inches of compacted ABC stone. The placement of roadway ABC stone is required to pass a proof-roll and pass density testing of 98% minimum every 150' feet. The Zebulon construction Inspector must have density testing results prior to start of paving. The roadway stone cross-slope, from crown to curb, shall be checked with a string line prior to the placement of asphalt.
- C. The roadway stone shall be proof rolled just prior to the placement of asphalt. If a section of roadway fails prior to placement of asphalt after all other successful tests; additional asphalt at the direction of the construction inspector may be allowed. One inch of asphalt may be substituted for every two inches of stone.

## **2.6 ASPHALT INSTALLATION REQUIREMENTS INSTALLATION AND TESTING**

- A. Asphalt placement should be in accordance with engineering drawings, signed and sealed by a licensed North Carolina professional engineer. The contractor shall install asphalt in two layers. The final 1" overlay will be at the 80% building permit level for each phase or at the direction of the Public Works Director. Asphalt cores will be taken at both overlays to insure compliance with Engineering Drawings for thickness.
- B. If more than 2.5 inches of SF 9.5 asphalt is required, asphalt must be placed in two lifts, the first lift having a thickness of not less than 1.5 inches.
  - a. SF 9.5A – 1.0- 1.5 inches
  - b. SF9.5B - 1.5-2.0 inches
- C. Asphalt mixtures shall not be placed during rainy weather, when subgrade or course is frozen, or when the moisture on the surface to be paved would prevent a proper bond. Asphalt material must not be placed when the air temperature measured in the shade away from artificial heat at the location of the paving operation and the road surface temperature in the shade at the paving site is below 40 degrees air temperature and 50 degrees minimum surface temperature.
- D. A tack coat of liquid asphalt is required for existing layers of asphalt or concrete surfaces to promote a bond between old pavement surfaces and the new asphalt layer. Prior to placing asphalt tack the following conditions must be met:
  - a. Existing pavement surface must be clean.
  - b. Rate of application must comply with NCDOT standards.
  - c. Uniform coverage over the entire areas to be paved.
  - d. Allow tack to thoroughly cure before placing the new asphalt.

Cleanness of the surface can not be stressed enough. Failure to remove debris could cause it to slip or shove under rolling conditions or traffic. Often times, this cleanness can be only achieved with power brooms and/or flushing with water and scrubbing.

The standard specifications for application of tack coat shall be uniformly applied at a rate of 0.04 to 0.08 gallons per square yard. The average asphalt material to be overlaid should receive an application rate of .05 to 0.06 gallons per square yard. Tack coat must be applied in the presence of the construction inspector. Tack coat shall be applied uniformly with spray bar on a pressure distributor. The tack coat is sufficiently cured when it is tack to the touch. All pavement contact surfaces of headers, curbs, gutters, manholes, core sample holes, vertical faces of old pavement and all exposed transverse and longitudinal of edges of each course must be painted or sprayed with tack before any asphalt is placed adjacent to such surfaces. A tack coat is not required on newly placed asphalt (within the same day); otherwise, all pavement surfaces to be overlaid will be tacked. Surfaces of headers, curbs, gutters, manholes, core sample holes, vertical faces of old pavement and all exposed transverse and longitudinal of edges of each course must be painted or sprayed with tack before any asphalt is placed adjacent to such surfaces.

**E. Note: Fuel Oil is not allowed for the use of release agent in loaded asphalt trucks.**

Asphalt delivery truck must be equipped with a 3/8 inch hole on each side of the truck for the purpose of inserting a thermometer to check the asphalt mix temperature. Asphalt deliveries will be rejected by the construction inspector unless the asphalt temperature is within the range of 275 and 350 degrees. Asphalt temperature should be checked prior to dumping into the paver hopper. Copies of all deliveries tickets shall be provided to the construction inspector.

- F. Great care, skill and knowledge should be used in rolling and compaction operations to ensure compaction requirements and aesthetic finished product. Rolling patterns that provide the most uniform coverage of the lane being paved should be used. Sharp turns and quick starts and stops are to be avoided.
- G. When ending a lane (for whatever reason) and paving is to be later resumed, end with a full depth pavement and establish a vertical face on the mat such that when paving is resumed, full depth pavement can be placed, beginning at the joint. This can be accomplished by a tapered paper joint. See NCDOT standard specification article 610-11.
- H. Core samples should be selected every 300' or minimum two cores per roadway for analysis of thickness and density. Asphalt pavement mix SF9.5 B should be compacted to a minimum of 92% of the maximum specific gravity. Asphalt pavement mix SF9.5 A should be compacted to a minimum of 90% of the maximum specific gravity. The contractor is responsible for developing/creating a chart/map of the cored locations for submittal with the testing. Cores will be randomly taken in the longitudinal directions across the roadway but not within the one foot of the edge of pavement. The results of the samples will **not** be averaged and used to verify compliance with Town of Zebulon specifications. Core Samples shall be taken by third party NCDOT certified technicians/firms. All cost associated with samples shall be the responsibility of the owner/developer or contractor. **(Amended August 31, 2011)**
- I. General: Testing for asphalt density is to follow NCDOT "Standard Specifications for Roads and Structures," Section 609-9, "Field Compaction Quality Management," latest revision. All other applicable sections of Section 609 of the NCDOT "*Standard Specifications for Road and Structures*" shall apply relating to Quality Control Plan, mix design, control limits, corrective action, equipment and measurement unless otherwise specified in specifications.
- J. The Town shall not be responsible for ensuring proper grades and alignment of Roadway and Curb and Gutter. If the alignment and grades are incorrect; it will be the responsibility of the contractor/developer/owner to make corrective repairs at their own expense.

- K. Set-up Period: Unless otherwise waived by the Town of Zebulon Public Works Director, for all new areas to be paved, the developer shall be required to wait at least six (6) months before the final lift of asphalt is placed. This setup includes the winter months through February or until 80% of permits for the phase has been taken out with the Zebulon Planning Department.

Any existing streets that are to be rebuilt or reconstructed will not be required to meet this setup period. These streets may be paved when the specifications in this manual are met and approved by the Public Works Director.

- L. All construction and testing of materials shall be in accordance with the *Town of Zebulon Street and Storm Drainage Standards & Specifications* manual.

## 2.7 STREET NAMES

Street names shall be subject to the approval of the Wake County GIS. New names shall not duplicate or be similar to existing street names. Existing street names; however, shall be projected where appropriate. Contractor is required to provide block numbers on all street signs.

## 2.8 ROADWAY AND SAFETY SIGNS

The purpose of this division is to define the policy of the Town of Zebulon with respect to the design and layout of roadway and safety signs, pavement markings and traffic control. In general, traffic signs and pavement markings shall conform to the latest edition of the FHWA "Manual of Uniform Traffic Control Devices" (MUTCD) and latest edition of NCDOT "Standard Specifications for Roads and Structures."

### A. Submittals

The developer and its engineer shall provide the Town of Zebulon for review the following:

- a. Layout plan illustrating the location of streets, signs, including speed limit signs, and stop signs.
- b. Location of stop bars shall be shown on layout plan. Stop bars shall be twelve (12) inches wide and shall meet the requirements of Section 1087 of the NCDOT "*Standard Specifications for Roads and Structures*."

### B. Sign Specification

Developer may choose which sign standard used unless the Planning Board or Board of Commissioners requires a specific type as a condition of development.

- a. Premium signs shall be manufactured by Southern Woodcraft and Design or approved equal (See Town of Zebulon Details).
- b. Standard signpost shall be u-channel with galvanized finish. All signs shall be assembled with galvanized nuts, bolts and clamps. (See Town of Zebulon Details).

All signage must be high intensity and stop/street combination signage is required. Street signs shall have name of street and block number. Stop signs shall be a minimum of 30" by 30".

C. Fire Department Signage

Where required by the Fire Code Official, fire apparatus access roads shall be marked with permanent “No Parking – Fire Lane” signs (See Town of Zebulon Details). Signage shall match all other signage in the development or project.

D. Traffic Signals

The design, construction and installation of traffic signals shall conform to specifications contained within the latest edition of “Traffic Signal Specifications” and applicable requirements of NCDOT’s Traffic Engineering Branch.

## **SECTION 3 RESIDENTIAL & COMMERCIAL LIGHTING STANDARDS**

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### **3.0 LIGHTING PERFORMANCE STANDARDS**

Adequate lighting shall be provided in commercial, industrial, residential, multifamily developments and parking lot construction conforming to accepted engineering standards. Parking areas, sidewalks, and building entrances shall be lighted in order to contribute to the security of property and to facilitate the safe passage of persons using the roads, sidewalks and parking lots after dark.

However measures shall be provided to prevent light spillover onto adjacent properties and glare toward motor vehicles operators. The purpose of these standards is to assure that exterior lights shall be shielded so that they do not cast direct light beyond the property line. In accordance with these standards:

A) Maximum Light Level:

- a. The maximum illumination at the edge of property line adjacent to residential zoning - 1 foot candles.
- b. The maximum illumination at the edge of property line adjacent to non-residential zoning – 5 foot candles
- c. The maximum illumination at the edge of property line adjacent to street – 5 foot candles.
- d. The maximum height for directional lighting fixtures, which are defined as fixtures design to insure that no light is emitted above a horizontal line parallel to the ground, shall be 25 feet.
- e. The maximum height for non-directional lighting fixtures, which are defined as fixtures designed to allow light to be emitted above a horizontal line parallel to the ground, shall be 16 feet. Non-directional lighting must be translucent or have baffles to prevent views of the light source. Non-Directional lighting fixtures are recommended only for sidewalks and streets.
- f. The Public Works department in conjunction with the Planning Department may adjust the standards for the maximum illumination at the edge of property adjacent to another non-residential use if the Town determines that the design and nature of the adjacent use creates a need to either reduce or increase the maximum illumination
- g. Existing lighting fixtures at the approval of these specifications may remain and shall be considered nonconforming structures. Modifications, replacement or expansions shall conform to the standards of the specification. Replacement of lamps, ballast, photocell, lenses, or similar components does not constitute compliance with the specification.

B) Minimum Lighting Requirements

- a. Commercial and Industrial Properties are required to provide 1.0 candle foot horizontal average along street, sidewalks and parking lots to ensure safety of vehicular traffic, pedestrian traffic and provide pedestrian security.
- b. Residential Street Lighting – Street and ROW lighting must meet minimum of 0.5 candle foot horizontal average for the proposed development or project.

## C) Exemptions from Specifications:

- a. Outdoor lights used for a temporary event.
- b. Outdoor lights used exclusively for public recreational activities, concerts, or other outdoor events which are open to the public, provided that the event or function meet all other planning and zoning requirements.
- c. Emergency lighting. Lighting required for public safety in the reasonable determination of public safety officials with authority.
- d. Decorative lighting. Low-wattage fixtures (comprised of incandescent bulbs of less than eight watts each or other lamps of output less than 100 lumens each) used for holiday decoration.

## D) Prohibited Lights

- a. Searchlights used for advertising purposes.
- b. Laser source lights for advertising purposes.
- c. Neon or fluorescent lighting used for advertising and architectural purposes mounted on exterior of building.
- d. Semi-opaque or transparent backlit canopies and awnings.
- e. Blinking or flashing lights use shall be prohibited.

## E) Architectural Accent Lighting

- a. Fixtures used to accent architectural features, materials, colors, style of buildings, landscaping or art shall be located, aimed and shielded so that light is directed only on those features. Such fixtures shall be aimed or shielded to minimize light spill from the light source in conformance with the luminaries' standards.
- b. Accent lighting shall not generate excessive light levels, cause glare or direct light beyond the façade onto neighboring property, streets, or night sky.
- c. National flags may be illuminated from below provided such lighting is focused primarily on the individual flag or flags to limit light trespass and spill into the sky.

**The Public Works Department or Planning Department may require a licensed engineer to certify and seal to the lighting levels for a property at completion to ensure lighting levels minimum and maximum amounts are in compliance with this specification. All cost associated with the certification process shall be the responsibility of the property owner/developer/contractor. Failure to comply with this requirement could cause a delay in the C.O. approval.**

- F) Residential Fixture Type – 16' fiberglass pole in black or green with Type "A" (Acorn) fixture with 9500 Lumens High Pressure Sodium. No wood or aluminum poles will be allowed. Installation must be coordinated with Duke Progress Energy and the Town of Zebulon Public Works Department. **As of June 2013, Duke Progress Energy charges a onetime fee per pole for installation. On November 25, 2013, the fee is \$563.63 per pole. The property owner/developer/contractor is responsible for payment of the fee. (Amended November 25, 2013)**
- G) Commercial/Industrial Fixture: A metal or fiberglass poles in black, brown or green not to exceed 25 feet in height with a directional shoebox fixture with full cutoff. High pressure sodium or Metal Halide lamps may be used. Surrounding development may dictate type of

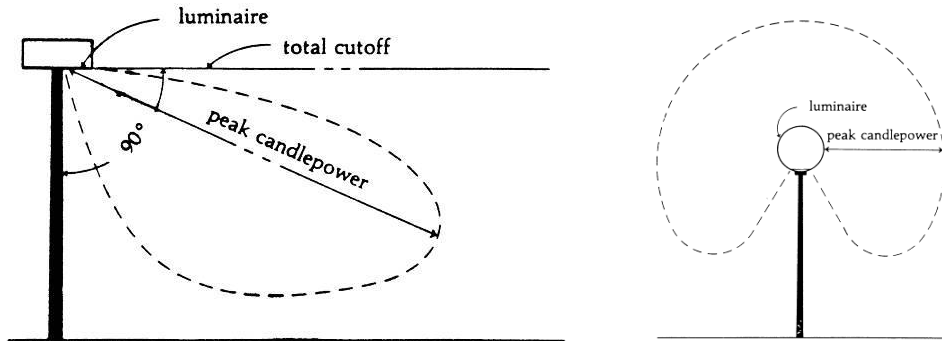
fixture style and lamp approved by the Town of Zebulon. Development continuity is an overriding consideration during the approval process. No wood or aluminum poles will be allowed. Other fixture and pole types will be evaluated on a case by case basis.

H) Submittal Requirements:

- a. Engineer Seal Photometric Plan for property.
- b. ISO Foot-candle curves
- c. Photometric plan should provide the average foot-candle, maximum foot-candle, minimum foot-candle, coefficient variation
- d. Luminaire Schedule should provide fixture type, quantities, label, lamp, arrangement, lumis, and pole description
- e. Engineer drawings for installation requirements
- f. Plan profile of Pole and Fixture.
- g. Landscape and building lighting plans and fixture types with outputs.

**Example – Fixture Types**

**Directional style light fixture (left) versus non-directional style (right)**





## **SECTION 4**

# **STORM DRAINAGE INTRODUCTION & STANDARDS**

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The following division has been established to assist developers and engineers with the design, construction and maintenance of stormwater infrastructure (private and public) within the jurisdiction of the Town of Zebulon. The methods, procedures, design factors, formulas, graphs, and tables presented in Town of Zebulon Ordinance 2010-27 or latest amended version (included in section) as well as the information presented in the various other sections herein are intended to establish minimal guidelines for residential, commercial and industrial storm drainage design. The Town of Zebulon believes that the following criteria are sufficient to insure the welfare and safety of the general public and to protect the economic investment of the citizens of our Town.

The Town of Zebulon has contracted with Wake County to administer its erosion and sedimentation control plus its stormwater ordinances as permitted by NC General Statutes 160A-461.

Alternative design methods may be considered by the Wake County on a case-by-case basis; however, there should not be extensive variations from the criteria and procedures within this division without the expressed approval of Wake County.

### **4.0 WAKE COUNTY**

Wake County shall be responsible for interpretation and implementation of the storm drainage design criteria for the Town of Zebulon. Approval from other applicable agencies may be required.

### **4.1 TOWN OF ZEBULON**

The Town of Zebulon shall be responsible for interpretation and implementation of storm drainage devices or structures that will be dedicated from developer/owner/contractor to Town of Zebulon.

#### **4.1.1 TOWN OF ZEBULON STORM DRAINAGE POLICY**

It is the policy of the Town of Zebulon that all developed land within the Town Limits has adequate stormwater facilities and controls to ensure the protection and safety of life and property. The Town may accept stormwater management systems for maintenance if the system provides drainage for streets that have been accepted for maintenance by the Town Board and have been designed and constructed in accordance with the provisions of the STORMWATER Ordinance of the Town Code and this specification manual.

The Town of Zebulon will not be responsible for maintenance of stormwater detention or retention facilities for subdivision, commercial, or industrial properties. Responsibility for maintenance shall be the sole responsibility of the property owner or homeowner association. The Town of Zebulon will not be responsible for any damage that may occur resulting from flooding of the facility or surrounding areas.

In designing stormwater systems and structures please review ordinance 2010-27, Section 2 (Streets/Subdivision Design/Construction/Inspection) Drainage, NC Drainage Law, North Carolina Stormwater Best Management Practices Design Manual and this section.

#### **4.1.2 LIMITS OF PUBLIC OWNERSHIP AND MAINTENANCE RESPONSIBILITY:**

The following components of the drainage infrastructure will not be maintained by the Town of Zebulon:

- a. All drainage easements shall be public to the end of any storm drainage pipe system stilling basin. All drainage beyond that point shall be carried in drainage easements which are private and will be owned and maintained by the individual property owner.
- b. The Town of Zebulon assumes no liability or responsibility for adjudicating disputes between property owners regarding non-publicly generated storm water.
- c. Drainage systems on private property that do not have dedicated easements.
- d. Drainage systems maintained by NCDOT as part of its State highway system.
- e. Detention/Retention/Water Quality Pond Areas: The Town will not accept these areas for maintenance; however, the Town reserves the right to enter these areas and remove any debris a blockage that is adversely affecting the Town's drainage system. This will be done in an emergency situation without notice. Under normal conditions, the Town will contact the owner/developer to have said blockages removed. If unable to do so within a reasonable time, the Town reserves the right to charge the owner/developer for any expense incurred by the Town in doing so.

#### **4.1.3 NATURAL WATER COURSES:**

Natural ditches, streams, creeks and rivers shall not be maintained by the Town except to remove debris/blockages that are adversely affecting the Town's drainage system.

#### **4.1.4 LIMITATION OF CONSEQUENTIAL DAMAGE TO PRIVATE FACILITIES LOCATED ON PUBLIC EASEMENTS**

All public easements, including storm sewer, are to remain clear of obstructions. No buildings, fences, trees, shrubs or other obstructions shall be placed in any easement. Driveways, walkways, asphalt and parking lots may be permitted in easements; however, the Town reserves the right to remove such asphalt, concrete, base course and sod as necessary to access its facility in the case of emergency. Pavement or concrete will be replaced with a patch. Sod will be replaced with fescue or rye seeding. The Town will not be responsible for replacing a property owner's sod after repairing a drainage line.

## SECTION 5 PIPE POLICY - MATERIAL/INSTALLATION/INSPECTION

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### 5.0 MATERIALS/INSTALLATION:

All materials and installation procedures, testing and acceptance of all publicly dedicated drainage infrastructures shall meet the requirements of the Town of Zebulon Street and Storm Drainage Standards & Specifications Manual and lies in dedicated public right –of-way or dedicated 20’ stormwater easement.

#### 5.0.1 Purpose and Definition

The purpose of this policy is to establish a written standard on the type of pipe to be used in a ditch or tributary carrying storm water run-off from a dedicated public street or from property owned and maintained by the Town (herein "public water") which is either subject to review, maintenance or inspection by the Town or located within either the Town limits of Zebulon, N.C. or under its extraterritorial jurisdiction.

#### 5.0.2 Pipe Material

- A. Storm drainage pipe to be dedicated and maintained by Town of Zebulon, shall be reinforced concrete pipe except for the following exemption:
  - a. Corrugated fully coated metal arch pipe may be used where head room, fill and flow conditions of the tributary warrant it with the approval the Town Public Works Director.
  - b. Other pipe may be considered on a case by case basis due adverse site conditions, depths or abnormal conditions may be allowed by the Public Works Director.
  - c. Driveway culvert on Town right-of-way or easement
- B. All concrete pipe to be used shall be either etched "RC X' (where X represents the class pipe) or marked visibly and legibly according to the following:
  - a. Stamp location: spigot end of pipe on inside.
  - b. Stamp size stenciled letters: 1-1/2" in height minimum.
  - c. Code Class 3 Reinforced Concrete: TWF-RC-3
  - d. Code Plain Concrete: TWF-P
  - e. Stamp color: fluorescent orange or red.

Unmarked pipe will be allowed only if the manufacturer furnishes a certified statement on the entire shipment and etchings are placed on each pipe joint.
- C. The minimum pipe culvert shall be 15” inches to minimize clogging and maintenance for all pipe culverts within Town of Zebulon Right-of-ways and easement. All pipe culverts to be a minimum class III reinforced concrete with a minimum pipe cover equal to 2 feet measured from the proposed finish grade to the top of the pipe.

## 5.1 INSPECTIONS:

- A. The following items must be inspected during and after installation of storm drainage lines and appurtenances:
  - a. All boxes and manholes for presence of weep holes, formed inverts, bolted down castings, pipe flushed against inside wall of box, steps and location of steps, proper corbeling of brick/block in accordance with the details and specs, wall thickness and depth of manhole.
  - b. Pipe for cracks, pipe markings for compliance with specifications (painted and etched).
  - c. Removal of debris and sediment in both pipe and box.
  - d. Rip rap outlet protection and filter fabric, stilling basin compliance with plan
  - e. Manhole casting cover reading "storm drainage."
  - f. Armor protection of ditches (concrete and/or temporary liners), scour and erosion.
  - g. Contractor to provide video documentation of entire storm drainage system. A copy of this video inspection will be provided to the Public Works Department during the acceptance and dedication process. Staff must be present during the videotaping process.
- B. All inspections must be scheduled the day prior to when needed. Inspections will be performed in the order received. Every effort will be made to accommodate the time of request; however, this cannot be guaranteed.
- C. Upon completion of construction the developer shall request a warranty inspection. Upon completion of all punch list items, the provision of a set of acceptable record drawings, and the submission of engineer's certifications, a one-year warranty period shall commence.

## 5.2 WARRANTY:

- A. Warranty and Defects Guarantee: Upon the acceptance of facilities, utilities or streets for permanent maintenance, a one-year warranty for all improvements shall become effective. This warranty must be satisfactory to the Town of Zebulon. In addition, the subdivider shall provide surety in the amount of 15% of the total construction cost to guarantee the correction of all defects in such facilities, utilities or streets that occur within the warranty period described above.

For the purposes of this section, the term "defects" refers to any condition in publicly dedicated facilities, utilities or streets that requires the Town to make repairs to such improvements over and above the normal amount of maintenance that they would require. If such defects appear, the warranty may be enforced regardless of whether the facilities, utilities or streets were constructed in accordance with the requirements of this ordinance.

- B. During the one-year warranty period the developer shall repair any latent defects which occur. At the end of the one-year warranty period the developer shall request a final inspection. Upon successful completion of all warranty items the developer shall be released from maintenance responsibilities for the warranted construction.
- C. Warranty repairs to the following common problems shall be as follows:
  - a. Street pavement trench failures shall be repaired in accordance with specification details
  - b. If more than 3 trench failures occur within a longitudinal distance of 800 feet on any segment of a street, the Town shall require a 1-inch overlay once repairs have been completed.
  - c. Cracks in sidewalk and/or curb and gutter shall be repaired by removing and re-pouring such sections as necessary;
  - d. All storm sewer systems, ditches and gutters shall be free of debris, dirt or silt;
  - e. All drainage and street appurtenances shall be in perfect condition and properly exposed.
  - f. All other defects shall be corrected in accordance with the recommendations of the Town of Zebulon Public Works Director
- D. If a developer fails to complete warranty items, future projects of the developer shall not be reviewed by the Department of Public Works. In addition, the Town may take additional legal action against the developer.

**Table 1**

<b>Drainage Location</b>	<b>Type of Pipe</b>	<b>Installation Requirements</b>	<b>Maintenance Responsibility</b>	<b>Material and installation cost responsibility</b>
Driveway Culvert on Town ROW or Easement	15" RCP Pipe or Double-wall smooth inside, NCDOT approved	Per Spec and Details	Town will maintain clear flow- owner replaces damaged pipe as needed	Town can provide service/installation for actual cost. Property Owner pays for initial installation. All future maintenance and repair will be the responsibility of the Town of Zebulon
Roadside Ditch in Town ROW or Easement	N/A	Per Spec and Details. Positive flow without creating adverse conditions	Town will maintain clear flow – Town will remove sediment and install matting as needed	Town of Zebulon
Cross Street Culverts and Storm Drain structures in Town ROW or easement	RCP, Reinforced Concrete Box Culvert	Per Spec and Details.	Town of Zebulon	Town of Zebulon
Ditch, Drainage Swell, Storm Drain structures – no easement	Varies	Private – No Requirements, except cannot cause adverse effect to upstream and downstream properties	Property Owners	Property Owners
Ditch, Drainage Swell and Storm Drain Structures in NCDOT ROW or NCDOT Easement	RCP	Per NCDOT Specifications	Per NCDOT Policy	Per NCDOT Policy
Town ROW – Property Owner wants to install curb and gutter, storm drainage system or pipe	RCP 15" or greater	Per Town of Zebulon Plans and Specifications.  Installed by Town or licensed utility contractor.	Property Owner will dedicate project at completion and maintenance will be provided by the Town of Zebulon	Property Owner pays for initial installation. All future maintenance and repair will be the responsibility of the Town of Zebulon
New subdivision, or street extension  Completed by developer	RCP 15" or greater	Per Town of Zebulon Plans and Specifications	Property Owner will dedicate project at completion and maintenance will provide by the Town of Zebulon	Property Owner or Developer – After dedication – Town of Zebulon responsible maintenance and repair.