

TECHNICAL AND WATERLINE SPECIFICATIONS

The Town of Kill Devil Hills
102 Town Hall Drive
Kill Devil Hills, North Carolina



Standard Technical and Waterline Specifications
For
Small, Informally-Bid Projects
Version 3.0 – December 2024

Prepared by:



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TECHNICAL SPECIFICATIONS

Part 1 - Description

Section 1.01 - General

A. Summary:

1. The Work covered by these Contract Documents consists of furnishing all labor, equipment, and materials and of performing all operations in connection with the excavating, filling, backfilling, grading, paving, finish, and cleanup as required for the completion of the Work in accordance with the terms and conditions set forth in the Contract Documents.
2. All Work performed under this Section shall be governed by the Contract Documents, as they are defined and enumerated herein.
3. Additions to and/or modifications of the Town's Water Distribution System shall be governed by the "WATERLINE SPECIFICATIONS" which follow these "TECHNICAL SPECIFICATIONS."

B. Required Submittals:

1. Construction Schedule:
 - a) The Contractor shall submit a project schedule that delineates the proposed construction schedule including all major tasks and their anticipated completion for each right-of-way improvement. This schedule shall be submitted to the Town at the preconstruction meeting for review and approval prior to the initiation of the Work. The Work schedule may, from time to time, be amended so long as it does not exceed the total time for the completion of the Work or represent a substantial deviation as defined below. Extension to the total time of the completion of the Work shall be in accordance with the General Conditions as specified in Article 13. Substantial deviation from the schedule may be a basis, the Owner's sole determination, to declare that a Delay, Neglect or Default, as defined in Article 18 of the General Conditions, has occurred. In the absence of mitigating factors, such as abnormal weather conditions, a substantial deviation shall mean any work element on the schedule falling behind by more than 15% of the total Contract Time.
 - b) The Contractor shall provide weekly schedule updates. These shall be submitted no later than noon on the preceding Friday. The weekly schedules shall include tasks, anticipated roadway closures, surveying needs and any other information as may be determined necessary.
 - c) As required by Article 4, Paragraph B of the General Conditions, the Contractor shall submit a list of the heavy equipment he proposes to use for the project to the Engineer

for his review and approval, which approval will not be unreasonably withheld. This information shall include the make, model, total gross weight and other information as the Engineer may require to determine whether the weight and ground pressure of the equipment is likely to cause harm to existing pavement in the area of the Work.

2. Testing Results:

The Contractor shall submit original testing results as specified in the construction specifications. The results shall be forwarded to the Town within 24 hours of receipt. Copies of the test results shall be forwarded to the Engineer for approval.

C. Availability of Lands:

Rights-of-way, permanent easements, and temporary construction easements are shown on the Drawings or described in the General Conditions. Lands not shown or described but required for construction shall be the Contractor's responsibility.

D. Notice to Utility Companies:

Utility companies shall be notified by Contractor, in writing, prior to construction and given a proposed schedule of progress. Copies of all letters of notification shall be furnished to the Owner. The Contractor shall protect all existing utilities. He shall assist and cooperate with the utility companies in locating and exposing existing facilities.

E. Responsibility Regarding Existing Utilities and Structures:

1. The existence and location of underground utilities or structures, whether indicated on the Drawings or not, are not guaranteed and shall be investigated and verified in the field by the Contractor before starting Work. Excavation in the vicinity of existing structures and utilities shall be carefully done by hand.
2. The Contractor shall be held responsible for any damage to, and maintenance for and protection of existing utilities and structures.
3. The Contractor is responsible for notifying the proper authorities to have any underground utilities, except waterlines, relocated to avoid conflicts with roadway and drainage improvements. In the event that the owner or operator of any such underground utility is unresponsive to the Contractor's efforts to coordinate such relocation or adjustment, Contractor shall promptly notify the Engineer. Engineer and Owner shall then assist in requiring the timely relocation/adjustment of such utility.
4. Where existing utilities can be dealt with by bracing, shoring, temporarily holding poles, hand-digging underground cables and setting them to the side of the trench, slight adjustments to lines and structures, etc., such measures shall be taken as necessary to accomplish the Work and without separate compensation to the Contractor. Any such methods and measures shall be approved in advance by the owning utility and the Engineer.

F. Notice of Roadway Closures:

In the event that a roadway must be closed to perform the required right-of-way improvements, the Contractor shall notify the Town Police and Fire Departments and Dare Central Emergency Services at least 72 hours prior to the closing of the roadway. The Contractor shall maintain some form of vehicular access, for emergency access purposes, to every building during construction.

G. Erosion and Sediment Control Plan:

1. All earthwork shall comply with the provisions for the Soil Erosion and Sedimentation Control Design Manual as approved by the NCDENR, Division of Environmental Management, Land Quality Section.
2. The Contractor shall plan, install and maintain his sediment and erosion control measures to balance the requirement to prevent erosion and sediment deposition with the need to reduce the risk of flood damage to public and private property in the vicinity of the work. For example, care shall be taken not to fully obstruct with filter cloth or other protective measures an inlet to a storm drainage system in cases where a low-lying, flood-prone adjacent property would have significantly increased probability of flooding damage. In any such situation where the Contractor is uncertain as to which consideration should take priority, he shall ask the Town for a written determination.

H. References:

The following industry standards are hereby referenced:

- a) American Concrete Institute (318. 522.1 & 530) PERVIOUS CONCRETE
- b) North Carolina Department of Transportation (NCDOT) Standard Specifications for Roads and Structures (SSRS) and Roadway Standard Drawings (RSD), latest edition as of date of bid in both cases.

Part 2 - Products

Section 2.01 - General

A. Summary:

This section includes definitions of materials associated with the execution of the Work.

B. Crushed Stone:

Unless stated otherwise, crushed stone shall conform to ASTM C-33 with gradation number 67.

C. Aggregate Base Course (ABC):

ABC shall meet Division 10 of NC DOT SSRS. Crushed concrete meeting the gradation requirements of NCDOT ABC may be substituted in other than NCDOT-maintained paved

areas, or in NCDOT areas if Contractor obtains approval of the NCDOT District Engineer or designee, provided test results are furnished to and found satisfactory by Engineer.

D. Bituminous Bases and Pavements:

Bituminous bases and pavement shall meet Division 6 & 10 of NC DOT SSRS. The terms “black base” and “HB” or “Type HB” shall mean Asphalt Concrete Base Course, Type B25.0B; the term “binder” or “binder course” shall refer to Asphalt Concrete Intermediate Course, Type I19.0B; and the term “surface” or “surface course” shall mean “Asphalt Concrete Surface Course, Type SF9.5A,” all as set forth in NC DOT SSRS. These designations shall take precedence over any reference to older asphalt concrete mix designations which may be found on the Drawings and/or in the Town Standards.

E. Reclaimed Asphalt Materials:

Asphalt pavement milled or removed from the project limits may be used in combination with aggregate base materials when pre-approval by the Town. The reclaimed material shall be processed so that all material is six inches (6") or smaller with a minimum of seventy percent (70%) passing a two-inch (2") sieve and a maximum of ten percent (10%) passing a number 200 sieve.

F. Geotextiles

1. Pavement Overlay Fabric:

Fabric placed under asphalt mixtures to provide waterproofing and delay/reduce reflective cracking shall be capable of withstanding installation stresses and shall not be damaged by temperatures common to asphalt mixtures. The fabric shall have the following properties:

Property	Value	Test Method
Grab strength, dry, minimum average value in either principal direction	90 lbs. (400 N)	Iowa 913
Elongation, dry, minimum average value in either principal direction	20%	Iowa 913
Grab Strength after 400°F (204°C) for 3 hr.* minimum average value in either principal direction	75 lbs. (335 N)	Iowa 913
*Applies only when asphalt temperatures exceeding 300°F (149°C) are anticipated.		

The asphalt absorption shall be sufficient to produce a good bond between the overlay and the overlaid surface when a tack coat of 0.20 gallon to 0.25 gallon of asphalt binder per square yard is used. Fabrics such as fiberglass, which do not lend themselves to testing by some of the previously specified methods, may be approved by the Engineer.

G. Concrete:

1. Hydraulic Cement Concrete: Shall meet the requirements of Division 10, NC DOT SSRS (Class A: 3,000 psi)
2. Flowable Fill: Shall meet the requirements of Division 3, Section 340, NC DOT SSRS, except that the Engineer may waive any requirements for mix design submittal and testing for quantities smaller than 50 cubic yards on any project.
3. Pervious Concrete: Shall be constructed in accordance with the latest version of ACI 522.1, *Specification for Pervious Concrete*. Void ratio shall be not less than 15%.

H. Drainage pipes:

1. Culverts and other pipes beneath paved surfaces shall have smooth interior wall and shall include gasketed joints and meet one of the following:
 - a) Pressure Class Poly (Vinyl Chloride), or PVC, Pipe conforming to ANSI/AWWA C900, with a minimum DR of 18 and a minimum pressure class of 150 psi, and having push-on type joints having bells made as an integral part of the pipe conforming to ASTM D3139. All materials and methods shall conform to Divisions 10 and 15 of NC DOT SSRS except as otherwise noted herein or on the Drawings. In applying said Divisions here and elsewhere in these specifications, their context shall be adjusted appropriately for the fact that this material, typically used in water and sewer utility settings, is being used for storm drainage purposes.
 - b) Corrugated PVC Sewer Pipe with Smooth Interior, and fittings, conforming to ASTM F949-06 and F794-03 (e.g., Contech A-2000), with watertight joints. Installation shall conform to the requirements of ASTM Practice D2321 and those of the manufacturer; in the case of conflict the stricter shall govern.
 - c) Ductile Iron Pipe conforming to ANSI/AWWA C110/A21.51, with push-on joints conforming to ANSI/AWWA C111/A21.11. All materials and methods shall conform to Divisions 10 and 15 of NC DOT SSRS except as otherwise noted herein or on the Drawings. In applying said Divisions here and elsewhere in these specifications, their context shall be adjusted appropriately for the fact that this material, typically used in water and sewer utility settings, is being used for storm drainage purposes.
 - d) Corrugated High Density Polyethylene (HDPE) pipe, and fittings, conforming to ASTM F2306 and AASHTO M294. All materials and methods shall conform to Divisions 3 and 10 (and especially the requirement that the supplier be a participant in the NCDOT HDPE Pipe Quality Control/Quality (QC/QA) Assurance Program) of NC DOT SSRS except as otherwise noted herein or on the Drawings. All pipe shall have smooth inner wall. Pipe shall be one of the following, as noted on the Drawings:
 - 1) Solid wall (not perforated) pipe shall be ADS N-12 WT IB by ADS, Inc. or approved equal, and shall be used when any portion of a section of pipe is under roadway pavement and at other locations where noted on the Drawings. Callouts for such pipe will be, for example, "12" HDPE N-12 @ 0.1%". Such pipe of 12" or greater diameters shall have a reinforced bell with a polymer

composite band, and shall be capable of passing testing for watertightness in accordance with ASTM F2487.

- 2) Perforated pipe shall be ADS N-12 ST IB by ADS, Inc. or approved equal, and shall be used when no portion of a section of pipe is under roadway pavement, and shall be perforated per AASHTO standards, at the factory, and shall be encased in drainage filter fabric, said configuration being commonly known as “sock drain.” Callouts for such pipe will be, for example, “15” HDPE N-12 SOCK DRAIN @ 0.05%”.
 - e) Corrugated High Performance Polypropylene Pipe shall be “HP Storm” by ADS, Inc. or approved equal. Pipe shall have a smooth interior and annular exterior corrugations and shall meet ASTM F2881 or AASHTO M330. Pipe shall be joined using a bell & spigot joint meeting the requirements of ASTM F2881 or AASHTO M330. The joint shall be watertight according to the requirements of ASTM D3212. Gaskets shall meet the requirements of ASTM F477. Gasket shall be installed by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant available from the manufacturer shall be used on the gasket and bell during assembly.
 - f) Reinforced Concrete Pipe (RCP) shall be Class III, except where a stronger class is noted on the drawings, and shall meet ASTM C76. Joints shall be sealed with a Town-approved mastic sealant and “diapered” with a full circumferential wrap of non-woven filter fabric extending at least 12” either side of the joint.
2. Except where otherwise noted herein or on the Drawings, transitions between pipe materials are not permitted except at drainage structures. Cut ends of the same size HDPE pipe shall be joined with a gasketed coupling of that size. Pipes of different type shall be joined with a “MarMac” coupling specifically made for the size(s) and types involved.
 3. Corrugated HDPE pipe shall include anti-flotation holes, except for “sock drain” as noted above.
- I. Drainage Structures:
1. Meeting Sections 846 and 840 NC DOT SSRS
 2. Precast boxes shall be fitted with flexible rubber boots at all inlets and outlet.
 3. Special Design Low-Head Drop Inlet and/or other special drainage structures shall be as indicated on the Drawings.
- J. Backfill Material:
1. General: Backfill, as referred to in these Technical Specifications, is that material placed above the initial and intermediate backfill as specified in applicable divisions for the installation of roadway, pipe, and appurtenances.
 2. Material: Backfill material shall consist of loam, sand, or gravel which is free of cinders, ashes, refuse, vegetable or organic material, frozen soil, or stones more than 2 inches in

their greatest dimension. Where excavated material does not provide sufficient quantity of material as described herein to complete the backfill, such additional material as may be required shall be furnished by the Contractor.

K. Warm Season Grasses:

SPECIES	Pounds of Seed per 1,000 sf	Optimum Time for Seeding
Centipede Grass	2 - 3	March - May
Bahia Grass (exclude when directed by Engineer)	2 - 3	March - July
Weeping Love Grass	2	March - July
Common Bermuda Stolongs	1 bushel	April - July
Common Bermuda (hulled)	2 - 3	April - July

Contractor shall provide a certification that the correct seed mix, at the required application rate, has been applied.

L. Cool Season Grasses:

SPECIES	Pounds of Seed per 1,000 sf	Optimum Time for Seeding
Italian Rye Grass	1 - 2	September - December
Tall Fescue	5 - 7	September - November
American Beach Grass	Sprig 1,000 plants per 2,500 sf	November - February
Common Bermuda (unhulled)	2 - 3	January - March

Contractor shall provide a certification that the correct seed mix, at the required application rate, has been applied.

M. Fertilizers:

Fertilizer shall be used if necessary to establish vegetation. Fertilizers shall be a 10-10-10 mix.

Part 3 - Execution

Section 3.01 - General

A. Prior Investigation:

Prior to general excavation, the Contractor shall make an investigation to the extent necessary to determine the location of existing underground utilities, structures, or conflicts. In cases where the presence and location of such utilities is so critical that an adjustment to the design may be required, and in all cases involving jack/boring of casings 8" or larger, such investigations shall include test pitting to positively locate and identify conflicting utilities, with surveyed locations and elevations, performed and the results furnished to the Engineer not later than 30 calendar days before the start of any jack/boring or other critical operation.

B. Protection of Existing Utilities:

Existing utilities, structures and fencing shall be protected during the construction period and, if damaged or removed by the Contractor in his operations, shall be repaired or replaced by him at no additional cost to the Town. All valve boxes, manholes and other existing appurtenances shall be raised or lowered by the Contractor as required to match the proposed finished grades as illustrated on the Drawings.

C. Access to Property:

Bridging (*i.e.*, aggregate material, steel plate(s) or similar measures) shall be provided to maintain vehicular driveway access to public or private premises. Bridging shall be considered as part of excavation and will not be paid for as an extra. Sand or soil alone shall not be considered acceptable bridging. Driveway access shall not be blocked longer than the actual duration of pipe-laying or other operations which cannot be feasibly accomplished without blocking such access, except with the concurrence of the affected property owner(s).

D. :Horizontal and Vertical Alignment:

Where detailed horizontal and vertical alignment is not given on the Drawings, the Contractor shall study the required horizontal and vertical alignment in relation to the existing roadway and pipes. Pavement widening, wedging, and leveling may be required to achieve final elevations, widths and grades as illustrated on the Drawings. All pavement overlays shall be feathered down at a rate of 1/4" per foot to match existing pavement elevations, except where noted on the drawings as requiring a more gradual transition.

E. Removal/Reclamation of Existing Asphalt Pavement:

Equipment shall include a self-propelled unit capable of removing the existing bituminous pavement depth and width. Reclaimed asphalt shall be stored at a storage area specified by the Town.

F. Topsoil Removal:

In cultivated areas, lawns and public improved areas, topsoil shall be stripped to minimum depth of four inches, stockpiled as directed, and care taken in so doing to avoid mixing of subsoil and topsoil. Topsoil shall be kept free from trash, brush and other debris, and shall only be handled when dry.

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G. Construction Tolerances:

Work shall be constructed and installed to the lines and grades indicated on the plans, unless permission is granted by the Engineer for a deviation, with the tolerances set forth in the NC

DOT SSRS. The following additional tolerance standards shall apply, and shall take precedence where they differ from those set forth in NC DOT SSRS:

Dimension or Parameter	Allowable Deviation from Plan Dimension	
	Minus	Plus
Roadway pavement width	Overall Average: 0.00' Not more than 10% of road: 0.10'	0.50**
Roadway pavement cross slope	0.5%*	0.5%*
Roadway pavement elevation	0.10**	0.20**
Sidewalk, path or trail width, cross slope, and elevation.	Same as for roadway. Additionally, Americans with Disabilities Act (ADA) maximum slope standards shall not be exceeded.	
Concrete or asphalt pavement component thickness	½", except that greater deviation may be allowed if another layer is thicker and, in Engineer's determination, compensates	No limit *
Length or horizontal alignment of pipe and horizontal location of drainage structures.	1', but must connect to structures as indicated	1'
Rim and invert elevations of storm drainage pipes and structures	0.10' for rims, 0.20' for inverts	0.10'
Driveway flowline elevations	0.04***	0.04***
Other driveway elevations	0.10***	0.10***
Concrete driveway thickness	½"	No limit *

* Provided, however, that a plus deviation shall not be deemed allowable if it causes an adjacent or other dimension or standard to violate a construction tolerance standard.

** Provided, however, that a deviation shall not be deemed allowable if it results, in the Engineer's determination, in either a flat or adverse (more than ¼" ponding) flowline slope, or in a reduction in the height of the backslope (elevation difference from the flowline to the right of way line) of more than 0.05' from that indicated on the Drawings, or, in the case of a driveway component steeper than 8% by design, an increase in the slope of that component of more than 1%.

Section 3.02 - Definitions (For use in these Technical Specifications):

- A. **Foundation:** the material placed between the bottom of pipe, appurtenance, or related structure, or their bedding, and the top surface of stable, undisturbed earth. Material may be flowable concrete fill, crushed stone or select backfill as shown on the Drawings or as specified.
- B. **Undercut:** the distance between the bottom of pipe, appurtenance or related structure and top of stable, undisturbed earth.
 1. Undercut Up to 12 Inches: fill with approved embedment material placed in layers not exceeding 6 inches, compacted to at least 95% maximum dry density as determined by AASHTO T-99, Method A.
 2. Undercut More Than 12 Inches: fill entire undercut with crushed stone (as described in this Section) placed as above.

Section 3.03 - Trenching

A. Summary:

1. The Contractor shall perform all excavation described of whatever substance encountered to dimensions and depths shown on the Drawings or as specified herein. Material suitable for backfill shall be stockpiled near the site. Rock or other material unsuitable for backfill shall be removed from the Work area and disposed by the Contractor.
2. The Contractor shall keep excavation as close to pipe laying operations as possible during the prosecution of the Work. The Owner or his Engineer reserves the right to stop the excavation at any time, when, in his opinion, the excavation is opened too far in advance of the pipe laying. In developed or improved areas, trenches shall not be left open overnight.

B. Dewatering:

The Contractor shall prevent the accumulation of water in trench excavation and shall remove, by well-point system and/or by other means satisfactory to the owner or his Engineer, any water or other liquid waste which accumulates in the excavation. The Contractor shall provide the proper equipment to remove the water and other liquids from the excavation and its adjacent area. The Contractor shall prevent damage of any sort to public or private property and shall not cause undue nuisance to the public. Low-noise equipment shall be used so that a noise level not higher than 55dBA results at the property line of any property used for residential, lodging, worship or other uses which, in the Engineer's determination, are noise-sensitive by nature, or at any location where the pump is operated after sunset and before dawn. The low noise characteristics of such equipment shall be subject to the approval of the Town and the Engineer. All water removed from the excavation site shall be piped to a storm drainage system or to a natural drainage area nearest to the excavation. The routing of discharge pipe and the location and configuration of discharge points shall be reviewed and approved by the Town and the Engineer before dewatering at a given location commences. This shall include placing and securing the end of the discharge hose in a manner that prevents erosion, flooding or other damage. Discharge onto private property without express written permission is prohibited. Discharge to a roadside area or other location where no swale, ditch or other defined drainage system exists is prohibited. The Contractor shall make his own investigations to determine whether or not dewatering is required, and, if so, the nature, extent, configuration, duration, etc. Dewatering shall be considered incidental to the pipe or structure work for which it is needed, shall not be separately compensated, and shall not be a basis for any claim for additional cost or time.

C. Sheeting and Shoring:

The Contractor shall furnish and place all necessary bracing, sheeting, or shoring necessary to construct and protect the excavation, existing utilities, structures of all types, and as necessary for the safety of the employees. All sheeting shall be removed by the Contractor during backfilling operations unless directed otherwise by the Owner or his Engineer.

D. Trench Dimensions:

1. Maximum Width: For general pipe laying, the maximum width of trench measured at the top of the pipe shall be the actual pipe outside diameter plus twenty-four inches. Where this dimension is exceeded, additional bedding or backfill requirements may be imposed by the Engineer. Such additional Work as may be required shall be performed by or installed by the Contractor at no additional cost to the Owner.
2. For installation of appurtenances, the trench shall be widened only to the extent necessary for proper installation.
3. Depth: The trench shall be excavated to a depth that will insure a minimum cover of twelve inches (12") for the installed pipe as measured from the top of the pipe barrel to the ground surface at the centerline of the trench unless otherwise shown on the Drawings or directed. This requirement is to establish a minimum depth only.
4. Excavations shall be made to the grades and/or depths shown on the Drawings or to such grade as may be required by the following paragraphs.

Section 3.04 - Unstable Subgrade

A. General:

1. In the event that the existing material encountered is considered by Engineer to be unstable or otherwise unsuitable to serve as foundation, an adequate foundation, approved by Engineer, shall be provided by Contractor and paid for as Extra Work.
2. When ordered in writing by Engineer, unstable or unsuitable material shall be removed and either disposed of or stabilized and replaced in a manner satisfactory to Engineer. When so directed, material disposed of shall be replaced with approved backfill material placed in layers not exceeding 6 inches, compacted to at least 95% maximum dry density as determined by AASHTO T-99, Method A. Measurement for payment shall be made in accordance with the contract unit prices.
3. When ordered in writing by Engineer, replacement material shall be suitable backfill, flowable concrete fill, or crushed stone placed as described above. Payment for this material, so ordered, shall be made in accordance with the contract unit prices.
4. The Contractor's particular attention is called to the fact that no payment shall be made for replacing excess, unauthorized excavation beyond the limits shown in the Drawings or used to correct conditions which have resulted from the Contractor's improper practices or negligence, or from Work during wet weather or other wet trench conditions resulting from the Contractor's choice of working area or weather conditions. The Contractor will be paid

for stabilizing subgrade or other efforts to provide a satisfactory foundation only when it can be shown that unstable or unsuitable subgrade conditions existed prior to excavation and when the Owner or his Engineer determines that a payment authorization is justified by pre-existing, natural ground conditions.

Section 3.05 - Base Material

A. Crushed Stone:

Placement - Unless otherwise specified, this material shall be placed and consolidated, if necessary, to achieve maximum density in place.

B. Reclaimed Asphalt:

Placement - Unless otherwise specified, this material shall be placed at a maximum depth of three inches (3"), and then overlaid with a minimum five-inch (5") depth of stone to achieve a total thickness of eight inches. The reclaimed asphalt must be compacted prior to placement of stone.

Section 3.06 - Final Backfill

A. Placement:

Final backfill shall be placed by either hand or mechanical methods at the Contractor's option. When backfilling flexible pipe (PVC, Truss), the Contractor shall provide the minimum cover over the top of the pipe, as recommended by the pipe manufacturer, before wheel loading the trench. Otherwise, no special placement method or procedure shall be required provided the required degree of compaction is obtained throughout the backfill.

Section 3.07 - Compaction

A. Unimproved Areas:

In unimproved areas, such as cross-county and wooded sections of the line, which are not subject to public travel, the backfill shall be lightly compacted by the machine placing the backfill. The trench shall be overfilled by the amount of anticipated settlement and left neatly rounded.

B. Under Sidewalks and Pavement, Other Traffic Areas and Lawns:

Soil density of not less than 98% maximum dry density shall be achieved, as determined by AASHTO T-99, Method A. Compaction to this standard shall be attained to an extent at least 6" outside the extent of all sidewalks, pavements and other traffic areas.

C. Appurtenances and Existing Structures:

Soil backfill placed under or around installed appurtenances or placed under or around existing structures or utilities shall be compacted to achieve not less than 95% maximum dry density as determined by AASHTO T-99, Method A. The volume receiving the specified degree of

compaction shall include all disturbed soil beneath a line, inclined to 45 degrees and passing one foot from the structure at finished grade.

D. Town or NCDOT Right-of-Ways:

In area covered by permit or special agreement, such as an NCDOT Encroachment Agreement, the backfill requirements shall be as described in the above paragraphs or as required by the permit or agreement, whichever is more stringent.

Section 3.08 - Drainage Features

A. Swales & Ditches:

1. All swales will be constructed pursuant to design elevations and in relationship to road centerline elevations, as shown. Special attention shall be given to those areas with special drainage concerns, as illustrated on the Drawings.
2. Swales and ditches shall be constructed with side slopes not steeper than 1:6 (vertical: horizontal) unless otherwise specified on the Drawings.

B. Drainage Structures:

1. Drainage structures and appurtenances shall be constructed in accordance with NC DOT SSRS and RSD. Structures shall be located as shown on the Drawings and connections to existing drainage features made accordingly. Culverts, pipes and drainage structures will not be considered Fully Completed until they are completely cleaned of all sediment, debris and other foreign materials.
2. Grates and frames shall be as specified on the Drawings and/or as illustrated in NC DOT RSD.
3. Special drainage structures, fittings, etc., shall be furnished and installed by Contractor in accordance with manufacturer/supplier's instructions and as indicated on the Drawings. Where manufacturer/supplier's instructions and the information indicated on the Drawings conflict, the Drawings shall govern.
4. Contractor shall coordinate with the Engineer or other Town representative when establishing rims or tops of drainage structures. Upon request of such representative, Contractor shall adjust the rim or top of each structure, after its initial construction, one time, by up to 4", to—in the representative's opinion—better suit surrounding grades, without additional compensation.

C. Culverts:

Culvert for driveways shall be furnished and installed by the Contractor except as shown otherwise on the Drawings and specifications. Culvert for under-road-crossings shall be furnished and installed by the Contractor and shall be as noted in "Part 2 - Products" and, if so indicated on the Drawings, include flared end sections as specified in the North Carolina Department of Transportation (NC-DOT) SSRS, Section 1032-4, and, if indicated on the Drawings or elsewhere in the Contract Documents, shall be encased in flowable concrete fill.

Sizes will be on drawings or as specified. Culverts, pipes and drainage structures will not be considered Fully Completed until they are completely cleaned of all sediment, debris and other foreign materials.

D. Pipes:

Drainage pipes other than driveway culverts and roadway culverts shall be furnished and installed by the Contractor and shall be as noted in "Part 2 – Products." All pipe under public streets and roadways, whether a “culvert” or a portion of a continuous storm drain system, shall be encased in flowable fill as required above for “culverts for under-road crossings.” Culverts, pipes and drainage structures will not be considered Fully Completed until they are completely cleaned of all sediment, debris and other foreign materials.

E. Locating Tape:

All continuous storm drainage systems and roadway culverts, but not including individual driveway culverts, shall have included in the pipe trench metallic locating tape: Terra-Tape or approved equal, labeled “STORM DRAIN BELOW” (or similar language acceptable to the Town) installed nine (9) inches (± 3 ”) above pipe. Any broken or damaged locating tape shall be replaced or repaired in a manner which effectively maintains electrical conductivity

Section 3.09 - Driveways

- A. Residential or commercial driveways that are cut to install drainage facilities are to be repaired using similar construction materials (*i.e.*, concrete where concrete, asphalt where asphalt), and of comparable or greater thickness.
1. Existing driveways which are Exposed Aggregate, as designated on the drawings or as determined in the field by the Engineer or other Town representative, shall be replaced with Exposed Aggregate.
 2. Other existing driveways which are neither asphalt nor standard broom finished concrete nor exposed aggregate concrete, such as stamped concrete, “Bowmanite” or other specialty finish, will be handled as follows:
 - a) Replacement of such a special driveway shall be bid as if it is to be replaced with standard broom finish concrete.
 - b) Town staff will contact the owner and offer him the option of replacing the special driveway with a special finish, using a contractor of his own choosing. In such case, a Change Order will be issued under which the Contractor’s cost of replacing such driveway with standard broom finished concrete, at the price indicated in the Unit Price Table, shall be deducted from the Contract Price. The amount of said deduction will be offered to the owner to partially defray the cost of such replacement with special-finished concrete.
 - c) If the owner declines to engage a contractor to replace such a driveway with a special finish, the Contractor for this project shall replace it with standard broom finished concrete.

3. That portion of any replaced driveway within 3' of the edge of roadway pavement shall be constructed to not less than 6" thickness.
- B. All new driveways, where none exist of concrete or asphalt, shall be concrete and extend from the road surface to the Town right of way line.
1. For single-family residential properties, concrete driveways shall be a minimum of ten feet (10') in width and four inches (4") in depth, except for the first three feet (3') adjacent to the paved road surface which shall be six inches (6") in depth, 3,000 PSI concrete. Asphalt shall be two inches (2") in depth with four inches (4") of ABC. Widths or lengths exceeding these shall be the responsibility of the property owner except where an existing concrete or asphalt driveway is wider than ten feet (10'), it shall be replaced in-kind.
 2. For properties which are multi-family residential, commercial or industrial, concrete driveways shall be six inches (6") in depth and asphalt shall be four inches (4") in depth (2" surface course over 2" intermediate course), with six inches (6") of ABC. Width and other geometrics shall be as per the Drawings.
- C. Driveways shall be constructed in accordance with the approved roadway section and sloped according to the drainage plan. Drainage plan may include design driveway flowline slopes of 0.5% or flatter, which will require careful attention to avoid unacceptable ponding (see Paragraph 301.G, Construction Tolerances, above. Contractor may provide a crack-control joint along the flowline to help mitigate ponding. Where no drainage plan or other detailed grading information is provided on the plan sheet, grading of the driveway in the direction of the adjacent road shall be provided to suit the general drainage pattern of that portion of the road, as directed by the Engineer or other Town representative.
- D. In removing portions of concrete driveways, Contractor shall be careful not to damage portions of such driveways which are to remain. Damage shall include scrapes, gouges, cracks, and any pulling open of an existing joint by more than ¼". (In determining whether any such crack has been pulled open by actions of Contractor, the Engineer shall consider the temperature at the time of the preconstruction photographs versus the temperature at the time the opened crack is observed.) Any such damage shall be corrected unless Contractor's pre-construction photographic evidence shows that the damage was pre-existing.
- E. When multiple driveways in a single block or section of street are being placed, Contractor shall use a long stringline to assure that the front edges of each driveway form a neat line, and properly establish the designed width of the road.
- F. No driveway shall be poured until the Engineer or other Town representative has inspected and approved the forms.

Section 3.10 - Roadway Improvements

- A. Standards:
1. Unless otherwise explicitly stated on the Drawings, the Town Streets Construction standards shall be used for new roadways, reconstruction or widening of existing roadways.

- a) Aggregate Base Course: ABC eight inches (8") in depth or four inches (4") of Asphalt Base Course, Type B25.0B (When pre-approved by the Town, three inches (3") maximum reclaimed asphalt and five inches (5") minimum ABC)
 - b) Asphalt Intermediate Course: Type I19.0B, two inches (2") in depth.
 - c) Asphalt Surface Course: Type SF9.5A, two inches (2") in depth.
 - d) Width: Width shall vary as shown on the approved Drawings.
 - e) Intersection radii: All radii shall be twenty-five feet (25') unless noted otherwise, with a standard taper. Radius shall be measured at the face of curb, if applicable; otherwise, at the edge of pavement.
- 2. Wedging and leveling is required on street overlayments to achieve the proper cross slope and pavement grades as shown on the Drawings.
 - 3. Streets shall be constructed in accordance with NC DOT SSRS Division 5, 6 & 8
 - 4. Mailboxes shall be maintained by the Contractor, and relocated if necessitated by the work. If it is necessary for a mailbox to be removed for more than one full day, it shall be temporarily placed in an alternate location acceptable to the property owner and the U. S. Postal Service. Landscaping and other temporary structures located within the right-of-way shall be removed and placed upon the property adjacent to the right-of-way.

B. New Roadway Construction

- 1. The Contractor shall clear and rough grade right-of-way to achieve preliminary grades as shown on the Drawings.
- 2. ABC shall be placed and compacted to achieve not less than 98% of maximum dry density as determined by AASHTO T -99 and a minimum thickness of eight inches (8").
- 3. Asphalt Intermediate Course, Type I19.0B shall be placed to achieve a minimum thickness of two inches (2"), except as otherwise noted on the Drawings.
- 4. Asphalt Surface Course, Type SF9.5A shall be placed to achieve a minimum thickness of two inches (2"), except as otherwise noted on the Drawings.

C. Roadway Resurfacing or Reconstruction

- 1. Existing Concrete Streets:
 - a) Existing concrete streets shall be rolled with a vibratory roller to promote settling and cracking. Sand shall be used to fill all cracks and voids and the roadway, unless otherwise noted on drawings.
 - b) If directed by the Drawings or other contract documents as part of Base Bid work or Alternate work, install pavement overlay fabric in accordance with manufacturer's instructions.

- c) The roadway will be widened in accordance with the specifications and Drawing with ABC or Asphalt Base Course of proper width and thickness.
 - d) Asphalt Intermediate Course, two inch (2") minimum thickness, will be placed to achieve the proper wedging and leveling and cross slopes.
 - e) The Asphalt Surface Course, two inches (2"), will be placed as per the Standards.
2. Existing Asphalt Streets:
- a) The roadway will be widened as shown on the Drawings, with ABC or HB Base of proper width and thickness.
 - b) Asphalt Intermediate Course, two inch (2") minimum thickness or as otherwise indicated on the drawings, will be placed to achieve the proper wedging and leveling and cross slopes.
 - c) The Asphalt Surface Course, two inches (2") or as otherwise indicated on the drawings, will be placed as per the Standards.
 - d) To minimize paving problems, just prior to the beginning of milling (if applicable) and paving operations, a field meeting shall be held, attended by the Engineer and the Contractor's Project Manager or General Superintendent, Paving Superintendent and at least one other key member of the Paving Crew. This Pre-Paving Meeting shall cover the following topics, at a minimum:
 - i) The pavement section for each portion of the work.
 - ii) Whether levelling or "scratch" course is required.
 - iii) The number of lifts required for each course.
 - iv) How compliance with cross-slope requirements will be met.
 - v) Any critical or unusual grade situations.
 - vi) Any special notes or requirements on the plans.
 - vii) Anticipated weather limitations.
 - viii) Means of controlling traffic.
 - ix) Any other topic(s) necessary to assure Contractor's field personnel clearly understand the design intent and the requirements of the Contract Documents.

Contractor shall assure that at least one hour is allotted for this meeting, so that all participants have ample time to understand the work, without undue time pressure.

3. Adjustment of Manhole Covers, Valve Boxes, etc.: Any and all manhole covers, valve boxes or similar castings within the limits of any roadway resurfacing or reconstruction project, or any new roadway construction project, will be adjusted to grade using appropriate rings, risers or other standard adjustment measures. Materials and effort for such measures shall be incidental to the Asphalt Surface Course.
4. Shoulder clipping and backing up of edges: In addition to the pavement reconstruction and overlay work itself, the following items shall be incidental and not paid separately:
 - a) Clipping grass, etc. which has encroached onto the existing pavement to be overlaid.
 - b) Furnishing, if necessary, and placing soil material to bring the shoulder grade up to ½" below the grade of the new edge of pavement, tying to existing grade at a slope not steeper than 1":1', and establishing vegetation on the disturbed shoulder area.

D. Other Right-of-Way Improvements:

1. Concrete Curb & Gutter:

- a) Concrete curb & gutters shall be constructed to match existing and/or finished grades as illustrated on the approved Drawings.
- b) Curbs and gutters shall be constructed in accordance with NC DOT SSRS Section 846.

2. Sidewalks, Bike Paths, Multi-Use Paths and similar facilities:

Concrete sidewalks shall be five feet (5') in width and, except where a greater width is noted on the Drawings or elsewhere herein, four inches (4") in thickness, unless greater thickness is noted on the drawings, and of 3,000 PSI concrete. Contraction (crack control) joints shall be installed at even intervals equaling 80% to 120% of the width, in no case exceeding twelve feet (12'); tooled or sawn joints are acceptable, to a depth of ¼ of the slab thickness. Expansion joints shall be provided against fixed objects, at changes of material, as directed by the Engineer, and in any case at intervals not exceeding 100'. All curb cuts shall meet current ADA standards. All asphalt sidewalks shall be based on two inches (2") of Asphalt Surface Course, Type SF9.5A over six inches (6") of ABC. Sidewalks that are anticipated to sustain heavy vehicular traffic shall have an asphalt sidewalk section consisting of four inches (4") of Asphalt Base Course, Type B25.0B, with two inches (2") of Asphalt Intermediate Course, Type I19.0B and two inches (2") of Asphalt Surface Course, Type SF9.5A.

Where sidewalks, paths or other paved areas are denoted as Pervious Concrete, it shall be constructed in accordance with the latest version of ACI 522.1, *Specification for Pervious Concrete*. Void ratio shall be not less than 15%. Pervious Concrete shall be placed over a base of 6" washed stone. Where total area of Pervious Concrete is 2,500 sf or less, requirement for cores and density testing will be waived; however, a 5' x 5' test panel shall be poured at a location directed by the Engineer for subsequent testing, at Contractor's expense, if Engineer determines there may be problems with density, void ratio, etc.

Timber boardwalks, paths, gazebos, etc., and their appurtenances, shall be constructed in conformity with local building codes and the provisions set forth on their drawings.

Sidewalks shall meet all current ADA standards, including but not limited to those for longitudinal slope and cross slope. No sidewalks shall be installed with more than a 2% cross slope, nor a 5% longitudinal slope, except ramps installed per ADA standards shall have longitudinal slopes not exceeding 1:12, or 8.33%. The Contractor shall immediately notify the Engineer if any provision of the Drawings, or any stakes or marks which have been set, would appear to result in a violation of these maximum slope standards. Unless explicitly stated on the Drawings, other non-vehicular ways, including bicycle paths and multi-purpose paths or trails, shall also meet the ADA standards set forth above.

3. Pavement Markings:

Pavement markings and placement shall be in accordance with the NC DOT SSRS standards and located as shown on Drawings. Crosswalk lines shall be evenly spaced.

E. Testing:

1. The Contractor shall employ an independent testing agency to sample and evaluate core samples on all improved streets (overlaid or new construction) as follows:
 - a) The testing agency shall be licensed in the State of North Carolina as an independent laboratory to conduct all testing required, and credentials shall be presented.
 - b) Samples shall be taken on all improved streets at an interval of three (3) cores per one thousand (1,000') linear feet of improved roadway, with a minimum of one core taken on each street improved with the Contract. Core sample locations shall be as directed by the Town.
 - c) Core samples taken shall be evaluated for asphalt mix composition, thickness and for compaction in accordance with procedures identified in the most current edition of the NCDOT SSRS.

Finishing

F. Disposal of Materials:

Such portions of the excavated materials as needed shall be used for backfilling and grading about the completed Work to the elevations as shown on the Drawings or as directed. All excavated material in excess of the quantity required for this purpose shall be disposed of, in a manner compliant with all requirements of these Contract Documents and with all applicable regulations governing such disposal, by the Contractor. The location of disposal sites shall be approved by the Owner. If disposal is at a private site not routinely known to accept such materials, Contractor shall provide the Owner with written confirmation of the agreement of the disposal site's owner to accept such materials, and, if applicable, evidence of any permits required for such disposal.

G. Finish and Cleaning:

1. The Contractor shall leave the mounding of earth over the trenches in a neat and uniform condition acceptable to the Owner or his Engineer. The Contractor shall make such provisions as may be necessary to divert surface water across or away from the line of the trench.
2. In cultivated or improved areas where topsoil has been stripped, the topsoil shall be replaced as uniformly as possible over the disturbed areas.
3. Cleanup of excess materials, debris, etc., shall be done as promptly as practicable and shall not be left until the end of the construction period.

Section 3.11 - Restoration

A. General:

All areas disturbed by this Work shall be restored to a condition equal to or better than the condition prior to construction, as determined by the Owner or his Engineer.

B. Lawns and Other Roadside Areas:

Grass plots, sod, shrubbery, ornamental trees, signs, fences, mail boxes, etc. shall be restored to the condition existing prior to making the excavation as determined by the Engineer. The cost of doing this Work shall be included in the cost of various applicable items.

C. Alleys, Driveways, Roadways:

Roadways, alleys and driveways constructed with concrete, asphalt pavement, stabilized soil or gravel that are traversed by the excavation Work shall be restored to the condition existing prior to making the excavation as determined by the Engineer. See Section 3.09 for additional details regarding driveways.

Pavement cuts on heavily traveled streets (Croatan Highway, Virginia Dare Trail, Ocean Bay Drive/Colington Road), if allowed, shall be patched with a temporary or permanent asphalt patch within 24 hours after the work causing the cut is complete. On lesser-traveled roads and streets, if a temporary or permanent asphalt patch is not made within 24 hours, the trench shall be filled to flush with the adjacent pavement grade with not less than 8" of ABC stone. Contractor shall monitor the condition of such stone patches at least daily, re-grading and adding make-up stone as required, until the permanent patch is placed.

The Contractor may reclaim existing material by stockpiling or other acceptable means, or he may furnish and compact new material. New or reused material shall be compacted to a minimum of 95% of the maximum density as determined by AASHTO T-99, Method A. The cost of doing this Work and the furnishing of any new material required shall be included in the cost of the Work and no separate payment shall be made, unless a separate bid item is provided in the Contract.

Restoration of roads and streets shall include restoration of pavement striping and marking to a condition equal to or better than before the project. As set forth elsewhere herein, Contractor

shall protect all existing infrastructure, including roadways and their marking and striping, as well as practical given the nature of the work and his operations. Generally, local areas of damage may be spot-repaired; however, when the Owner and the Engineer determine that areas of damage are so extensive and frequent that spot repairs would result in an unsatisfactory, “patchwork” appearance, they may require Contractor to replace the affected striping for long sections or the whole length of the project, without separate compensation.

D. Paved Ditch, Sidewalk, Curb and Gutter Removal and Replacement:

Paved ditch, sidewalk, curb and gutter removal and replacement required in the construction of this Work shall be done by the Contractor. The Contractor shall either stockpile or dispose of this material, as directed by the Owner or his Engineer. All brick, concrete or built-up asphalt sidewalk replacement and curb and gutter replacement shall be replaced with like material in a manner and condition equal to or better than that existing at the time of removal, as determined by the Engineer. Materials and method of replaced state highway sidewalks or curbs or ditches shall conform to the Specifications of the agency having jurisdiction.

E. Fine Grading:

All finished areas shall be graded smooth, hand-raked where necessary and shall meet the elevations and contours shown on the Drawings. All lumber, earth clods, rocks larger than $\frac{3}{4}$ ” inch, or exposed roots larger than $\frac{3}{4}$ ” in diameter, and other undesirable materials, shall be removed from the site at the completion of construction. In general, rocks which will not pass between the tines of a standard steel-tine garden rake shall be removed.

Section 3.12 - Finish Grading and Seeding:

A. General:

1. Contractor shall adhere to the following requirements as well as the seeding requirements shown on the Drawings. In general, any and all areas within the project limits which are not covered by hard surface (pavement, structure, etc.) or otherwise indicated on the Drawings to receive some other surface treatment or to remain bare, shall have a healthy stand of turfgrass established by the Contractor as part of the project work.

2. NCDOT Right-of-Way:

In those areas covered by permit or agreement, the conditions of the permit or agreement shall prevail.

3. Landscaped Areas:

- a) In landscaped areas finished grading shall result in a uniform finish free of clods, rills, or depressions. Hand-raking shall be performed where required to achieve the degree of finish or provide suitable surface for seeding.
- b) Areas requiring seeding shall be seeded as required to achieve a finish of equal type, quality, and density to surrounding areas. Sufficient mulch shall be applied, and reapplied as necessary, to maintain the surface and protect the new vegetation until stabilized.

4. Unimproved Areas:

Unimproved areas created or disturbed by this construction shall be finish graded and seeded to stabilize soil. Seeding shall be applied as specified in Part 2 Products.

B. Fertilizer Recommendations:

1. Apply 10-10-10 at rates of 25 lbs/1,000 square feet in early spring (April) and late summer (August) to build up food reserves and increase winter hardiness. Apply nitrogen at rates of 1-2 lbs/1,000 square feet every 4 to 8 weeks during summer. Do NOT apply large amounts of nitrogen in the growing season (early fall) since this makes warm season grasses more susceptible to winter kill. These are general recommendations; soil test to be sure in fertilizing warm-season grasses.
2. Proper fertilization for cool-season grasses should be guided by soil tests. In the absence of a soil test, follow these general recommendations:

Apply 25 lbs/1,000 square feet of 10-10-10 in early fall (September) and late winter (February).

3. Do not apply nitrogen on cool season grasses between June-September when these grasses are dormant. This may increase chances for disease to invade and kill these plants.

C. Liming:

The sands of the Outer Banks generally require little or no liming. Lime according to soil test only.

D. Mulch:

Mulch with 4,000 lbs/acre of straw, anchor straw by tacking with asphalt, netting, or a mulch anchoring tool. A disk with blade set nearly straight can be used as a mulch anchoring tool. "Hydroseeding," where seed, fertilizer and mulch in a water-based slurry are all sprayed on at once will be acceptable in lieu of separately-applied mulch, etc., provided that hydroseeding must be accomplished in a workmanlike manner, achieve full coverage of disturbed areas, and lead to well-established vegetative cover.

E. Maintenance and Completion:

1. General:

- a) Satisfactory stabilization and erosion control requires a complete vegetative cover. Even small breaches in vegetative cover can expand rapidly and, if left unattended, can allow serious soil loss from an otherwise stable surface. A single heavy rain is often sufficient to greatly enlarge bare spots, and the longer repairs are delayed, the more costly they become. Prompt action will keep sediment loss and repair cost down. New seedlings should be inspected frequently and maintenance performed as needed. If rills and gullies develop, they must be filled in, re-seeded, and mulched as soon as possible. Diversions may be needed until new plants take hold.

- b) Maintenance Requirements Extend Beyond the Seeding Phase. Weak or damaged spots must be re-limed, fertilized, mulched, and reseeded as promptly as possible. Re-fertilization may be needed to maintain productive stands.
- c) Stabilization shall be done by hydroseeding, mats, or sod, subject to the following:
- 1) UNLESS OTHERWISE NOTED ON THE DRAWINGS, ALL DISTURBED AREAS WITH A SLOPE OF 2% OR GREATER SHALL RECEIVE SOD.
 - i) However, the side slopes of swales and ditches, even when 2% or greater, shall not receive sod under this provision unless the longitudinal slope is 2% or greater.
 - ii) Where the limits of sod are shown on the drawings, such depiction shall govern, instead of the 2% rule.
 - iii) Sod shall be Bermuda to match the predominant turf of adjacent lawns, or, where few or no adjacent lawns are Bermuda, sod shall be Centipede. Species of sod shall not change within a single block without the approval of the Engineer.
 - iv) Sod placement shall be in accordance with the SSRS, except as otherwise noted herein and/or on the drawings.
 - v) Sod will be priced as a separate item on a per square foot basis, except where it is called for as part of the base bid work.
 - vi) Sod shall be watered as required to keep it alive; watering shall be incidental to the price for sod and not paid separately. Sod shall not be paid for, and should not be included in any application for payment, until at least 30 days after it is placed. Dead sod shall not be paid for.
- d) All stabilization will be done to the Town's satisfaction after substantial project completion. Watering of seeded and sodded areas shall be as follows:
- 1) Areas to be stabilized shall be watered every day, including weekends and holidays, by the Contractor, after seeding and sodding have occurred, to promote growth until satisfactory stabilization is obtained. Once watering has begun, a daily record of the time and amount of watering shall be kept and forwarded weekly to the Engineer. The individual performing each watering shall call the Town's representative approximately 30 minutes before each watering is to begin.
 - 2) Each individual watering shall be at a rate of not less than 2,500 gallons per seeded/sodded acre.
 - 3) Water shall be applied using nozzles and spraying techniques which do not erode the seeded areas; the first watering shall be observed by a Town representative to confirm that watering techniques are acceptable.

- 4) A rainfall event of at least 0.1" may take the place of a scheduled watering, ONLY if such rain is actually occurring at the time watering is to begin; *i. e.*, watering will not take place while it is raining. If a rain occurs between midnight and 7 a.m., or between sunset and midnight the previous day, watering will still take place that day. A heavier rain shall not be a basis not to water on the next day; *i. e.*, rainfall amounts may not be "carried forward."
 - 5) The duration of such daily watering shall be thirty (30) calendar days, The Town, in its sole discretion, may allow termination of watering early, ONLY if vegetation is fully established to its satisfaction
 - 6) If overseeding or reseeding of areas is required, due to erosion, seed problems, etc., watering of those areas will be extended as needed until they germinate and are established.
 - 7) Watering shall be paid for on a Unit Price basis, where provisions for such are made in the Bid Proposal Form. The bid quantity for watering, in such case, shall be multiplied by the unit price indicated in the Unit Price Items table, and will be included in the "Total Base Bid" amount for purposes of evaluating which bidder is the Low Bidder. A DAY of Watering shall be paid for each day that watering is accomplished in full compliance with the foregoing 6 provisions.
- e) The Contractor's Schedule of Values, established at the beginning of the Project and serving as the basis for his Applications for Payment, shall include a separate Pay Item, which may be called "Seeding and Mulching," for example, that includes all work required to establish grass on all disturbed areas.
- 1) The value of this line item shall not be less than 3% of the total amount bid.
 - 2) If there are Additive Alternate(s), a separate such line item shall be proved for each, being not less than 3% of the bid amount for the Alternate.
 - 3) Not more than 50% of said line item(s) shall be deemed earned when all areas have been fine graded, approved for seeding and mulching, and seed and mulch have been properly applied. The remainder shall not be deemed earned until, in the Town's determination, vegetation is fully established in all areas.

2. Completion:

- a) As noted in Article 14 of the General Conditions, the Town may elect to accept the project and establish the Date of Substantial Completion, subject to a list of discrepancies (punch list), which discrepancies must be completed within forty-five (45) days of said acceptance.
- b) The Town may, at its sole discretion, elect to accept the project with some or all of the "complete vegetative cover" described above not in place. Such acceptance with incomplete vegetative cover shall be subject to the following:

- 1) This will not be the Town's general practice, and will only occur if the Town believes that weather conditions at the time of the end of the project are such that it is not feasible to achieve complete vegetative cover. Bidders should not bid the project expecting that such a deferral of vegetation establishment beyond acceptance will occur. With no such deferral, late attainment of vegetative cover to the Town's satisfaction WILL result in the incurring of liquidated damages.
- 2) Acceptance shall not occur until, at a minimum, all areas to be vegetated have been fine-graded, limed, fertilized, seeded and mulched as required above, including the repair and re-doing of any and all areas damaged by erosion, contract operations or any other cause.
- 3) Contractor shall be obliged to deliver an established stand of vegetation on all disturbed areas before the project is consider fully and satisfactorily complete.
- 4) Where such acceptance occurs, a portion of the Contract Amount shall be withheld until vegetation is fully established. Said portion shall be determined by the Engineer, but shall be not less than 1.5% of the Contract Amount.

-- End of Technical Specifications --

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WATERLINE SPECIFICATIONS

PART A. GENERAL

Section A.1. Relationship to other Contract Documents.

- (a) When these Waterline Specifications are used by the Town of Kill Devil Hills (the Town) as part of an overall set of Contract Documents, said Contract Documents will include Instructions to Bidders, Bid Proposal, General Conditions, Technical Specifications, these Waterline Specifications, the Contract Agreement, any Addenda or Special Conditions which may be provided, and the Drawings. In such case, and in case of any conflict between any of the Contract Documents,
- (1) Regarding the details of installation of any water improvements (mains, services, fittings, valves, hydrants, casing pipe, etc.), these Waterline Specifications shall take precedence over the Technical Specifications.
 - (2) Regarding matters not specific to water improvements (trenching, roadway cutting and patching, roadside restoration, storm drainage work, dealing with utilities and other conflicts, etc.), the Technical Specifications shall take precedence over these Waterline Specifications.
 - (3) Regarding legal, procedural, financial matters and the protection of public and private property and persons, the General Conditions shall take precedence over these Waterline Specifications.
- (b) These Waterline Specifications may also be used to govern work being done by a private entity (the Developer) for eventual acceptance by the Town. In such case, special attention is directed to PART G. CROSS-CONNECTION PREVENTION PROGRAM below. The terms of the private contract between Developer and his Contractor shall govern the legal, procedural, financial and other aspects of the work. However, in no such case shall such provisions of a private contract supersede or replace any provision in these Waterline Specifications.

Section A.2. Definitions.

For the purposes of this article, the following words, phrases and abbreviations shall have the meanings respectively ascribed to them by this section

AASHTO shall mean the American Association of State Highway and Transportation Officials.

ASTM shall mean the American Society of Testing and Materials.

AWWA shall mean the American Water Works Association.

PWSS shall mean the Public Water Supply Section of the Division of Water Resources of the North Carolina Department of Environmental Quality (NCDEQ).

Approved equal shall mean an alternate product or material which is, in the opinion of the Town's Department of Public Services or Town Engineer, of equal quality, durability and suitability to the product or material specified herein, and which has received express written approval as such.

As-built drawings shall mean final drawings, including all changes from the original drawings, prepared by a registered engineer showing the location, character and dimensions of a project as finished and completed.

Contractor shall mean the firm hired by the developer or the Town, as applicable, for installation of the water system.

Defective work shall mean work that does not conform to the specifications stated in these Waterline Specifications, other Contract Documents, approved drawings, Town Code, or applicable state or federal law.

Developer shall mean any person who owns or improves or subdivides land. In the case where the work is being done by the Contractor for the Town, *Developer* shall mean the Contractor

Drawings shall mean the Drawings prepared by a registered engineer showing the location, character and dimensions of the work as approved in writing by the Town.

Engineer shall mean a professional registered in the state and duly authorized to act as the representative of the developer for the Town; or, in the case of work being done by Contractor hired by the Town, shall mean the person or firm engaged by the firm to serve as Town Engineer.

Inspector shall mean the Town's employee or the engineer's authorized representative approved by the Town assigned to make detailed inspections of the work

NCDOT Standards shall mean "Policies and Procedures for Accommodating Utilities on Highway Rights-of-Way," State of North Carolina, Department of Transportation, July 1, 1975, revised April 1, 1993, or most current edition.

Shop drawings shall mean all drawings, diagrams, illustrations, brochures, schedules and other data that are prepared by a Contractor, a subcontractor, manufacturer, supplier or distributor and which illustrate the equipment, material or some portion of the work.

Subcontractor shall mean an individual, partnership, firm corporation or joint venture contracting with the Contractor or developer to do a portion of the work or furnish materials for the work.

Superintendent shall mean the Contractor's authorized representative in charge of the work.

Work shall mean the furnishings of all labor, materials, equipment and incidentals necessary to successfully complete the project and satisfy the duties and obligations imposed by this article.

Section A.3. Scope of Contractor's responsibility.

The Contractor shall furnish all labor, materials, land, and equipment required to construct the water line, appurtenances, and other miscellaneous items, excavate the trench, keep the trench dry, maintain proper slopes and high safety standards, using a shoring box where required, furnish and install pipe, plug watertight the pipe end when left unattended, backfill the trench, maintain the backfilled trench

until final acceptance, replace pavement; sidewalks, curb and gutter and any permanent structures where required, and clean up the right-of-way after construction, in a manner consistent with best practice in the industry for this type of Work.

Section A.4. Work within public rights-of-way.

- (a) Work included. The Contractor shall furnish all labor and materials for the complete installations of bored and jacked casings or tunnel liners as specified herein. If it has not already been obtained by the Owner or Engineer and furnished prior to bid opening, the Contractor shall obtain from the North Carolina Department of Transportation (NCDOT) the necessary Highway Encroachment Permit. It shall be the responsibility of the Contractor to obtain, or cause to be obtained, any additional permits or approvals necessary for this construction.
- (b) Bored highway and street crossings. In addition to complying with all PWSS regulations, bored and jacked highway or street crossing shall comply with standards set forth in the NCDOT Standards. Where the water line is to be laid in streets or on the shoulders of paved streets, the Contractor shall be responsible for maintaining the streets and adjacent private drives and entrances in usable condition at all times.
- (c) Open cut street crossings. All paved surfaces to be disturbed by the installation of the underground utilities shall be saw cut, straight and true, along the extremities of the trench excavation required. Upon completion of the installation, the crossing shall be restored to its original condition in accordance with the detail shown on the contract drawings. Where streets are shown to be open cut, the Contractor must provide sufficient flag persons and allow one lane of traffic to be open at all times.
 - (1) After pipe laying operations are completed in each area or designated section, the Contractor or developer shall clean up all debris and surplus earth and restore the street or area immediately adjacent to the street to the same condition or better as existed before construction.
 - (2) If open cutting is allowed, all pavement on Town streets and on state highways shall be replaced in kind or as required by the NCDOT. In street areas, the trench backfill shall be maintained for traffic until, in the opinion of the Town, complete settlement and compaction have been obtained. The cut area shall then be excavated to proper depth, base course placed and compacted, and the pavement surface replaced. Base course and pavement shall conform to the requirements of the NCDOT or the Kill Devil Hills Town Code. See also Section 3.12, Paragraph C of the Technical Specifications.
- (d) Right-of-way conditions. During the progress of the work, the Contractor shall keep the premises and vicinity of the work free from unsightly and disorderly piles of debris and materials resulting from or used in his/her operations. Suitable locations shall be allotted for the various materials and for debris. The materials shall be kept in their storage locations except as needed in the work; and debris shall be promptly and regularly collected and deposited in the allotted location, the intent being to avoid unsightly and disorderly appearance and confusion, and to promote an orderly and efficient conduct of the work. Upon completion of each structure or element of the work, the Contractor shall shape up the ground adjacent thereto, removing all surplus excavated material and leaving the area free from humps and hollows.

PART B. JOB CONDITIONS

Section B.1. Laws to be observed.

The Contractor and subcontractor must keep fully informed of all federal and state laws, local laws, ordinances and regulations, and all orders and decrees of bodies having any jurisdiction or authority, which in any manner affect those engaged or employed on the work, or which in any way affect the conduct of the work. Such persons shall at all times observe and comply with all such laws, ordinances, regulations, orders and decrees and shall protect and indemnify the Town and its representatives against any claim or liability arising from or based on the violation of any such law, ordinance, regulation, order or decree, whether by himself/herself or his/her employees.

Section B.2. Before starting work.

A preconstruction meeting shall be held to review the progress schedules, to establish procedures for handling shop drawings and other items submitted in accordance with this chapter, and to establish an understanding between the parties as to the project. The Town, developer, Contractor, utility companies and other interested parties may attend.

Section B.3. Protection and restoration of property and landscape.

- (a) The developer shall be responsible for the preservation of all public and private property and shall protect carefully from disturbance or damage all land monuments and property markers, and shall not move them until directed. Monuments or markers disturbed or damaged shall be replaced by a licensed land surveyor at Contractor's expense.
- (b) The developer shall be responsible for all damage or injury to property of any kind during the execution of the work, resulting from any act, omission, neglect or misconduct in his/her manner or method of executing the work, or at any time due to defective work or materials.

Section B.4. Shutting off for connections.

- (a) The existing water supply and fire protection systems shall not be disturbed, except as absolutely necessary, by the developer's operations. Special care shall be exercised where pipes are being removed and replaced with new lines. The developer shall carefully plan his/her work in order to avoid contamination and lengthy shutdowns of existing water lines.
- (b) Prior to commencing work on any existing water line, the Contractor shall furnish the Town with workers and tools to enable the Town to shut off the water in order to make connections. Existing valves shall be operated by the Town's employees only. All materials and equipment necessary for work shall be on-site at least eight (8) hours prior thereto.
- (c) Prior to shutting off the water, the Contractor or the developer shall notify any affected property owners and the fire department at least twenty-four (24) hours prior thereto; copies of such notice shall be furnished to the Engineer. Notice to the Fire Department shall be in writing, via e-mail, to the following addresses: johnr@kdhnc.com; frank@kdhnc.com; troy@kdhnc.com; pam@kdhnc.com. Contractor shall send a test e-mail to this list, early in the project, to confirm that the list is valid and shall make any updates or corrections as directed by the Fire Department. In planning his shutoff, Contractor shall minimize the number of all fire hydrants which will be out of service during the shutoff, and shall report those to the

Fire Department. The Town reserves the right to disapprove a shutoff if, in its sole determination, the number of hydrants disabled is excessive and can be reduced by an alternate plan or method.

- (d) Timing of shut-offs shall, to the maximum extent practical and subject to approval by the Engineer, avoid peak business hours of customers. Shut-offs to restaurants shall be avoided between 5 a.m. to 8 a.m., 11 a.m. to 2 p.m. and 5 p.m. to 9 p.m. Shutoffs to hotels or motels shall be limited to between 8 a.m. and 5 p.m. Additional provisions regarding water outages may be provided on the Drawings.

Section B.5. Cleanup.

All surplus construction material shall be removed from the site by the Contractor; however, cleanup work, including complete trench backfill, may be delayed for testing purposes, but shall be limited to single sections of pipe that can be valved off. Cleanup must be done prior to or concurrent with pipe laying operations for the next valved section.

Section B.6. Access to work.

The Town and its representatives shall at all times have access to the work. The Contractor shall provide facilities for such access and observation of the work as well as inspection and testing by others.

Section B.7. Warranty; defective work.

- (a) If work has been rejected by the Town, it must be removed from the site and replaced with non-defective work. If the developer does not correct such defective work or remove and replace such rejected work within a ninety (90) day period, as specified in a written notice thereof from the Town, the Town may have the deficiency corrected or the rejected work removed and replaced. The developer shall pay all direct and indirect costs of such correction or removal and replacement, including compensation for additional professional services. The developer shall also bear the expenses of making good all work of others destroyed or damaged by the developer's defective work. No permits shall be issued to or approvals granted to the developer until all such costs have been paid to the Town.
- (b) The Town must approve the work in writing after its completion. However, such approval shall not affect or waive the Town's warranty rights and remedies as set forth in this section. The developer shall warrant and guarantee all workmanship and materials against defects for a period of two (2) years after the date of final approval. The Town may, at its election, require the developer to secure the warranty obligation with a deed of trust or other form of security satisfactory to the Town. If any work is found to be defective during the warranty period, the developer shall promptly correct such defective work or, if the work has been rejected by the Town, remove the defective materials from the site and replace them with non-defective materials. If the defect is such that it causes a break in the water line or is of such a nature that, in the opinion of the Town's Public Services Department or Town Engineer, it impairs the operation of the water system, then the Town may repair or replace the defective work or material or have the defective work corrected, and all direct and indirect costs thereof, including compensation for additional professional services, shall be paid by the developer. If the developer fails to pay all such costs and expenses, then the Town may proceed against the security posted by the developer without waiving or prejudice to any other rights, claims, or remedies.

PART C. MATERIALS

Section C.1. Generally.

All water system and water line materials used shall conform to the specifications set out in this division and any changes shall be submitted in writing to and approved by the Town. All backflow prevention assemblies and other materials associated with the Cross Connection Control Program shall be as set forth in PART G. CROSS-CONNECTION PREVENTION PROGRAM below.

Section C.2. Pipe standards.

- (a) *PVC:* Except for 2" diameter pipe, PVC pipe shall conform to all requirements of AWWA Specification C900, latest edition, and AWWA C905, latest edition, for sizes larger than 12". PVC pipe and fittings shall be pressure rated at one hundred fifty (150) psi (pounds per square inch) with a standard dimension ratio (SDR) of eighteen (18) for both barrel and bell dimensions. 2" diameter pipe shall be 2" Schedule 80 PVC, Iron Pipe Size (IPS). Pipe shall bear the National Sanitation Foundation seal of approval and shall comply with the requirements for Type 1, Grade I (PVC 1120) of the ASTM resin Specification D-1784.
- (1) Joints. PVC pipe shall have push-on joints, incorporating a rubber ring bell joint which shall be an integral and homogeneous part of the pipe barrel. Solvent-welded joints shall not be used, except for 2" pipe.
 - (2) Fittings shall be the same as for ductile iron pipe as set forth below.
- (b) *Ductile Iron:* Ductile Iron Pipe shall be furnished in 18 or 20-foot laying lengths, with push-on type joints, except where mechanical joint or pipe is called for on the Drawings. Ductile iron pipe shall conform to the requirements of AWWA C151. Flanged ductile iron pipe shall comply with the requirements of AWWA C115.
- (1) Thickness Class of the pipe shall be Pressure Class 350 as required by the pipe size, bedding type and depth. The pipe shall be round and gaged throughout its entire length. Ungaged pipe will not be accepted.
 - (2) Lining – All pipe shall be single coat cement lined and sealed coated in accordance with AWWA C104.
 - (3) Joints shall be either mechanical, push on, or flanged conforming to AWWA C111 (ANSI A21.11) or AWWA C115 (ANSI A21.15) as applicable. All flanges and glands for pipes and fittings shall be made of ductile iron.
 - (4) Fittings shall be manufactured in accordance with AWWA C110 (ANSI A21.10) or AWWA C153 (ANSI A21.53), and shall be ductile iron. The minimum acceptable pressure rating shall be 350 psi. All fittings shall be lined in the same manner as ductile iron pipe.
 - (5) Coating shall be provided on the exterior of all ductile iron pipe, joints and fittings as required by AWWA C110, C111, C115, C151, or C153 as applicable. All pipes, joints and fittings shall be examined before and after laying to determine if the coating has been damaged. Any damaged areas and all joints shall be coated with approximately 1 mil of a bituminous coating, such as Koppers No. 50 or Intertol No. 49.
 - (6) Polyethylene Wrap, where indicated on Drawings, shall conform to the requirements of AWWA C105.

- (7) Retainer Glands, or other joint restraint devices, shall be cast from high strength ductile iron. Restraint devices shall be rated to perform their restraining function at the full rated pressure of the pipe itself. Devices used on mechanical joint pipe shall be compatible with mechanical joint connectors meeting requirements of AWWA C111. Acceptable types:
- (a) For PVC Pipe: Only devices which apply pressure around the full circumference of the pipe. Devices which use radial screws to press pads against only a portion of the pipe's circumference are not acceptable. Acceptable devices include Romac "GripRing" for PVC and Romac 600 Series, and EBAA Iron's 1600 and 2800 series where a bell restraint is appropriate.
 - (b) For Ductile Iron Pipe: Acceptable devices shall be Romac "GripRing", "RomaGrip" and 600 Series, and EBAA Iron's "MegaLug," Series 1100 (1100SD may be used if a split restrainer is required), and Series 1700 where a bell restraint is appropriate.
- (8) Tracer Wire shall be 14 gauge CCS with 30 mil (min) insulation for open-trench installations. Thicker wire and insulation will be required for directional-bored or jack-bored lines.
- (c) *Casing pipe.* Casing pipe shall be smooth wall or spiral welded steel pipe with a minimum yield strength of thirty-five thousand (35,000) psi. All joints shall be welded. The casing pipe shall be new and shall conform to ASTM A139 Grade B, ASTM A53 Grade B, and AWWA C200-75.

Casing pipe for water service lines shall be PVC, Schedule 40 conforming to ASTM D1785, provided in 20' lengths with integral coupling bells; not more than 1 joint shall occur underneath any roadway. HDPE tubing, having a DR of 11 or less, may also be used for service line casings, provided that no connector or joining of HDPE is allowed, only a single, continuous piece for each casing.,

- (1) Size and thickness shall be as follows (larger and/or thicker casing may be substituted at no additional cost to Town.

Carrier Pipe Size, (nominal)	Casing Pipe Size, (O.D.)	Casing Wall Thickness, (minimum)
16" DI	30 inch	0.3750 inch
12" DI	24 inch	0.3125 inch
10" DI	18 inch	0.3125 inch
8" DI	16 inch	0.250 inch
6" DI	12 inch	0.250 inch
4" DI	10 inch	0.250 inch
2" water service	3" nominal	Sch. 40 PVC or DR11 HDPE
Up to 1 ½" water service	2" nominal	Sch. 40 PVC or DR11 HDPE

- (2) Except for casings for water service lines, the interior and exterior of the casing pipe shall be coated with coal tar epoxy. The Contractor shall submit specifications on the proposed casing pipe for approval by the Kill Devil Hills Public Services Department prior to construction.
- (3) Spacers to center carrier pipe within the casing pipe shall be stainless steel, bolt-on style, either Model CCS as made by Cascade Waterworks Manufacturing Company or Model SSI as made by Advance Products & Systems, Inc., or approved equal. Spacers are not required in casings for water service lines.
- (4) Bulkheads at end of casing shall be of brick and mortar. Manufactured neoprene end seal systems, such as made by Advance Products & Systems, Inc., or equal, may be used if approved by the Engineer. For water service lines, use common duct tape to seal end of PVC casing to water service line at each end.
- (d) *Size.* Except for water service lines, all pipelines shall be a minimum of six (6) inches and shall meet the size requirements of the North Carolina Department of Environment and Natural Resources, unless otherwise approved by the Board of Commissioners.

Section C.3. Valves.

- (a) *Resilient wedge gate valves.* All resilient wedge gate valves shall conform in all respects to latest AWWA Specification C500 and shall be American Flow Control, Mueller "O" ring or M&H, or approved equal. Resilient wedge gate valves shall be vertical, shall open counterclockwise, and shall be of the non-rising stem type with mechanical joint ends and two (2) inch square operating nut. Resilient wedge valves shall be iron body, double disc, parallel seat, fully bronze mounted. Resilient wedge valves shall be designed for a working pressure of two hundred (200) psi
- (b) *Butterfly valves.* Butterfly valves shall have the following characteristics:

- (1) Butterfly valves shall be class 150-B meeting or exceeding AWWA Specification C- 504, with cast iron disc.
 - (2) Butterfly valves shall be manually operated with the operator assembly meeting all requirements of section 12, AWWA Specification C-504-70. Operating torques shall comply with Table 1 of C-504 for class 150-B valves. They shall open counterclockwise and be provided with two (2) inch square operating nuts. The operator assembly shall be suitable for trench bury.
 - (3) Butterfly valves shall have mechanical joint ends. Each valve shall have a serial number permanently indented into the body. The number shall be kept on file by the manufacturer for future reference. Certified copies of the teals shall be forwarded to the Town for record purposes.
 - (4) Butterfly valves shall be American-Darling, Henry Pratt Ground Hog or approved equal quality.
- (c) *Ball valves:* Where valves on 2" PVC water lines are called for, they shall be 2" Ball Valve Curb Stops (Ford B11-777-NL).
- (d) *Valve boxes.* Valve boxes shall have the following characteristics:
- (1) Valve boxes shall be of close-grained, gray cast iron, in three (3) pieces consisting of
 - (a) a lower base piece which shall be flanged at the bottom to fit around the stuffing gland and rest on the valve bonnet.
 - (b) an upper part which shall also be flanged on the lower end, of such size so as to telescope over the lower part and the upper end being constructed in the form of a socket to receive the cover.
 - (c) The centerpiece shall be minimum five (5) inches inside diameter.
 - (2) The valve box shall be Dewey Brothers, Inc., VBX-TE-3B or approved equal.
 - (3) The cover shall have cast on the upper surface in raised letters the word "WATER." Valve boxes shall be painted prior to shipment with a coat of protective asphaltum paint and contain a cement collar.

Section C.4. Hydrants.

- (a) Fire hydrants shall be AWWA Specification C502, of the compression type and designed for a minimum working pressure of one hundred fifty (150) psi and a hydrostatic test pressure of three hundred (300) psi with the valve in both open and closed positions.
- (b) The hydrant valve opening shall be a minimum of four and one-half (4½) inches. Hydrants shall be equipped with two (2) two and one-half (2½) inch hose nozzles, and one (1) four and one-half (4 ½) inch pumper nozzle. All nozzles shall have N.P.T. threads. Nozzles shall be bronze with cast iron caps secured thereto with suitable steel chain. A drain outlet shall be provided.
- (c) The upper hydrant operating stem within the bonnet shall be sealed and lubricated by means of an oil or grease bath. The operating nut shall be standard pentagon type

measuring one and one-half (1½) inches from point to flat. Hydrants shall open counterclockwise.

- (d) The hydrant shoe shall be six (6) inches in size, of the mechanical joint type.
- (e) Hydrants shall be of the safety type so that if the upper barrel is broken off, the hydrant valve will remain closed and reasonably tight.
- (f) All hydrants shall be furnished with barrel and stem extensions as required for the final field location. The nominal minimum bury shall be three (3) feet
- (g) Hydrants shall be M & H or approved equivalent.

Section C.5.

Service pipe and fittings.

- (a) Tubing for water services up through 2" shall be HDPE, Copper Tube Size (CTS), conforming to AWWA C901, maximum SODR 9, 200 psi.
- (b) The service clamp shall be a brass saddle with double brass bolts conforming to AWWA C800.
- (c) The corporation valve shall be Hays Mfg. Co. #5605-DF or approved equal quality.
- (d) Minimum size tap and service line shall be 1".
- (e) Plastic inserts shall be used on all compression fittings and couplings.
- (f) Corporation stops shall not be required.
- (g) Compression couplings shall be Ford or approved equal, 3-part CTS, as follows:
 - (1) ¾" x ¾" shall be C34-33G
 - (2) 1" x ¾" shall be C44-34G
 - (3) 1" x 1" shall be C44-34G
- (h) Water meters shall be Sensus TR/PL positive displacement or approved equal quality.
- (i) Meter boxes shall be Carson Industries, LLC, black, solid flush cover, or approved equal, as follows:
 - (1) For ¾" meters, model 1015-12
 - (2) For 1" meters, model 1220-12
 - (3) For 1½" and larger, model 1730; confirm details with Public Services Department before ordering.
- (j) Coppersetters shall be Ford, or approved equal, as follows:
 - (1) For ¾" meters, model VHH72-7W-41-33-G-SNCSTR
 - (2) For ¾" meters, model VHH74-7W-41-44-G-SNCSTR
 - (3) For 1½" and 2" Series 70, confirm details with Public Services Department before ordering.

Section C.6. Miscellaneous conditions.

- (a) The tapping valve shall be mechanical joint equal to Clow F-5903 and tapping sleeve shall be Romac stainless steel, full-gasket wraparound or approved equal.
- (b) Concrete shall be composed of Portland cement, sand and crushed stone or gravel mixed in proportions to develop the twenty-eight (28) day compressive strength of not less than three thousand (3,000) psi.
- (c) Welded steel pipe shall be used for encasement pipe and shall conform to the NCDOT Standards, section 932-8. The inside diameter of the casing pipe shall be not less than four (4) inches greater than the largest outside diameter of the carrier pipe, joints or couplings, minimum one-fourth (1/4) inch thickness.
- (d) All water line installations shall have included in the pipe trench metallic locating tape: Terra-Tape or approved equal, labeled “WATER LINE BELOW;” installed eighteen (18) inches above pipe and a minimum width of six (6) inches. Tracer wire shall also be provided, installed per industry standard practice.

Section C.7. Certificate of compliance.

Certificates of compliance with the standard specifications shall be furnished with each lot of pipe supplied.

Section C.8. Shop drawings for valve, hydrant and miscellaneous items.

Two (2) copies of shop drawings shall be furnished to the Town before installation to allow the Town to review the proposed materials that will be installed. The Town’s written approval of the shop drawings shall be required before commencing work.

PART D. PREPARATION TO INSTALL LINES

Section D.1. Alignment and grade.

- (a) *Deviations.* Wherever obstructions, not shown on the Drawings, are encountered during the progress of the work and interfere to such an extent that an alteration in the plan is required, the Town shall be notified at once for approval of any changes.
- (b) *Depth of pipe.* The pipe shall be buried to provide thirty-six (36) inches of cover over the top of the pipe, unless otherwise specified by the Town or on the approved Drawings. High points in the line shall be avoided in intersections and when crossing streets. Required cover shall be provided at the lowest grade in the street. High points shall be located at house services or air vents. Ditch crossings shall have a minimum thirty-six (36) inch cover unless otherwise approved by the Engineer.
- (c) *Location.*
 - (1) The pipe shall be located a minimum of ten (10) feet from any wastewater pipe or sewer.
 - (2) Water mains shall be laid at least 10 feet laterally from existing or proposed sewers, unless local conditions or barriers prevent a 10-foot lateral separation—in which case:
 - (a) The water main is laid in a separate trench, with the elevation of the bottom of the water main at least 18 inches above the top of the sewer; or

- (b) The water main is laid in the same trench as the sewer with the water main located at one side on a bench of undisturbed earth, and with the elevation of the bottom of the water main at least 18 inches above the top of the sewer. NOTE: This condition shall not generally be allowed, and may be employed only with the advance permission of the Public Water Supply Section. Contractor shall not use this technique unless advance approval is obtained through the Engineer.
 - (c) Crossing a Water Main Over or Under a Sewer. This provision shall apply to gravity sanitary sewers and sanitary sewer force mains. New water mains shall be laid to cross sewers with a minimum of 18" separation, over or under, with water OVER the sewer where practical. In either case, a full, un-cut section of new water pipe shall be centered on the point of crossing.
 - (d) In applying the provisions above, the term "Sewer" shall include, in addition to sanitary sewer lines, pipes carrying reclaimed water.
- (3) Relative to storm drainage or stormwater management piping, or other utilities, the following vertical separation standards shall apply when either the water main or the storm drain, or both, is/are new:
- (a) Maintain 12" of vertical separation, over or under.
- (4) Dead-end lines. No non-looping lines shall be permitted unless otherwise approved by the Town's Board of Commissioners. Non-looping waterlines shall terminate with a fire hydrant or 2" blow-off assembly. Dead end lines without flushing capabilities are not allowed.

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Section D.2. Trench width and bedding.

- (a) All excavation shall be made in such a manner and to such widths as will provide ample room for properly installing the pipe and permit thorough compaction of backfill around the pipe. All excavation and trenching shall be done in strict accordance with these specifications and all applicable parts of the OSHA regulations, 29 CFR 1926, Subpart E.
- (b) Enlargements of the trench shall be made as needed to give ample space for operations at pipe joints. The width of the trench shall be limited to the maximum dimensions shown on the approved drawings, except where a wider trench is needed for the installation of and work within sheeting and bracing. Except where otherwise specified, excavation slopes shall be flat enough to avoid slides that will cause disturbance of the subgrade, damage to adjacent areas, or endanger the lives or safety of persons in the vicinity.
- (c) Hand excavation shall be employed wherever, in the opinion of the engineer or the Town of Kill Devil Hills, it is necessary for the protection of existing utilities, poles, trees, pavements, or obstructions.
- (d) No greater length of trench in any location shall be left open, in advance of pipe laying, than shall be authorized or directed by the engineer or the Department of Public Services and, in general, such length shall be limited to approximately one hundred (100) feet.
- (e) The Contractor shall excavate the trenches to the full depth and grade indicated on the approved drawings including the relevant requirements for bedding. The trench bottoms shall then be examined by the engineer as to the condition and bearing value before any pipe is laid or bedding is placed.
- (f) If, in the opinion of the Department of Public Services, the trench requires excavation below the requirements for bedding to provide a sound base, the Department of Public Services shall direct the Contractor to perform the additional excavation. It is the intent that unsatisfactory subgrade materials for pipe be removed.

Section D.3. Boring and jacking.

Installation. The boring equipment to be used for installing the jacked casing shall be of such size and capacity to allow the boring to proceed in a safe and expeditious manner. The installation of the casing and boring of the hole shall be done simultaneously to avoid cave-ins or settlement and for safety of traffic above. Provide dewatering adequate to prevent running sand ahead of casing.

- (a) Pits shall be well sheeted and braced as necessary for safe and adequate access for workers, inspectors and materials and shall be of size suitable to equipment and material handling requirements.
- (b) Stainless steel spacers shall be installed to support the carrier pipe at the proper elevation inside the casing pipe. Two spacers shall be installed for each full joint of carrier pipe, one within two feet of the end of each joint and the other half a joint length away so as to provide a uniform spacing pattern.
- (c) Each of the casing conduits shall be made watertight with a brick masonry bulkhead, or, if submitted to and approved by the Engineer, a manufactured neoprene end seal. In addition, a Class B concrete cradle shall be provided from the end of the tunnel bulkhead to the first pipe joint outside the tunnel.

- (d) All joints of carrier pipe inside casing pipe and for at least one addition joint beyond each end of casing shall be restrained.
- (e) Under no conditions shall jetting or wet boring of the encasement be allowed.
- (f) Water services shall have PVC Schedule 40 or HDPE DR 11 casings as provided herein, which shall be installed by pneumatic “mole” or similar method. Final cover after installation shall be not less than 30 inches. Boring logs shall be maintained. Any resulting humping or other damage to pavement shall be corrected immediately in a manner satisfactory to the Engineer.

PART E. INSTALLATION OF LINES

Section E.1. Laying pipe.

- (a) *Generally.* Waterlines are to be installed in accordance with C600, C602, C603, C605, and C606 of the AWWA Standards.
 - (1) *Contamination protection.* Prevent entrance of foreign material; plug watertight where left unattended.
 - (2) *Placement.* Pipe length and bedding as a unit in a frost-free, dry trench.
 - (3) *Special supports and saddles.* See approved drawings.
- (b) *Joint deflection.* Manufacturer’s recommendation.
- (c) All piping shall be installed by skilled workers and in accordance with the best standards for piping installation. Proper tools and appliances for the safe and convenient handling and installation of the pipe and fitting shall be used. Great care shall be taken to prevent any pipe coating from being damaged on the inside or outside of the pipe and fittings.
- (d) All pieces shall be carefully examined for defects, and no piece shall be installed which is known to be defective. If any defective piece should be discovered after having been installed, it shall be removed and replaced with a sound one in a satisfactory manner by the Contractor at his/her own expense. Pipe and fittings shall be thoroughly cleaned before they are accepted in the complete work.
- (e) All exposed piping shall be installed with vertical and horizontal angles properly related to adjoining surfaces or pipes to provide evidence of good workmanship.
- (f) All piping shall be installed to the correct line and grade, with no abrupt changes in line or grade, and as shown on the approved drawings. Joint deflection shall not exceed seventy-five (75) percent of the manufacturer’s recommended deflection. Excavation and backfilling shall conform to the requirements of this section. Maximum trench widths shall conform to the trench width excavation limits on the approved drawings.
- (g) Following proper preparation of the trench subgrade, pipe and fittings shall be carefully lowered into the trench so as to prevent dirt and other foreign substances from gaining entrance into the pipe and fittings. Under no circumstances shall any of the materials be dropped or dumped into the trench. Proper facilities shall be provided for lowering sections of pipe into trenches.
- (h) The full length of each section of pipe shall rest solidly upon the bed of the trench, with recesses excavated to accommodate bells, couplings, joints, and fittings.

- (i) Pipe that has the grade or joint disturbed after installation and removed shall be reinstalled by the Contractor at his/her own expense. Pipe shall not be laid in water or when trench conditions are unsuitable for work. Water shall be kept out of the trench until jointing and backfilling are completed. When work is not in progress, open ends of pipe, fittings, and valves shall be securely closed so that no water, earth, or other substance will enter the pipes, fittings or valves. Pipe ends left for future connection shall be valved, plugged, or capped, and anchored as required. All piping shall be installed in such a manner that it will be free to expand and/or contract without injury to itself or to structures to which it is connected.
- (j) Where pipe having joint systems other than conventional (push-on, mechanical joint, etc.), during the laying of such pipe, the Contractor shall arrange for a representative of the pipe manufacturer to instruct the Contractor's pipe laying personnel in the correct procedure to be followed.
- (k) When it is necessary to cut ductile iron pipe in the field, such cuts shall be made carefully in a neat workmanlike manner using approved methods to produce a clean, square cut. The outside of the cut end shall be conditioned for use by filing or grinding a small taper, at an angle of approximately thirty (30) degrees.
- (l) Before joints are made, each pipe shall be well bedded on a solid foundation, and no pipe shall be brought into position until the preceding length has been thoroughly bedded and secured in place.
- (m) Proper and suitable tools and appliances for the safe convenient handling and laying of pipe shall be used and shall in general agree with manufacturer's recommendations.
- (n) The Town shall be notified prior to installation of any pipe. The Town shall be allowed to inspect joints, valves, hydrant construction and thrust blocks prior to covering. Contractor shall allow inspection by the Town during normal business hours.

Section E.2. Jointing.

Mechanical joints shall be lubricated with an approved pipe lubricant meeting C111/A21.11 and bolts tightened evenly using a torque of between seventy-five (75) and ninety (90) foot-pounds. Push-on joints shall be lubricated as above and pushed fully home; final position shall be at least 80% to the home mark. Restrain joints with approved devices as described herein, to the extent indicated on the Drawings or as specified elsewhere herein. Every bolt of all mechanical joints, bolted fittings, bolted restraints, etc. shall be tightened to the correct torque, as determined by the manufacturer's specification, by standard practice, or as directed by the Engineer, with final tightness confirmed by a torque wrench.

Section E.3. Cleaning pipe and fittings.

The Contractor shall maintain the interior of pipe and fittings free of foreign material and joint surfaces free of lumps and blisters.

Section E.4. Setting valves and fittings.

- (a) Valves, fittings, fire hydrants, plugs and caps shall be set and joined to the pipe in a manner as specified for cleaning, laying and joining pipe and shall be installed with Romac grip rings or approved equal on all MJ fittings.

- (b) Valves shall be placed as shown on the drawings or as directed by the Town. Two valves shall be located at all tees, three valves at all crosses and not farther apart than one thousand (1,000) feet
- (c) The valve shall be set plumb.
- (d) A valve box shall be provided for each valve. The box shall not transmit shock or stress to the valve when the box cover is flush with the surface of the pavement or such level as may be directed. The base section of the valve box shall be set two (2) inches above the flanged bonnet joint of the valve and accurately centered on the valve operating unit.
- (e) A precast concrete ring shall be provided around the top of each valve box; flush with the surface. The ring shall be a minimum of twenty-eight (28) inches in diameter with a nine (9) inch center hole. The ring shall taper from a four (4) inch center thickness to three (3) inches or less on the edges.

Section E.5. Hydrants.

- (a) Hydrants shall be installed where shown on drawings or as directed by the Town. Hydrants shall be set a maximum of five hundred (500) feet apart and at any high points.
- (b) The hydrant shall be set on a compacted crushed stone base thirty (30) inches square and ten (10) inches thick. Reaction backing shall be installed behind the base of the hydrant.
- (c) The hydrant shall be plumb with the pumper nozzle facing the street and nozzle centerline twenty (20) inches above finished grade.
- (d) Each hydrant must be connected to the main line with a six (6) inch cast iron or ductile iron branch and controlled by a six (6) inch resilient wedge valve. Romac grip rings or approved equivalent shall be used also.
- (e) Drainage shall be provided at the base of the hydrant by placing coarse gravel from the bottom of the trench to at least six (6) inches above the weep hole.
- (f) Hydrants shall be painted to the Kill Devil Hills Public Services Department standards. Factory painting alone shall not suffice; a fresh, field coat is required.

Section E.6. Plugs, tees and bends.

Plugs, tees and bends deflecting eleven and one-fourth (11¼) degrees or more shall be provided with restraint.

Section E.7. Method of Restraint.

Of the three commonly-used methods of restraint—thrust or reaction blocks, restraining rods and joint restraint devices—only joint restraint devices are approved for use in all circumstances.

- (a) Thrust blocks shall be used at fire hydrants as shown in the detail on the drawings.
- (b) Use of thrust blocks other than at fire hydrants or tie-ins to existing mains, and any use of restraining rods, is generally not allowed, and will be allowed only with the express, advance permission of the Engineer.
- (c) Extent of joint restraint shall be as shown on the drawings.

- (d) Restraint devices shall be installed in full accordance with manufacturer's instructions.
- (e) Where joint restraint is not indicated on the drawings, the restrained length shall be determined using the methods promulgated by the Ductile Iron Pipe Research Agency (DIPRA), using Laying Condition 5, Soil Designation "Good Sand," Design Pressure 150 psi, Safety Factor 1.5, and use the restrained length value for "Polywrapped" to account for the smoother exterior wall of PVC versus Ductile Iron.

Section E.8. Thrust Block Dimensions (when and where thrust blocks are allowed).

- (a) The following table shows the minimum bearing area against undisturbed trench wall in square feet:

Pipe Size	Tees, Plugs	Hydrants, 90° Bends	Wyes, 45° Bends	22½ ° Bends	11¼° Bends
4"	1	2	1	1	1
6"	3	3	2	1	1
8"	4	6	3	2	1
10"	7	9	5	3	2
12"	9	11	6	3	2
14"	11	15	8	5	3
16"	13	20	10	6	3
18"	16	25	12	7	4
20"	20	28	12	8	4
24"	28	40	20	11	6

- (b) Unsuitable soil conditions for trench wall shall require securing fittings with tie rod clamps and concrete or doubling square footage requirements.

Section E.9. Connections.

- (a) Existing water lines. Connections shall be made with system pressure on or off as specified by the Town. Existing water lines shall be adequately supported during the tie-in operations and prior to placement of backfill. Reaction backing shall be placed behind all tie-in fittings.
- (b) Prior to cutting existing pipelines, the surface of the existing pipe shall be thoroughly cleaned by wire brushing and scraping. When a cut-in is made under pressure, the existing pipe surface shall be washed down with a four (4) percent solution of chlorine prior to installing the tapping valve and sleeve. All fittings, pipes, valves, etc., used in the connection that cannot be disinfected during normal water line

chlorination shall be swabbed out with a four (4) percent or stronger solution of chlorine meeting AWWA B301 standards during assembly. Care shall be exercised in order to prevent contamination of the existing water lines, and failure to comply with this requirement will necessitate chlorination of existing water lines at the Contractor's expense. After cutting, the Contractor shall provide the Town with the coupon for its inspection.

- (c) After connection is made, the Contractor shall drain sufficient water from the connection to effect removal of the chlorine solution.
- (d) The dimensions of existing water lines may not allow use of standard mechanical joint fittings, since these water mains may be pit case pipe, asbestos-cement pipe or classes other than standard. Contractor shall make such investigations as he feels prudent to discover any such non-standard situation and shall, at his expense, make special arrangements to connect to such lines in a manner satisfactory to the Town.
- (e) Tapping valve and sleeve shall be installed with the pressure on. Solid or cutting-in sleeve shall be installed with the pressure off.

Section E.10. Service lines.

- (a) *Generally.* Service lines shall meet AWWA C800 standards. The Contractor shall provide minimum **three quarter (3/4) inch** service to all lots. Larger services may be required for commercial, multiple housing or those single-family homes requiring such.
- (b) *New Services:* When the work includes replacing an existing water main with a new line, all services shall be new. New taps shall be made to the new main and new services extended all the way back to the existing "Coppersetter." If the existing setter is damaged or otherwise unsuitable for connection, the Town shall furnish a replacement to the Contractor from its stock, and the Contractor shall replace the setter, all without additional compensation to Contractor.
 - (1) *Exception:* Services larger than 2" shall be transferred using a tapping sleeve and valve assembly and cutting in to the existing service pipe.
 - (2) Existing 3/4" service piping shall be replaced with new 1" tap, 1" service piping back to the meter, with a 1" x 3/4" compression coupling back to 3/4" 2'± before the meter.
- (c) *Line and grade.* The service lines shall be located on the property line of each lot and shall be at right angles to the street centerline.
- (d) *Minimum depth.* The minimum depth to top of pipe shall be thirty (30) inches.
- (e) *Tapping water line.* The corporation valve shall be installed forty-five (45) degrees above center and provide a horizontal loop with service line at tap.
- (f) *Meter and box.* A meter and box shall be provided for each lot and located on the right-of-way line.

Section E.11. Maximum tap sizes.

The following shall be the maximum tap sizes:

Type of Tap	Pipe Size
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	4"	6"	8"	10"	12"	24"
Direct Tap, All Pipe	½"	¾"	1"	1¼"	2"	2"
w/Service Saddle, All Pipe	1"	1½"	2"	2"	2"	2"

Section E.12. Backfilling.

After the pipelines have been laid and valves, blowoffs and fittings installed, the trenches shall be backfilled by depositing the excavated material, carefully, under and around the pipe and thoroughly tamping up to the elevation of the top of the pipe. The remaining backfill shall be placed in maximum layers twelve (12) inches thick thoroughly tamped with mechanical tampers. The Contractor will be held responsible for settlement over all trenches. The Contractor shall keep all backfill even with the surrounding road surface until the work has been accepted by the Town. Extreme care shall be exercised in placing warning signs, lights and substantial barricades on the work.

PART F. TEST AND CLEANUP

Section F.1. Testing and inspections.

- (a) The Town shall monitor all testing and inspect all lines as construction progresses. All testing shall be completed before connecting to existing water lines. The Contractor or developer shall notify the Town twenty-four (24) hours in advance when he/she will be ready for inspection and testing and shall pretest before notifying the Town.
- (b) After the pipe has been laid and backfilled as specified, all newly laid pipe, or any valve section thereof; shall be subjected to a pressure of not less than one hundred fifty (150) psi. Air or air-water methods of applying pressure are prohibited. The duration of the pressure test shall be at least four (4) hours, for which time the Contractor shall fill the line slowly, expelling air at the high points, and bring it up to required pressure.
- (c) The only lines not required to be pressure tested are short (not longer than 25' unless approved by the Engineer) connection sections used to tie new mains into existing lines.
- (d) The Town shall inspect the entire line and appurtenances for leaks and movement. Any leaks or defects shall be repaired and the test repeated until acceptable.
- (e) A leakage test shall be conducted after a pressure test has been satisfactorily completed. The average pressure range shall be one hundred fifty (150) psi and be held for four (4) hours, provided that the Engineer may, at his discretion, allow this time to be reduced to (2) hours. The lines shall be filled as for the pressure test or the Contractor shall continue to maintain the pressure from the test. A source of makeup water shall be provided that can be measured. The test will be made to determine the leakage, or the amount of water required to maintain test pressure.
- (f) The allowable leakage, as determined by measuring the amount of makeup water added, is less than the value computed by the formula:

$$Q = \frac{L D P^{1/2}}{\quad}$$

148,000

Where,

Q = Leakage in gallons per hour

L = Length of pipe in feet

D = Nominal pipe diameter in inches

P = Average test pressure, psi (gauge)

Should any test of pipe disclose leakage greater than that specified above, the Contractor shall locate and repair defective joints until the leakage is within the specified allowance.

- (g) The Contractor shall maintain pressure on the line and close each valve progressively, starting from the far end of the system, and vent extreme ends of the line. Allowable pressure drop shall be less than ten (10) psi in five (5) minutes with test pump off.

Section F.2. Adjustment and cleaning.

- (a) *Flushing.* The water shall be flushed by providing taps in sufficient size or number to provide a velocity of two and one-half (2 ½) feet per second in the line flushed. Hydrants may be used provided the requirements listed below are met
- (1) The Contractor shall submit to the Town a procedure schedule outlining the method he proposes to use for flushing water lines. Lines shall be flushed at a maximum of one fourth (¼) mile intervals.
 - (2) Flushing may be done prior to pressure testing or following pressure testing but, in any case, prior to chlorination of the water line.
- (b) *Disinfection.* All newly-laid lines shall be disinfected. The Contractor shall furnish all necessary equipment and materials and furnish all necessary assistance for effective disinfection of the water lines. Disinfection of waterlines shall comply with Section 4.4.3 (the Continuous Feed Method) of AWWA C651 and 15A NCAC 18C.1003 (Disinfection of Storage Tanks and Distribution Systems)..
- (1) After the water line has been pressure tested and flushed, the Contractor shall pump a chlorine solution into the water line in such a manner and at such strength that the residual free chlorine shall be not less than fifty (50) ppm (parts per million) at the end of each line tested.
 - (a) Using high test calcium hypochlorite, or approved equal, the Contractor shall prepare a ten thousand (10,000) ppm solution in water and pump at a constant rate into the water line while bleeding off the water at the extreme end. The bleed rate will determine the feed rate of the chlorine in order to arrive at fifty (50) ppm solution in the water line.
 - (b) Liquid chlorine may be applied to the water line much the same way as the hypochlorite solution. The liquid must be mixed with water before pumping into the water line. The rate of application will have to be adjusted for the degree of concentration of the liquid chlorine.
 - (c) Chlorine gas shall not be used to chlorinate the water line.

- (2) The chlorinating agent shall be applied at the supply end of the line through a corporation valve. The water for injecting the chlorine into the new line shall be taken from an isolated container and injected by utilizing a pressure pump. Care shall be exercised to prevent any of the chlorine solution from entering an existing water line.
 - (3) The chlorinated water shall be retained in the new water line for a period of twenty-four (24) hours with a chlorine residual of 10 ppm. While the chlorine solution is in the line, the Contractor shall operate valves in the chlorinated section to ensure the complete disinfection thereof.
 - (4) Chlorinated water shall be flushed from the line at the end of the retention time so that the entire line is clear of any residual chlorine. Chlorinated water shall be wasted in accordance with C651 of the AWWA standards. A sample will be taken from the line twenty (24) hours AFTER the line is flushed. Samples shall be analyzed by a State Certified lab. The number of bacteriological samples and locations will be determined by the Kill Devil Hills Department of Public Services but no less than one every one thousand two hundred (1,200) feet. Authorized Town employees shall monitor all sampling. If the water does not pass the bacteriological test, the test procedure outlined above shall be repeated until the quality of the water is substantially the same as that being delivered from the existing distribution system.
- (c) *Pressure test and chlorinating report forms.* All information relative to pressure tests and chlorinating procedures shall be witnessed and verified in writing by the project engineer and the results shall be reported on standard forms available at the office of the Public Services Director. These reports shall be submitted immediately upon completion of such tests and disinfection.

Section F.3. Bacteriological test.

- (a) Once all required tests have passed, the Contractor shall furnish one (1) approved set of the bacteriological test results to the Public Services Department. The Town reserves the right to perform a follow-up bacteriological test of its own if the time between the original sampling and the date of placing the line in service exceeds 10 days. The time required for this additional sampling and testing shall not be a basis for a claim for extension of the Contract Time.

Section F.4. Abandonment of Existing Pipe in Place:

- (a) In the event that an existing pipe is abandoned as the result of the installation of new pipe, the ends of the abandoned pipe shall be capped or plugged.
- (b) All valve boxes shall be removed from the abandoned line and the valves buried with the nuts removed. No remnant of the abandoned pipe shall remain at or above grade.
- (c) All hydrants shall be removed from the abandoned line and disposed of legally, or if so directed, delivered to KDH Water Division yard. Plug hydrant branch.

PART G. **CROSS-CONNECTION PREVENTION PROGRAM**

Section G.1. **Intent, Purpose and Control.**

- (a) This Cross-Connection Prevention Program (this Program) is published as part of the Waterline Specifications of the Town of Kill Devil Hills, NC (the Town), pursuant to § 51.20, STANDARDS FOR CONSTRUCTION of the Town Code, which states as follows:
 - All design and construction associated with the water system shall be in conformance with Title 15 A, Subchapter 18C of the North Carolina Administrative Code, “Rules Governing Public Water Systems” and the latest version of the town's standard specifications and details for water construction.
- (b) It is the intent of this Program to eliminate the potential hazards to the potable water system from uncontrolled cross connections. It is also the intent to apply the principle that the degree of protection should be commensurate with the degree of hazard.
- (c) The purpose of this cross-connection control Program is to define the role of the Town as the water purveyor in the elimination or control of all cross-connections within its public water supply.
- (d) This Program shall apply to all consumers connected to the Town’s public potable water supply.
- (e) This Program will comply with the Federal Safe Drinking Water Act (P.L. 93-523) the North Carolina State Administrative Code (Title 15A, Subchapter 18C), and the North Carolina State Building Code as they pertain to cross- connections with the public water supply.

Section G.2. **Definitions.**

- (a) ***Air gap.*** A physical separation between the free-flowing discharge end of a potable water supply pipeline and an open or non-pressure receiving vessel. An approved air gap distance shall be at least double the diameter of the supply pipe measured vertically above the overflow rim of the vessel but not less than 1 inch.
- (b) ***Atmospheric Type Vacuum Breaker.*** A device containing a float-check, a check seat and an air inlet port used to prevent backsiphonage, which is designed as not to be subject to static line pressure.
- (c) **Auxiliary Water Supply.** Any water supply on or available to the premises other than the purveyor’s approved water supply.

- (d) Backflow. Any reverse flow of water or mixtures of water, gas or any other liquid substances into the public water system from any source or sources.
- (e) Backflow Prevention Assembly. An assembly used to prevent backflow into a consumer's or public potable water system. The "backflow prevention assembly" shall mean an assembly used for containment and/or isolation purposes that has been inspected and approved by the Town and has been shown to meet the design and performance standards of the American Society of Sanitary Engineers (ASSE), American Water Works Association (AWWA), or the Foundation for Cross Connection Control and Hydraulic Research of the University of Southern California.
- (f) Backflow Prevention Assembly Type. A "backflow prevention assembly" shall mean an assembly used to prevent backflow into a consumer's or public water system. The type of assembly used should be based on the degree of hazard either existing or potential. The types are:
 - (1) Double Check Valve Assembly (DCVA)
 - (2) Double Check Detector Assembly (DCDA)
 - (3) Pressure Vacuum Breaker (PVB)
 - (4) Reduced Pressure Zone Assembly (RPZA)
 - (5) Reduced Pressure Detector Assembly (RPDA)
- (g) Backpressure. Any elevation of pressure in the downstream piping system caused by pumps, elevation of piping, or steam and/or air pressure above the supply pressure at the point of consideration, which would cause a reversal of the normal direction of flow.
- (h) Backsiphonage. A reversal of the normal direction of flow in the pipeline due to a negative pressure (vacuum) being created in the supply line with the backflow source subject to atmospheric pressure.
- (i) Certified Backflow Prevention Assembly Tester. A person who holds a current certification as a Backflow Prevention Assembly Tester from the North Carolina Chapter of American Water Works Association, the North Carolina Rural Water Association, a comparable organization in Virginia, or is currently certified as a Backflow Prevention Assembly Tester by another municipal water distribution system in North Carolina or Virginia. Testers shall present their credentials to the Town prior to performing work. The Town will maintain a list of Certified Backflow Prevention Assembly Testers who have presented their credentials and meet the above criteria.
- (j) Consumer. Any person, firm or corporation using or receiving water from the Town's public water system.
- (k) Consumer's Water System. Any water system commencing at the point of delivery and continuing throughout the consumer's plumbing system located on the consumer's premises, whether supplied by public potable water or an auxiliary water supply.
- (l) Consumer's Potable Water System. That portion of the privately owned potable water system lying between the point of delivery and the point of use and/or isolation protection. This system will include all pipes, conduits, tanks, receptacles, fixtures, equipment and appurtenances used to produce, convey, store or use potable water.

- (m) Containment. Preventing the impairment of the public potable water supply by installing an approved backflow prevention assembly at the service connection.
- (n) Contamination. An impairment of the quality of water which creates a potential or actual hazard to the public health through the introduction of hazardous or toxic substances or waterborne health hazards in the form of physical or chemical contaminants or biological organisms and pathogens.
- (o) Cross-Connection. Any actual or potential connection or piping arrangement between a public or a consumer's potable water system and any other source or system through which it is possible to introduce into any part of the potable system any used water, industrial fluids, gas or substance which could be harmful or hazardous to the potable water system.
- (p) Double Check Valve Assembly (DCVA). An assembly composed of two independently acting, approved check valves, including tightly closing shut off valves located at each end of the assembly and fitted with properly located test cocks. This assembly shall only be used to protect against a non-health hazard.
- (q) Double Check Detector Assembly (DCDA). A specially designed assembly composed of a line size approved double-check valve assembly with a specific bypass water meter and a meter size approved double-check valve assembly. The meter shall accurately register in U.S. gallons and show a registration for all rates of flow. This assembly shall only be used to protect against a non-health hazard.
- (r) Degree of Hazard. The evaluation of a hazard within a water system, which can be, classified as either a pollutant (non-health) or contaminant (health) hazard as determined by the Town.
- (s) Health Hazard. An actual or potential threat of contamination of a physical, chemical, biological, pathogenic or toxic nature to the public or consumer's potable water system to such a degree that there would be a danger to health as determined by the Town.
- (t) Non-health Hazard. An actual or potential threat to the quality of the public or the consumer's potable water system. A non-health hazard is one that, if introduced into the public water supply system, could be a nuisance to water consumers but would not adversely affect human health as determined by the Town.
- (u) Health Agency. Shall mean the North Carolina Department of Environment and Natural Resources (NCDENR), Division of Water Resources.
- (v) Industrial Fluids. Any fluid or solution, which may be chemically, biologically or otherwise contaminated or polluted in a form or concentration such as would constitute a health or non-health hazard if introduced into the public or consumer's potable water system.
- (w) Industrial Piping System. A system used by the consumer for transmission, conveyance or storage of any fluid, solid or gaseous substance other than an approved water supply.
- (x) Isolation. Confining a localized hazard within a consumer's water system by installing approved backflow prevention assemblies.
- (y) Point of Delivery. The termination of the meter assembly downstream of the meter on the consumer's side and is generally the end of the meter assembly where the

consumer's service line connects. The consumer shall be responsible for all water piping and control assemblies located on the consumer's side of the point of delivery.

- (z) Pollutant. An impairment of the quality of the water to a degree which does not create an actual hazard to the public health but which does adversely and unreasonably affect the aesthetic qualities of such waters for domestic use.
- (aa) Potable Water. Water from any source, which has been approved for human consumption by the North Carolina Department of Environment and Natural Resources (NCDENR).
- (bb) Pressure Vacuum Breaker (PVB). An assembly containing an independently operating internal loaded check valve and an independently operating loaded air inlet valve located on the discharge side of the check valve. The assembly is to be equipped with properly located test cocks and tightly closing shut off valves attached at each end of the assembly. This assembly is designed to protect against a health hazard (contaminant) under a backsiphonage condition only.
- (cc) Private Water System. Any water system located on the consumer's premise whether supplied by public potable water or an auxiliary supply such as a well.
- (dd) Public Potable Water System. Any publicly or privately-owned water system operated as a public utility, under a current North Carolina Department of Environment and Natural Resources NCDENR permit, to supply water for public consumption or use. This system will include all sources, facilities, and appurtenances between the source and the point of delivery such as valves, pumps, pipes, tanks, equipment, and appurtenances used to convey, treat, or store potable water for public consumption or use.
- (ee) Reduced Pressure Zone Assembly (RPZA). An approved, properly functioning assembly containing two independently acting check valves with a hydraulically operating, mechanically independent pressure differential relief valve located between the check valves and at the same time below the first check valve. The assembly must include properly located test cocks and tightly closing shutoff valves at each end of the assembly. This assembly is designed to protect against a health hazard.
- (ff) Reduced Pressure Detector Assembly (RPDA). A specially designed assembly composed of a line size approved reduced pressure principle backflow prevention assembly with a specific bypass water meter and a meter sized approved reduced pressure principle backflow prevention assembly. The meter shall register in U.S. gallons accurately for only very low rates of flow and shall show a registration for all rates of flow. This assembly shall be used to protect against health hazard.
- (gg) Registered Professional Engineer. An individual currently licensed by the North Carolina Board of Examiners for Engineers and Surveyors to practice engineering in the State of North Carolina.
- (hh) Service Connection. The terminal end of the piping connection from the public potable water system, i.e., where the water purveyor's jurisdiction and sanitary control over the potable water stops at its point of delivery to the consumer's water system.

- (ii) Unapproved Water Supply. A water supply or any natural supply such as a well, spring, river, stream, etc. which has not been approved for human consumption by the NCDENR.
- (jj) Used Water. Any water supplied by a water purveyor from a public water system to a consumer's water system after it has passed through the point of delivery and is no longer under control of the water purveyor.
- (kk) Water Purveyor. The operator of a public potable water system providing an approved water supply to the public.

Section G.3. Objective of the Program.

The specific objectives of the Program are as follows:

- (a) To protect the public water supply of the Town against the actual or potential contamination or pollution by isolating within the consumer's private water system, contaminants or pollutants that could under adverse conditions, backflow through uncontrolled cross-connections into the public water systems.
- (b) To eliminate or control existing cross-connections, actual or potential, between the consumer's potable water system(s) and non-potable water system(s), plumbing fixtures and industrial piping system(s).
- (c) To provide a continuing inspection program of backflow and cross-connection control which will systematically and effectively control all actual or potential cross-connections that may be installed in the future.

Section G.4. Responsibility

- (a) Responsibility of Health Agency – NCDENR (Division of Water Resources) has the responsibility for promulgating and enforcing laws, rules, regulations and policies applicable to all water purveyors in the state of North Carolina in carrying out an effective cross-connection control program. The N.C. Division of Water Resources also has the primary responsibility of ensuring that the water purveyor operates the public potable water system free of actual or potential sanitary hazards including unprotected cross-connections. NCDENR also has the responsibility of ensuring that the water purveyor provides an approved water supply at the connection to the consumer's water system and further that the purveyor requires the installation of a backflow prevention assembly for all facilities where cross-connections exist or may exist on the basis of the degree of hazard.
- (b) Responsibility of the Town - Except as otherwise provided herein, the Town is the water purveyor and is responsible for ensuring a safe water supply, beginning at the source and including all of the public water distribution system, including the service connection and ends at the point of delivery to the consumers' water systems. In addition, the Town shall exercise reasonable vigilance to ensure that the consumer(s) has taken the proper steps to protect the public potable water system. The Town will determine the degree of hazard or potential hazard to the public potable water supply system, the degree of protection required and will provide for proper containment protection through an on-going inspection program. The Town will identify all facilities where approved backflow prevention assemblies are required to be installed. When it is determined that a backflow prevention assembly is required for the

protection for the public system, the Town shall require the consumer, at the consumer's expense, to install an approved backflow prevention assembly at each service connection, to test within ten (10) days of installation and annually thereafter, to properly repair and maintain assembly or assemblies and to keep adequate records of each test and subsequent maintenance and repair, including materials and/or replacement parts and submit annual certifications of these tests to the Town.

- (c) Responsibility of Building Inspector - The Building Inspection Department of the Town has the responsibility not only to review building plans and inspect plumbing as it is installed, but they also have the explicit responsibility of preventing cross-connections from being designed and built into the plumbing system within its jurisdiction. Where the review of building plans suggests or detects the potential for cross-connections being made an integral part of the plumbing system, the building inspector has the responsibility, under North Carolina State Building Code, for requiring that such cross-connections be either eliminated or provided with backflow prevention equipment approved by the North Carolina State Building Code.
- (d) Responsibility of the Consumer - The consumer has the primary responsibility for preventing pollutants and contaminants from entering his/her potable water system(s) or the public potable water system. The consumer's responsibility starts at the point of delivery from the public potable water system and includes all of his/her water system(s). The approved backflow prevention assemblies shall be installed, operated, tested and maintained at his/her expense as directed by the Town. The consumer shall maintain accurate records of tests and repairs made to backflow prevention assemblies and shall maintain such records for a minimum period of 3 years, and, when requested, provide them to the Town. The records shall be on forms approved by the Town and shall include the list of materials or replacement parts used. Following any repair, overhaul, re-piping or relocation of an assembly, the consumer shall have it tested to ensure that it is in good operational condition and will prevent backflow. A Certified Backflow Prevention Assembly Tester shall test; perform maintenance and repairs of backflow prevention assemblies, consistent with the provisions of the Plumbing Code.
- (e) Responsibility of Certified Backflow Prevention Assembly Tester - When employed by the consumer to test, repair, overhaul or maintain backflow prevention assemblies, a certified backflow prevention assembly tester (Tester) shall have the following responsibilities:
 - (1) The Tester shall be responsible for making competent inspections and for repairing or overhauling backflow prevention assemblies and making reports of such repairs to the consumer and responsible authorities on a form approved by the Town. The Tester shall include a list of materials or replacement parts used. The Tester shall be equipped with and be competent to use all necessary tools, pressure gauges, site tubes, differential gauges, compensating tees, manometer and other equipment necessary to properly test, repair and maintain backflow prevention assemblies. It will be the responsibility of the Tester to ensure that original manufactured parts are used in the repair of, or replacement of parts in a backflow prevention assembly. It will be the Tester's further responsibility not to change the design, material or operational characteristics of an assembly during a repair or maintenance without prior approval of the Town. A Tester shall perform

the work and be responsible for the competency and accuracy of all tests and reports. The Tester shall provide a copy of tests and reports to the consumer and to the Town within 10 business days of any completed repair work. A Tester shall maintain such records for a minimum of 3 years.

- (2) All certified backflow prevention testers must obtain and employ backflow prevention assembly test equipment that has been evaluated and/or approved by the Town. All test equipment shall be checked for accuracy at a minimum annually, calibrated if necessary, and certified to the Town as to such calibration, employing an accuracy/calibration method acceptable to the Town.
- (3) Nothing herein shall be construed to authorize a Certified Backflow Prevention Assembly Tester to assume any roles that would conflict with the Plumbing Code.

Section G.5. Right of Entry

- (a) Authorized representatives from the Town shall have the right to enter any building, structure or premises during normal business hours to perform any duty imposed by this Program. Those duties shall include, but are not limited to, sampling and testing water and/or inspections and observations of all piping systems connected to the public water supply. Refusal to allow entry for these purposes may result in discontinuance of water service.
- (b) Where a user has security measures in force, the user shall make necessary arrangements with the security guards so that town personnel will be permitted to enter, without delay, for the purpose of performing their specific responsibilities. Refusal to allow entry for these purposes may result in discontinuance of water service.
- (c) Upon request, the consumer shall furnish to the Town any pertinent information regarding the water supply system on such property where cross-connections and backflow are deemed possible.

Section G.6. Elimination of Cross-Connections; Degree of Hazard

- (a) When cross-connections are found to exist, the owner will be notified in writing to disconnect the same within the time limit established by the Town. The degree of protection required and the maximum time allowed for compliance will be based upon the potential degree of hazard to the public water supply system. The maximum time limits are as follows:
 - (1) Unprotected cross-connections with private wells or other auxiliary water supplies require immediate disconnection.
 - (2) All facilities, which pose a potential health hazard to the potable water system shall be considered health hazard facilities. All health hazard facilities shall install an approved backflow prevention assembly within 60 days of notification.
 - (3) All facilities not identified as a “health hazard” shall be considered non-health hazard facilities. All non-health hazard facilities shall install an approved backflow prevention assembly within 90 days of notification.

- (4) If, in the judgment of the Town, an imminent health hazard exists, water service to the building or premises where a cross-connection exists may be terminated unless an air gap is immediately provided, or the cross-connection is immediately eliminated.
- (5) Water mains, served by the Town but not maintained by the Town, will be considered cross-connections, with a degree of hazard to be determined by the Town. Degree of protection shall be based upon the degree of hazard, as determined by the Town.
- (6) In the event that town personnel do not have sufficient access to every portion of a private water system (i.e. classified research and development facilities; federal government property) to allow a complete evaluation of the degree of hazard associated with such private water systems, an approved RPZA shall be required as minimum protection.
- (7) No person shall fill special use tanks or tankers containing pesticides, fertilizers, toxic chemicals or their residues from the public water system except at a location equipped with an air gap or an approved RPZA properly installed on the public water supply and with prior approval from the Town.
- (8) No person shall install any water operated equipment or mechanism or use any water treating chemicals or substance if it found that such equipment, mechanism, chemical or substance may cause pollution or contamination of the domestic water supply. Such equipment or mechanism may be permitted only when equipped with an approved backflow prevention device or assembly.
- (9) There are no grandfather clauses that exist for backflow assembly installation. Any existing backflow preventer shall be allowed by the Town of Kill Devil Kills to continue in service unless the degree of hazard is such that it supersedes the effectiveness of the present backflow preventer, or results in an unreasonable risk to the public health. Where the degree of hazard has increased, as in the case of a residential installation converting to a business establishment, any existing backflow preventer must be upgraded to a RPZA, or a RPDA must be installed in the event that no backflow device was present.

Section G.7. Installation of Assemblies

- (a) All backflow prevention assemblies shall have approvals from the University of Southern California Foundation for Cross-Connection Control and Hydraulic Research (USC FCCCHR) and the American Society of Sanitary Engineering (ASSE), conform to AWWA C510 (double check valve assemblies) or AWWA C511 (reduced pressure assemblies), and adhere to ANSI and ASTM standards. All assemblies installed on fire lines shall have approval by Factory Mutual system (FM).
- (b) All backflow prevention assemblies shall be installed in accordance with the specifications furnished by the Town, manufacturer’s installation instructions or in the latest edition of the North Carolina Building Code, whichever is most restrictive.
- (c) All new construction plans and specifications, when required by the North Carolina Building Code and NCDENR, shall be made available to the Town for review and approval and to determine the degree of hazard.
- (d) Ownership, testing and maintenance of the assembly shall be the responsibility of the consumer.
- (e) All backflow prevention assemblies must be located in a place where they are readily accessible for regular testing, maintenance and inspection. Backflow prevention assemblies installed above ground must be in freeze proof enclosures.
- (f) All backflow prevention assemblies with gravity drains that do not drain to daylight or atmosphere shall be classified as potential cross-connections and be raised above ground and placed in freeze proof enclosures.
- (g) Assembly owners are responsible for the environment that assemblies are installed in. Assembly owners are responsible for supplying supplemental heat when assemblies are endangered of freezing.
- (h) The installation of any backflow prevention assembly, which is not approved by the Town, must be replaced by one that is approved by the Town.
- (i) When it is not possible to interrupt water service, provisions shall be made for a “parallel installation” of backflow prevention assemblies. Both backflow prevention assemblies must be equal in protection for the degree of hazard. The Town will not accept an unprotected bypass around a backflow prevention assembly when the device is in need of testing, repair or replacement.
- (j) Backflow prevention assemblies may be installed in a vertical position with prior approval from the Town provided the flow of water is in an upward direction and the backflow prevention assembly was designed for a vertical installation.
- (k) Following installation, all backflow prevention assemblies are required to be tested by a certified backflow prevention assembly tester within ten days. The consumer is required to furnish the following information to the Town after installation:
 - (1) Service address where assembly is located
 - (2) Owner (and address, if different from service address)
 - (3) Description of assembly’s location
 - (4) Date of installation
 - (5) Installer (include name, company represented, license number)
 - (6) Type of assembly and size of assembly
 - (7) Manufacturer, model number, serial number

(8) Test results/report

- (l) All installations of backflow prevention assemblies shall include the installation of strainers located immediately upstream of the backflow device. The installation of strainers will preclude the fouling of backflow devices due to both foreseen and unforeseen circumstances occurring to the water supply system such as water main repairs, water main breaks, fires, periodic cleaning and flushing of mains, etc.
- (m) No consumer side water connections shall be permitted between the meter assembly and the backflow prevention assembly.
- (n) When a backflow prevention assembly is being installed retroactively in an existing facility, a thorough hydraulic analysis, including revised hydraulic calculations, new fire flow data, and all necessary system modifications to accommodate the additional friction loss, should be performed by a Registered Professional Engineer and be approved by the consumer's insurance underwriters prior to the installation of the backflow assembly.
- (o) For existing facilities, the requirement for an RPZA or DCVA assembly on the water service pipe may be waived if the consumer can demonstrate to the satisfaction of the Town that (a) it would impede the function of existing fire sprinkler equipment and (b) sufficient internal isolation backflow preventers have been installed and tested. To qualify for this exception, the consumer shall provide a report prepared by a Registered Professional Engineer providing hydraulic calculations demonstrating impairment of the function of the existing fire sprinkler equipment and identifying the locations of backflow preventers within the premises that provide complete internal protection against cross connections. The consumer will be required to submit reports of annual testing results for the internal isolation backflow assemblies.

Section G.8. Testing and Repairs of Assemblies

- (a) Testing of backflow prevention assemblies shall be made by a certified backflow prevention assembly tester at the expense of the consumer. Such tests are to be conducted upon installation and on an annual basis. A record of all testing and repairs is to be retained by the consumer. Copies of the records must be provided to the Town within ten (10) days after the completion of any testing and/ or repair work.
- (b) Any time that repairs to backflow prevention assemblies are deemed necessary, whether through annual or required testing, or routine inspection by the consumer or the Town, these repairs must be completed within a specified time in accordance with the degree of hazard. In no case shall this time period exceed:
 - (1) Health Hazard Facilities – 7 days
 - (2) Non-Health Hazard Facilities- 21 days
- (c) All backflow prevention assemblies with test cocks are required to be tested annually or at a frequency established by the Town.
- (d) It shall be unlawful for any consumer or certified backflow prevention assembly tester to submit any record to the Town that is knowingly false or incomplete in any material respect. It shall be unlawful for any consumer or certified backflow prevention assembly tester to knowingly fail to submit to the Town any record that is required by this Program. Such violations shall result in any of the enforcement actions outlined in Section G.14, Enforcement, below.

Section G.9. Examples of Facilities Requiring Protection

The following types of facilities or services have been identified by the Town as having a potential for backflow of non-potable water into the public water supply system. Therefore, an approved backflow prevention assembly for containment will be required on all such services according to the degree of hazard present.

This is not intended to be an exhaustive list. Other types of facilities or services not listed below may also be required to install approved backflow prevention assemblies if determined necessary by the Town. As a minimum requirement, most commercial services will be required to install a Double Check Valve Assembly unless otherwise listed below.

Abbreviations:

DCVA = Double Check Valve Assembly
RPZA = Reduced Pressure Zone Assembly
DCDA = Double Check Detector Assembly
RPDA = Reduced Pressure Detector Assembly
AG = Air Gap

- (a) Automotive Service Stations, Dealerships, etc.
 - (1) Non-Health Hazard: DCVA
 - (2) Health Hazard: RPZA
- (b) Auxiliary Water Systems
 - (1) Approved Public/Private Water Supply: DCVA
 - (2) Unapproved Public/Private Water Supply: RPZA
 - (3) Feed to Non-Potable Water Source: AG
 - (4) Used Water and Industrial Fluids: RPZA
- (c) Bakeries
 - (1) Non-Health Hazard: DCVA
 - (2) Health Hazard: RPZA
- (d) Beauty Shops/Barber Shops
 - (1) Non-Health Hazard: DCVA
 - (2) Health Hazard: RPZA
- (e) Beverage Bottling Plants: RPZA
- (f) Breweries: RPZA
- (g) Buildings-Hotels, apartment houses, public and private buildings or other structures having unprotected cross-connections:
 - (1) (Under five stories) Non-Health Hazard: DCVA
 - (2) (Under five stories) Health Hazard: RPZA
 - (3) (Over five stories) All: RPZA
- (h) Canneries, packinghouses and rendering plants: RPZA
- (i) Chemically contaminated water system: RPZA
- (j) Commercial carwash facilities: RPZA
- (k) Commercial greenhouses: RPZA

- (l) Commercial sales establishments (department stores, malls etc.)
 - (1) Non-Health Hazard: DCVA
 - (2) Health Hazard: RPZA
- (m) Concrete/asphalt plants: RPZA
- (n) Dairies and cold storage plants: RPZA
- (o) Dye works: RPZA
- (p) Film Laboratories: RPZA
- (q) Fire Systems: All Fire System Connections shall be protected with a RPDA, except simple fire sprinkler systems with no booster pump or chemical injection and less than five stories building height may be DCDA or DCVA
- (r) Hospitals, medical buildings, sanitariums, morgues, mortuaries, autopsy facilities, nursing and convalescent homes, medical clinics and veterinary hospitals: RPZA
- (s) Laundries:
 - (1) Non-Health Hazard: DCVA
 - (2) Health Hazard: (i.e. dry cleaners): RPZA
- (t) Lawn Irrigation Systems: RPZA, except DCVA for simple systems with neither chemical injection nor booster pumps
- (u) Metal manufacturing, cleaning, processing and fabricating plants: RPZA
- (v) Oil and Gas production, storage or transmission plants: RPZA
- (w) Pest Control exterminating and fumigating: RPZA
- (x) Printing Facility: RPZA
- (y) Power Plants: RPZA
- (z) Restaurants:
 - (1) Non-Health Hazard: DCVA
 - (2) Health Hazard: RPZA
- (aa) Restricted, Classified or other closed facilities: RPZA
- (bb) Sand and Gravel Plants: RPZA
- (cc) Schools and Colleges: RPZA
- (dd) Sewage and Storm Drain Facilities: RPZA
- (ee) Swimming Pools: RPZA
- (ff) Temporary Service:
 - (1) Non-Health Hazard: DCVA
 - (2) Health Hazard: RPZA
- (gg) Used Water: RPZA
- (hh) Waterfront Facilities: RPZA

Facilities not specifically mentioned above, shall comply with the guidelines established in AWWA Manual M-14, current edition.

Section G.10. Fire Protection Systems

All connections for fire protection systems connected to the public water system shall be protected with an approved RPDA as a minimum requirement. All fire systems using toxic additives or booster pumps shall be protected by a RPDA at the main service connection.

Section G.11. Unapproved Sources of Supply

- (a) No person shall connect or cause to be connected any supply of water, not approved by the NCDENR, to the water system supplied by the Town.
- (b) In the event the consumer has reason to believe that a backflow incident has occurred, between the consumer's private water system and the public water system, the consumer must notify the Town immediately so that appropriate measures may be taken to isolate and remove the contamination.

Section G.12. Other Connections

All other connections to the public water supply shall have backflow prevention assemblies as specified by the Town. This shall include water mains installed but not maintained by the Town, including but not limited to mobile home parks, apartments, group housing projects and other private distribution systems or similar hazard potential as determined by the Town.

Section G.13. Limitation of Liability

- (a) **Consumers should be aware that installation of a backflow prevention assembly in a plumbing system may limit the volume for thermal expansion unless an expansion tank is provided. The Town shall not be liable for any loss or damage caused by thermal expansion in a plumbing system due to the installation of a backflow preventer on existing water systems.**

Section G.14. Enforcement

- (a) Any violation or failure to conform with the provisions of this Program shall constitute a violation of Chapter 51 of the *Town Code*, subject to the penalties set forth in §51.55 thereof.
- (b) Failure for a consumer or certified tester to submit any record required by this Program or the submission of falsified reports/records shall constitute a violation as set forth above.
- (c) The owner of any installation found not to be in compliance with the provisions of this Program shall be notified in writing of the non-compliance and be given specific corrective action(s) necessary to bring the installation into compliance.
- (d) Such notice must explain the violation and give the time period within which the violation must be corrected. The time period set to correct a violation shall not exceed thirty- (30) days after receiving notice unless otherwise specified by the Town. If the violation has been determined to be an imminent hazard, the consumer shall be required to correct the violation immediately.
- (e) In the event a consumer is found in violation of this Program and fails to correct the violation in a timely manner or pay any civil penalty or expense assessed under §51.55 of the *Town Code*, water service may be terminated, and shall be reestablished when the violation is corrected and any civil penalties are paid.
- (f) If, in the judgment of the Town, any consumer or person in charge of any installation is found to be in non-compliance with the provisions of this Program and/or neglects their responsibility to correct a violation, water service may be discontinued until compliance is achieved.
- (g) If a certified backflow prevention assembly tester submits falsified reports/records, the Town shall permanently revoke that tester.

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