



# Standard Specifications

For

The City of Oxford

2001

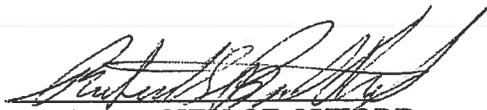
**RESOLUTION  
FOR ADOPTION OF THE STANDARD SPECIFICATIONS &  
CONSTRUCTION DETAILS**

WHEREAS, the Board of Commissioners of the City of Oxford believe that it is in the best interests of the citizens of the City of Oxford to promote and encourage residential, commercial and industrial development in and around the City; and

WHEREAS, the City does not currently have a minimum standard for all subdivision and utility construction projects within the jurisdiction of the City of Oxford.

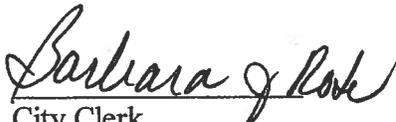
NOW, THEREFORE, BE IT RESOLVED that these Standard Specifications & Construction Details for the City of be adopted and all prior policies are hereby rescinded effective as of the date of the adoption of this Policy. Any residential, commercial or industrial development being developed pursuant to prior policies of the City is not affected by this Policy.

Adopted by the Mayor and Board of Commissioners on October 9<sup>th</sup>, 2001.

  
MAYOR, CITY OF OXFORD

ATTEST:

*Robert S. Bradsher, Jr.*

  
City Clerk

(Seal)



# City of Oxford

## Standard Specifications

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**STANDARD SPECIFICATIONS**

**SECTION 1 – PRELIMINARY CONSIDERATIONS & INSTRUCTIONS**

**1.01 General**

The Standard Specifications as contained herein are to be utilized as a minimum standard for all subdivision and utility construction projects within the jurisdiction of the City of Oxford. The City of Oxford is committed to upgrading its existing infrastructure to meet these standards set forth in this document.

The purpose of these Specifications is to present standards for typical conditions encountered. All subdivision roadway construction and utility extension projects require that the design services be performed by, or under the direct supervision of, a Professional Engineer licensed to practice in the State of North Carolina. The existence of these Standard Specifications and Construction Details does in no way relieve the Professional Engineer of the responsibility to correctly adapt these standards to the actual site conditions encountered on any project. The engineer preparing construction drawings for a specific project must review the applicable portions of these specifications and determine that these minimum standards will function correctly for the project. There may be circumstances whereby the engineer may wish to increase pipe strength classification, bedding requirements, reinforcing, etc. In such situations where changes or modifications are proposed, the City of Oxford should be consulted prior to completion of final design and plan submittal. This will serve to help ensure that the plan review time is minimized. Such deviations from the City’s minimum standards receiving such preliminary approval shall be clearly indicated at one location on the construction drawings, labeled “Exceptions to the Standard Specifications of the City of Oxford.”

Each set of plans for subdivision construction and/or utility extension project which is submitted to the City of Oxford for review shall have affixed to the cover sheet or first sheet, the following note and certification:

These improvements shall be constructed in accordance with the following drawings and with the Standard Specifications of the City of Oxford.

I, \_\_\_\_\_, PE, certify that the Standard Specifications of the City of Oxford have been thoroughly checked and found to be applicable to this project. All exceptions to the applicable City Standards have been previously approved by the City of Oxford and said exceptions are shown on Sheet(s) \_\_\_\_\_ of these drawings.

S E A L

By: \_\_\_\_\_, PE

Date: \_\_\_\_\_

## **STANDARD SPECIFICATIONS**

The City of Oxford will periodically update these Specifications. Any purchaser of the Specifications will be eligible to receive the updates as they become available. The City will also periodically consolidate the changes and republish the document in its entirety. To be eligible to receive updates, a new set of the current specifications must be purchased.

Projects shall be constructed according to the Standard Specifications in effect at the time the project received final approval by the City of Oxford for construction.

If construction of the project or phase of the project does not commence within twelve (12) months after the date on which the final project plat was approved, the approval shall be null and void. If a project approval is deemed null and void, all preliminary submittal procedures shall be repeated, and the resubmitted shall reflect any revisions in the Oxford Standard Specifications and Construction Details in effect on the date of the resubmittal.

The project contractor shall have at least one (1) complete set of approved plans and specifications at the jobsite at all times that work is being performed.

### **1.02 Submittal Requirements**

Persons desiring to construct subdivisions or other utility extensions within the jurisdiction of the City of Oxford must submit final construction drawings sealed by a Professional Engineer licensed to practice in the State of North Carolina. The submittal shall be made to the City of Oxford Engineering Department.

The submittal process shall be as described below:

#### **a. Initial Submittal:**

For the initial review, the following items shall be submitted:

- 1) Final Construction Plans – Five (5) sets. The plan size and content shall conform to the requirements outlined in Subsection 1.03 hereof.
- 2) “Application for Approval of Plans & Specifications for Water Supply Systems” – NC Department of Human Resources, Division of Health Services – Form DHS-2136 (if applicable) – Two (2) penciled (draft) copies.
- 3) “Non-Discharge Permit Application” – Multi-carbon form from NC DNR & CD, Division of Environmental Management (if applicable). Two (2) penciled (draft) copies.

## STANDARD SPECIFICATIONS

4) Storm Drainage Computations – Two (2) copies of complete storm drainage calculations, maps and other supporting material shall be submitted, addressing the following special issues as applicable:

- Impact of concentrated run-off from upstream areas released onto the property being developed, and the measures selected to mitigate these impacts, i.e. – either piping of this run-off into the storm water collection system, or the enhancement of existing drainage channels by enlargement, armoring, etc.
- Impact of concentrated run-off from the property being developed onto downstream private property. In such cases, the discharge velocity must be reduced to non-erodible levels.

5) Wastewater Pump Station & Force Main Computations – (if applicable) Two (2) copies.

6) Pavement Design Calculations – Pavement design for all streets shall be based on subgrade soil conditions, a 15-year (minimum) design life and projected traffic loadings (ADT and percent trucks). For residential rural streets, cul-de-sac streets, and minor local streets, the subgrade soil classification used to estimate subgrade strength may be based upon field observation by a qualified soils engineer. For collector streets, thoroughfare streets and streets in commercial and industrial projects, the subgrade soil conditions must be substantiated by laboratory tests performed by a qualified geotechnical firm or soils laboratory. The laboratory tests shall include moisture content, plasticity indexes, Proctor density, and California Bearing Ration (CBR – soaked values). Soil samples for laboratory analysis shall be obtained at intervals of not more than 300 feet.

Pavement designs shall be performed by a qualified professional engineer using standard methods developed by the NC DOT, AASHTO, The Asphalt Institute, or other similar method as may be approved by the ENGINEER.

The final pavement thickness shall be the calculated thickness, but in no case shall be thickness be less than that shown in the standard street section details, or that required by the NC DOT for streets to be maintained by the State.

Two (2) copies of the pavement design calculations with accompanying laboratory test reports shall be submitted with the initial design documents.

7) Additional Design Data – As may be requested.

## STANDARD SPECIFICATIONS

### **b. Second Submittal:**

The City of Oxford staff will review the initial items and will return one (1) set of plans with notations marked in red. One (1) copy of the various applications and calculations will also be returned to the submitter with notations and corrections indicated. The submitter shall then make the corrections, additions, or changes to the construction drawings, pursuant to the initial review comments. The second submittal shall then be made to include the following items:

- 1) Final Construction Plans – Five (5) sets.
- 2) “Application for Approval of Plans & Specifications for Water Supply Systems” – Form DHS-2136 (if applicable) – Four (4) completed, typewritten duplicate originals for signature by the City Manager.
- 3) “Non-Discharge Permit Application” – Multi-carbon form from NC DNR & CD, (if applicable). One (1) completed, typewritten original for signature by the City Manager.
- 4) NC Department of Transportation (NCDOT) – Encroachment Forms, Driveway Permits, etc. – Sufficient copies as required and prepared to conform to the NCDOT requirements.
- 5) Storm Drainage Computations – Two (2) copies of computations, if revised after initial review.
- 6) Wastewater Pump Station & Force Main Computations – Two (2) copies of computations, if revised after initial review.

The City of Oxford will review the revised plans and, if they are satisfactory, the submitter will be requested to bring the originals (tracings) to the City of Oxford Engineering Department for approval signatures. At that time, the executed forms will also be returned to the applicant or the design engineer so that the applications and proper number of plans may be submitted to the various state regulatory agencies.

Erosion and sedimentation control plans should be submitted directly by the owner to the NC State Sediment Control Division for approval and issuance of a grading permit.

## STANDARD SPECIFICATIONS

### **1.03 Plan Requirements**

#### **a. Subdivisions:**

All plan submittals for subdivision construction should include the following elements:

- 1) Plans sealed and signed by a professional engineer registered to practice in North Carolina. Plan size shall generally be 24" x 36"; however, for very small projects, the sheet size may be reduced to 18" x 24'.
- 2) Plan/profile drawings shall be provided for all street improvements, off-street sanitary sewers and storm sewers, water mains 12 inches and larger, sanitary sewer force mains, and for all utility extensions. Profiles will not be required for water mains 8 inches and smaller. All plan/profile drawings shall be prepared at a scale of not less than; 1" = 50' Horizontal and 1" = 5' Vertical.
- 3) Boundary of the tract with all courses and distances indicated. One (1) corner of the tract shall be tied to the NC Plane Coordinate System.
- 4) Vicinity Map, scale of drawings, and NC Grid North directional arrow.
- 5) Master Plan(s) showing all improvements and including: existing contour elevations (2-foot intervals) and USGS datum with benchmarks indicated.
- 6) 100-year flood plain.
- 7) Owner and zoning of all properties adjoining the site.
- 8) Tract area – number of lots, average and minimum lot size, etc.
- 9) Public Streets
  - Street width – back-to-back of curbs
  - Right-of-way width
  - Horizontal curve data for each curve (centerline only)
  - Vertical curve alignment
  - Distances to existing streets and intersections
  - Centerline linear footage; intersection of intersection; intersection to radius point in cul-de-sacs
- 10) Wastewater Facilities

## STANDARD SPECIFICATIONS

- Pipe material, size, length, slope, invert elevations at all manholes, separation from other utilities
- 100-year flood elevations and manhole top elevations – no lift stations may be constructed within the 100-year flood plane.
- Special construction details – piers, boring, encasement, etc.
- Easement widths
- Pump station and force main calculations
- Location of service laterals

### 11) Water Distribution Facilities

- Pipe material, size, location and separation from other utilities
- Valves, fittings, blow offs
- Fire hydrant locations – conforming to minimum spacing
- Service lateral locations
- Special details – boring, etc.
- Easement widths (if applicable)

### 12) Storm Drainage

- Complete storm drainage calculations (Note special requirement to address impact of off-site drainage, per Sub-section 1.02a4)
- Invert elevation and top elevations at each structure – catch basin, curb inlet, etc.
- Invert elevation at each inlet and outlet point – flared end section, headwalls, etc.
- Pipe material, length, slope, etc.
- Exit velocity and details of velocity reduction facilities at each open outlet
- Complete hydraulic calculations
- Special details – easement widths, open channels, etc.

## STANDARD SPECIFICATIONS

### 13) Miscellaneous Data

- Owner/developer: name, address, and telephone number
- Engineer: name, address, and telephone number

### **b. Site Plans:**

All site plans submittals should include the following elements:

- 1) Plans sealed and signed by an engineer registered to practice in North Carolina, where public utilities, streets and pavement designs are involved, or where otherwise required by North Carolina General Statutes. Plan size shall generally 24" x 36", except for very small projects, in which case, the plan size may be reduced to 18" x 24".
- 2) Boundary of the tract with all courses and distances indicated. One corner of the tract shall be tied to the NC Plane Coordinate System. Total gross area of tract shall be indicated.
- 3) Vicinity map, scale of drawing, and NC Grid North directional arrow.
- 4) Existing and proposed contour elevations at minimum interval of 2 feet. Elevations based on USCGC Datum with benchmark indicated.
- 5) 100-year flood plain or alluvial soils line.
- 6) Owner and zoning of all properties adjoining the site.
- 7) Data on Streets
  - Street name
  - Street width, right-of-way dimensions, and pavement design.
  - Existing utilities and storm drainage
  - Driveway entrances onto site and adjoining properties

## STANDARD SPECIFICATIONS

### 8) Building Site Data

- Number of buildings and dwelling units in each (for residential site plans)
- Building “footprint” dimensions and finished ground floor elevation
- Front, side and rear yard setbacks

### 9) Parking Data

- Number of parking spaces provided
- Number of parking spaces required
- Location and dimensions of parking areas – angle of parking, typical width, length, aisle width, etc.

### 10) Storm Drainage

- Pipe material, size, length, slope, etc.
- Drainage areas and run-off for each storm drain pipe
- Invert elevation, and top elevation for each structure – catch basin, curb inlet. Invert elevations for each flared end section, headwall, etc.
- Exit velocity and details of velocity reduction facilities at each outlet
- Complete hydraulic calculations
- Complete Storm Drainage Calculations (Note special requirement to address impact of off-site drainage, per Subsection 1.02a4).
- Special details and easements widths as required.

## **STANDARD SPECIFICATIONS**

### 11) Utilities

- Water line location and size
- Water meter location and size; size of service branch
- Sewer line location and size
- Sewer service lateral – size and location
- Water and sewer easements
- Fire hydrant location
- Valve vault for fire sprinkler line (if applicable)

### **1.04 Approval of Materials**

Prior to beginning construction of water, sewer or storm sewer facilities, the contractor shall submit to the DPW a complete list of all materials to be used on the project, including pipe, valves, fittings, fire hydrants, and all service accessories. The list shall include the manufacturer, model number and such other additional information as may be requested by the DPW to determine compliance with these Specifications.

## STANDARD SPECIFICATIONS

### **1.05 Record Drawings**

Record drawings that reflect “as-built” conditions must be submitted prior to final acceptance of roadways and/or public utilities to be maintained by the City of Oxford. The record drawings must be labeled “**RECORD DRAWINGS**” and signed by the Project engineer of record. The record drawings submitted to the City of Oxford shall consist of two (2) sets of blue line drawings and one (1) set of permanent, reproducible drawing – on polyester film (Mylar) sepia, 2 mil minimum weight. All applicable information listed below shall be included on all “As Built” drawings:

#### **1. SITE DATA**

- a) Boundary of tract with all courses and distances indicated. One (1) corner of the tract shall be tied to the NC Plane Coordinate System
- b) Vicinity map, scale of drawings, and NC Grid North directional arrow
- c) Master Plan(s) showing all improvements and including; existing contour elevations (2 foot intervals) and USGS datum with benchmarks indicated
- d) All easements identified and dimensioned
- e) Tract total acreage
- f) Total number of lots and average size

#### **2. PUBLIC ROADWAY SYSTEM**

- a) Street widths and right-of-way dimensions
- b) Horizontal alignment with radii, P.C.’s, and P.T.’s of all curves
- c) Vertical alignment with center line grades, vertical curve lengths, station and elevation of all PVC’s and PVT’s, and centerline profile
- d) Pavement sections and typical cross sections
- e) Geotextile fabric locations

#### **3. STORM WATER DRAINAGE SYSTEM**

- a) 100 year flood limits and elevations
- b) Structure top and invert elevations
- c) Pipe size and type material
- d) Pipe grades and distances
- e) Permanent storm water impoundments with access easements
- f) Include any applicable maintenance clauses from homeowner covenants
- g) Storm water drainage and retention easements

#### **4) WATER DISTRIBUTION SYSTEM**

- a) Pipe size and type material
- b) Separation from sanitary and storm sewer system
- c) Location of valves, fire hydrants, meters, blow-off assemblies, bore and jack casings with distance locations tied to two permanent reference points

## STANDARD SPECIFICATIONS

### **5. SANITARY SEWER SYSTEM**

- a) Pipe size and type of material
- b) Manhole top and invert (in & out) elevations
- c) Pipe grades and manhole to manhole distances
- d) Clean-out locations with distance references
- e) Horizontal control, deflection angles at all manholes
- f) Easement location and widths
- g) Separation from water distribution and storm sewer systems
- h) Pump station and force main calculations
- i) Force main location, size, and type of material
- j) Pump station and associated appurtenances operation and maintenance manuals per Oxford Specifications, Section 8.

# STANDARD SPECIFICATIONS

## **SECTION 2 – GENERAL PROVISIONS**

### **2.01 General**

All construction shall conform to the requirements and dimensions on the approved construction plans, City Standard Details, the Code of the City of Oxford, or as stated in these Specifications.

### **2.02 Abbreviations & Definitions**

#### **a. Abbreviations:**

AASHTO – American Association of the State Highway Transportation Officials

ASTM – American Society for Testing & Materials

AWWA – American Water Works Association

NC DOT – North Carolina Department of Transportation

ANSI – American National Standard Institute

DPW – Director of Public Works of the City of Oxford

#### **b. Definitions:**

Where the word “Engineer” is used in these Specifications, it shall be the City Engineer of Oxford, the City’s Consulting Engineer as designated by the Director of Public Works, an assistant or other representative duly authorized by the City Engineer or the City’s Consulting Engineer.

Where the words “Director of Public Works” (DPW) or “Inspector” is used in these Specifications, it shall be the Director of Public Works of the City of Oxford, an assistant to the Director or other duly authorized representative of the Oxford Department of Public Works.

Where the word “City” is used in these Specifications, it shall be the City of Oxford, North Carolina.

Where the word “Developer” or “Contractor” is used in these Specifications, it shall be the developer of the project, or his authorized contractor performing work on the site. For purposes of these Specifications, these words are to be considered synonymous.

Where the words “Project Engineer” are used in these Specifications, they shall mean the design engineer retained by the developer, and the person responsible for the preparation of the final construction drawings.

## STANDARD SPECIFICATIONS

### **2.03 Erosion & Sedimentation Control**

#### **a. General Requirements:**

Temporary and permanent erosion control measures shall be provided in accordance with the erosion control plan approved by the Sediment Control Division of the NC State Community Development Services Department. The approved Erosion Control Plan shall be kept on site by the Contractor at all times that work is being performed.

All permanent erosion control measures shall be incorporated into the work at the earliest practicable time, and in no case shall an area remain denuded for more than 30 calendar days. Temporary erosion control measures shall be coordinated with permanent erosion control measures and all other work on the project to ensure economical, effective and continuous erosion control throughout the construction and post construction period and to minimize siltation of streams, lakes, reservoirs, and other water impoundments, ground surfaces, roadways, or other property.

#### **b. Seeding & Mulching:**

Seeding and mulching shall be carried out immediately behind construction in accordance with the following specifications:

#### **Shoulders, Side Ditches, Slopes (Max. 3:1)**

<u>SEEDING PERIOD</u>	<u>TYPE</u>	<u>APPLICATION RATE</u>	
		<u>PER ACRE</u>	<u>PER 1000 FT<sup>2</sup></u>
Aug 15 – Nov 1	Tall Fescue	120#	2.8#
Nov 1 – Mar 1	Tall Fescue <u>and</u> Abruzzi Rye	120# 25#	2.8# 0.6#
Mar 1 – Apr 15	Tall Fescue	120#	2.8#
Apr 15 – July 30	Hulled Common Bermuda grass	12#	0.3#
July 15 – Aug 15	Tall Fescue <u>and</u> * Browntop Millet <u>or</u> Sorghum – Sudan Hybrids	60# 35# 30#	1.4# 0.8# 0.7#

## STANDARD SPECIFICATIONS

### Slopes (3:1 to 2:1)

<u>SEEDING PERIOD</u>	<u>TYPE</u>	<u>APPLICATION RATE</u>	
		<u>PER ACRE</u>	<u>PER 1000 FT<sup>2</sup></u>
Mar 1 – Jun 1	Sericea Lespedeza (scarified) and	50#	1.2#
(Mar 1 – Apr 15)	<u>ADD</u> Tall Fescue	60#	1.4#
(Mar 1 – Jun 30)	<u>OR ADD</u> Weeping Lovegrass	5#	0.1#
(Mar 1 – Jun 30)	<u>OR ADD</u> Hulled Common Bermuda grass	8#	0.2#
Jun 1 – Sep 1	* Tall Fescue <u>and</u> * Browntop Millet	60# 35#	1.4# 0.8#
Sep 1 – Mar 1	* <u>or</u> Sorghum-Sudan Hybrids Sericea Lespedeza (unhulled, unscarified)	30#	0.7#
(Nov 1 – Mar 1)	<u>and</u> Tall Fescue <u>ADD</u> Abruzzi Rye	70# 50# 25#	1.6# 1.2# 0.6#

Consult Conservation Engineer or Soil Conservation Service for additional information concerning other alternatives for vegetation of denuded areas. The above vegetation rates are those which do well under local conditions; other seeding rate combinations are possible.

\*Temporary – Reseed according to optimum season for desired permanent vegetation. Do not allow temporary cover to grow over 12" in height before mowing, otherwise fescue may be shaded out.

### SEEDBED PREPARATION

1. Chisel compacted areas and spread topsoil 3 inches deep over adverse soil conditions, if available.
2. Rip the entire area to 6-inch depth.
3. Remove all loose rock, roots, and other obstructions leaving surface reasonably smooth and uniform.
4. Apply agricultural lime, fertilizer, and super phosphate uniformly and mix with soil (see below\*).
5. Continue tillage until a well-pulverized, firm, reasonably uniform seedbed is prepared 4 to 6 inches deep.
6. Seed on a freshly prepared seedbed and cover seed lightly with seeding equipment or cultipack after seeding.

## STANDARD SPECIFICATIONS

7. Mulch immediately after seeding and anchor mulch.
8. Inspect all seeded areas and make necessary repairs or reseedings within the planting season, if possible. If stand should be over 60% damaged, re-established following original lime, fertilizer and seeding rates.
9. Consult Conservation Inspector or maintenance treatment and fertilization after permanent cover is established.

\*Apply:           Agricultural Limestone – 2 tons/acre (3 tons/acre in clay soils)  
                      Fertilizer – 1,000 lb/acre – 10-10-10  
                      Super phosphate – 500 lb/acre – 20% analysis  
                      Mulch – 2 tons/acre – small grain straw  
                      Anchor – Asphalt Emulsion @ 300 gals/acre

### **c. Construction Entrances:**

Construction vehicles shall be afforded entrances and exits separate from the developed portions of the subdivision to preserve the integrity of paving in such areas; entrances and exits to such developed areas shall exhibit a sign or signs bearing the legend “**NO CONSTRUCTION VEHICLES**” and directing such traffic to the appropriate entrance.

Gravel construction entrance pads shall be constructed at each point of construction access to the site, including residential lots. The gravel pads shall be maintained in such a manner as to prevent the deposition of mud and debris onto existing public roadways adjacent to the site.

Gravel pads for construction sites other than single-family lots shall be 50' long. The width shall be equal to that of proposed street or 25' as a minimum. Washed stone, No. 57 or equivalent shall be placed to a nominal depth of 12 inches for the first 15' and 6 inches for the remaining 35'.

Gravel pads for individual single-family lots shall be 35' long and 12' minimum width. Washed stone shall be 6 inches thick.

## STANDARD SPECIFICATIONS

### **2.04 Earthwork**

#### **a. General:**

Earthwork shall be defined as the removal of soil (including rock) from its natural location and the depositing of such material into the proper fill areas as indicated on the plan.

#### **b. Rock Excavation – by Blasting:**

- 1) Permit – Where rock must be removed by blasting, a written permit must first be obtained from the City of Oxford Police Department a minimum of 24 hours before any explosive materials or blasting agents are used within the corporate limits of the City of Oxford.
- 2) Hours of Blasting – Blasting for rock removal shall be conducted only Monday through Friday between the hours of 7:00 AM TO 6:00 PM.

#### **c. Removal of Unstable Material:**

Where unstable and/or organic material (“muck”) is encountered in trenches or in roadways, the material shall be completely removed and replaced with suitable material, thoroughly compacted.

#### **d. Placement of Fill:**

Fill material for roadway embankments shall be free from stones greater than 4 inches in size, construction debris, frozen, organic and/or other unstable material. Fill material placed in roadway embankments shall be placed in lifts of 8 inches or less, and compacted to a density of not less than 95% of maximum dry density as measured by AASHTO Method T-99. The 95% requirement shall apply for that portion of the roadway measured from the back of curb and extending outward on a slope of 1 to 1, measured perpendicular to the centerline. The remaining fill shall be compacted to a density of not less than 90% of maximum dry density as measured by AASHTO Method T-99.

#### **e. Compaction Tests:**

During roadway construction, the DPW shall require the developer or Contractor to provide compaction tests to demonstrate compliance with the compaction requirements outlined herein. Such tests may be required at any time that the DPW believes the compaction to be less than the required density.

## STANDARD SPECIFICATIONS

### **2.05 Safety**

The Contractor shall provide for and maintain safety measures necessary for the protection of all persons on the work; and shall fully comply with all laws and regulations and building code requirements to prevent accident or injury to persons on or about the location of the work, including all applicable provisions of OSHA regulations. The Contractor shall protect all trees and shrubs designated to remain in the vicinity of the operations and barricade all walks, roads, and areas to keep the public away from the construction. All trenches, excavations, or other hazards in the vicinity of the work shall be well barricaded, and properly lighted at night.

The Contractor shall be responsible for the entire site and the necessary protection as required by the City and by laws or ordinances governing such conditions. He shall be responsible for any damage to City property, or that of others, by the Contractor, his employees, subcontractors or their employees, and shall correct and/or repair such damages to the satisfaction of the City of Oxford and/or other affected parties. He shall be responsible for and pay for any such claims against the City.

**The City shall in no way be responsible for interpretation or enforcement of the Occupational Safety and Health Administration (OSHA) regulations or standards. However, the City may report suspected violations of unsafe practices to the appropriate enforcement agency.**

### **2.06 Work Within Right-of-Way of State Maintained Roads**

#### **a. General:**

No construction shall be initiated within the right-of-way of roads, which are maintained by the NC Department of Transportation (NCDOT) without the prior approval of the NCDOT. The NCDOT approval shall be evidenced by an appropriate Encroachment Agreement and/or Driveway Permit, as applicable. A copy of the approved Encroachment Agreement and/or Driveway Permit shall be in the contractor's possession at the jobsite at all times that work is being performed. The Contractor shall notify the NCDOT District Office and shall post any required Indemnity Bond prior to beginning work in the NCDOT right-of-way.

#### **b. Utility Construction:**

The installation of public utilities within NCDOT right-of-way shall be accomplished in accordance with the Policies & Procedures for Accommodating Utilities on Highway Rights-of-Way, latest revision, as published by the NC Department of Transportation, Division of Highway, where such DOT requirements are more stringent than those of the City.

## STANDARD SPECIFICATIONS

### **c. Roadway Improvements – Pavement Widening, Curb & Gutter, and Storm Drainage:**

All improvements along existing NCDOT roadways, including pavement widening, curb and gutter, and storm drainage improvements, shall be accomplished in strict accordance with the Standard Specifications for Roads and Structures, latest edition, as published by the NC Department of Transportation. The NCDOT specification shall supersede the construction specifications of the City.

The contractor shall call for all inspections as required by the NCDOT District Office.

### **2.07 Maintenance of Traffic**

Existing public streets or highways shall be kept open to traffics at all times by the Contractor unless permission to close the streets, or portions thereof, if granted by the DPW. The City of Oxford Police Department must also be contacted by the Contractor a minimum of 24 hours before any streets are closed or partially closed. Proper and sufficient barricades, lights, signing and other protective devices shall be required to be installed when deemed necessary by the Police Department or DPW.

### **2.08 Concrete**

Concrete shall be only plant-mixed or transit-mixed concrete conforming to ASTM C33 for aggregates and to ASTM C94 for ready-mixed concrete. Any concrete poured that has a slump over 4 inches as per ASTM C143, or has a batched time of more than 90 minutes, will be considered unacceptable. Concrete shall not be deposited on frozen subgrade. Concrete shall not be poured when the air temperature is falling and below 40 degrees F, and/or the predicted low temperature for the succeeding 24-hour period is less than 32 degrees F. All concrete when placed in forms shall have a temperature of between 50 and 90 degrees F and shall be maintained at a temperature of not less than 50 degrees F for at least 72 hours for normal concrete and 24 hours for high-early strength concrete, or for as much time as is necessary to secure proper rate of curing and designed compressive strength.

Concrete shall be air entrained at 5% (+/- 1%). Retarders and accelerators shall be used only upon approval of the DPW.

## STANDARD SPECIFICATIONS

### **2.09 Underground Storage Tanks**

No person shall install an underground storage tank within the jurisdiction of the City of Oxford without first having notified the City of Oxford Public Works Department. Each installation shall be accompanied by EPA form 7530-1 (11-85) per applicable State and Federal regulations.

The following tanks are currently exempt from these permitting requirements:

- Farm or residential tanks of 1100 gallons or less which are used for storing motor fuel for non-commercial purposes
- Tanks for storage of heating oil to be used on premises where stored
- Septic tanks
- Flow through process tanks
- Underground tanks which are above floor level

### **2.10 Grease Traps**

#### **a. General Requirements:**

All establishments engaged in the preparation of food shall install a grease trap. The grease trap shall be located outside the building and shall intercept all kitchen wastes, floor drains, and can wash drains. Domestic waste from toilets and lavatories shall not be directed to the grease trap.

#### **b. Design Criteria:**

1) Liquid Capacity – The EPA Design Manual Formula should be used as follows:

$$LC = D \times GL \times ST \times HR/2 \times LF$$

Where:	LC	=	liquid capacity (gallons)
	D	=	number of seats in dining area
	GL	=	gallons of wastewater per meal (1.5 single services; 2.5 full service)
	ST	=	storage capacity factor (2.5 for on-site disposal)
	HR	=	number of hours open

## STANDARD SPECIFICATIONS

LF = loading factor = 1.25 – interstate highway  
= 1.00 – other freeways  
= 1.00 – recreational areas  
= 0.8 - main highways  
= 0.5 - other highways

2) Tank Construction & Tank Configuration – The grease trap tank shall be of precast concrete construction. The length and width ratio should not be less than 3:1 to maximize cooling.

3) Baffle Wall Opening – The baffle wall opening should extend down at least 50 percent of the liquid depth.

4) Outlet – The outlet shall consist of a sanitary tee which shall extend down to be approximately 12 to 24 inches above the tank bottom.

### **2.11 Dumpsters – Installation Requirements**

All dumpsters shall be placed on a reinforced concrete pad conforming to the requirements shown on Standard Drawing No. 2.07.

### **2.12 Notification Prior to Beginning Work**

The Developer or responsible contractor shall notify the DPW not less than 48 hours prior to the commencement of any new construction activity. No new work shall commence without approval of the DPW.

### **2.13 Materials**

All materials incorporated in work to be accepted by the City of Oxford for maintenance shall be new, first quality material installed in accordance with the manufacturer's instructions or these Specifications, whichever, in the opinion of the DPW, is more stringent or applicable.

It is the intent of this Specification to provide materials and Construction methods of high standard and quality; and to provide materials free from defects in workmanship and product. Equal material not specified may be used provided documentation and samples are furnished to the Director of Public Works & Utilities not less than fourteen (14) days before their delivery to the construction site. The DPW will issue written approval or disapproval of the alternate materials. Current Specifications and/or the latest revisions shall apply in all cases where materials are described.

## STANDARD SPECIFICATIONS

### **2.14 Inspections**

The presence of the Engineer, DPW, or other City employee at the work site shall not lessen the Contractor's responsibility for conforming to the approved construction plans and/or specifications. Should the engineer or inspector accept materials, or work that does not conform to the approved plans and specifications, whether from a lack of discovery or for any other reason; it shall in no way prevent later rejection or corrections to materials or work when discovered. The Contractor shall have no claim for losses suffered due to any necessary removals or repairs resulting from the unsatisfactory work. Any work that has been covered without the approval, shall at the City's request, be uncovered and be made available for inspection at the Contractor's expense. After regular working hours or weekend work shall comply with the City's specifications and shall include only such work that does not require continuous observation.

### **2.15 Utility Easements – Special Provisions**

All off-street water and sewer mains to be operated and maintained by the City shall be located in a public easement.

Private easements for water and sewer service lines are not permitted.

### **2.16 Water for Construction**

The City of Oxford does not provide free or otherwise unmetered water for use on any construction project. Contractors or construction personnel shall not take water from fire hydrants, blow-offs, water meter boxes, etc. Contractors desiring to use City water for construction purposes shall apply to the DPW for water service and shall pay for the water service in accordance with the City of Oxford policies and requirements.

**Bulk water for construction or other water requirements may be obtained at the Oxford Water Works Department located at 300 Williamsboro Street. Bulk water rates will be billed per load of water obtained. Bulk water rate is the current City outside rate.**

### **2.17 Street Lights**

The City of Oxford will provide one street light at each intersection and one street light near the midpoint of each block or approximately every five hundred (500) feet in a residential area. Additional public street lighting is provided only in areas where needed for public safety, such as major intersections, the downtown area, and in cases of clearly defined needs.

## **STANDARD SPECIFICATIONS**

### **2.18 Guarantee**

The developer shall provide a guarantee on workmanship and materials for a period of one (1) year after the date of acceptance by the City of Oxford. Any defects observed within the one (1) year guarantee period shall be repaired and/or replaced to the City's satisfaction. The guarantee shall apply to street construction, water lines and appurtenances, sanitary sewers, storm sewers (including ditches, drainage channels, etc.), pumping stations, force mains and appurtenances.

**STANDARD SPECIFICATIONS**

**SECTION 3 – STREETS**

**3.01 General**

Unless otherwise provided herein, all materials and street construction methods shall conform to the applicable requirements as outlined in the Standard Specifications for Road & Structures, latest edition, as published by the North Carolina Department of Transportation.

Whenever the following terms are used in said NC DOT specifications, the intended meaning of such terms shall be as follows:

“State” or “Commission” shall be replaced by “City of Oxford”.

“Resident Engineer” shall be replaced by the words “DPW”, in which context it shall mean the duly authorized DPW, assistant, or representative acting within the scope of the duties assigned to him or of the authority given him by the City Manager.

“Sampling and testing by Commission” shall be replaced by the words “sampling and testing by the City or its authorized testing agent”.

“Inspection by Commission” shall be replaced by “inspection of City or its duly authorized representative”.

**3.02 Pavement & Right-of-Way Widths:**

**Minimum pavement width, measured from back of curb to back curb, shall not be less than:**

<b><u>STREET CLASSIFICATION</u></b>	<b><u>PAVEMENT WIDTH (b-b)</u></b>	<b><u>RIGHT-OF-WAY</u></b>
Major Thoroughfare	65 feet	90 feet
Minor Thoroughfare	45 feet	70 feet
Urban Street	32 feet	60 feet
Minor Residential Street	27 feet	50 feet
Cul-de-sac Street	27 feet	50 feet
Cul-de-sac turnaround (res)	37 foot radius	45 foot radius
Cul-de-sac turnaround (non-res)	47 foot radius	55 foot radius

**a. Grades**

Unless necessitated by exceptional topography and subject to the written approval of the Board of Commissioners, maximum street grades shall not exceed those indicated in the Public Street Geometric Standards (Detail 3.09), nor be less than one-half of one (1) percent, on any street. Vertical curves shall be designed in accordance with the guidelines indicated.

## STANDARD SPECIFICATIONS

Grades approaching intersections shall not exceed five (5) percent for all distance of not less than one hundred (100) feet from the right-of-way of such intersection.

### **b. Radii of Curvature**

Where a street centerline deflection of more than five (5) degrees occurs, a curve shall be introduced. Centerline curves shall have a radius curvature of not less than determined from the table, Detail 3.09 in the Construction Details.

At intersections, all streets shall be rounded with radii not less than:

Intersection/Curb Radius – 25 feet (back of curb)

Property Lines                      - 20 feet

### **c. Tangents**

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

### **d. Sight Triangle**

A sight triangle easement shall be provided at all intersections. Sight triangle easements shall not be less than ten (10) feet by seventy (70) feet. The ten (10) foot dimension shall be the setback from the right-of-way of the major street, and the seventy (70) foot dimension shall be measured along the right-of-way of the minor street. Sight triangle distances shall be increased if appropriate for traffic conditions and speed limits. Sight triangle easements shall be shown on the final plat for the developed tract.

### **e. Pavement Design:**

The pavement designs presented in the standard drawings shall be considered as the minimum design requirements. The Developer shall furnish pavement design calculations by a professional engineer as required under paragraph 1.02a (6). The report shall address the suitability of the native soils for subgrade materials. The soils report shall develop and present a calculated pavement design thickness, which shall be used if the calculated thickness is greater than the standard pavement thickness. If the calculated thickness is less than the standard design thickness, the standard design shall be used.

In non-residential subdivisions, the DPW, acting upon the advice of the City Engineer, may require a pavement design in excess of the minimum requirements if the street is expected to be subjected to heavy traffic loads imposed by trucks and heavy equipment.

## STANDARD SPECIFICATIONS

### **3.03 Construction Requirements**

#### **a. General**

All roadway subgrade, storm sewer and utility construction shall be inspected and approved by the DPW prior to placement of base course materials.

All streets shall be cleared and graded for the full width of the right-of-way within 50 feet of any street intersection. Additional street clearing and grading shall be as follows:

Major Streets & Thoroughfares – the full width of the right-of-way.

Collector Streets – the full width of the right-of-way.

Urban Street & Urban Cul-de-Sac – the full width of the right-of-way on the sidewalk side, and 8 feet back of curb on the “non-sidewalk” side.

#### **b. Placement of Bituminous Surface Course:**

The I-2 bituminous surface course pavements shall have a total thickness of not less than 2 inches as shown on the standard details. The bituminous surface course material shall be placed in two lifts.

The initial lift shall be 1” thick (minimum). The contractor shall provide temporary drains through the concrete gutter at all low points to allow the first lift of asphalt to drain and to eliminate ponding at the low points.

The second lift shall be 1-inch nominal thickness and its placement shall be delayed during the period of initial residential construction activity and until such time as its placement is approved by the DPW, subject to the following conditions:

- (1) Placement of the second lift shall be no earlier than nine months after placement of the first lift and only after 60 percent of the building permits have been issued for the subdivision or phase of subdivision under construction.
- (2) If the 60% active construction permit goal is not achieved within a twelve-month period, the developer may negotiate a cash settlement with the City of Oxford to install the final lift. The negotiated fee will include, but not be limited to, any administrative and other reasonable charges incurred by the City of Oxford by this process.

Prior to placement of the final 1-inch lift of I-2 pavement, the existing initial lift shall be thoroughly cleaned and all cracks, spalling, and other failure shall be repaired to the satisfaction of the DPW.

Bituminous mixtures shall not be produced or placed under any of the following conditions:

## STANDARD SPECIFICATIONS

- During rainy weather or whenever moisture on the surface to be paved would prevent proper bond.
- When the subgrade or base course is frozen.
- When the air temperature, measured in the shade away from artificial heat at the location of the paving operation, is less than 40 degrees F.

### **3.04 Inspection**

#### **a. Proof-Rolling:**

Street embankments shall be graded and compacted as described in Section 2 of these Specifications. After all utilities and storm sewers have been installed, the subgrade shall be fine graded and restored to the required grade, and then be proof-rolled by using a fully loaded tandem dump truck. Should any “pumping” or displacement be observed during the proof-rolling, the defective area(s) shall be removed and replaced with suitable material, thoroughly compacted. The proof-rolling shall be repeated until there is no evidence of “pumping” or displacement.

#### **b. Compaction Testing – Subgrade:**

Upon completion of the proof-rolling, the Developer/Contractor shall furnish to the DPW a report from a certified soils testing laboratory. The report shall present the results of a Proctor analysis demonstrating that the subgrade compaction is acceptable in accordance with standard requirements of NC DOT. The subgrade shall then be inspected by the DPW, and upon its acceptance and approval, the stone base course may be placed. However, no stone base may be placed prior to backfilling behind the curb.

The cost of laboratory testing of the subgrade density and compaction shall be borne by the Developer/Contractor.

#### **c. Base Course & Surface Course Inspection Requirements:**

Prior to placement of bituminous surface course material, a Proctor analysis shall be furnished on the Aggregate Base Course placed in the roadway. The report shall be prepared by a certified testing laboratory and shall evidence compliance with the compaction requirements. Quarry tickets shall also be presented to the DPW to enable a check for yield at the specified final thickness. The base material shall then be proof rolled using a fully loaded tandem dump truck, and upon acceptance and approval, the bituminous surface course may be placed.

Bituminous surface course material shall be placed and compacted in accordance with NC DOT requirements. Copies of delivery tickets shall be furnished to the DPW to enable a check for yield at the specified final thickness.

## **STANDARD SPECIFICATIONS**

Should there be a question as to the final thickness of Aggregate Base Course bituminous surface course, the DPW reserves the right to require the Developer/Contractor to provide random corings by an independent testing laboratory to demonstrate actual thickness of base and surface courses. Core samples shall be taken by a certified testing laboratory and the results shall be presented to the DPW. Should the coring reveal insufficient thickness, the Contractor shall provide additional surface course as may be required or shall furnish other remedial measures as may be acceptable to the DPW. The cost of compaction testing and coring work shall be borne by the Developer.

## STANDARD SPECIFICATIONS

### **SECTION 4 – CURB & GUTTER, DRIVEWAYS AND SIDEWALKS**

#### **4.01 Materials**

##### **a. Concrete:**

Concrete for curb and gutter, driveways, or sidewalks shall be Portland cement concrete having a 28-day strength of 300 psi when tested in accordance with ASTM C39. Detailed specifications for concrete shall conform to the specifications contained in section 2.08 hereof.

##### **b. Bituminous Concrete (Asphalt):**

Asphalt for driveways shall meet the requirements as set forth in Section 645 of the NC DOT Specifications for type I-2 and grade 85-100 (AP-3).

##### **c. Joint Fillers:**

Joint fillers shall be a non-extruding joint material conforming to ASTM D1751.

#### **4.02 Dimensions**

The minimum thickness of a sidewalk shall be 4 inches. Sidewalks shall have a uniform slope perpendicular to the curb of not less than ¼ -inch per foot or greater than 1/2 –inches per foot toward the roadway. The utility strip between the sidewalk and the back of curb shall not be less than ½--inch per foot nor greater than ¾-inch per foot toward the roadway.

**Sidewalks shall be installed during roadway construction and/or widening.**

**Where a sidewalk intersects with a driveway access, the sidewalk section shall be 6-inches thick. All sidewalks and greenways shall meet the current Americans With Disabilities Act (ADA) requirements.**

**Sidewalks shall be constructed on the north or east side of the roadway.**

Curb and gutter, where required, shall be standard 30” combination curb and gutter. Rolled and valley type gutter shall be not used without written permission of the DPW.

## STANDARD SPECIFICATIONS

### **4.03 Construction Methods**

#### **a. Subgrade:**

The subgrade shall be excavated to the required depth, and shaped to the proper cross-section. Where tree roots are encountered, they shall be removed to a depth of 1 foot for the full width of the excavation. The subgrade shall be stable and thoroughly compacted.

#### **b. Forms:**

Forms shall be set and maintained true to the required lines, grades, and dimensions. Forms shall be constructed with the material of such strength and with such rigidity to prevent any appreciable deflection between supports. Straight forms shall be within a tolerance of 1/2 -inch in 10 feet from a true line horizontally or vertically. Forms shall be thoroughly cleaned of all dirt, mortar and foreign material before being used. All inside form surfaces shall be thoroughly coated with commercial quality form oil.

#### **c. Grooved Contraction Joints:**

Contraction joints shall be cut to a depth equal to at least 1/3 of the total slab thickness. The joint shall be no less than 1/8 inch in width and cut at intervals equal to the width of sidewalk. Formed curb and gutter contraction joint spacing shall be 10 feet, while a 15' spacing may be used for extruded curb and gutter. A 1/2 inch expansion joint filled with joint filler shall be placed between all rigid objects and placed no farther than 50 feet apart for sidewalks and formed curb and gutter, extending the full depth of the concrete with the top of the filler 1/2 inch below the finished surface. Expansion joint spacing may be increased to 90 feet for extruded curb and gutter. The surface of sidewalks shall be finished to grade and cross-section with a float, troweled smooth and finished with a broom.

### **4.04 Inspection**

No concrete shall be placed until the forms and subgrades have been inspected and approved by the DPW.

## STANDARD SPECIFICATIONS

### SECTION 5 – STORM DRAINAGE

#### 5.01 Design

Storm drainage facilities shall be designed to dispose of storm water generated upon or passing through the project location. The determination of the quantities of water, which must be accommodated, will be based upon peak flows from storms having the following return periods:

<u>Drainage Structure</u>	<u>Storm Event – Return Frequency</u>
Curb inlet, Gutters, Roadside Ditches	2-year storm
Storm Sewer Collector	10-year storm
Cross Street Storm Drainage	25-year storm
Structures in Flood Plain	100-year storm*

\* Drainage structures in flood plain should pass 100-year storm without over-topping the roadway – or in the alternative, the structures may be designed to pass only the 25-year event, in which case, the downstream roadway embankment shall be fully protected from the residential flow which may overtop the roadway during a 100-year event.

Prediction of the peak flow rates shall be calculated using the procedure in the USDA Soil Conservation Service Method, the Rational Method, or other acceptable calculation procedures. The size of storm water conduits shall be determined by utilizing the standard energy equation for inlet control or outlet control and headwater nomographs as published by various federal agencies – US Bureau of Public Roads – H.E.C. #5, Soil Conservation Service, etc. The minimum pipe size to be used shall be 15-inch diameter.

All storm sewers shall be installed in dedicated street rights-of-way or easements. Minimum widths of storm sewer easements shall be 20 feet for pipe up to and including 48 inches in diameter, and 30 feet in width for pipes larger than 48 inches. Where multiple pipes are installed, the edges of the easement shall be a minimum of 10 feet from the center line of the outside pipe with a 3-foot clearance between the parallel storm sewer pipes. As a rule, pipes shall not outfall in the front yard of a lot, but should extend into the rear third of the lot.

Erosion and sedimentation control measures shall be so designed to provide control from the calculated peak rates from a 10-year frequency storm. Discharge from the drainage system shall not be of such a velocity as to cause damage after leaving the pipe. At pipe outlets, flared end sections, or head walls shall be provided, with rip-rap aprons designed to reduce velocity and dissipate energy so that downstream damage does not occur.

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Manholes or structures shall be installed at each deflection of line or grade. No "blind" junction boxes shall be permitted. The maximum distance between access openings shall not exceed 400 feet for pipes 30" and smaller. For pipes 36" and larger, the maximum distance between access openings may be increased to 800 feet.

Manhole base diameters shall conform to the following for the various storm sewer pipe sizes:

<b>Storm Sewer <u>Pipe Size</u></b>	<b>Manhole <u>Base Diameter</u></b>
15" - 36"	5'0"
42" - 54"	6'0"

For pipes greater than 54", manhole base sections shall be sized as required, but are subject to approval of the DPW.

**Joints between sections of pipe shall be constructed utilizing a water tight gasket, o-rings, or bitumastic impregnated rope-type joint material for the full circumference of the joint. For pipes over 36-inches in diameter, each interior joint shall also be filled with a Portland cement grout and troweled smooth for the circumference of the pipe.**

**No storm pipe shall enter a structure through its corners.**

The minimum cover shall be two (2) feet from finish subgrade to the top of pipe under roadways, and one (1) foot under a non-roadway area.

Storm water shall be not allowed to flow across the roadway. Drainage shall be provided to intercept the flow prior to the radius of an intersection, or the design of the roadway shall indicate a continuous grade around the radius to allow the flow to continue down the intersecting street. Water shall be picked up before the spread into the roadway exceeds 8 feet for curb and gutter roadways. The inlets may be spaced using a 2-year frequency storm. No catch basin shall be installed in the radius of a curve.

### **5.02 Pipe Materials**

#### **a. General:**

All storm sewer pipes to be installed in projects within the jurisdictional limits of the City of Oxford shall be reinforced concrete pipe (RCP) conforming to the specifications presented herein. Corrugated Steel Pipe (CSP) may be permitted only in very large installations where RCP is not readily available, or in special cases where CSP arch pipe must be used because of limited fill heights. In such special cases, the applicant's plan submittal must contain a formal request to use CSP material and complete background data to justify its use. Approval to use CSP may only be granted by the City Manager upon the recommendation of the DPW.

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### **b. Reinforced Concrete Pipe (RCP):**

RCP shall be as per ASTM C76, Table III or Table IV with a minimum 15-inch diameter as furnished by NC Products or Gray Concrete Pipe Company. Joints shall be wiped with mortar or sealed with a plastic cement putty meeting Federal Specification SS-S-00210 such as "RamNek".

### **c. Corrugated Steel Pipe (CSP) and Pipe Arch:**

Corrugated steel pipe and pipe arch, where permitted, shall conform to AASHTO M36 with pipe ends having no less than 2 round corrugations on each end. Bands for pipe connection shall be corrugated, also with a minimum of 2 corrugations for each pipe.

Gauge thickness shall be one gauge heavier than that established in Tables 5-5 and 5-6 of the Roadway Design Manual, as published by the NC Department of Transportation. Corrugated steel pipe and pipe arch shall be fully bituminous coated, with paved invert per ASSHTO M190, or it may be aluminized, Type 2, per ASSHTO M274.

Where CSP, CSP arch, or aluminized Type 2 is permitted, the manufacturer of the pipe or pipe arch shall furnish a notarized affidavit certifying as to conformance with the applicable ASSHTO and NC DOT specifications, and certifying that the gauge thickness conforms to these Specifications.

## **5.03 materials – Storm Drainage Solutions**

### **a. General:**

All structures – manholes, curb inlets, catch basins, junction boxes, etc. shall be constructed of clay brick masonry units, concrete brick masonry units, or precast concrete. End walls and headwalls shall be constructed of clay brick masonry units, concrete brick masonry units, or structural cast-in-place concrete.

Curb inlets in streets with curb and gutter shall be of the "open-throat" type with a 5-foot curb opening. Yard inlets and area drains shall utilize a grate and frame, 2' X 2' size, minimum.

### **b. Clay Brick Masonry Units:**

Clay brick shall be solid, rough, sound clay brick conforming to ASTM C32, Grade MS.

### **c. Concrete Brick Masonry Units:**

Concrete brick masonry units shall be solid units meeting the requirements of ASTM C55, Grade S-II.

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### **d. Precast Concrete Manholes:**

Precast concrete manholes shall meet the requirements of ASTM C478. Manholes shall have joints sealed with a pre-formed plastic gasket per Federal Specifications SS-S-00210. Manholes shall have 5-foot diameter for storm drains 15-inch through 36-inch, and 6-foot diameter for storm drains 42-inch through 54-inch.

Transition reducing slabs may be used to enable the use of 4' diameter eccentric cones at the top. All precast manholes for storm sewers shall be of the eccentric type for ease of access.

### **e. Mortar:**

Mortar shall be proportioned as shown below for either Mix No. 1 or Mix No. 2. All proportions are by volume. Water shall be added only in the amount required to make a workable mixture.

MIX NO. 1: 1 part Portland Cement  
          1/4 part Hydrated Lime  
          3 3/4 parts Mortar Sand (maximum)

MIX NO 2: 1 part Portland Cement  
          1 part Masonry Cement  
          6 parts Mortar Sand (maximum)

Portland cement shall be ASTM C-150, Type 1. Hydrated lime shall conform to ASTM C207, Type S. Masonry cement shall meet the requirements of ASTM C91. Mortar sand shall be standard size 4S, per requirements of the NC DOT.

### **f. Castings:**

- 1) General – All castings shall be one of the manufacturers specified. If the Developer/Contractor desired to use a casting or another manufacturer, samples of the casting(s) shall be provided to the DPW for review and approval. In addition to samples, the names of other users of the castings shall be furnished along with names and telephone numbers of persons whom the DPW may contact for an evaluation of the casting.

All castings shall meet the requirements of ASTM A48, Grade 30 iron.

- 2) Open-Throat Curb Inlet Frame & Cover – Open-throat curb inlet castings shall have a minimum opening length of 5 feet. The casting shall be Type CB-SO-1 as manufactured by Dewey Brothers, or its equivalent as manufactured by Southern Foundry Company.

## STANDARD SPECIFICATIONS

- 3) Grates & Frames – Cast iron grates and frames for yard inlets shall be of the size indicated on the approved plans. Grates and frames shall be Dewey Brothers type CHBN-3A for a 2' X 2' masonry opening, or its equivalent with comparable features for other larger size openings as may be required. Equivalent units manufactured by Southern Foundry Company will be accepted.

Grates and frames shall only be used outside of street rights-of-way.

- 4) Manhole Rings & Cover – Cast iron manhole rings and covers shall be Dewey Brothers type MH-RCR-2001 with the words "STORM SEWER" cast on the cover. Covers shall have four 1-inch holes. Manhole castings shall be machined to provide a continuous bearing around the full periphery of the frame.

### **g. Portland Cement Concrete:**

Portland cement concrete used for storm drainage structures, end walls, etc. shall conform to the technical requirements presented in sub-section 2.06 of these Specifications, and shall have a minimum compressive strength of 3,000 psi at 28 days. Primary structures, such as box culverts, may require concrete having a compressive strength greater than 3,000 psi, and may require the submission of mix designs and testing of the concrete by an independent laboratory. These special requirements may be imposed by the DPW for all such structures where recommended by the Engineer.

### **h. Reinforcing Steel:**

Reinforcing steel shall be new billet steel conforming to ASTM A615 for grade 60. Reinforcing steel shall be deformed per ASTM A305.

## **5.04 Miscellaneous Materials**

### **a. Rip Rap:**

Rip rap shall be large aggregate of the size and class shown on the approved drawings.

## **5.05 Urban Storm Water Rules Requirements**

- a. All new development may not cause erosion of receiving waters, and at a minimum, no net increase in peak flow leaving the site from the pre-development conditions for the 1-year, 24-hour storm;**
- b. Phosphorous loads from new development shall not exceed 0.4 lbs./acre/year; and**
- c. Nitrogen load from new development shall not exceed 4 lbs./acre/year.**

## STANDARD SPECIFICATIONS

### **5.06 Construction Methods**

#### **a. Trenching & Bedding for Storm Sewers:**

The trench shall be excavated to the line and grade indicated on the Drawings. The trench bottom shall provide a firm and uniform support for the pipe. Where bell and spigot type pipe is used, recesses shall be excavated to receive the pipe bell.

Where the foundation is found to be of poor supporting value, the pipe foundation shall be conditions by undercutting the unacceptable material to the required depth as directed by the DPW, and backfilling with stone or other approved material. Where necessary, surface water shall be temporarily diverted in order to maintain the pipe foundation in a dry condition. The flow of water from such temporary diversions shall be directed into suitable erosion control devices.

#### **b. Pipe Laying:**

Concrete pipe culverts shall be laid carefully with bells or grooves upgrade and ends fully and closely jointed. Joints of concrete pipe shall be made with cement mortar or with plastic gasket material as specified.

Where mortar is used, the joint shall be thoroughly wetted before making the mortar joint. Before succeeding sections of pipe are laid, the lower portions of the bell or groove of the pipe shall be filled on the inside with cement mortar of sufficient thickness to bring the inner surface of the abutting pipes flush and even. After the pipe is laid, the remainder of the joint shall be solidly filled with mortar and sufficient additional mortar used to form a bead or ring around the outside of the joint. The inside of the joint shall be wiped and finished smooth. Pipe which is not true to alignment, or which shows any settlement after laying, shall be taken up and re-laid.

#### **c. Backfilling:**

The storm sewer trench shall be backfilled with approved material free from large stones or clods in 6-inch layers, loose measurement, and compacted to 95% of maximum dry density (AASHTO T-99), where the trench is within an area to be paved, or where the trench is immediately behind the curb. The backfilling shall be done on both sides of the pipe simultaneously to prevent displacement of the pipe. The backfill materials shall be moistened when necessary in the opinion of the ENGINEER, to obtain maximum compaction. Water settling or puddling shall not be permitted. Backfill in trenches not within the limits to be paved may be compacted in 12-inch layers after backfill is one foot above the top of the pipe.

All trash, forms, debris, etc., shall be cleared from around all pipes and structures before backfilling. Backfilling around structures shall be done symmetrically and thoroughly compacted in 6-inch layers with mechanical tampers to the specified 95% density.

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### **d. Masonry Structures:**

Excavations shall be made to the required depth, and the foundation on which the brick masonry is to be laid shall be approved by the DPW. The brick shall be laid so that they will be thoroughly bonded into the mortar by means of the "shove-joint" method. Buttered or plastered joints will not be permitted. The headers and stretchers shall be so arranged as to thoroughly bond the mass. Brickwork shall be of alternate headers and stretchers with consecutive courses breaking joint. All mortar joints shall be at least 3/8 inches in thickness. The joints shall be completely filled with mortar. No spalls or bats shall be used except for shaping around irregular openings or when avoidable to finish out a course. Competent bricklayers shall be employed on the work and all details of construction shall be in accordance with approved practice and to the satisfaction of the DPW.

Steps as shown on the plans shall be placed in all catch basins and inlets when they are greater than five feet in depth. The steps shall be set in the masonry as the work is built up, thoroughly bonded, and accurately spaced and aligned.

Inverts in the structures shall be shaped to form a smooth and regular surface free from sharp or jagged edges. They shall be sloped adequately to prevent sedimentation.

The castings shall be set in full mortar beds. All castings when set shall conform to the finish grade shown on the Drawings. Any castings not conforming shall be adjusted to the correct grade.

### **e. Concrete Construction:**

The forming, placing, finishing and curing of Portland cement concrete shall be performed in strict accordance with all applicable requirements as contained in the Standard Specifications for Road & Structures, latest edition, as published by the NC DOT.

### **f. Installation of Precast Concrete Structures:**

Precast concrete manholes, junction boxes, etc. shall be installed level and upon a firm, dry foundation, approved by the DPW. Structures shall be backfilled with suitable materials, symmetrically placed and thoroughly compacted so as to prevent displacement. Castings shall be set in full mortar beds to the required finished grade.

## **5.07 Riparian Buffer Protection Rule**

These rules require that existing vegetated riparian (streamside) areas in the basin be protected and maintained on both sides of intermittent and perennial streams, lakes, ponds, and estuarine waters. This rule does not establish new riparian buffers unless the existing use changes. The footprints of existing uses such as agriculture, buildings, industrial, commercial, and transportation facilities, maintained lawns, utility lines, and on-site wastewater systems are exempt. A total of 50 feet of riparian area is required on each side of streams. Within this 50

## STANDARD SPECIFICATIONS

feet, the first 30 feet is to remain undisturbed with the exception of certain activities. The outer 20 feet must be vegetated, but certain additional uses are allowed in this Zone 2. These activities shall conform with current state regulations.

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## SECTION 6 – WATER DISTRIBUTION

### **6.01 Preliminary Considerations**

All water main extensions and distribution facilities, which connect to the water distribution system of the City of Oxford, shall be considered as public facilities up to the metering point. Therefore, all such facilities must be installed in public street right-of-ways or in the easements, having a width of not less than 20 feet.

Where water main extensions are proposed, the extension shall terminate at the furthestmost property line fronting the property. Where deemed necessary to enhance water flow and/or pressures in the effected area, this extension may be required to be “looped” to an existing water main within the area being developed.

Where water mains “dead end” or are terminated for future extension, at least one 18 foot joint of ductile iron pipe shall be installed with a thrust collar, main line valve, and blow-off assembly. The “dead end” water main shall terminate within a right-of-way or dedicated easement where required by the DPW.

**Ductile iron pipe (DIP) shall be used for water mains ten (10) inches and larger in diameter.**

Where public water mains are installed within easements crossing private property, the City’s Public Works Department shall have the right to enter upon the easement for purposes of inspecting, repairing or replacing the water mains and appurtenances. Where paved private streets, driveways, parking lots, etc. have been installed over the public water mains, the City of Oxford shall not be responsible for the repair or replacement of pavement, curbing, etc. which must be removed to facilitate repairs. The Public Works Department shall excavate as necessary to make the repair, and shall backfill the disturbed area to approximately the original grade. Replacement of privately owned pavement, curbing, and walkways shall be the responsibility of the property owner.

### **6.02 Design**

#### **a. Location:**

Water mains shall be located either in the north or east side of the street pavement.

Water mains shall be laid at least 10 feet laterally from existing or proposed sewers. Where local conditions prevent a separation of 10 feet, the water main may be laid closer, provided that the elevation of the bottom of the water main is at least 18 inches above the top of the sewer with a horizontal separation of at least 3 feet.

Where a water main and a sanitary sewer cross, and the vertical separation is less than 18 inches, or the water line passes under the sewer, both the water main and sewer shall be ductile iron

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pipe, equivalent to water main standards for a distance of 10 feet on each side at the point of crossing. The water line pipe section shall be centered at the point of crossing.

### **b. Cross Connection Control In The Water Distribution System:**

No facility may connect to the Oxford water distribution system prior to approval from the DPW. The installation of an approved reduced pressure zone backflow preventor and/or double check valve assembly will be required. These devices will be of manufacture and models approved by the State of North Carolina, Underwriters Laboratories, and the Southern California Foundation for Cross Connection Control and Hydraulic Research.

**All existing and proposed water services, dedicated fire and irrigation lines must be equipped with an approved backflow prevention device. For projects having any combination of these lines, suitable approved devices must be provided to contain or “isolate” each level through containment.**

**On service lines serving a facility that is in operation continuously, the lines must have duplicate parallel backflow prevention devices on a single service line or adequate protection on each supply line.**

**Approved double check valve assemblies shall be installed above ground or inside of building, as long as there are no unprotected taps between the main and the building. Double check valves may also be permitted in below ground vaults provided test cocks are piped above ground.**

**An approved dual check valve must be installed at the meter service on residential service lines.**

**OS & Y shut-off valves shall be used on all fire lines and backflow prevention devices (2-inch and larger) and each backflow preventer will have approved test cocks.**

**“Processed water” is water where extra chemicals are added by the user on site to reduce freezing, pipe corrosion, etc. If a fire line or domestic service is connected to any “processed water” source, or booster pump system, backflow protection shall be provided by using the USC approved Reduced Pressure Zone (RP) type device. Fire lines require a reduced pressure detector assembly, with detector meter. This RP device shall include gate valves and test cocks, and meet the requirements of AWWA C-506-78. If the RPDA is 2 ½-inches or larger, then it must be supplied with OS & Y shut-off valves. The unit shall be within an above ground vault or inside of the building.**

**If the backflow preventor is located on site for fire lines, it shall be located outside of the structure. All internal or confinement devices (isolation) will have strainers upstream of the device with the exception of devices for fire lines.**

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All devices ¾" – 2" must have a ball valve that is full port, have a blow-off proof stem, have resilient seats and a 400 psi WOG rating (water, oil or gas). All devices 2 ½" – 10" must have fusion bonded, epoxy coated resilient wedge valves. All test cocks must have approved ball valves of the appropriate size.

Backflow prevention devices shall be tested and certified when they are installed; coordination with the Public Works Department must be maintained to have additional water meter installed. All backflow devices must be tested and recertified on a yearly basis. Maintenance must be performed for all rubber parts every five (5) years. All testing and maintenance must be performed by certified personnel.

All backflow prevention devices must be installed above ground, and in the horizontal position.

All backflow prevention devices shall be installed with a minimum clearance from the vault floor of 12-inches (60-inches maximum). There shall be a minimum 18-inch clearance around all devices. Drainage shall be provided; two (2) times the diameter of the device (1-inch minimum).

### c. Fire Flow Requirements:

All water distribution system extensions shall provide water pressures and fire flows at a standard acceptable value for the applicable zoning requirements. Flows shall be estimated for a given structure and/or developed area based on the following formula:

$$F = 18C(A)$$

Where: F = required flow in gpm  
C = construction type coefficient

C = 1.5 for wood frame construction  
C = 1.0 for ordinary construction  
C = 0.9 for heavy timber construction  
C = 0.8 for noncombustible construction  
C = 0.6 for fire resistive construction

A = the total floor area (all stories), excluding basements, for the building being considered. For fire resistive buildings, the six largest successive floor areas are used if the vertical openings are unprotected; but where the vertical openings are protected, only the three largest successive floor areas are included.

Regardless of the calculated value, the fire flow shall not exceed 8000 gpm for wood-frame or ordinary construction, or 6000 gpm for noncombustible or fire-resistive building; except that for a normal one-story building of any type it may not exceed 6000 gpm. The fire flows shall not be less than 500 gpm. For groupings of single-family dwellings not exceeding two stories in height, the following fire flows may be used:

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<u>DISTANCE BETWEEN DWELLING UNITS (FT)</u>	<u>REQUIRED FIRE FLOW * (GPM)</u>
Over 100	500
31 to 100	750 to 1000
11 to 30	1000 to 1500
10 or less	1500 to 2000
Continuous buildings	2500

\* Where wood shingle roofs could contribute to spreading fires add 500 gpm

All other applicable recommendations set forth by the Insurance Services Office (ISO) for the various land use type must be met.

The calculated flows shall be reviewed by the DPW, flows and water main extension size may be adjusted.

### **d. Size of Mains:**

- 1) All water distribution system extensions shall conform with the Oxford Water System Facilities Plan as developed in 1988, or current revisions to the plan if applicable.
- 2) Residential Zoning Districts – Water mains shall be 6-inch and 8-inch minimum in residential districts. Six-inch shall be used only where it completes a good grid, but in no case in blocks of more than 600 feet in length. Maximum lengths of 6-inch and 8-inch lines without connection to a larger feeder main are 1200 feet and 2000 feet, respectively. Within residential cul-de-sacs 200 feet and less in length, a 4-inch water main is permissible. If the cul-de-sac is serving a multi-family development, then a 6-inch main is required.
- 3) Business, Commercial, Industrial Zoning Districts – Water mains shall be 8-inch and 12-inch minimum. Eight-inch shall be used only when it completes a good grid and the maximum length of 8-inch lines without connection to a larger feeder main is 1,200 feet unless special approval for deviation from this requirement is recommended by the Engineer and is granted by the DPW. In all cases, water mains shall be of such size as to maintain the minimum residential pressure as specified in Sub-section 6.02 (i) hereof.

### **e. Fire Hydrants Location:**

- 1) All fire hydrants shall be installed on a minimum 6-inch water line. Only one fire hydrant may be installed on a dead end 6-inch line.
- 2) In all residential districts, there shall be a fire hydrant located at each street intersection. The maximum distance between fire hydrants in these districts, measuring along public street centerlines and/or private travel ways, shall be 500 feet. On group housing projects, all parts of the buildings shall be within 300 feet of a fire hydrant. For single family

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residence projects, a hydrant shall be located at the end of each cul-de-sac greater than 300 feet in length measured along the cul-de-sac centerline from the street centerline to the cul-de-sac radius point.

- 3) In all business, commercial, office and institutional, shopping center, multi-family, mobile home and industrial districts there shall be at least one fire hydrant at each street intersection. The maximum distance between fire hydrants in these districts, measuring along public street centerlines and/or private travel ways shall be 300 feet. If a building is completely equipped with a fire sprinkler system and the project is developed with a private water distribution system all parts of the building shall be within 300 feet of a hydrant.
  
- 4) **All premises where buildings or portions of the building are located more than 300 feet (commercial) or 500 feet (residential) from a fire hydrant shall be provided with approved on-site fire hydrants and water mains capable of supplying the fire flow required by the fire Department. The location and number of on-site fire hydrants shall be as designated by the Fire Official, with the minimum arrangement being so as to have a hydrant available for distribution of hose to any portion of any building at distances not exceeding 500 feet of hose length.**
  
- 5) **A clear level space of not less than three (3) feet shall be provided and maintained on all sides of a fire hydrant for immediate access. Clearance from the ground surface to the steamer nozzle shall be between eighteen (18) inches and twenty-four (24) inches.**

**f. Valves:**

Valves shall be installed on all branches from feeder mains and on hydrant branches according to the following schedule:

3 valves at cross intersections

2 valves at tee intersections

1 valve on hydrant branches

Main line valves on straight runs between intersections shall be spaced at interval distances not exceeding the following:

<u>MAIN SIZE</u>	<u>MAXIMUM SPACING</u>
6"	600'
8"	900'
12"	1,200'
16"	1,600'

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However, main line valves should coincide with fire hydrants and must be within fifty feet of the nearest hydrant.

Gate valves shall be used for water mains through 12-inch size. For water mains 16-inch and larger, butterfly valves may be used.

Double check valve assemblies shall be required on privately owned and maintained fire lines where processed water or fluids are involved. On processed water systems where extra chemical are added by the user on site to reduce freezing, pipe corrosion, etc., backflow protection shall be provided by using a USC approved Reduced Pressure zone-type preventer.

**g. Services**

- 1) **General** – Each dwelling unit, whether attached or detached, shall be metered. Multifamily units will be metered per current City of Oxford policy. Check with the Engineering Department for details of the City of Oxford multifamily metering policies.

Water services shall be extended from the main to a meter box located within the street right-of-way or within an easement. The installation of the tap, service line, and meter box shall be the responsibility of the Developer or the property owner. **Water service supply line shall be continuous from the water main to the meter, no connections, up to and including 2-inch services.**

The City shall provide and install a water meter subject to the Developer of property owner having installed specified improvements or guaranteed their installation and having paid all required fees.

- 2) **Multiple Meters** – Multiple meters on branched services are acceptable for multi-family projects, providing they conform with the following table:

<b><u>SIZE OF INDIVIDUAL SERVICE (METER)</u></b>	<b><u>SIZE OF FEEDER SERVICE</u></b>	<b><u># OF BRANCHES</u></b>
** 3/4"	3/4"	2
3/4"	1"	3
3/4"	1 1/4"	4
3/4"	1 1/2"	5-10

**\*\* For individual irrigation system meters only**

All multiple meter installations shall conform to the standard detail drawing and shall contain a curb stop on the feeder line. The curb stop shall be buried and shall be equipped with a curb box.

- 3) **Meter Installation** – The City of Oxford shall provide and install the water meters subject to the following conditions:

- Developer (or property owner) has paid prescribed meter fee

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- Developer has installed all specified improvements or guaranteed their installation as prescribed in the City of Oxford

### **h. Looping to Existing Water Mains:**

New water mains in cul-de-sacs or dead-end streets shall be extended or “looped” to existing mains in adjacent streets when, in the opinion of the Engineer or the DPW, it is practical to do so in order to enhance flow and pressure in the affected area.

### **i. Residual Pressure Requirements for Fire Flow:**

Fire service lines to commercial or industrial sites shall be sized so that a minimum residual pressure of 20 psi can be maintained in the Oxford distribution system.

### **j. Private Irrigation Systems:**

No private irrigation system shall be installed within the public right-of-way or any public easement. An approved yard hydrant may be installed within the median centerline of a divided roadway section if indicated on the proposed construction plans. Yard hydrant locations and quantities are subject to approval of the DPW. All yard hydrants shall be metered.

**Irrigation systems outside of the public right-of-way and easements shall be installed utilizing an approved backflow prevention device (RPZ) for high hazard applications.**

## **6.03 Materials**

### **a. General Requirements – Water Distribution Mains:**

All water mains to be installed within the jurisdictional limits of the City of Oxford shall be either PVC Pipe or Ductile Iron Pipe, except in the case of dead-end mains and 6-inch hydrant branches, for which only ductile iron pipe shall be used.

### **b. PVC Pipe:**

All PVC pipe shall meet the requirements of AWWA C900. PVC pipe shall be approved by the DPW.

### **c. Ductile Iron Pipe:**

All ductile iron pipe shall be designed as per AWWA Standard C150 for a working pressure of 150 psi, laying condition 1. Pipe shall be manufactured in accordance with all applicable requirements of AWWA Standard C151.

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Pipe joints shall be of the push-on type as per AWWA Standard C111. Pipe lining shall be cement mortar with a seal coat of bituminous material, all in accordance with AWWA Standard C104.

Ductile iron pipe shall be as manufactured by Griffin, U.S. Pipe, American, or Clow, and shall be furnished in 18 or 20 foot lengths.

### **d. Hydrants:**

Fire hydrants shall be of the compression type meeting AWWA standards, designed for a minimum working pressure of 150 psi and a hydrostatic test pressure of 300 psi with the valve in both the open and closed positions.

All hydrants shall be equipped with two 2 ½-inch nozzles and one integral hydrant Storz nozzles/connections shall be installed during factory assembly. The nozzle/connection shall be capable of connecting to 5" Storz equipped large diameter hose and/or associated hardware. The lugs shall be of a locking style and construction. The connection shall meet or exceed requirements of ANSI/AWWA C502 regarding construction materials and pressure thresholds. The Storz nozzle/connection shall have a brass metal face seal and hardened aluminum Storz ramps and Lugs. The adapter shall be made of forged or extruded 6061-T6 aluminum or comparable material. The blind cap shall be of matching material and workmanship and equipped with a suction seal. The cap shall be connected to the adapter or hydrant with a 0.125" vinyl coated aircraft cable. All design characteristics shall meet or exceed expectations of NFPA-1963 and should be UL tested and FM approved. Each nozzle shall be bronze with cast iron caps secured thereto with a suitable steel chain. Nozzles shall have National Standard threads

The hydrants shall be open-left and equipped with a pentagon-type operating nut (National Standard) measuring 1-½ inches from point to flat. Hydrants shall be of the "dry top" type with the upper rod threads completely enclosed in a sealed grease or oil chamber, equipped with "O" ring seals and a Teflon thrust bearing.

The hydrant valve opening shall be of sufficient size to insure such flows and corresponding minimum losses as set forth by the American Water Works Association.

The hydrants shall have a 6-inch shoe or boot, mechanical joint. Hydrants shall have bronze-to-bronze threads provided between the hydrant seat or seat ring and the seat attaching assembly. The hydrant shall be of the "safety" type so that, if the upper barrel is broken off, the hydrant valve will remain closed and reasonably tight. All hydrants shall be furnished with barrel and stem extensions as required by the final field location to provide a nominal minimum bury of three feet, six inches (3'-6"), or greater, if indicated on the drawings.

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### **e. Gate Valves:**

- 1) 12-inch and Smaller – Gate valves 12 inches and smaller shall be designed and manufactured in accordance with AWWA C-500, or of the resilient wedge type conforming to AWWA C-509. They shall be designed for a working pressure of 200 psi and shall be hydrostatically shop tested to 400 psi. They shall be open-left, non-rising stem, cast or ductile iron body, double disc, parallel seat, fully bronze, mounted and equipped with O-ring seals and a standard 2-inch square operating nut. Valve ends shall be mechanical joint.
- 2) 16-inch and Larger – Gate valves 16 inches and larger shall be designed for a working pressure of 150 psi and shall be hydrostatically tested to 300 psi. Sixteen-inch gate valves shall meet all other requirements as stipulated above for valves 12-inch and smaller. Gate valves larger than 16-inch size shall be manufactured and supplied with other special features, such as gears and by-pass, etc., as may be recommended by the Engineer.
- 3) Tapping Valve – All tapping valves shall conform to the Standard Specification for gate valves, 12 inches and smaller, as noted above, except that the inlet end shall be flanged, faced and drilled per ANSI B16.1 for 125 lb. Standard. The outlet end shall be of the mechanical joint type capable of receiving a standard tapping machine.
- 4) Acceptable valves shall meet:

Double Disc/Parallel Seat Gate Valves (AWWA C-500)

Resilient Wedge Gate Valve (AWWA C-509)

### **f. Butterfly Valves:**

Butterfly valves may be used in lieu of gate valves for water mains 16-inches or greater.

Butterfly valves shall meet or exceed AWWA Specification C-504 for Class 150-B, latest revision.

Valve bodies shall be of close grain cast iron conforming to ASTM designation A-126, Class B.

Valve disc shall be cast bronze or cast iron with bronze or stainless steel sealing surfaces. The disc shall have adjustable stops preset by the factory and the seats shall be natural rubber.

Butterfly valves shall be open-left, manually operated with the operator assembly meeting all requirements of Section 12, AWWA C-504. Operating torques shall comply with Table 1 of AWWA C-504 for Class 150-B valves. Valves shall have mechanical joint ends and a 2-inch square operating nut, unless otherwise indicated on the approved project drawings.

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### **g. Valve Boxes:**

All valve boxes shall be of the adjustable type. Valve boxes shall be cast from close-grained gray iron, in three pieces consisting of a lower base piece, upper part, and cover. The lower base piece shall be flanged at the bottom to fit around the valve and shall not rest on the valve bonnet. The upper part shall also be flanged on the lower end and of such size as to telescope over the lower part with the upper end cast on the upper surface in raised letters the word "WATER". Valve boxes shall be painted prior to shipment with a coat of protecting asphaltic paint.

### **h. Tapping Sleeves:**

The tapping sleeves shall be the split type, ductile iron, or stainless steel body, mechanical joint, designed and manufactured for a minimum working pressure of 200 psi. The tapping sleeve shall be Mueller H-615, Rockwell 622 or Romac SST304. The tapping sleeve branch shall be flanged and manufactured in such a manner as to assure proper alignment with the flanged inlet end of the tapping valve. The drilling of the branch flange shall correspond to that of the inlet flange of the tapping valve.

### **i. Tapping Saddles:**

Tapping saddles may be used in lieu of tapping sleeves on mains 6 inches and larger. Saddles may be made of ductile iron providing a factor of safety of 2.5 with a working pressure of 250 psi. Saddles shall be equipped with an AWWA C110 flange connection on the branch. Sealing gaskets shall be "O" ring type, high quality molded rubber having approximately 70 durometer hardness, placed into a groove on the curbed surface of the saddles. Straps shall be alloy steel. Saddles shall be as manufactured by American.

### **j. Blow-Off Assemblies:**

Blow-off assemblies shall be constructed in accordance with the City Standard Detail for Blow-Off Assemblies. The Blow-off valves may be a 2-inch curb stop, Mueller "ORISEAL II" or a Ford Ball Valve, B11-777, in lieu of a 2-inch gate valve. If a curb stop or ball valve is used, it shall be equipped with an adapter to enable operation with a standard valve key having a 2-inch square operating nut.

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### **k. Iron Fittings:**

Iron fittings shall be ductile iron, all bell, mechanical joint, conforming to the following specifications.

3" – 16" Size – Standard fittings – AWWA C110, latest revision; or Compact Fittings – AWWA C153, latest revision

18" – 48" Size – Standard fittings – AWWA C110, latest revision

Mechanical Joint – AWWA C111

Inside Lining – Cement mortar with bituminous seal coat – AWWA C104

Fittings through 24" size shall have a minimum pressure rating of 350 psi. Fittings larger than 24" shall have a pressure rating of 250 psi.

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### I. Water Service Accessories:

- 1) General Requirements – Service saddles shall be used for taps in all PVC water mains. Direct taps (without) saddles may be permitted to ductile iron pipe in accordance with the following table:

<u>MAIN SIZE</u>	<u>MAXIMUM SIZE OF DIRECT TAP – D.I. PIPE</u>
4" D.I. Pipe	¾"
6" D. I. Pipe	1 ½"
8" & Larger D. I. Pipe	2"

Service connections larger than 2" shall be made by means of tapping sleeve and valve.

All water service tubing shall be copper. Polyethylene or other plastic service tubing will not be permitted.

All new water service shall be equipped with a dual check valve which shall be located immediately downstream of the meter.

All water meters shall register in gallons. All water meters shall be approved by the Engineering Department prior to installation.

Multiple meters may be installed in accordance with the Standard Detail.

Upon request of the DPW and prior to beginning work, the Contractor shall furnish samples of service accessories to the DPW for approval and to demonstrate compliance with these Specifications. Samples shall include saddles, corporation stops, meter setters, meter boxes, etc.

- 2) Service Saddles – Service saddles shall be all bronze with double bronze straps and with a neoprene "O" ring gasket attached to the body. The outlet shall be AWWA tapered threads for direct connection to the corporation stop. Service saddles shall be Mueller H16100 Series or approved equal.
- 3) Corporation Stops – Corporation stops shall be designed and manufactured in accordance with AWWA Standard C800, latest revision. Corporation stops shall be equipped with an AWWA standard tapered thread on the inlet end and a compression nut on the outlet end for connection to flared copper tubing. The stops shall be fully shop tested for leaks with air pressure under water. The corporation stops shall be Mueller H15000, Ford F600, or approved equal.
- 4) Cooper Service Tubing – Cooper tubing shall be Type K soft copper tubing conforming to ASTM Standard B88.

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- 5) Meter Setters & Accessories for ¾" & 1" Services – Meter setters shall be cooper, 12" high with lockable angle meter stop and angle duel check valve. The meter setters and accessories shall be as follows:
  - Ford VHH-70 Series with HHA angle duel check valve. Meter stop shall be equipped with padlock wings.
  - Mueller #14000 Series with #14244 angle duel check valve. Meter stop shall be equipped with padlock wings.
  - Other copper meter setter and accessories equal to Ford or Mueller and approved by the DPW.
- 6) Meter Setters & Accessories for Services Larger than 1" – shall be as shown on Standard Detail 6.04 or 6.05, as applicable.
- 7) Meter Boxes for ¾" and 1" Services - shall be cast iron – Dewey Brothers, MBX-2 or equal.
- 8) Meter Boxes for Services Larger than 1-inch – shall be as shown on the Standard Detail 6.04 or 6.05, as applicable.
- 9) Meters – 5/8" X ¾" through 1" – for residential and small commercial service shall be supplied by the City.

### **6.04 Installation of Water Mains, Fittings, Valves & Appurtenances**

#### **a. Unloading & Storage of Materials:**

The unloading and loading of pipe, fittings, valves, and related accessories shall be performed with care so as to avoid any damage to these materials. All such materials shall not be stored directly on the ground, but shall be on pallets, or other suitable supports, so as to prevent the entry of mud and debris into the pipe or other materials. Contractors shall also endeavor to store these materials in accordance with any special practices as may be recommended by the manufacturer.

#### **b. Trench Excavation:**

Water main trenches shall be excavated to such depth that the pipe will have a minimum cover of 3 feet. Where water mains are installed in new subdivision streets, the depth of cover shall be measured from the finished subgrade. The Contractor shall do all excavation in strict accordance with all applicable OSHA regulations.

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Trench width shall be minimum of 16 inches plus the outside diameter of the pipe and a maximum of 24 inches plus the outside diameter of the pipe, unless approval for deviation from this requirement is granted by the DPW.

Where water main trench excavation is in rock, the rock shall be excavated to a minimum depth of 6 inches below the bottom of the pipe. This space shall be filled with No. 67 stone or other material approved by the DPW. Rock excavation requirements for water mains shall conform to requirements outlined hereinafter in Section 7.05 d.

In trenches where water is present or where dewatering is required, the trench bottoms shall be stabilized with No. 67 stone. When material of poor supporting value (i.e. "muck") is encountered in the trench, it shall be removed and replaced with No. 67 stone or other material approved by the DPW.

All water main trenches shall be protected from the entrance of surface water. Any water observed in the trench shall be promptly removed by pumping, provided that water pumped from trenches is directed to suitable erosion control devices to prevent deposition of sediment into nearby streams, ponds, etc. The Contractor shall use all means necessary to prevent the entrance of water, including the construction of temporary berms or dikes.

### **c. Pipe Installation:**

- 1) **General** – All water main pipe shall be clean before installation. Any dirty pipe shall be thoroughly swabbed by the Contractor. Pipe showing evidence of oil or grease contamination shall not be used.

Pipe laying and jointing shall be accomplished in strict accordance with the recommendations of the pipe manufacturer. Care shall be taken during pipe installation so as not to exceed the maximum joint deflection as prescribed below for ductile iron pipe.

### **MAXIMUM JOINT DEFLECTION IN INCHES – D. I. PIPE**

<b><u>Pipe Size</u></b>	<b><u>MJ</u></b>	<b><u>Push-On-Joint</u></b>
6"	27"	19"
8	20	19
10	20	19
12	20	19
14	13	11
16	13	11
18	11	11
20	11	11
24	9	11

The maximum horizontal deflection for C-900 PVC pipe shall be in accordance with the manufacturer's recommendations for each twenty-foot joint of pipe.

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Open ends of the pipe shall be plugged at all times that pipe laying is not in progress.

Bell ends shall generally face the direction of laying. Where water mains are installed on an appreciable slope, the DPW may require that the bell ends face upgrade.

- 2) Special Requirement – PVC Pipe Installation – All PVC pipe shall be installed with a metallic detector tape in accordance with the Standard Detail. The detector tape shall be as manufactured by Allen or Reef Industries.

### **d. Pipe Bedding:**

The barrel of the pipe shall bear uniformly upon the supporting trench bottom at all times. The foundations of ductile iron and C900 PVC water pipe shall conform to the minimum requirements described below.

- 1) Ductile Iron Pipe – shall rest on a firm and stable flat bottom trench with bell holes excavated such that the pipe rests uniformly on its entire barrel length. Refer to Standard Detail 6.01.
- 2) C900 PVC Pipe – shall rest on a firm flat bottom trench with a minimum of four inches of No. 67 stone properly compacted with bell holes. Refer to Standard Detail 6.01.

### **e. Backfilling:**

All water mains shall be backfilled in accordance with the Standard Details 6.01 as applicable. In backfilling PVC water mains, care shall be taken to ensure that the material in the “haunching” zone (up to the spring-line of the pipe) is carefully placed and compacted so that the pipe is properly supported in accordance with the pipe manufacturer’s recommendations.

No rocks, boulders, or stones shall be included in the backfill material for at least two (2) feet above the top of the pipe. In traffic areas, the final backfill shall be placed and compacted in 6-inch layers. Backfill shall be such density as to ensure no settlement of the trench.

Should any water line trench exhibit settlement, the Contractor shall correct the deficiency to the complete satisfaction of the DPW. Where a water line crosses existing State roads or other public roads, the backfill shall be compacted to at least 95% standard density as measured by AASHTO Method T-99. Where deemed necessary, the DPW may require compaction tests to be performed (at the Contractor’s expense) on backfill placed in trenches across such roads.

**For permitted open-cut water main extensions and/or tie-ins, the DPW may require that “flowable fill” be used for backfill material. If required, one (1) foot of approved natural backfill material shall be compacted over the water main per Oxford Specifications; the remaining excavated trench shall be backfilled with “flowable fill”. Within seven (7) days after the excavation has been filled, the open-cut are shall be repaired per Oxford Detail 3.05.**

## STANDARD SPECIFICATIONS

### **f. Setting Valves & Valve Boxes:**

Valves shall be set at locations shown on the plans with care being taken to support the valve properly and to accurately position the valve box over the operating nut of the valve. Where pavement is existing, the box shall be adjusted to finished street grade. When valves are located in street right-of-way, but out of pavement, the boxes shall be adjusted to finish grade a concrete collar 2 feet square and 6 inches thick shall be poured around the box ½ inch from the top of the casting, in lieu of the poured in place concrete a pre-cast concrete collar may be used such as manufactured by Brooks, Inc. or Buckhorn Products.

When valves are located outside of street right-of-way, the boxes shall be adjusted 6 inches above the finished grade, and a concrete collar 2 feet square and 6 inches thick shall be poured around the casting.

All valves used on PVC pipe shall be set on a solid precast concrete block. The blocks shall be 4-inch thick; width shall be nominal pipe size, plus 4 inches. Length shall be the length of the valve, plus 4 inches. Minimum block size shall be 8" X 16" X 4".

### **g. Setting Fittings:**

Fittings shall be installed at the location indicated on the drawings with care taken to insure that joints are fully homed and that the fittings are fully and properly supported.

### **h. Reaction Blocking:**

Fittings shall be blocked to solid, undisturbed earth with concrete. This reaction blocking shall be of sufficient size to prevent the fitting from blowing off the main at maximum test pressure, and as indicated in the Standard Details.

### **i. Setting Blow-Offs:**

Blow-offs shall be installed on all dead end lines as noted on the Plans. The blow-off assembly shall be constructed in accordance with the Standard Details.

### **j. Setting Hydrants:**

Fire hydrants shall be installed at all points indicated on the drawings and in strict accordance with the standard detail.

## **STANDARD SPECIFICATIONS**

### **6.05 Cutting & Replacement of Existing Pavements**

The open cutting of existing pavements may be permitted for water line installations across designated City streets. The cutting and replacement of such pavements shall conform to the specifications presented in Section 3.05 of these Specifications. Requested permission must be in writing to the DPW and approved, prior to cutting City maintained roadways.

### **6.07 Water Service Connections**

Water services shall be installed using only the materials as specified herein under sub-section 6.03.

Taps shall be made only on lines under pressure and after the main has been tested and chlorinated. No taps on dry lines shall be allowed, unless specific authorization is obtained from the DPW.

Taps shall be installed at an angle of 45 degrees to the vertical axis of the water main. Direct taps shall only be made in accordance with the provisions of sub-section 6.03, item "1" hereof.

Water service lines from the main line to the metering point shall be a continuous run with no intermediate connections and/or joints.

Services larger than 2 inches shall be made by using a tapping sleeve and valve.

Each service shall be flushed and disinfected after installation, all to the complete satisfaction of the DPW. The Contractor shall have the same responsibility for disinfection of service laterals as required for mains.

### **6.08 Water Meter Installations**

Water meter installations shall conform to details 6.03 through 6.05 for meter sizes through 4-inch.

Installations larger than 4-inch shall require a special detail and are subject to the review and approval of the DPW on a case-by-case basis. Such installations shall be made using ductile iron pipe, complete with bypass line. The installation may be similar to that required for a 4-inch meter except that the vault size shall be increased accordingly.

## STANDARD SPECIFICATIONS

### **6.09 Hydrostatic Testing**

No valve in the existing City of Oxford Water System shall be operated without giving a minimum 4 hours notice to the Public Works Department.

A section of line to be hydrostatically tested shall be slowly filled with water at a rate that will allow complete evacuation of air from the line.

The line shall be tested to a pressure of 200 psi as measured at the lowest elevation of the line for duration of 2 hours. The pressure gauge used in the hydrostatic test shall be calibrated in increments of 10 psi or less. At the end of the test period, the leakage shall be measured with an accurate water meter.

Pipe size and the corresponding allowable leakage (gal.) per 1000 feet of pipe are as follows:

<u>PIPE SIZE</u>	<u>ALLOWABLE LEAKAGE/1000 FT. (GALLONS)</u>
4"	0.85
6"	1.28
8"	1.70
12"	2.56
16"	3.40
20"	4.24
24"	5.10

All visible leaks are to be repaired regardless of the amount of leakage.

### **6.10 Disinfection**

All additions or replacements to the Oxford water system shall be chlorinated before being placed into service. Such chlorination must take place under the supervision of an inspector. The utility contractor performing the chlorination of the main shall be responsible for any health or environmental damage that might occur as a result of his operations.

Chlorination of a completed line shall be carried out in the following manner:

- a) Taps will be made at the control valve at the upstream end of the line and at all extremities of the line including valves. The taps shall be strategically located so as to allow High Test Hypo Chlorite (HTH) solution to be fed into all parts of the line.
  
- b) A solution of water containing high test hypo chlorite (70%) available chlorine shall be introduced into the line by regulated pumping at the control valve tap. The solution shall be of such a concentration that the line shall have a uniform concentration of 50-ppm total chlorine immediately after chlorination. The chart below shows the required quantity of 70% HTH compound contained in solution in each 1000 feet of line to produce the desired concentration of 50 ppm.

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<u>PIPE SIZE</u>	<u>POUNDS OF HIGH TEST HYPO CHLORITE (70%) PER 1000 FEET OF LINE – TO PRODUCE A 50 PPM</u>
6"	0.88
8"	1.56
10"	2.42
12"	3.50
16"	6.22

The HTH solution shall be circulated in the main by opening the control valve end systematically manipulating hydrants and taps at the line extremities. The HTH solution must be pumped in at a constant rate for each discharge rate in order that a uniform concentration will be produced in mains.

HTH solution shall remain in lines for no less than 24 hours, but longer than 24 hours if so directed by the DPW.

Extreme care will be exercised at all times to prevent the HTH solution from entering existing mains.

### **6.11 Bacteriological Sampling**

Free residual chlorine after 24 hours shall be at least 10 ppm, or the DPW will require that the lines be rechlorinated.

Flushing of lines may proceed after 24 hours, provided the free residual chlorine analysis is satisfactory. Flushing shall be continued until an orthotolidine check shows that the lines contain only the normal chlorine residual.

Within 24 hours after flushing is complete, the Contractor shall collect samples for bacteriological analysis, **under direct observation of a City inspector. Contractor is responsible for the delivery of the sample(s) to a testing laboratory certified by the NC Department of Human Resources, Division of Health Services Laboratory.** The Contractor shall furnish the DPW with a copy of the results.

In the event that three successive bacteriological tests fail, that section of the main shall be rechlorinated by the Contractor and new tests performed prior to moving to the next section of the main.

## STANDARD SPECIFICATIONS

### SECTION 7 – SANITARY SEWERS

#### 7.01 Design

##### **a. Location:**

All public sanitary sewer mains shall be within dedicated street rights-of-way or dedicated sanitary sewer easements. When sanitary sewer mains are installed in the street rights-of-way, they shall be located in the center of the pavement or right-of-way, where practical, or to the south or west side of the pavement.

In natural drainage ways, sewers shall be extended to the property line to readily enable future connection to adjoining property.

Sanitary sewers shall not be installed under any part of an existing impoundment or beneath any area to be impounded.

**A one hundred (100) foot minimum separation must be maintained from any private or public water supply source, including any WS-1 waters or Class I or Class II impounded reservoirs used as a source of drinking water. A fifty (50) foot minimum separation from waters classified WS-II, WS-III, B, SA, ORW, HQW, or SB. And ten (10) feet from any other stream, lake or impoundment.**

**If a deviation from these separations is proposed, and with prior approval from DPW, ferrous sewer main materials with joints equivalent to water main standards must be used. But in no case shall minimum separations be less than twenty five (25) feet from a private well or fifty (50) feet from a public water supply.**

Sanitary sewers shall be laid at least 10 feet laterally from the existing or proposed water mains unless the elevation of the top of the sewer is at least 18 inches below the bottom of the water main with a horizontal separation of at least 3 feet.

Where public sanitary sewer mains are installed within easements crossing private property, the City's Public Works Department shall have the right to enter upon the easement for purposes of inspecting, repairing, or replacing the sewer main appurtenances. Where paved private streets, driveways, parking lots, etc. have been installed over public sewer mains, the City of Oxford shall not be responsible for the repair or replacement of pavement, curbing, etc. which must be removed to facilitate repairs. The Public Works Department shall excavate as necessary to make the repair, and shall backfill the disturbed area to approximately the original grade. Replacement of privately owned pavement, curbing, walkways, etc. shall be the responsibility of the property owner.

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### **b. Easements:**

Minimum widths of permanent sanitary sewer easements, for public sewer mains, are:

- 8" & 10" – 20 feet wide
- 12" & 15" – 30 feet wide
- 18" & 24" – 40 feet wide

Sewer mains shall be centered in the easement. Under special conditions, temporary construction easements may be required upon approval of the Director of Public Works.

The minimum permanent combination easement width for sanitary sewer and storm sewer is 30 feet. There must be a separation of 10 feet between outside diameters of pipes and 10 feet from the centerline of the sanitary sewer to the easement line.

All sanitary sewer lines shall have an easement width during construction of not less than 40 feet.

### **c. Depth of Cover:**

All sanitary sewer mains in non-traffic areas shall be installed with a minimum cover of 3 feet measured from the finish grade to the top of the pipe. In traffic areas, the minimum depth of cover shall be 4 feet measured from finish subgrade to the top of the pipe.

The depth of sewer mains shall be great enough to serve adjoining property, allowing for sufficient grade on the sewer line. Lateral connections are to be into manholes or into the top quarter of sewer mains.

Proposed sewers paralleling a creek shall be designed to a proper depth to allow lateral connections, such that all creek crossings will be below the stream bottom elevation. The top of the sewer pipe should be at least 1 foot below the stream bed elevation.

**No bells or connections shall be within the waterway crossing area.**

For sewer mains excavated 14 feet or more, special bedding details will be required. These details must be provided to and approved by the DPW prior to installation.

Where a sanitary sewer and a water main cross, and the vertical separation is less than 18 inches or the water line passes under the sewer, both the sewer and the water main shall be ductile iron pipe for a distance of 10 feet on each side at the point of crossing. The water line pipe section shall be centered at the point of crossing.

**Transition of sewer main materials shall only occur at manholes.**

Sanitary sewers shall have the top of pipe at least 12 inches below the bottom of storm sewer pipe when the horizontal separation is 3 feet or less from existing or proposed storm sewer. Where a sanitary sewer and a storm sewer cross, and the vertical separation is less than 12

## STANDARD SPECIFICATIONS

inches, the sanitary sewer shall be ductile iron pipe equivalent to water main standards for a distance of 180 feet on each side at the point of crossing. The sanitary sewer pipe section shall be centered at the point of crossing.

### **d. Construction Drawings:**

Construction drawings for sanitary sewer collection systems shall be prepared by or under the direct supervision of a professional engineer licensed to practice in North Carolina. Drawings shall conform to the applicable requirements outlined in sub-section 1.03 of these Specifications and the guidelines established by the NC Department of Natural Resources & Community Development, Division of Environmental Management.

Plans shall indicate the deflection angles at all manholes. Profile elevations shall be on USC & GS datum and benchmarks shall be shown and described on the drawings.

### **e. Size:**

Gravity sewer mains shall be designed to serve the total natural drainage basin. Total off-site drainage area in acres must be shown on the plans. An 8-inch main shall be the minimum size permitted.

Sewers shall be designed so as to carry the total peak tributary flow at one-half of full depth (50% capacity) for sewers 15-inch and smaller, and two-thirds of full depth (approximately 75% of full capacity) for sewers 18-inch and larger.

**The minimum velocity for gravity sanitary sewer mains is two (2) feet per second. The recommended minimum velocity is three (3) feet per second. Minimum velocities less than three (3) feet per second must receive approval from DPW.**

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For residential zoning districts, sewer size shall be based on an average daily flow of 100 gpd and a peak/average ratio of 2.5 which includes an allowance for infiltration. Minimum flow per dwelling unit shall not be less than 300 gpd. Where average daily flows are less than 10,000 gpd, the peak/average ratio shall be increased to 3.0. For non-residential development, sewer size shall be based on a reasonable population equivalent applied to the same 100 gpd unit flow and peaking factors utilized for residential flow. In all cases involving on-residential flow, the project engineer shall furnish complete calculations to establish the basis for pipe sizing.

Pipe diameter changes shall occur in a manhole with the pipe crowns matched as long as a minimum drop of approximately 0.20 feet is maintained between inverts.

The minimum gradient for sanitary sewer shall not be less than the following:

<u>SEWER SIZE</u>	<u>MINIMUM SLOPE (FT/100 FT)</u>
8"	0.500
10"	0.300
12"	0.250
15"	0.160
18"	0.130
21"	0.110
24"	0.085
27"	0.075
30"	0.065

The maximum gradient for sanitary sewers shall be 10 percent, or such lesser gradient as may result in maximum velocity of 15 fps.

### **f. Manholes:**

Manholes shall be spaced a maximum distance of 400 feet apart. Manholes shall be installed at each deflection of line and/or grade with a minimum drop of 0.2 feet. Drop manholes shall be required where the difference in pipe inverts exceeds 2.5 feet in elevation.

### **g. Service Laterals:**

Service laterals may be tapped directly into the top quarter of 8-inch and 10-inch mains or manholes. Connections 6-inch and larger shall be made into manholes. Connections to sewer mains 12-inch and larger shall only be made at manholes. All individually owned structures shall require at least one sewer tap. Clean-outs for sewer services shall be located at intervals no greater than 50 feet or 4" pipe and 100 feet apart for 6" pipe.

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Multiple service connections are to be for private use only and will not be maintained by the City of Oxford. A clean-out (or manhole) shall be installed for each serviced lot's right-of-way or easement for the City's use, and shall extend a minimum of 6 inches above the finish grade. Minimum grade for service laterals shall be 1/8 inch per foot for 4-inch and 0.6 percent for 6-inch.

All service laterals shall connect directly into an 8-inch (minimum) sewer main in the fronting street or into an easement which is contiguous to the lot, or which traverses through the lot. No service lateral may cross another adjacent lot to gain access to a sewer main. Private service easements will not be permitted.

**All service laterals fourteen (14) feet and deeper shall be ductile iron or CISP material. Reference Oxford Detail 7.10.**

Service laterals to be maintained by the City shall not be located beneath a driveway; nor shall a cleanout be located in a sidewalk area. In the event that a service lateral is located beneath a driveway or other concrete area, the service lateral shall be relocated. The relocated service lateral shall be constructed perpendicular to the main line or as approved by the DPW, and the cleanout shall be positioned at the edge of the street or easement right-of-way line.

### **7.02 Pipe Materials For Gravity Sewers**

#### **a General:**

Sanitary sewer collection lines, trunk sewers and interceptors shall be constructed using any of the following materials:

#### **SEWERS 8" THROUGH 15" DIAMETER**

Vitrified Clay Pipe

Ductile Iron Pipe

PVC Pipe – SDR 35 (ASTM D3034)

Ribbed PVC Pipe (8" – 18" dia.)

#### **SEWERS 18" & LARGER**

Vitrified Clay Pipe

Ductile Iron Pipe

PVC Pipe – SDR 35  
(ASTM F-679)

Ribbed PVC Pipe (21" – 24")

Reinforced Concrete Pipe

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### **b. Vitrified Clay Sewer Pipe:**

- 1) General Requirements – Vitrified clay pipe shall be extra strength pipe complying with ASTM C700 (latest edition). Laying length of vitrified clay pipe shall not be less than 5 feet.
- 2) Joints – The ends of the pipe shall be square with their longitudinal axis, within the tolerance set forth in ASTM C700. The bell and spigot joint used for this pipe shall be of the compression joint type and conform to ASTM C425. The material used for making this type of joint shall be flexible and be resistant to the acids, alkalis, and gases generally found in a sewer.

The joint shall be a Type III material forming a single, true-round, resilient gasket or compression ring.

- 3) Manufacturer's Certification – The manufacturer of the vitrified clay pipe shall furnish an affidavit certifying as to the compliance with ASTM C700 and ASTM C425.

### **c. Ductile Iron Sewer Pipe:**

Ductile iron pipe shall be designed in accordance with ANSI Standard A21.50, latest revision. Unless noted otherwise on the drawings, the pipe thickness class may be Class 50 and shall be designed for an 8-foot minimum cover and a "Type 1" laying condition as denoted in Figure 1 of ANSI A21.50.

The ductile iron pipe shall be manufactured in accordance with ANSI A-21.51, latest revision. Pipe shall have cement mortar lining and seal coat in accordance with ANSI A21.4. Joints for ductile iron pipe shall be mechanical or of the "push-on" type conforming to the requirements of ANSI A21.11.

### **d. PVC Sewer Pipe – SDR 35:**

- 1) 8" – 15" Diameter General Requirements – 8" through 15" PVC sewer pipe for gravity flow installations shall be manufactured in accordance with all requirements of ASTM Standard D-3034 for SDR 35, "Type PSM Polyvinyl Chloride Sewer Pipe and Fittings". PVC gravity sewer pipe shall be furnished in nominal laying lengths of 12.5 feet.
- 2) 18" – 27" Diameter General Requirements – 18" through 27" PVC sewer pipe for gravity flow installations shall be manufactured in accordance with all requirements of ASTM Standard F-679, "Standard Specification for Polyvinyl Chloride (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings". Large-diameter PVC gravity sewer pipe shall be furnished in nominal laying lengths of 12.5 feet.
- 3) Materials – PVC sewer pipe (SDR-35) and fittings shall be of PVC material having a cell classification of 12454-B, as defined in ASTM D-1784. PVC of other cell classifications will not be accepted. This pipe shall be appropriately marked.

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### **f. PVC Ribbed Sewer Pipe (21" – 24" Diameter):**

- 1) General Requirements – PVC pipe in sizes 21" – 24" diameter shall have a smooth interior with a solid cross-sectional rib exterior. The pipe shall meet the requirements of ASTM F794 "Standard Specifications for Polyvinyl Chloride Ribbed Gravity Sewer Pipe & Fittings Based on Controlled Inside Diameter".

Ribbed PVC Pipe (21" – 24") shall be manufactured by J-M Manufacturing Co., Inc.

- 2) Material – The ribbed PVC sewer pipe shall be made of material having a cell classification of 12454-C or 13364-C, as defined in ASTM D-1784 "Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds".
- 3) Stiffness – The minimum "Pipe Stiffness" shall be 46 psi for all sizes when tested in accordance with ASTM D2412 "External Loading Properties of Plastic Pipe by Parallel Plate Loading".
- 4) Joints – The joints shall utilize an integral bell gasketed joint, so that when assembled, the gasket will be compressed radially on the pipe spigot to form a watertight seal in accordance with ASTM D3212 "Specification for Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals".
- 5) Laying Length – Nominal laying length shall be 13 feet.
- 6) Manufacturer's Certification – The manufacturer of PVC ribbed sewer pipe shall furnish an affidavit certifying compliance with the foregoing specification.

### **g. Reinforced Concrete Sewer Pipe:**

- 1) General Requirements – Reinforced concrete sewer pipe may only be used on interceptor lines, 18-inch and larger, and then only after review and approval by the DPW.

All concrete sewer pipe shall be reinforced and shall conform to the requirements of ASTM Specification C76, latest revision. "Standard Specifications for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe". Pipe reinforcing shall be Class III for depth of cover to 12 feet. Where depth of cover exceeds 12 feet, the pipe shall be Class IV.

Pipe laying length shall not be less than 8 feet.

- 2) Pipe Joints – Joints for reinforced concrete sewer pipe shall be of the tongue and groove type with rubber gasket, conforming to the requirements of ASTM C443.
- 3) Lining Requirements – Where recommended by the DPW, concrete pipe shall have an interior lining of coal tar epoxy, factory applied. The pipe interior shall be prepared for

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- 4) Pipe Joints – Pipe joints for PVC Sewer Pipe shall be of the bell and spigot type with rubber gasket conforming to ASTM F-477.
- 5) Manufacturer's Certification – The manufacturer of non-pressure PVC Sewer Pipe shall furnish a notarized affidavit certifying as to compliance with the foregoing ASTM Specifications and with the PVC cell classification as specified.

### **e. Ribbed PVC Pipe (8" – 18" Diameter):**

- 1) General Requirements – PVC pipe in sizes 8" – 18" diameter shall have a smooth interior with a solid cross-sectional rib exterior. Exterior ribs shall be placed perpendicular to the axis of the pipe to allow placement of the sealing gasket without additional cutting. The pipe shall meet the requirements of ASTM F-794 "Standard Specifications for Polyvinyl Chloride Ribbed Gravity Sewer Pipe & Fittings Based on Controlled Inside Diameter". Ribbed PVC Pipe (8" – 18") shall be manufactured by Extrusion Technologies, Inc.
- 2) Material - The ribbed PVC sewer pipe shall be made of material having a cell classification for 1254-B, as defined in ASTM D-1784, "Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) Compounds".
- 3) Stiffness – The minimum "Pipe Stiffness" (F/y) at 5% deflection shall be 60 psi for all sized when tested in accordance with ASTM D-2412 "External Loading Properties of Plastic Pipe by Parallel Plate Loading".
- 4) Marking – Each length of pipe shall be marked with the following information: size, company name or log, "PVC Sewer Pipe", "ASTM F794", year, manufacturer's code, cell classification.
- 5) Joints – The joints shall utilize an integral bell gasketed joint, so that when assembled, the gasket will be compressed radially on the pipe spigot to form a watertight seal in accordance with ASTM D3212 "Specification for Joints for Drain and Sewer Plastic Pipes using Flexible Elastomeric Seals".
- 6) Laying Length – Nominal laying length shall be 13 feet.
- 7) Manufacturer's Certification – The manufacturer of PVC ribbed sewer pipe shall furnish an affidavit certifying compliance with the foregoing specification.

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lining after sandblasting according to SSPC-SP-10 Specifications. The lining shall be applied so as to provide a physical-chemical adhesion with the pipe wall. The epoxy shall be applied in strict accordance with the manufacturer's recommendations so as to develop a minimum dry film thickness of 40 mils. The coal tar epoxy lining shall be Indurall Coatings, Inc. "Ruff-Stuff", Koppers Company, Inc. "Bitumastic No. 300-M" or equal.

In lieu of a coal tar epoxy lining, the pipe manufacturer may substitute a polyethylene lining. The polyethylene compound shall conform to ASTM D1248. The polyethylene compound shall be applied in accordance with the manufacturer's recommendations to achieve a nominal thickness of 50 mils.

- 4) Manufacturer's Affidavit – The pipe manufacturer of reinforced concrete pipe shall submit an affidavit certifying compliance with the Specifications.

### **h. Steel Pipe:**

- 1) For aerial Crossings & Miscellaneous Special Uses Where Approved by the DPW – Steel pipe shall be high strength steel, welded or seamless manufactured in accordance with ASTM A139 and consisting of grade "B" steel with a minimum yield strength of 35,000 psi. On 8- and 10-inch pipe, the minimum wall thickness shall be 0.375 inches.

The outside of the pipe shall have one shop coat of epoxy primer. The pipe shall receive a field touch up primer and two (2) field coats of black coal tar epoxy.

Pipe ends shall be square so as to receive a Dresser style "62" – Type I or approved equal mechanical transition coupling.

- 2) For Bored Casings – Steel encasement pipe shall be welded or seamless, consisting of grade "B" steel with a minimum yield strength of 35,000 psi and manufactured in accordance with ASTM A139.

The pipe thickness shall be as specified on the encroachment agreement or approved plans, and the ends shall be beveled and prepared for field welding of the circumferential joints.

**Metal fabricated "spiders" shall be used for support of the carrier pipe within the bored casing.**

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### **7.03 Manholes & Accessory Materials**

#### **a. General Requirements:**

All new manholes shall be of precast concrete construction. Brick or block masonry units may only be used for the lower portion of manholes where required for tie-ins to existing sewers.

**The following minimum diameter manholes shall be utilized dependent upon the size of the mains and depth of installation.**

<u>DIAMETER MANHOLE</u>	<u>PIPE SIZE</u>	<u>OR</u>	<u>DEPTH</u>
4' - 0"	8" to 12"		0' to 12'
5' - 0"	15" to 30"		12' - 18'
* 6' - 0"	* + 30"		+ 18'

\* or as directed by DPW

**Variance from this specification must be approved by the DPW prior to construction. Each manhole shall be of consistent diameter throughout its entire height.**

**Inside drop manholes shall be a minimum five (5) foot diameter. If more than one (1) inside drop occurs within the same manhole, a six (6) foot diameter manhole is required.**

#### **b. Precast Manholes:**

- 1) Design – Precast concrete manholes shall be designed and manufactured in accordance with ASTM C478. The manhole walls shall be a minimum of 5 inches thick and the base slab shall have a minimum thickness of 6 inches. The minimum compressive strength of the concrete shall be 4,000 psi. The manhole sections shall have reinforcement as required to provide resistance to the hydrostatic and passive earth pressures to which they will be subjected, and to provide adequate resistance to temperature and shrinkage cracking.

All manholes shall be equipped with a flexible watertight connection and sealing system for all pipe penetration 6-inch and larger.

- 2) Joints – Manhole sections shall have a standard tongue and groove joint with a rubber "O" ring, conforming to ASTM Standard C-443.
- 3) Cone Sections – The upper precast cone sections shall be of the eccentric type with a minimum height of 32 inches. Concentric cones and/or flat top slabs may be used where required for shallow manholes.

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### **c. Manhole Steps:**

Manhole steps shall be constructed of a slip resistant reinforced molded polypropylene plastic shell. Reinforcing shall be of single 3/8" steel bar, ASTM 615 grade 60. The steps shall be equal in all respects to step PS-1 as manufactured by M.A. Industries, Inc. or equivalent product by Oliver Tire & Rubber.

### **d. Manhole Ring and Cover:**

Manhole ring and cover shall meet the requirements of ASTM Specification for Gray Iron Castings, latest edition for Class 30. Minimum weight for the ring and cover shall be 190 lbs. and 120 lbs. respectively. The cover shall be perforated with 2 -1" diameter holes unless otherwise noted on plans. Where deemed necessary in low areas of streets, solid manhole covers may be required by the DPW to prevent surface water inflow into the sewer.

### **e. Mortar:**

Mortar used in manhole invert construction shall consist of one part Portland Cement and two parts sand. Portland Cement shall meet the requirements of the latest ASTM Specification C-150, Type I. Sand used for mortar shall meet the requirements of ASTM Specifications C-144, latest edition. Mortar shall be mixed in a clean, tight mortar box or in an approved mechanical mixer and shall be used within 45 minutes after mixing.

### **f. Flexible Sealing System for Joining Pipes of Precast Manholes:**

Each connection to a manhole shall be sealed watertight by means of a flexible sleeve or gasket type sealing system. The flexible sleeve type system, if used, shall be equal to Flexible Manhole Sleeve as manufactured by the Interpace Corporation. The gasket type system, if used, shall be equal to the PSX system as manufactured by the Press Seal Gasket Corporation. The sealing system shall be furnished by the manhole manufacturer.

### **g. Stone for Stabilization of Trench Foundation:**

Stone used for pipe bedding and trench stabilization shall meet the graduation requirements of table 1005-1 for standard aggregate size number 67 as contained in Section 1005 of the Standard Specifications for Roads and Structures as published by the NC Department of Transportation – latest edition.

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### **7.04 Service Lateral Materials**

#### **a. General Requirements:**

All sewer service laterals shall be constructed of either of the two types of materials indicated herein. The use of lightweight PVC (SDR 23.5) shall not be permitted.

Prior to beginning work, the Contractor shall furnish samples of service material fittings to the DPW for approval. Samples shall include saddles, wyes, cleanouts, adapters, couplings, etc.

#### **b. Cast Iron Soil Pipe & Fittings:**

Cast iron soil pipe and fittings shall be coated, service weight pipe meeting Federal Specification WW 401. Joints shall be compression type per ASTM C425.

#### **c. PVC Service Pipe & Fittings:**

PVC pipe and fittings for sewer laterals shall conform to ASTM D2665 "PVC" Plastic Drain, Waste & Vent Piping" and shall be Schedule 40 and NSF approved. Laying lengths may be 10 or 20 feet. Joints shall be of the solvent weld type.

#### **d. Service Saddles on VCP & DIP Sewers:**

Service saddles or connection for laterals of VCP or DIP sewers shall be cast iron. 45-degree deflection, equipped with a single stainless steel clamp. The saddle shall be furnished with adapters as required to properly receive the service pipe to be used.

#### **e. Saddles for PVC Sewer Pipe:**

Saddles for PVC sewer pipe shall be of PVC material, 45-degree deflection, conforming to the requirements of ASTM D3034. The saddle shall be equipped with two (2) stainless steel clamps and bell adapters as required to properly receive the service pipe to be used. The saddle service branch shall stub slightly into the sewer main so that when installed, the saddle shall not slip or rotate.

#### **f. Saddles for Ribbed PVC Sewer Pipe:**

Service saddles for ribbed PVC sewer pipe will not be allowed for new construction. Connections, due to existing conditions, shall be made only by means of an in-line wye fitting.

### **7.05 Trench Excavation and Preparation**

#### **a. General Requirements:**

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The pipeline trench shall be excavated to the line and gradient shown on the approved drawings. The minimum width of the trench as measured at the top of pipe shall be the outside diameter of the pipe bell, plus 8 inches on each side. The maximum trench width measured at the top of the pipe shall not exceed the outside diameter of the pipe bell, plus 12 inches on each side.

The length of trench which may be open ahead of pipe laying operations shall be no more than 100 feet and no less than 20 feet unless warranted by special circumstances, and then only upon approval of the DPW.

The trench bank shall be vertical from the bottom to a point not less than one foot above the top of the pipe. The Contractor shall do all bracing, sheeting, sloping of bank, shoring, pumping, etc., as required to prevent caving of the banks, all in strict accordance with applicable O.S.H.A. regulations. Trench sheeting shall be cut off and left in place where its removal might adversely affect the sewer pipe installation.

During trench excavation operations, the Contractor shall endeavor to separate the excavated materials by soil types, so that the better materials (if any) may be used in the bedding, haunching, and initial backfill zones.

### **b. Dewatering:**

The ground adjacent to the excavation shall be graded to prevent surface water from entering the trench. The Contractor will, at his expense, remove by pumping or other means approved by the DPW, any water accumulated in the trench and shall keep trench dewatered until bedding and pipe lying are complete. When water is pumped from the trench, the discharge shall follow natural drainage channels. Proper erosion control measures shall be employed for prevention of siltation.

### **c. Rock Excavation:**

Where rock is encountered, the trench shall be excavated to a depth of not less than 6 inches beneath the bottom of the pipe and then refilled with No. 67 stone. For ductile iron sewer pipe, vitrified clay pipe, or cast iron soil pipe, the bedding may be other native granular soil as may be approved by the DPW. The trench width in rock excavation shall be as previously specified.

### **d. Blasting Procedures:**

Blasting for trench rock may be initiated only after the permitting requirements prescribed in Section 2.04 of these Specifications have been complied with. The Contractor is also reminded of the work hour limitations for blasting, as also established in Section 2.04.

Blasting Procedures shall conform to all applicable local, state, and Federal laws and ordinances. The Contractor shall take all necessary precautions to protect life and property, including the use of an approved blasting mat where there exists the danger of throwing rock or overburden. The Contractor shall keep explosive materials which are needed on the job site in specially constructed boxes provided with locks. These boxes shall be painted red and plainly identified

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as to their contents. After working hours, the boxes containing explosive materials shall be removed from the job site.

Failure to comply with these specifications shall be grounds for suspension of blasting operations until full compliance is made. No blasting shall be allowed unless a galvanometer is employed to check cap circuits. Where blasting takes place within 500 feet of a utility, structure, or property which could be damaged by vibration, concussion, or falling rock, the Contractor shall be required to keep a blasting log containing the following information for each and every shot:

1. Date of shot
2. Time of shot
3. Foreman's name
4. Number and depth of holes
5. Approximate depth of overburden
6. Amount and type of explosive used in each hole.
7. Type of caps used (instant or delay)
8. The weather

This blasting log shall be made available to the DPW upon request and shall be kept in an orderly manner. Compliance by the Contractor with these specifications does in no way relieve him of legal liabilities relative to blasting operations.

The DPW reserves the right to require removal of rock by means other than blasting where any utility, residence, structure, etc. is either too close to, or so situated with respect to the blasting as to make blasting hazardous.

### **e. Excavation in Unstable Material:**

In trenches where water is present or where dewatering is required, the trench bottom shall be undercut and stabilized with No. 67 stone, having a minimum depth of 8 inches.

### **7.06 Soils Classifications – for Bedding and Backfill**

Soils for pipe bedding and backfill are described in the ASTM D 2487 Figure 1 soils classification chart and for purposes of these specifications are grouped in (5) categories as follows, according to their suitability for this application:

#### **a. Class I Soil:**

Angular, 6 to 40 mm (1/4 to 1 1/2 in.), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.

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### **b. Class II Soil:**

Course sands and gravels with maximum particle size of 40 mm ( 1 ½ in.), including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. Soil types GW, GP, SW, and SP are included in this class.

### **c. Class III Soils:**

Fine sand and clayey gravels, including fine sands, sand-clay mixtures, and gravel-clay mixtures. Soil types GM, GC, SM, and SC are included in this class.

### **d. Class IV Soil:**

Silt, silty clays, and clays, including inorganic clays and silts of medium to high plasticity and liquid limits. Soil types MH, ML, CH, and CL are included in this class. These materials are not recommended for bedding, haunching, or initial backfill on PVC sewer pipes.

### **e. Class V Soil:**

Include the organic soils – types OL, OH, and PT, as well as soils containing frozen earth, debris, rocks larger than 1 ½” diameter, and other foreign materials. These materials are not recommended for bedding, haunching, or initial backfill for any of the accepted sewer pipe materials.

## **7.07 Pipe Bedding Classes – Definition**

For these specifications, pipe-bedding classes shall be those classes as defined below:

**a. Class “D” Bedding** is that condition existing when the ditch is excavated slightly above grade and cut to finish grade by hand. Bell holes are dug, and the pipe bears uniformly upon the trench bottom. Soil is tamped to 90% of maximum Proctor Density (ASTM T-99) around the pipe and to a point one foot above the pipe; the remainder of the soil to ground surface is compacted to specified density.

**b. Class “C” Bedding** is that condition existing when the trench bottom is undercut a minimum of 4 inches below the pipe bell and filled to pipe grade with No. 67 stone in such a manner that the pipe will be bedded in stone to a vertical height of one-sixth the outside diameter of the pipe barrel. The remainder of the soil to ground surface is compacted to specified density.

**c. Class “B” Bedding** is that condition existing when the trench bottom is undercut a minimum of 4 inches and No. 67 stone is placed in the trench in such a manner that the pipe is bedded to the pipe spring line in stone. Soil of a granular nature is placed to the top the pipe and compacted to 90% of maximum Proctor Density (ASTM T-99). Soil is then compacted to specified density to ground surface.

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**d. Class "A" Bedding** is that condition existing when the trench bottom is undercut a minimum of 4 inches and the pipe bedded in No. 67 stone to the spring line. The top half of the pipe is then covered with a monolithic arch or reinforced, 2000 psi concrete, extended to a point at least 4 inches above top of pipe barrel. Backfill is compacted to a specified density to ground surface.

### **7.08 Pipe Bedding Requirements – Vitrified Clay Pipe, Ductile Iron Pipe, Cast Iron Pipe, Reinforced Concrete Pipe**

The trench bedding for these sewer pipe material shall be Class "D" as defined under Section 7.07 hereof.

### **7.09 Pipe Bedding Requirements – PVC Sewer Pipe – SDR 35, or Ribbed PVC Sewer Pipe**

The trench bedding for these sewer pipe materials shall be Class "B" as defined in Section 7.07 hereof – i.e. No. 67 Stone from 4 inches beneath pipe to the spring line.

### **7.10 Pipe Bedding Requirements – Schedule 40 PVC Service Pipe**

The trench bedding for Schedule 40 PVC Service Pipe shall be Class "C", defined under Section 7.07 hereof, i.e. – 4" stone bedding.

### **7.11 Unloading and Storage of Pipe Materials**

The unloading and loading of all pipe, fittings, and other accessories shall be in accordance with the manufacturer's recommended practices and shall at all times be performed with care to avoid any damage to the material.

Once on the job site, all materials shall be stored in accordance with the manufacturer's recommendation practices, and within the limits of the Project site.

### **7.12 Pipe Laying**

After the trench bedding has been prepared and properly shaped and bell holes excavated as required, the gravity sewer pipe, including service laterals, shall be installed so as to have a full and uniform bearing throughout its entire length. Sewer pipe shall be installed in strict accordance with the manufacturer's recommendations and the requirements of these Specifications. Pipe shall be carefully handled and in no case shall pipe be duped or dropped into the trench. Any damaged pipe shall be rejected and replaced.

All gravity sewer lines and manholes shall be laid to the line and grade shown on the approved drawings with no deviations whatsoever unless approved by the DPW. Laser equipment shall be used by the Contractor for maintaining proper alignment. The installation shall begin at the downstream end of a sewer segment and progress upstream.

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The pipe interior shall be kept clean throughout the pipe laying operation. Pipe ends shall be plugged at the end of each workday. Plugs shall be watertight to prevent the entrance of foreign matter into the pipe.

Where a sewer line crosses an existing or proposed water line or water service line, the sewer shall always be installed beneath the water line, with a minimum separation of 18 inches. The Contractor shall locate the conflicting water main or service sufficiently far in advance to ensure that the sewer can be laid at the proper gradient and meet the 18 inch separation requirement. If this separation cannot be attained, then both the water line and the sewer line shall be constructed of ductile iron pipe. With joints equivalent to water main standards, for a distance of not less than 10 feet on each side of the crossing.

### **7.13 Backfilling**

#### **a. General:**

Backfilling shall be completed as soon as possible, so as to minimize the length of time that the trench or any part thereof is left open. Material classification for backfill materials as may be noted hereinafter shall conform to the allowable soil classifications as defined in Section 7.06 hereof.

#### **b. Backfilling- Vitrified Clay Pipe, Ductile Iron Pipe, C.I. Soil Pipe, Reinforced Concrete Pipe:**

These pipe materials shall be backfilled with suitable native materials. The initial backfill to a point of 12 inches above top of the pipe shall be placed in shallow 6-inch layers, individually compacted. See last paragraph of this section for the final backfill requirements.

#### **c. Backfilling – PVC Sewer Pipe – SDR 35, or Ribbed PVC Sewer Pipe:**

The initial backfill for these pipe materials shall be Class I, Class II, or Class III soils placed in 6-inch layers to a point 12 inches above the top of the pipe. No soils in the Class IV group may be utilized for the initial backfill of these pipe materials. The initial backfill placed directly over the top of the pipe should receive very little tamping to avoid disturbing the embedded pipe. This initial backfill zone shall extend to a point 12 inches above the top of the pipe. If there is a question as to soils classification, the Contractor shall have representative samples of the soil(s) classified by an approved testing laboratory to ensure that Class IV materials have been excluded from the initial backfill zone. See last paragraph of this section for final backfill requirements.

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### **d. Backfilling – Schedule 40 PVC Service Pipe:**

The initial backfill for this pipe material shall be Class I, Class II, Class III or Type ML and CI soils in the Class IV grouping, placed in 6 inch layers with extreme care taken to ensure that the material in the “haunching” zone (up to the spring-line of the pipe) is carefully and properly placed and compacted as necessary to ensure that the pipe is properly supported in accordance with the manufacturer’s recommendations. This initial backfill zone shall extend to a point 12 inches above the top of the pipe. See last paragraph of this section for final backfill requirements.

### **e. Final Backfill – All Pipe:**

The remaining or final backfill for all pipe materials shall be suitable native material placed and compacted in layers not to exceed 12 inches. No rocks, boulders, or stones shall be included in the backfill material for at least two (2) feet above the top of the pipe. In traffic areas the final backfill shall be placed and compacted in 6-inch layers. Backfill shall be of such density as to ensure no settlement of the trench. Should any sewer trench exhibit settlement, the Contractor shall correct the deficiency to the complete satisfaction of the DPW. Where the sewer pipe is placed in public roads the backfill shall be compacted to at least 95% standard density as measured by AASTHO Method T-99. Where deemed necessary, the DPW may require compaction tests on backfill placed under State roads or other public roads. The cost for such tests shall be borne by the Contractor or Developer.

## **7.14 Manhole Construction**

### **a. General:**

Precast concrete manholes shall be set true to the alignment and elevations indicated on the plans. The monolithic base section shall be set on an 8” thick, No. 67 stone base. Inlet and outlet piping shall be connected using the gasket seal system as previously specified, in strict accordance with the manufacturer’s recommendation.

Backfill around manholes shall be placed uniformly in shallow layers and thoroughly compacted with mechanical tampers and with care taken to ensure against displacement of the structure.

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Inverts shall be constructed in all manholes and shall be of concrete or other approved masonry construction. The inverts shall be shaped to form a smooth and regular surface free from sharp and jagged edges. The benches shall be sloped so as to prevent sedimentation. The inverts from intercepted cross lines shall be tied into the main flow line wherever possible, so as to provide a smooth transition. Wherever such cross lines tie-in at a substantially higher elevation than that of the downstream invert, the connecting line shall extend into the manhole a sufficient distance to enable the flow to spill into the flow line rather than onto the invert bench.

**NOTE – DEAD END MANHOLE:** On dead end manholes receiving service connections, the invert must be constructed and the invert flow line shall extend through the manhole so that all flow entering the manhole shall be readily conveyed downstream.

The manhole rings shall be set in full mortar beds. The rings with covers shall be set to the final grade indicated on the plans or as may be directed by the DPW. Any rings and covers not conforming to the correct grade shall be adjusted as required by the Contractor.

The exterior surface of all manholes shall be thoroughly cleaned of all grease, dirt, etc. All lifting lugs shall be removed and holes patched thoroughly with non-shrink mortar, color to match that of the manhole where such patches are exposed.

### **b. Special Provisions – Drop Manholes:**

Where the drop manholes are noted to the Drawings, they shall be constructed in accordance with the Standard Detail 7.07. Drop pipe and fittings shall be ductile iron. The sewer pipe entering the drop tee shall consist of one joint of ductile iron pipe.

### **7.15 Construction of Sewer Service Laterals – Additional Provisions**

Connection to the sewer main shall be made by means of a special saddle and 1/8 bend as previously specified and shown on the detail and specifically designed to fit the sewer pipe selected. The inlet connection shall include any required adapters to accommodate the selected service pipe material.

The saddle shall be installed in strict accordance with the manufacturer's recommendations and shall be properly bedded and backfilled so as to prevent slippage or rotation on the sewer main.

The service lateral shall terminate with a combination wye and 1/8 bend. A vertical riser shall extend and project slightly above grade (6 inches nominal). The riser shall terminate with a removable plug.

All specifications previously presented relative to bedding and backfill shall apply. Four-inch service pipe shall be laid on a gradient of not less than 1/8 inch per foot. Minimum gradient for 6-inch pipe shall be 0.6 percent.

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Where service laterals connect to a manhole, an invert shall be constructed wherever possible to provide a smooth flow line. Where the drop is 30 inches or greater, a service drop connection with cleanout shall be provided in accordance with the standard detail.

### **7.16 Installation of Steel Casing Pipes by Boring & Jacking**

Steel casing pipe to be installed by simultaneous boring and jacking shall be constructed to the required standards of the NC DOT. For railroad crossings, the construction requirements shall conform to the requirements of the affected railway company.

The project drawing shall show a plan and profile for each casing pipe to be installed. The plan shall clearly note the casing pipe wall thickness and length. For railroad crossings, the Contractor shall be certain that a proper license agreement has been obtained and that any special insurance requirements are complied with.

### **7.17 Cutting & Replacement of Existing Pavements**

The City of Oxford may allow open-cuts of existing bituminous pavement of City streets. Where bituminous pavements are open-cut, the pavement shall be restored with pavement replacement conforming to the detail shown on the approved drawings. Prior to open-cutting of the roadway, approval by DPW and/or NCDOT must be obtained in writing.

Open-cut of concrete pavement may also be permitted where required at existing private driveways. Concrete pavement shall be restored with pavement replacement conforming to the standard detail and to the complete satisfaction of the affected property owner.

The pavement shall be cut to true neat lines, with cutting equipment as may be approved by the DPW, and in such a manner as not to damage the pavement outside the cutting line. The cut pavement shall then be broken up as necessary and then hauled away before trench excavation is begun to prevent its being mixed with the excavated material which would be used for backfill. The edge of the pavement cut shall be at least 12 inches beyond the edge of the trench line.

Specifications previously presented relative to excavation, bedding, and backfilling shall apply with special care taken to ensure that backfill material is of select quality, and is placed and compacted in shallow 6-inch lifts.

After completion of the trenching and pipe laying operations, the backfill shall be brought to the required subgrade depth, from which point, the remaining depth (8" – 12") shall be backfilled with Aggregate Base Course, compacted in two lifts. The base course shall remain for a minimum of four (4) days prior to placement of paving, so as to allow for further natural settlement which may result from normal traffic.

When final settlement is obtained, a portion of the aggregate base course (ABC) shall be removed as required to accommodate the final pavement section. All materials and pavement

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placement methods shall be in strict accordance with the requirement of the NC DOT – Standard Specifications for Roads & Structures, latest edition.

### **7.18 Inspection & Testing of Gravity Sewers**

#### **a. Visual Inspection of Pipeline Interior:**

Upon completion of any designated portion of the sewer lines, a visual inspection of the pipeline interior shall be conducted by the DPW in the presence of the Contractor. The test shall be conducted by flashing a light between manholes, by use of mirrors, or by such other devices as will allow an adequate inspection of the line to detect misalignment or structural defects. Any portion of the line which does not exhibit a true alignment and uniform grade, or which shows any defect shall be corrected to the complete satisfaction of the DPW.

The DPW may re-inspect the line at any time prior to final acceptance if any damage or displacement is suspected to have occurred subsequent to the initial inspection.

#### **b. Low Pressure Air Tests:**

Portions of the sewer lines which do not exhibit a ground water problem during construction shall be subjected to a low pressure air test. The portions of the line to be so tested shall be as determined by the DPW.

The low pressure air testing shall be conducted in accordance with ASTM C-828. Prior to testing, the sewer line shall be clear of debris and flushed with water as necessary. The line shall be plugged and the plugs shall be securely braced to prevent slippage. The line shall be pressurized with air to 5 psi and allowed to stabilize for a period of two (2) minutes.

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To simplify the ASTM procedure, the following table shall be used to determine the test time. If there are multiple sizes, add the various times together.

<u>Normal Pipe Size</u> <u>Inches</u>	<u>Time (t) – Minutes/100ft.</u>
4	0.3
6	0.7
8	1.2
10	1.5
12	1.8
15	2.1
18	2.4
21	3.0
24	3.6
27	4.2
30	4.8
33	5.4
36	6.0
42	7.3

If the pressure stays at 5 psi for the required test time length as noted above, the pipe is acceptable.

Should the section of pipe being tested fails to meet these requirements, the source of leakage shall be determined and repaired. The section shall then be retested until it is deemed to be acceptable.

The Contractor shall furnish all plugs, compressors, hose, gauges, etc., as required to conduct the low pressure air test.

### **c. Infiltration Tests:**

Portions of the sewer lines which exhibit a higher ground water table during construction shall be tested for infiltration. The portions of the line to be infiltration testes shall be determined by the DPW.

The portion of the sewer line designated by the DPW shall be tested for infiltration by installing a V-notch weir or other suitable measuring device in the downstream end of the pipe to be tested. When a steady flow occurs over the weir, the rate of flow (infiltration) shall be measured. The rate thus measured shall not exceed 100 gallons per 24 hours per inch of sewer pipe diameter per mile of pipe. Weirs and other equipment required for infiltration tests shall be furnished by the Contractor and the tests shall be performed in the presence of the DPW.

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Should the infiltration tests reveal leakage in excess of the allowable, the leaking joints shall be re-laid if necessary or other remedial construction shall be performed by and at the expense of the Contractor. The section of sewer thus repaired shall then be retested to determine compliance with the Specifications.

**d. Deflection Testing of PVC Sewer Pipe (SDR-35):**

If PVC Sewer Pipe (SDR-35) is used for gravity sewer, a deflection test shall be conducted on all such pipe installed. These pipes shall be mandrelled with a rigid device sized to ensure that the final long term deflection or deformation of pipe barrel has not exceeded 5 percent for PVC sewer pipes.

The mandrel (Go/No-Go) device shall be cylindrical in shape and constructed with nine or ten evenly spaced arms or prongs.

The outside diameter of the mandrel shall be as shown below for 8-inch PVC Pipe. The mandrel diameter shall have a tolerance of + or -0.01". Contact length shall not be less than 2 inches.

<b>MANDREL DIMENSIONS</b>	
<b><u>Main Size</u></b>	<b><u>PVC Sewer</u></b>
8"	7.28"
10"	9.08"
12"	10.79"
15"	13.20"

The contact length of the mandrel shall be at least 2 inches.

Any lines not meeting this test shall be corrected by the Contractor and the test repeated.

Allowances for pipe wall thickness tolerances or ovality shall not be deducted from the "D" dimension but shall be counted in as part of the deflection allowance.

The mandrel shall be hand pulled by the Contractor through all PVC sewer lines. Any sections of sewer not passing the mandrel shall be uncovered and the Contractor shall reround or replace the sewer to the satisfaction of the DPW. These repaired sections shall be retested.

The initial inspection shall be conducted no earlier than thirty (30) days after reaching final trench backfill grade. Deflection testing shall be accomplished at such times as may be directed by the DPW. Upon completion of all work, the DPW may require such final deflection testing as may be deemed necessary to ensure that the long term deflection has not exceeded the allowed maximum deflection allowance.

The mandrel shall be approved by the DPW. Drawings of the mandrel with complete dimensions shall be furnished by the Contractor to the DPW.

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Any portions of the sewer lines not meeting the test shall be corrected by the Contractor and the test repeated.

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### **SECTION 8 – WASTEWATER PUMPING STATIONS & FORCE MAINS**

#### **8.01 General**

In situations where gravity flow is not feasible, the City will consider the installation of a wastewater pumping station and a force main. Certain factors must be addressed by the developer for the project for consideration by the City Of Oxford. The factors include:

1. Determine the wastewater flow that would be generated by the total natural drainage basin based upon the existing zoning. Design flow factors for this use are found in Section 7.01 (d) of these Specifications. Specifications.
2. Evaluate the capacity of the receiving sewer main at the point of discharge and downstream to determine that the line could handle the transformed sewer flow.
3. Perform a cost analysis of the pumping versus gravity alternative to demonstrate that gravity service is not feasible. The estimated installed cost of gravity alternative must be not less than 3.5 times more costly than the pumping station alternative in order for the City to allow a pumping station.

The above information shall be furnished to the DPW for consideration. The DPW, in collaboration with the City Manager and the Engineer shall determine whether a pumping station will be permitted. In no case shall a pump station be sited in the 100-year flood plane.

#### **8.02 Design**

##### **a. General Requirements:**

Site or subdivision plans which propose a wastewater pumping station shall show in summary form the number of lots or units served, the off-site drainage area and zoning, the average daily flow, peak daily flow, and the rated capacity of pumps at a specified total dynamic head.

Pump stations may be either of the following types:

1. Flooded Suction – Package – Type Dry Pit Pump Station
2. Submersible Pump Station with guide rail pump removal system
3. Submersible Grinder Pump Station – These stations may only be considered where their use will be temporary and where they will ultimately be replaced with permanent gravity facilities and/or permanent pumping station. In all such cases where grinder pumping stations are allowed, they shall be privately operated and maintained.

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Such temporary grinder pump stations may only be used upon written approval of DPW. All stations shall have a minimum of two (2) pumps of equal capacity, and shall be capable of handling flows in excess of the expected peak flow. Where three or more pumps are required, they should be of such capacity that with any one unit out of service, the remaining units will have capacity to handle peak sewage flows. Pumps shall be sized to provide a minimum velocity in the force main of 2.5 psi.

Wastewater pumping stations, structure, controls, etc. shall be protected from physical damage by the 100-year flood. Stations shall remain fully operational and accessible during the 25-year flood. The 100-year flood elevation shall be shown on all site plans.

### **b. Standby Power:**

All wastewater pumping stations shall be equipped with an automatic alternative power source. Alternative power sources include on-site standby power generator or dual power feed from a separate electric substation.

### **c. Site Work:**

The site work shall be generally level graded to remove runoff from site in a non-erosive manner. Drainage swales shall be provided to direct drainage away from the site.

The site shall be stabilized by concrete slab or pavement, crushed stone, low maintenance vegetative ground cover or other suitable materials.

The site area shall be secured by a 6-foot high chain link fence topped with three (3) strands of barbwire. Fence products shall be only new materials using hot dipped galvanized iron or steel components and aluminum coated fabric after fabrication. Gates shall permit 180 degree opening and located so as to provide vehicle accessibility to lift the pumping units. There shall be a minimum gate opening of twelve (12) feet to facilitate truck access.

An all-weather (stone base) access road shall be provided to the pumping station site. The road shall be constructed of Aggregate Base Course, compacted to 8" minimum thickness, and shall be a minimum of 10 feet in width, with shoulders and side ditches, as applicable. The maximum roadway grade shall be 10 percent. The site shall feature adequate turn around areas for service vehicles.

A 150-watt high-pressure sodium light fixture shall be strategically located upon a lighting standard or timber utility pole. The light fixture shall be operated by a circuit breaker in the main control panel; or if a timber pole is used, a pole mounted disconnect switch shall be installed. Mounting height shall be 20 feet (minimum) above finished grade.

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### **d. Odor Control:**

An adequate odor control facility may be required at a proposed waste water pump station where deemed necessary by the DPW. This type of facility will be required when lengthy detention times are anticipated thus creating anaerobic conditions resulting in the release of hydrogen sulfide gas. Detention time, length of the force main, slow build out of design capacity, etc., will factor in this determination.

### **e. Piping & Valves:**

Suction and discharge piping shall be ductile iron flanged pipe designed and manufactured per AWWA Specifications C150 and C151.

A check valve and a plug valve shall be provided for the discharge line of each pump. Valves shall be rated for 175 psi (minimum) working pressure. Plug valves shall have full port openings equal to 100% of the adjacent pipe area and shall be capable of passing a 3-inch solid. Check valves and plug valves shall be mounted in the horizontal position. Upon approval of the DPW, gate valves may be used in lieu of plug valves for discharge sizes 6" and smaller.

All piping, couplings, fittings, valves, etc. shall be Class 125 flanges meeting ANSI B16.1 Specifications, unless class 250 flanges are required for high head installations.

Piping shall be designed to provide adequate thrust restraint during pump operating cycle.

### **f. Structural:**

All pump station structures shall be designed to withstand the hydrostatic forces that they will be subjected to, including uplift.

Cover slabs for wet well and valve vaults shall be reinforced concrete with integral cast in place access hatch covers. Cover slabs shall be reinforced as per ACI Code and specially reinforced around openings. Access covers shall be double leaf or single leaf (as required) aluminum diamond pattern floor hatch of ¼ inch (minimum) thickness capable of withstanding 150 psf without permanent damage. Each leaf shall open 90 degrees and be attached to the frame by steel hinges. The door shall have a lock in the open position and vinyl grip handle to release lock for closing.

A separate valve vault shall be required for submersible pump stations. The valve vault shall consist of a precast manhole base section, or a cast-in-place custom built section, or a precast rectangular structure all complete with drain, access ladder or steps, and access cover cast in the structure roof.

Wet well structures may be cast in place reinforced concrete or precast concrete construction. If precast manhole units are utilized, they shall conform to the requirements of ASTM C478, with watertight joints per ASTM C443 with durable mastic sealing compound. Special requirements of wet wells for submersible pumping stations are noted in Subsection 8.03 hereof.

## STANDARD SPECIFICATIONS

### **g. Wet Well Features:**

- 1) Vents – All wet well structures shall have screened vents to allow the escape of gases and to enable air intake during pump down. Vents shall be of ductile iron flanged elbows with an insect screen at the exposed end of the vent. The insect screen shall be of bronze or aluminum mesh.
- 2) Ladders – Each wet well shall be equipped with aluminum ladders or standard manhole steps as specified to enable access.
- 3) Waterproofing – Precast structures shall have a coal tar epoxy material applied to the outside of all tongue and groove joints. Prior to backfilling the wet well structure, the entire surface shall receive one (1) coat of coal tar epoxy. The coal tar epoxy material used for exterior coating shall meet the requirements of Corps of Engineers Specification C-200 and shall be Bitumastic No. 300M as manufactured by Koppers or equal as approved by the DPW. The coal tar exterior coating shall be applied to as to achieve a dry film thickness of not less than 10.0 mils. The exterior surface shall be clean and dry prior to application of the coating.
- 4) Interior Corrosion Protection – The interior surface of the wet well shall be thoroughly cleaned of all oils, laitance, dirt, loose concrete, etc. All voids or surface blemishes shall be filled or repaired using Portland cement grout. The joints of precast units shall receive three (3) coats of Portland cement grout so as to achieve a smooth surface at each joint. After the interior patching has thoroughly dried, the entire surface of the wet well interior shall receive two (2) successive coats of coal tar epoxy material meeting requirements of Corps of Engineers Specification C-200. The coal tar epoxy coating shall have a minimum dry film thickness of 10 mils per coat – 20 mils total. Coal tar epoxy material used for interior coating shall be equal to Bitumastic No. 300M as manufactured by Kopper's, or equal as approved by the DPW. If material other than Koppers is proposed, it shall be approved by the DPW prior to use.

All bolted connections (including pipe flanges) inside the wet well shall be made using stainless steel bolts, nuts and washers.

- 5) Handrail Around Hatch Opening – Submersible Pumping Stations – An aluminum handrail shall be provided around the wet well opening of all submersible pumping stations or submersible grinder type pumping stations. The handrail shall be closed on three sides, with the fourth side closed by a latching chain. The handrail shall be permanently attached to the concrete cover slab. The chained side of handrail shall face the chain link gates for access and pump maintenance.

## STANDARD SPECIFICATIONS

### **h. Electrical Controls:**

Power service to wastewater pumping stations shall be three phase where pump motors are three horsepower (3HP) or greater.

- 1) Control Sequence – On rising liquid level in the wet well, a mercury type float switch shall initiate operation of the lead pump at the elevation indicated on the DRAWINGS. Should the liquid level continue to rise, a second mercury float switch would initiate operation of the Lag Pump. The pump (s) would continue to operate until the liquid level recedes to the point where a third mercury float switch would stop the pumps.

The two (2) pumps shall automatically alternate between the “lead” and “lag” positions by means of an electric alternator in the panel.

Should the liquid level continue to rise above the “Lag Pump On” level, a fourth mercury float switch would activate the alarm circuit.

- 2) Control Panel – The duplex pump control panel shall be furnished by the Pump Manufacturer, completely pre-wired, factory assembled, tested and ready for service. Where possible, pump controls shall be housed in a single panel.

For outside installations at submersible stations, the panel shall be a NEMA 3R door-in-door enclosure, fully gasketed with drip cap. The panel shall be suitable for mounting on the panel board as indicated on the DRAWINGS.

The panel shall contain the following elements.

- Separate Manual Disconnect for each pump with 2-pole adjustable overload protection for each phase
- Magnetic starter for each pump motor with all leg quick trip ambient compensated overload protection for each motor. Overloads are to have an auxiliary contact for automatic dialer.
- Hand-Off-Auto selector switch for each pump
- Automatic Electric Alternator
- Circuit Breaker for Control Circuit
- Motor Thermal Protection – Motor control circuit is to shut down if high temperature occurs. Manual resets to be provided.
- 4-Float control system for duplex pumps and alarm system
- Control Disconnect

## STANDARD SPECIFICATIONS

- Seal failure light for each pump and contact closure for automatic dialer (submersible installations only)
  - Running light for each pump
  - Non-resettable, elapsed time meter for each pump, reading in tenths of hours. Capacity – 100,000 hours.
  - High-level alarm light with Red Glove and contact closure for automatic dialer. (Remote mounting for “package” pump station where panel is inside pump compartment)
  - All necessary internal wiring, relays, etc. to provide the operation as described.
- 3) Protection from Weather – All external electrical control apparatus shall be protected from the weather by means of a weather shield fabricated of aluminum sheet, 3/16” thickness. The weather shield shall be of adequate size to accommodate all electrical control apparatus, including meter base, service entrance disconnect switch, automatic transfer switch, alarm dialer, and pump control panel (submersible pump stations only). The weather shield shall have a clear height of 7’-0”, and a minimum overhang of 4’-0”. The width shall not be less than 8’-0”. The weather-shielded structure shall consist of structural steel or galvanized pipe supports with horizontal members as required for individual support of each equipment item and the weather shield. If bare structural steel is used for the weather shield structure, the steel shall be hand tool cleaned, primed and painted with a high-build epoxy polyamide coating system. Tnemec Series 66 or equal. A suitable barrier of neoprene or similar material shall be placed between the steel support members and the aluminum sheet to prevent galvanic corrosion.

### **i. Alarm Dialer:**

On all wastewater pumping station installation, an automatic alarm dialer shall be furnished and installed. The dialer unit shall conform to the specifications presented herein under Section 8.05.

### **j. Water Service Lines:**

Each pumping station shall have a potable water supply device service line consisting of a ¾” service line with approved backflow preventer and terminating at the pump station site with a freeze-proof yard hydrant.

## STANDARD SPECIFICATIONS

### 8.03 Package-Type Pumping Stations

#### a. General:

Package-type pumping stations shall be the flooded suction, dry pit type. The pumping station shall be furnished to include features as follows:

- 1) Factory-built Steel Pumping Chamber – with entrance tube.
- 2) Duplex, Non-Clog Pumps – capable of passing a 3-inch solid. Motors may be “built together” with the pump for horsepower of 10 or less. For units greater than 10 horsepower, the motor shall be connected to the pump via a flexible coupling. Motors shall be open, drip-proof, squirrel cage induction type with NEMA B speed torque design, capable of continuous duty at full load with a temperature rise of 40 degrees centigrade and a 1.15 service factor. Motors shall be non-overloading at all points on the performance curve.

Pumps shall have double mechanical seals. A pump seal filter with a 50 micron filter shall be provided.

- 3) Control Panel
- 4) Dehumidifier Unit – minimum capacity of 15 pints of water per day at 80 degrees F, 68 percent RH. The unit shall be controlled by an adjustable humidistat and low air temperature cut out.
- 5) Heater – 1500 watt with integral thermostat to maintain a minimum temperature of 50 degrees F.
- 6) Ventilation System – minimum size for 6 air changes per hour.
- 7) Interior Lights – two tube 40-watt fluorescent light with guard.
- 8) Vent/Light Controls – Spring loaded entrance switch to activate light and vent blower automatically when entrance hatch is opened. A manual switch shall also be mounted on the side of the entrance tube to enable manual operation with the hatch cover closed.
- 9) Sump Pump – with built-in float switch. Pump shall discharge into wet well above high level through double check valves.
- 10) Precast Wet Well – 4-foot minimum diameter.
- 11) Site Work Improvements – as required per Section 8.02 (c) hereof.
- 12) Alarm Dialer System – as required per Section 8.05 hereof.
- 13) Water Supply Line – as required per Section 8.02 (i) hereof.

## **STANDARD SPECIFICATIONS**

### **b. Manufacturer:**

Package-type, factory-built wastewater pumping stations and accessory equipment shall be as manufactured by Smith & Loveless. Equipment of other manufacturers may be considered by the DPW upon submittal of complete data, including specifications, performance curves, etc. and also including a list of references of other municipal users and names and telephone numbers of contact persons.

### **c. Shop Drawings:**

Prior to purchase of factory-built pumping equipment, the Contractor shall submit not less than four (4) sets of data to the DPW for approval, including pump performance data, control panel wiring diagrams and other material required to determine compliance with these Specifications.

### **d. Operation & Maintenance Manuals:**

Three (3) complete O & M Manuals shall be furnished to the DPW covering all equipment furnished – pumps, motors, controls, alarm dialer, etc.

### **e. Spare Parts**

At the time that the pumping station is accepted for operation and maintenance by the City of Oxford, certain spare parts shall be furnished, consisting of:

- 1) Replacement pump shaft, seal assembly & wear sleeve
- 2) Spare filter element
- 3) Complete set of volute gaskets
- 4) Other items as may be recommended by the manufacturer

### **f. Warranty:**

The manufacturer of the factory-built pump station and dialer shall warrant to the City of Oxford that the equipment which is supplied be free of defect in materials and workmanship for a period of 12 months following acceptance of the facility for maintenance by the City. The warranty shall name the City as warrantee and shall be delivered to the DPW at the time of final acceptance.

## **8.04 Submersible Pump Stations**

### **a. General**

Submersible pumping stations shall be furnished with the following principal features:

- 1) Duplex, Non-Clog Pumps – capable of passing a 3-inch sphere.

## STANDARD SPECIFICATIONS

- 2) 2) Guide Rail System – including a quick-connect, base discharge elbow mounted to the wet well floor. Guide rails shall be stainless steel pipe, 2-inch minimum diameter, schedule 40.
- 3) 3) Submersible Pump Motors – shall meet UL requirements for Class I, Division I, Group D for hazardous locations. Dual seals shall be provided and all leads shall be epoxy sealed. Pumps shall be fitted with seal moisture sensor and thermal sensor, both wired to the control panel and alarm system. Motors shall be furnished with a minimum of 3 feet of waterproof, multi-conductor power and control cable for direct feed to control panel without splicing.
- 4) Precast Concrete Wet Well
  - Minimum size: 6' 0" (inside diameter)
  - Base Slab: cast in place, reinforced concrete having a minimum 28-day compressive strength of 4,000 psi. No precast base sections may be used.
  - Riser Sections: precast concrete sections conforming to ASTM C-478 with watertight joints per ASTM C-443.
  - Top Slab: Cast-in-place, reinforced concrete having a minimum 28-day compressive strength of 4,000 psi.
- 5) Separate Precast Valve Vault – with cast in place concrete cover slab with waterproof, lockable aluminum access hatch. Vault shall be sized to provide adequate clearance around valves and fittings. The valve vault shall consist of a precast concrete manhole base section minimum 6' diameter, or a precast concrete rectangular structure a minimum 6' square. Valve vault shall have floor drain and a drain line to the wet well equipped with a back water valve.
- 6) Site Work Improvements – as required per Section 8.02 (c) hereof.
- 7) Control Panel
- 8) Alarm Dialer System
- 9) Water Supply Line – as required per Section 8.02 (i) hereof.
- 10) Hoist – mounted on post with cantilevered arm and winch to facilitate pump removal. The unit shall be designed to lift the dead weight of one submersible pumping unit. The hoist assembly shall be of stainless steel construction as manufactured by Halliday Products, or equal as may be approved by the DPW.

## STANDARD SPECIFICATIONS

### **b. Manufacturer:**

Submersible pumps, motors and accessory equipment shall be as manufactured by Fairbanks Morse, ABS Pumps or Hydr-O-Matic. Pumps of other manufacturers may be considered by the DPW upon submittal of complete data, including specifications, performance curves, etc. and also including a list of references of other municipal users, and names and telephone numbers of contact persons.

### **c. Shop Drawings:**

Prior to purchase of submersible pumping equipment, the Contractor shall submit not less than four (4) sets of data to the DPW for approval, including pump performance data, control panel wiring diagrams and other material required to determine compliance with these Specifications.

### **d. Operation & Maintenance Manuals:**

Three (3) complete O & M Manuals shall be furnished to the DPW covering all equipment furnished – pumps, motors, controls, alarm dialer, etc.

### **e. Spare Parts:**

At the time that the pumping station is accepted for operation and maintenance by the City Of Oxford, certain spare parts shall be furnished, consisting of any items which may be recommended by the equipment manufacturer and listed in the O & M Manual. In the case of submersible pump stations, it is anticipated at the spare parts requirements will be minimal. For submersible pumps, a replica of the name plate with serial number, model number, manufacturer, operating conditions, etc. shall be provided.

### **f. Warranty:**

The manufacturers of the pumping equipment, control panel, and dialer shall warrant to the City Of Oxford that the equipment which is supplied shall be free of defect in materials and workmanship for a period of 12 months following acceptance of the facility for maintenance by the City. The warranty shall name the City as warrantee and shall be delivered to the DPW at the time of final acceptance.

## STANDARD SPECIFICATIONS

### **8.05 Alarm Dialer System**

#### **a. General:**

Each pump station shall be equipped with an automatic monitoring and alarm dialer system.

It shall be the responsibility of the Developer/Contractor to install the necessary switches, contacts, relays, etc. and associated wiring required to monitor and report the alarm conditions as noted herein. The Contractor shall also be responsible for arranging for the telephone service and installations of the required phone jack.

#### **b. Functional Description:**

The Alarm Dialer System shall be completely self-contained and fully automatic. The system shall monitor a minimum of four (4) independent alarm conditions plus power failure. (Common alarm conditions shall be wired in series to limit the number of independent conditions).

Alarm status shall be indicated by the operation of any single or multiple sets of normally open or closed isolated contacts. Multiple faults shall be reported in one (1) call if necessary.

The system shall be connected into the telephone line network through a self-contained FCC approved coupler and shall plug into a standard jack supplied with the telephone line. A regular telephone line shall be used with the system.

Upon operation of any alarm contact, the system shall address the telephone line, wait for a dial tone, and begin dialing the first four (4) field programmed telephone numbers consisting of from two (2) to sixteen (16) digits. A keyboard shall remain in operation during reprogramming of telephone numbers.

The voice message shall be electronically synthesized and programmed prior to installation in sufficiently clear language to advise operator of the alarm status. Dialer units using motors, tapes, pick-up heads, etc., are not acceptable.

After dialing the first priority number, the system shall indicate the pump station name and alarm message. The message shall be repeated up to sixteen (16) times with time between to allow party to acknowledge by pressing a "touch-tone" key or calling in. After acknowledgement the system shall vocalize a sign-off and hang up. After a 30 minute delay to allow for corrective action, the system shall begin the re-dial sequence at one minute intervals if corrective action has not been taken. Should other alarm conditions occur during the delay, the system shall redial the numbers in order of priority until a party is reached. The system shall be capable of being called to check the alarm status at the station.

If the first priority part is not reached, the system shall hang up, wait 60 seconds, and dial the second priority number. If no party is reached after dialing all four (4) numbers in order of priority, the system shall return to the first priority number and repeat the sequence indefinitely.

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The system shall operate from a 120 VAC source with continuously float charged batteries capable of 24 hours standby operation during power outages. The operating temperatures range shall be -20 degrees C to +50 degrees C.

Alarm contacts to the system shall be provided through standard AC wire from various locations in the pump station. Contacts shall be rated 120 VAC, 1 AMP resistive.

For outside installations, the alarm dialer enclosure shall be equipped with a thermostatically controlled strip heater.

### **c. Alarm Conditions:**

The following alarm conditions shall be monitored at the pump station. The fault conditions shall be grouped to provide six (6) alarm groups to the dialer:

	<u>SUBMERSIBLE STATIONS</u>	<u>FLOODED SUCTION PACKAGE STATION</u>
<b>FAULT I</b>	- Wet Well High Level	Wet Well High Level
<b>FAULT II</b>	- Pump #1 Failure (Over temp/ Overload/Seal Moisture)	Pump #1 Failure (Over temp/ Overload)
<b>FAULT III</b>	- Pump #2 Failure (Over temp/ Overload/Seal Moisture)	Pump #2 Failure (Over temp/ Overload)
<b>FAULT IV</b>	- Generator Running (Report)	Generator Running (Report)
<b>FAULT V</b>	- Generator Failure	Generator Failure
<b>FAULT VI</b>	- Power Failure	Power Failure

### **d. Manufacturer:**

The automatic alarm dialer system shall be Chatterbox CB-4 as manufactured by RACO Manufacturing & Engineering Company, or equal, as may be approved by the DPW.

### **e. Installation:**

- 1) For Package Pump Stations – The system shall be housed in NEMA 1 enclosure and housed in the pump compartment. The unit shall be furnished and installed by the pump station manufacturer
- 2) For Submersible Pump Installations – The system shall be housed in a heavy gauge, UL listed steel cabinet painted with epoxy or baked-on enamel paint, NEMA 4.

## STANDARD SPECIFICATIONS

### **8.06 Standby Power Generator System**

#### **a. General:**

All pump stations shall have an automatic standby power generation system conforming to these specifications.

The system shall consist of a propane (0% buttan) fueled standby generator in weatherproof enclosure complete with all equipment and accessories required to automatically supply power to the pump station during a utility power failure. The engine generator set shall start the two wastewater pumps in sequence and will run both simultaneously under full load. Simultaneous starting is not required.

Diesel fueled generators may be considered on large installations (greater than 50 KW). Units 50 KW and smaller shall be propane fueled.

#### **b. Engine:**

The engine shall have the following features:

- 1) Engine shall be propane fueled, 4 cycle. Engine shall be 1800 rpm, unless the City waives this requirement.
- 2) Engine shall be liquid cooled and shall have a radiator, coolant pump, thermostat and fan. Air-cooled engines may be approved by the City or installation of less than 10 kw.
- 3) Fuel system shall be for gaseous propane.
- 4) Governor shall be mechanical flyweight type with a speed regulation of 5 percent maximum.
- 5) Lubrication shall be by a positive displacement lube oil pump with positive pressure lubrication to all bearings. Full flow lube oil filter shall be provided.
- 6) Starting system shall be 12 volt, positive shift gear engaging starter.
- 7) Battery charging alternator shall be belt driven, 12 volts, 35 amps with solid state voltage regulator. A battery float charger shall be provided.
- 8) An engine block shall be provided with control thermostat. The unit shall be 120 volt.

## **STANDARD SPECIFICATIONS**

### **c. Alternator:**

The alternator shall have the following features:

- 1) Alternator shall be revolving field, broad range, brushless type designed for minimum resistance, low voltage, waveform distortion, and maximum efficiency. Rotor shall be dynamically balanced permanently aligned to engine by flexible disc coupling. Maximum allowable voltage dip shall be 30%.
- 2) Exciter shall be 3 phase, fullwave rectified with silicon diodes mounted on a common motor shaft, sized for maximum motor starting.
- 3) Voltage regulator shall be solid state with silicon controlled rectifiers with phase controlled sensing circuits.
- 4) Temperature rise at rated load shall be within limits for class F insulation in accordance with NEMA MG 1-22.40.
- 5) Insulation system shall be Class F in accordance with NEMA MG1-1.65. Rotor shall be vacuum impregnated with 100% solid epoxy resin for complete environmental protection. Stator shall be impregnated twice with varnish conforming to MIL-I-24092, Type M, Class 155.
- 6) Output circuit breaker shall be 3-pole, rated at 145% of alternator full load current.

### **d. Unit Performance:**

Frequency regulation of the generator unit shall be 3 hertz maximum, no load to rated load. Voltage regulation shall be plus or minus 2 percent, no load to rated load. Voltage drop during motor starting shall not prevent the successful starting of the pump motors in the pump station.

### **e. Control Panel:**

A unit mounted control console shall be furnished with the following items, completely wired and installed:

- 1) Engine start/stop controls
- 2) Run/Stop/Remote switch
- 3) Remote start/stop terminals for 2-wire starting from automatic transfer switch
- 4) Oil pressure gauge
- 5) Coolant temperature gauge

## STANDARD SPECIFICATIONS

- 6) Charge rate ammeter
- 7) Overcrank protection and alarm light
- 8) Low pressure shutdown and alarm light
- 9) High coolant temperature shutdown and alarm light
- 10) Overspeed shutdown and alarm light
- 11) AC voltmeter and selector switch
- 12) AC ammeter and selector switch
- 13) Voltage adjusting reostat
- 14) Running time meter
- 15) Exciter circuit breaker, manual reset
- 16) Alarm contact for automatic dialer (generator fail signal)
- 17) Frequency meter

**f. Accessories:**

All accessories needed for the proper operation of the generating set shall be furnished and installed. These shall include, but are not limited to, the following:

- 1) Muffler with residential silencing
- 2) Flexible exhaust connection
- 3) Exhaust pipe
- 4) Starting batteries
- 5) Battery cables
- 6) Battery rack (inside weatherproof enclosure)
- 7) Battery float charger
- 8) Propane tanks, pressure regulator, air and fuel filters, valves and piping
- 9) Flexible fuel line connections to the engine

## **STANDARD SPECIFICATIONS**

### **g. Weatherproof Enclosure:**

The generator control panel, batteries and battery charger shall be installed in a weatherproof enclosure.

The weatherproof enclosure shall be welded reinforced sheet steel, 14 gauge, prime coated and finished painted, and shall have hinged or lift-off doors for access to the generator set and all other equipment inside.

### **h. Gaseous Fuel System:**

All equipment and piping for the propane fuel system shall be furnished and installed. The fuel system shall conform to NFPA 58.

- 1) Fuel Tank – above ground tank sized to ensure starting and running of the generator set under full load for a period of not less than twenty-four (24) hours, or longer if required by State regulatory authorities, at an ambient temperature of 20 degrees F. Design pressure rating shall not be less than 250 psig.
- 2) Fuel Piping- shall comply with NFPA 58 for a design working pressure of 250 psig. Pipe size shall be per manufacturer's recommendations, but not less than ½-inch.
- 3) Vapor Withdrawal System – shall include a manual shut-off valve at the tank(s), a vaporizer, dry full filter, line service regulator, solenoid fuel shut-off valve to open when engine runs, flexible pipe connection at the engine, and a gas flow regulator.

### **i. Fuel, Antifreeze, & Oil:**

An 80% charge of propane in the propane storage tank shall be provided at the time of final acceptance by the City.

Complete charges of antifreeze and oil shall be provided.

### **j. Tests:**

After installation of the engine generator set is complete, and prior to its acceptance by the City, the supplier shall demonstrate the capability of the system to perform in accordance with these specifications to the satisfaction of the City.

A 4-hour load bank test shall be performed to load the generator set to the alternator KW rating at 1.0 power factor. The test shall be witnessed by the City.

Any defects which become evident during this test shall be corrected.

Safety shutdown features shall be tested by simulating the primary device contact closure.

## STANDARD SPECIFICATIONS

### **k. Manufacturer:**

The standby power generator set shall be ONAN, KOHLER, CATERPILLAR, GENERAC or equal.

### **1. Parts & Service:**

The generator set, controls, and transfer switch shall be furnished by a single supplier.

The engine-generator set supplier shall be authorized dealer of the engine-generator set manufacturer, and shall be fully qualified and authorized to provide service and parts for the engine and generator at any time during the day or night. Parts and service shall be available 24 hours per day 7 days a week, from a location within a 100 mile radius of the location of the installed generator set.

### **m. Automatic Transfer Switch:**

The transfer switch, supplied as part of the standby power supply, shall be capable of switching all classes of load and shall be rated for continuous duty when installed in a non-ventilated enclosure constructed in accordance with Underwriter's Laboratories, Inc., Standard UL-508.

The transfer switch shall be housed in a NEMA 3R enclosure. Switch size/rating shall be as indicated on the approved Drawings.

The transfer switch shall be double throw, actuated by a single electrical operator momentarily energized, and connected to the transfer mechanism by a simple overcenter type linkage with a total transfer time not to exceed ½ second from line-to-neutral and from neutral-to-line. The transfer switch shall be capable of transferring successfully in either direction with 70% of rated voltage applied to the switch terminals.

An adjustable time delay in the neutral position (0.5 sec.) between the opening of the closed contacts and the closing of the open contacts shall be provided to allow the loads to be demagnetized before transfer. This type transfer switch shall allow the motor and transfer loads to be re-energized after transfer with normal inrush current.

The normal and standby contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing.

Main contacts shall be mechanically locked in position in both the normal and standby positions without the use of hooks, latches, magnets, or springs, and shall be silver tungsten alloy protected by arcing contacts, with magnetic blow-outs on each pole. Interlocked molded case circuit breakers are not acceptable.

## STANDARD SPECIFICATIONS

The transfer switch shall be equipped with a manual operator that is designed to prevent injury to the operating personnel if the electrical operator should suddenly become energized during manual transfer. The manual operator shall provide the same contact-to-contact transfer speed as the electrical operator to prevent a flashover from switching the main contacts slowly.

In addition to the above, the transfer switch must have a short circuit with capability in excess of the UL minimum requirements as follows:

100-150 amperes	16,000 RMS amperes symmetrical
225 amperes	20,000 RMS amperes symmetrical
400-800 amperes	40,000 RMS amperes symmetrical
1000-1600 amperes	50,000 RMS amperes symmetrical
2000-3000 amperes	73,000 RMS amperes symmetrical

Engine starting contacts shall be provided to start the generating plant if any phase of the normal source drops below 80% of rated voltage, after an adjustable time delay period of 3 seconds to allow for momentary dips. The transfer switch shall transfer to standby as soon as the voltage and frequency have reached 90% of rated voltage. After restoration of normal power on all phases to 90% of rated voltage, an adjustable time-delay period of 0-30 minutes shall delay retransfer to normal power until it has had time to stabilize. If the standby power source should fail during the time delay period, the time delay shall be bypassed, and the switch shall return immediately to the normal source. After the switch has retransferred to normal, the engine generator shall be allowed to operate at no load for an adjustable period of time (0-15 minutes) to allow it to cool before shutdown. The transfer switch shall include a test switch to simulate normal power failure, pilot lights on the cabinet door to indicate the switch closed on normal or standby, and two (2) auxiliary contacts on the main shaft; one (1) closed on normal, the other closed on emergency. In addition, one (1) set of relay contacts shall be provided to open on loss of the normal power supply. All relays, timers, control wiring and accessories shall be front accessible. Contacts shall be provided to the alarm dialer for generator "RUN" and generator "FAIL". In addition, contacts interlocked to the pump control shall be provided to open when the switch is in the EMERGENCY position to **lockout the "LAG" pump.**

As a pre-condition for approval, all transfer switches, complete with timers, relays and accessories shall be listed by Underwriter's Laboratories, Inc. in the Electrical Construction Materials Catalogue under Standard UL-1008 (Automatic transfer switches) and approved for use on Emergency Systems.

A programmable exerciser shall be provided which will allow the operator to schedule the starting and transfer time based on the City's standard exercising schedule. The exerciser program shall allow the operator to monitor run time.

### **n. Submittal Data:**

The Contractor shall furnish to the DPW six (6) copies of complete data and shop drawings for the generator set to be furnished.

## STANDARD SPECIFICATIONS

### **o. Operating Instructions:**

Six (6) complete copies of operating instructions and parts list shall be provided prior to acceptance of the unit. Parts list shall include schedule of type and quantity of parts recommended for stock.

### **p. Warranty:**

The complete standby power generating system shall be warranted for one year after the acceptance of the generating system by the City. The warranty shall cover all defects in equipment, parts, assembly and installation. The warranty shall be issued in writing by the supplier and delivered to the DPW.

## **8.07 Force Main Materials**

### **a. General:**

Force mains shall be constructed of ductile iron or PVC pipe as specified herein. PVC pipe shall be installed with a metallic locator tape installed directly over the force main at a depth of 18 inches below finished grade.

Force mains from pumping stations which are to be maintained by the City Of Oxford shall not be less than 4-inch nominal diameter, so as to convey a 3-inch solid which may be passed by a non-clog solids handling wastewater pump. Temporary force mains which may connect to privately maintained grinder pump stations, where permitted by the City, may be 3-inch or smaller in size.

### **b. Ductile Iron Pipe:**

All ductile iron pipe shall be designed as per AWWA Standard C150 for a working pressure of 150 psi, laying condition 1. Pipe shall be manufactured in accordance with all applicable requirements of AWWA Standard C151.

Pipe joints shall be of the push-on type as per AWWA Standard C111. Pipe lining shall be cement mortar with a seal coat of bituminous material, all in accordance with AWWA Standard C104.

Ductile iron pipe shall be as manufactured by Griffin, U.S. Pipe, American, or Clow. The pipe shall be furnished in 18-foot or 20-foot lengths.

## **STANDARD SPECIFICATIONS**

### **c. PVC Pipe – 4-Inch & Larger (City Maintained Force Mains):**

Polyvinyl Chloride (PVC) pressure pipe 4 inches and larger shall meet the requirements of AWWA C900 “Standard for PVC Pressure Pipe, 4-inch through 12-inch” for pressure class 150. PVC Pressure Pipe may be used for the force main except where ductile iron pipe is specifically required on the approved plans. The PVC pressure pipe shall be furnished in ductile iron pipe equivalent outside diameters. Laying length shall be 20 feet nominal. Each length of PVC pipe shall be factory tested hydrostatically to 600 psi for 5 seconds.

Pipe joints shall be of the bell and spigot type utilizing a rubber ring elastomeric bell joint which shall be an integral and homogeneous part of the pipe barrel.

PVC C900 pipe shall be as manufactured by Johns-Manville, Clow, Robin-Tech or approved equal.

### **d. PVC Pipe – 3-Inch & Smaller (Private Force Mains):**

Unless otherwise shown on the proposed plans, small diameter PVC pipe shall be Class 200, SDR 2, conforming to ASTM Designation D-2241. Joints for pressure rated PVC pipe may be of the rubber ring, bell joint type, where the bell is an integral and homogenous part of the pipe barrel. The basic pipe material shall meet the requirements for Type 1, Grade 1, for PVC 1120 of the ASTM Resin Specification D-1784.

### **e. Fittings:**

Fittings for ductile iron or PVC pipe force mains, 4-inch diameter and larger, shall be ductile or cast iron conforming to the specifications for fittings as previously presented for water distribution under Section 6.03 paragraph “k” of these Specifications. Fittings for PVC force mains, 3-inch diameter and smaller, may be Schedule 40 PVC fittings with solvent weld socket joints. PVC fittings shall be manufactured by the same company manufacturing the PVC pipe, so as to assure compatibility.

## **8.08 Force Mains – Installation Methods**

### **a. General Requirements:**

All force main construction methods, including trench excavation, bedding, backfill, etc. shall conform to the requirements for water main installation as specified herein under Section 6.04.

The engineering drawings for all force mains shall include a profile drawing for the entire length of the main.

Force mains shall be installed in dedicated public rights-of-way or in dedicated utility easements conforming to Section 7.01b.

## STANDARD SPECIFICATIONS

### **b. Sewer Air Valves:**

Sewer air valves and or air and vacuum valves shall be installed at all high points on the force main. The sewer air valves shall be installed in a precast concrete manhole per Standard No. 7.09. The manhole interior surface shall receive a coal tar epoxy coating (one coat).

### **c. Receiving Manholes – Special Requirements:**

The interior surface of the receiving manhole at the discharge end of the force main shall also receive a single coat of coal tar epoxy coating. Coal tar epoxy coating shall conform to Corps of Engineers Specification C-200 and shall be Koppers Bitumastic No.300M, or approved equal. The coating shall have a dry film thickness of 10 mils, and all nicks and scratches shall be touched up prior to acceptance.

Force mains shall discharge at the invert of the receiving manhole and at an angle which is as close as possible to 180-degrees of the outlet pipe.

### **d. Force Main Identification:**

All force mains shall be appropriately identified upon installation so that the pipe will not be confused with potable water distribution mains. The force main pipe shall be marked on top of the pipe with the word "sewer".

In addition, where force mains are of PVC pipe, a color coded metallic detector tape shall be installed in the force main trench approximately 12" below ground surface. The tape shall be as previously specified for PVC water mains, except the tape shall be marked with standard underground marking – "CAUTION – BURIED FORCE MAIN BELOW". The tape shall meet the APWA color code requirement for sewer force mains.

### **e. Testing of Force Mains:**

All force mains shall be subjected to a hydrostatic test according to the provisions of Section 6.08 of these Specifications.

**\* \* \* END OF STANDARD SPECIFICATIONS \* \* \***