



OLD NORTH STATE WATER COMPANY
TECHNICAL SPECIFICATIONS FOR WELLS AND WATER
TREATMENT

REVISED: XXXXX-XX-XXXX

XXXX XXXXXX SUBDIVISION

GROUNDWATER SYSTEM

XXX S/D Water System No. NC XX-XX-XXX XXXXX County

Serial No. XX-XXXXX

Old North State Water Company

TECHNICAL SPECIFICATIONS FOR WELLS AND WATER TREATMENT

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T-1. INTRODUCTION

1. Jurisdiction

This MANUAL shall apply to all proposed water systems and assets to be owned, operated, or maintained by Old North State Water Company, Inc.

3. Purpose

These standards and specifications are adopted to establish minimum acceptable standards for the design and construction of water distribution/transmission facilities that are to be dedicated to Old North State Water Company, Inc. or facilities that interconnect to other utilities. Such facilities include water supply, distribution, and miscellaneous related appurtenances associated with such systems. These standards and specifications apply only to approval by Old North State Water Company, Inc. and not by any state or local authorities.

It is the responsibility of the design ENGINEER to ensure that this specification and/or his amendments (as approved by Old North State Water Company, Inc.) meet all applicable building codes and governing laws.

Approval by Old North State Water Company, Inc. does not relieve the ENGINEER from obtaining approval from state or local authorities.

4. Scope

This document is grouped into five Sections:

Section T-1: General Requirements, presents general requirements governing review and approval of plans and construction inspection and acceptance.

Section T-2: Design Standards contains all the criteria required for the acceptable design of water mains.

Section T-3: Construction Specifications, contains detailed technical specifications governing the construction of water facilities.

Section T-4: Standard Details, consists of drawings showing typical installation/construction of water facilities.

Section T-5: List of Materials and Approved Manufacturers consists of approved equipment for construction per region.

Section T-2 GENERAL REQUIREMENTS

1. Definitions

Except where specific definitions are used within a specific section, the following terms, phrases, words and their derivations shall have the meaning given herein when consistent with the context. Words used in the present tense include the future tense, words in the plural number include the singular number and words in the singular number include the plural number. The word "shall" is mandatory, and the word "may" is permissive.

AASHTO - American Association of State Highway and Transportation Officials. Any reference to AASHTO standards shall be taken to mean the most recently published revision unless otherwise specified.

ANSI - American National Standards Institute. Any reference to ANSI standards shall be taken to mean the most recently published revision unless otherwise specified.

ASTM - American Society for Testing Materials. Any reference to ASTM standards shall be taken to mean the most recently published revision unless otherwise specified.

AWWA - American Water Works Association. Any reference to AWWA Standards shall be taken to mean the most recently published revision unless otherwise specified.

CONTRACTOR - the person, firm, or corporation with whom the contract for work has been made by the Owner, the Developer or Old North State Water Company, Inc.

COUNTY - the applicable county and/or its designated representative(s).

DEVELOPER - the person, firm or corporation engaged in developing or improving real estate for use or occupancy.

DEVELOPER'S ENGINEER - an engineer or engineering firm registered with the State of North Carolina Board of Examiners for Engineers & Surveyors, retained by the DEVELOPER to provide professional engineering services for a project.

DIPRA - Ductile Iron Pipe Research Association. Any reference to DIPRA standards shall be taken to mean the most recently published revision unless otherwise specified.

DRAWINGS - engineering drawings prepared by an ENGINEER to show the proposed construction.

ENGINEER - an engineer or engineering firm registered with the North Carolina Board of Examiners for Engineers & Surveyors. Old North State Water Company, Inc.

FM - Factory Mutual. Any reference to FM standards shall be taken to mean the most recently published revision unless otherwise specified.

GEOTECHNICAL/SOILS ENGINEER - a Registered North Carolina Engineer who provides services related to terrain evaluation and site selection, subsurface exploration and sampling, determination of soil and rock properties, foundation engineering, settlement and seepage analysis, design of earth and earth retaining structures, the design of subsurface drainage systems and the improvement of soil properties and foundation conditions and testing and evaluation of construction materials.

MANUAL - these Specifications for Water Construction.

MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES - the United States Department of Transportation Manual on Traffic Control Devices, latest edition.

NCBELS – The North Carolina Board of Examiners for Engineers and Surveyors

NCDEQ – the North Carolina Department of Environmental Quality

NCDOT - the North Carolina Department of Transportation

NEMA - National Electrical Manufacturers Association. Any reference to NEMA Standards shall be taken to mean the most recently published revision unless otherwise specified.

NSF - National Sanitation Test Laboratory Foundation. Any reference to NSF Standards shall be taken to mean the most recently published revision unless otherwise specified.

OSHA - the Federal Occupational Safety and Health Administration.

OWNER - the person, firm, corporation, or governmental unit holding right of possession of the real estate upon which construction is to take place.

PLANS - DRAWINGS as defined herein above.

PWS – NCDENR Public Water Supply Section

RULES GOVERNING PUBLIC WATER SYSTEMS: North Carolina Administrative Code, Title 15a, Department of Environment and Natural Resources, Subchapter 18C – Water Supplies – Sections .0100 through .2200, latest edition.

SPECIFICATIONS - the specifications contained in Division 3 of this MANUAL.

STANDARDS - the minimum design standards contained in Division 2 of this MANUAL.

STANDARD DETAILS - the detailed drawings in Division 4 of this MANUAL related to water materials and installation of same.

SURVEYOR - a surveyor or surveying firm registered with the North Carolina Board of Examiners for Engineers & Surveyors.

2. Plan Review, Approval, Construction, and Acceptance of Water Improvements

A Plans, Specifications, and Models:

1 General: All submitted plans should be a standard size sheet (24" x 36") with title block. Graphic scale(s) shall be provided on each sheet and all lettering shall be 1/8" or larger to permit photographic reproduction. All PLAN sheets and the title page of submitted SPECIFICATIONS, Engineer's Report & calculations must be signed, sealed, and dated by the DEVELOPER'S ENGINEER in accordance with the rules and regulations of the NCBELS. All submitted plans, specifications, calculations, reports, and any other associated documents will be submitted in hard copy and electronic copy. Electronic copies will be in a standard format of PDF and ACAD (DWG.). Any deviations in format must be preapproved by the UTILITY.

2 Master Plan: The entire water system shall be shown on a single Master Plan. For systems where the UTILITY is the owner and operator of both the water and wastewater systems, the entire water and wastewater systems will be shown on a single Master Plan. The Master Plan shall indicate the general locations of all mains, manholes, valves, hydrants, services and service laterals with respect to the proposed development improvements and the existing water and wastewater systems. Main sizes shall be indicated on the Master Plan.

3 Plan and Profile: All water mains shall be drawn in plan and profile. Any occurrence of phased construction should be clearly represented on the plan sheets upon submission to UTILITY for review.

Whenever possible, on-site water and wastewater systems shall be shown on the same PLAN sheet. As a minimum, the plan and profile drawings shall include the following information:

- a.** General information such as north arrow, names of designer and engineer, revision block with dates, graphic scale(s) and sheet number.
- b.** Profile with elevations at 10-foot interval, or more frequently if required by good design practice.
- c.** Development layout with horizontal and vertical controls.
- d.** All conflicts with other utility and drainage systems, including clearances.
- e.** Pipe data including size, lengths, class, and material.
- f.** Size, type, and locations of fittings, valves, hydrants, air release/vacuum relief valves and other related appurtenances.
- g.** Limits of pipe deflection.
- h.** Limits of special exterior coatings.
- i.** Limits of special bedding requirements.
- j.** Pipe restraint requirements.
- k.** Details of connection to existing systems.
- l.** Construction notes regarding cover, horizontal and vertical control, special construction requirements, and references to standard and special details.

4. Details: The PLANS shall include all applicable STANDARD DETAILS as shown in Division 4 of this MANUAL. Special details shall be prepared by the DEVELOPER'S ENGINEER for aerial and underwater crossings of rivers, streams, canals and ditches. Other special details shall be prepared by the DEVELOPER'S ENGINEER as required.

5. Scale: The master plan shall be prepared at a scale not to exceed 1" to 200'. Plan and profile sheets shall not exceed a scale of 1" to 50'. Special details shall be of sufficiently large scale to show pertinent construction information. On especially large systems, a larger scale can be used with the permission of UTILITY, or an overall plan of a greater scale can be used as long as smaller scale plans are also provided.

6. Hydraulic Modeling: A hydraulic model utilizing WaterCAD or WaterGEMS may be required for all new systems planning to provide irrigation, containing 2 wells or more or for any system connecting to a master system. On single well system, the Utility reserves the right to require modeling to verify pressure and flows. If the proposed system is to be connected to an existing system, the entire interconnected system shall be modeled. Contact UTILITY's engineer to determine if the model will be required. If a system provides fire flow, additional modeling may be requested.

a. If a hydraulic model already exists for the system being connected to, the DESIGNER, with the permission of the UTILITY, may provide a hydraulic model of the proposed system to be placed in the existing model. In this case, UTILITY shall provide pressure and flow data for the system being connected to.

7. General Notes: All drawings will have these notes somewhere in the set:

- • Old North State Water Company, Inc. shall be notified 72 hours before construction is to begin.
- • Old North State Water Company, Inc shall be notified 72 hours before any construction is buried.
- • Old North State Water Company, Inc shall be notified 48 to 72 hours before any testing is conducted

8. Project Summary: A summary of the project will be included with the submittal. The submittal will include the following information, at a minimum. This summary can be combined with the Engineer's Report.

- • Project name and location.
- • Water system name and PWSID (if connecting to existing system).
- • A brief description of the project.
- • The number of proposed connections.
- • All proposed wells/water sources with capacity and proposed storage (if applicable).

B. Subdivision Related Water Improvements:

1. General: This section covers all water improvements that are dedicated to UTILITY.

2. Design and Plan Review: Design of water improvements associated with UTILITY approved projects shall be in compliance with the DESIGN STANDARDS in Division 2, and the SPECIFICATIONS outlined in Division 3 of this MANUAL. PLANS will be reviewed and approved by UTILITY as part of the project review and approval process. Any occurrence of phased construction should be clearly represented on the plan sheets upon submission to UTILITY for review.

3. Preconstruction Meeting: A preconstruction meeting will be required before work begins on any project. The meeting will consist of, at minimum, the DEVELOPER'S ENGINEER, the CONTRACTOR, and a representative of UTILITY. Other attendees can be required by UTILITY as needed, including any subcontractors and regulators. It shall be the CONTRACTOR's responsibility to contact any local and state regulators to see if their presence is required at the preconstruction meeting.

4. Construction Inspection: DEVELOPER's ENGINEER shall periodically inspect (and issue periodic reports to ONSWC) all construction subject to these STANDARDS and SPECIFICATIONS.

After all required improvements have been installed; the DEVELOPER'S ENGINEER shall submit certification to UTILITY that the improvements have been constructed substantially in accordance with approved PLANS and SPECIFICATIONS. A walkthrough of the improvements by the DEVELOPER'S ENGINEER and a representative of UTILITY to ensure compliance with the PLANS and SPECIFICATIONS will be required before closing. Non-compliance with approved PLANS or SPECIFICATIONS or evidence of faulty materials or workmanship shall be recorded by the DEVELOPER or DEVELOPER'S ENGINEER and if not corrected in an expeditious manner, all work on the project will be suspended and service withheld.

DEVELOPER'S ENGINEER is responsible for all inspections and certifications.

C. Compliance with other Regulatory Requirements:

1. It shall be the responsibility of the DEVELOPER to obtain and comply with all applicable Federal, State and Local regulatory requirements.

- a. **SPECIFICALLY HIGHLIGHTED:** Old North State Utilities, Inc
Specifications for Water Systems

15A NCAC 18C .1537 DRINKING WATER TREATMENT CHEMICALS AND SYSTEM COMPONENTS

(a) The standards established by the American National Standards Institute/NSF International, codified as ANSI/NSF Standard 60 and ANSI/NSF Standard 61, are incorporated by reference including subsequent amendments and editions. ANSI/NSF Standard 60 applies to drinking water treatment chemicals. ANSI/NSF Standard 61 applies to drinking water system components. Copies may be obtained for public inspection as set forth in Rule .0503 of this Subchapter.

(b) A water supply product used in a public water system shall meet the standards incorporated by reference in Paragraph (a) of this Rule. A product certified by an organization having a third-party certification program accredited by the American National Standards Institute to test and certify such products may be used in a public water system.

(c) A supplier of water shall maintain a list of all water supply products used in a public water system for inspection by the Department. Prior to using a product not previously listed, a supplier of water shall either determine the product is certified as required by Paragraph (b) of this Rule or notify the Department of the type, name, and manufacturer of a product.

(d) A supplier of water shall not introduce or permit the introduction of a water supply product into a public water system that does not meet the requirements of this Rule.

2. Acceptance of the PLANS by the UTILITY does not imply acceptance of the PLANS by any state or local authorities. It is the responsibility of the ENGINEER to submit the PLANS to all required agencies and to obtain any approvals necessary before construction is to begin.

D. Guidelines for the Acceptance of New Water Mains from Contractors

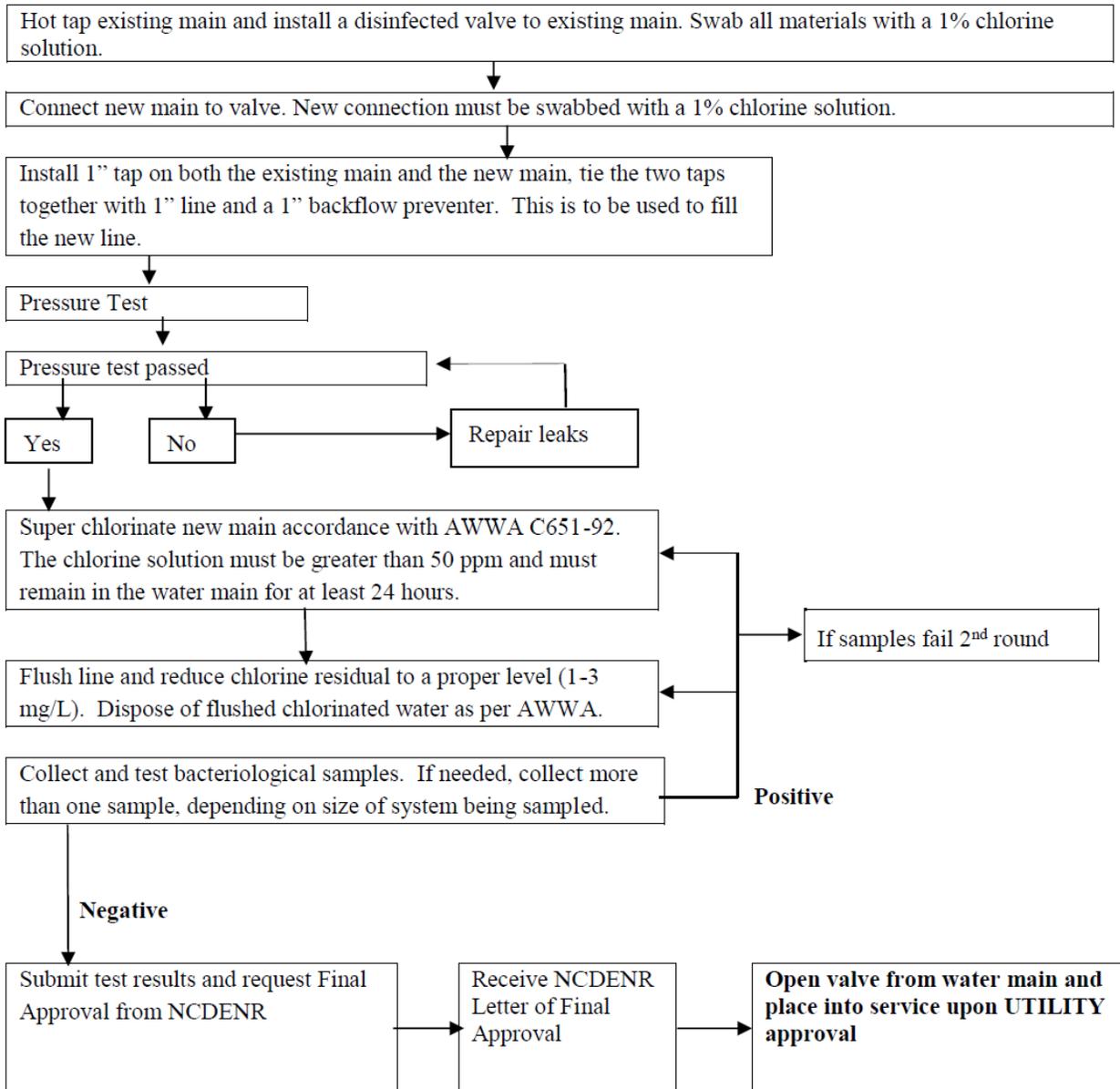
General: UTILITY as a purveyor of clean and high-quality water is responsible to prevent or minimize the exposure of its customers to any possible risk of chemical or microbiological contaminants that may result in illness to the community.

This document, which is in a flow chart format, is based on AWWA standard policies, practices, and procedures for accepting new water mains and is addressed to both internal operation personnel and outside contractors. The purpose of these guidelines is to provide a step by step procedure delineating the construction and final clearance of water main extensions.

It applies to all UTILITY facilities. All contract or operations employees are responsible and required to follow these procedures. Construction inspectors and supervisory employees will be responsible for ensuring compliance.

Incorporated Reference: ANSI/AWWA C651-92

GUIDELINES FOR THE ACCEPTANCE OF NEW WATER MAINS FROM CONTRACTORS



E. Engineering Design Requirements

1. NCDENR Application for Approval: NCDENR Application for Approval on Engineering Plans and Specifications shall name UTILITY as applicant.

2. Easements: PLANS shall clearly show and label all access and utility easements for any portion of the water system not within publicly dedicated rights of way, including any construction easements needed for the project.

3. NCDENR Submittal Documents: All applicable documents listed in the table below shall be provided by the project’s ENGINEER for UTILITY’s review prior to applying for NCDENR approval for Authorization to Construct.

4-Table

| | |
|---|---|
| 1 | 1 hard copy and 1 '.pdf' set of Design Drawings. |
| 2 | 1 copy and 1 PDF of the NCDENR Checklist for New Well Construction, sealed by the ENGINEER (see attached, this section). |
| 3 | 1 hard copy and 1 '.pdf' copy of Engineer's Report, completed in the format approved by NCDENR pursuant to the RULES GOVERNING PUBLIC WATER SYSTEMS, sealed by the ENGINEER. |
| 4 | 1 copy and 1 '.pdf' copy of the Project Summary. |
| 5 | 1 copy and 1 '.pdf' set of all water system design calculations, sealed by the ENGINEER. |
| 6 | 1 copy and 1 '.pdf' set of all well construction reports and testing reports for each well in the water system, if any. |
| 7 | 1 copy and 1 '.pdf' set of all project specification sheets and MSDS sheets |
| 8 | 1 copy and 1 PDF of the NCDENR Application for Approval of Engineering Plans and Specifications for Water Supply Systems. |
| 9 | 1 copy and 1 '.pdf' set of the well lot survey for each well lot in the water system showing the well head location, the 100' radius from the center of the well head and the 20' access and utility easement to each well lot that does not front upon publicly dedicated rights of way, sealed by the SURVEYOR, if any. |

F. Project Completion and Acceptance

UNDER NO CIRCUMSTANCES SHALL ONSWC SUPPLY WATER UNLESS ALL OF THE FOLLOWING ITEMS ARE COMPLETED:

A – The Engineering Certificate is completed and submitted

B – All appropriate information is supplied so that an Applicant's Certificate can be executed, is executed and submitted

C – ONSWC receives appropriate Final Approval from all applicable regulatory agencies

D – All appropriate documents are supplied for the Closing Documents and the documents executed

- 1.** Project Documentation: All applicable documents shall be provided prior to project's acceptance by UTILITY and prior to placing the water system in service. The format for these document submissions will be 1 hard copy and 1 PDF and 1 DWG (for drawings)
- 2.** Backflow Prevention Inspection Report and Testing: CONTRACTOR is responsible for providing all reports and testing results per most current PWS rules and regulations.
- 3.** As-Built Inspection: ENGINEER is responsible for scheduling field inspection/site visits by UTILITY prior to UTILITY's acceptance of the project.
- 4.** ENGINEER's Final Completion Package: Documents listed in the table below shall be provided by the ENGINEER

5-Table:

| | |
|---|---|
| 1 | Water system pressure and leakage test results and bacteriological analysis results. |
| 2 | ENGINEER's Electronic Record Drawings for the project, which shall include the longitude and latitude of each valve, fire hydrant, meter, etc, in '.dwg' format, AutoCAD Release 14 minimum, 2000, or 2000i |
| 3 | 1 copy and 1 '.pdf' set of ENGINEER's signed and sealed Record Drawings for project |
| 4 | ENGINEER's Letter of Certification of Completion (signed, sealed, and dated) for the project. The original to be sent by the ENGINEER to NCDEQ. |

- 6** Record Drawings: The DEVELOPER's ENGINEER shall submit a certified set of Record Drawings sealed by the Engineer prepared in conjunction with a North Carolina Licensed Professional Land Surveyor to ensure proper locations and coordinates of built and installed devices/facilities to UTILITY prior to acceptance of the project. The DEVELOPER's ENGINEER shall be responsible for recording information on the

approved PLANS concurrently with construction progress. Record Drawings submitted to UTILITY, as part of the project acceptance shall comply with the following requirements:

- • Record Drawings shall be legibly marked to record actual construction.

- • Record Drawings shall show actual location of all underground and aboveground water and wastewater piping and related appurtenances (Plan and profile). For systems where UTILITY is the owner and operator of both the water and wastewater systems, the entire water and wastewater systems Record Drawings shall show all underground and aboveground water and sewer piping and related appurtenances. All changes to piping location including horizontal and vertical locations of utilities and appurtenances shall be clearly shown and referenced to permanent surface improvements. DRAWINGS shall also show actual installed pipe material, class, etc.

- • Record Drawings shall clearly show all field changes of dimension and detail, including changes made by field order or by change order.

- • Record Drawings shall clearly show all details not on original contract drawings but constructed in the field. All equipment and piping relocation shall be clearly shown.

- • Location of all hydrants, meters, meter boxes, valves, and valve boxes shall be shown. A benchmark shall be shown on the plan referencing the state plane coordinate system.

- • Record Drawing format shall be georeferenced .DWG file and .PDF.

Each sheet of the PLANS shall be signed, sealed and dated by the DEVELOPER'S ENGINEER as being "Record Drawings." Construction PLANS simply stamped "As-Built" or "Record Drawings" and lacking in the above requirements will not be accepted and will be returned to the DEVELOPER'S ENGINEER. The NCDENR "Applicant Certification" for Final Approval will not be released until correct "Record Drawings" have been submitted.

CHECKLIST for NEW WELL CONSTRUCTION Date: _____

Name of Public Water System: _____

Public Water System Identification number (PWSID) if known: _____

County: _____ Well name or number: _____

Engineer: _____

Well Driller's name: _____ Driller's Cert. number: _____

Casing: Length installed: _____ Type of Casing installed: _____

(should be 50 ft. minimum below grade)

Casing should be grouted full length. Length of Casing Grouted: _____

Grouting Method Used:

Pressure Method: _____ Pumping Method: _____ Other: _____

Well Site Deed(s) enclosed? (Y / N) Recorded Plat(s) enclosed? (Y / N)

Drive shoe used on bottom of well casing? (Y / N)

Signed well driller's log with driller's certification number (Y / N)

Monitoring: Bacteriological Analysis (Y / N) VOC Results (Y / N)

"New Well" Inorganic Results (Y / N) SOC Results (Y / N)

Radiological (if required) (Y / N) Asbestos (if required) (Y / N)

Nitrate/Nitrite (if not included in Inorganic Analysis) (Y / N)

Signed 24-hour well yield and drawdown report enclosed? (Y / N)

Engineer's well construction verification statement sealed and signed? (Y / N)

Total dynamic head design calculations? (Y / N)

Selected pump data and performance curves? (Y / N)

3 sets of "Application for Approval"? (Y / N)

Well site approval letter? (Y / N)

By signing and sealing the below, the Engineer certifies that he/she or someone under his/her direct control was present for the drilling of the subject well. If not he/she certifies and provides a video investigation record/log of the new well submitted with these documents.

Engineer's Seal & Signature:

Section T-3 DESIGN STANDARDS

Old North State Daily Flows

1. Design Demand

- A. DEVELOPER'S ENGINEER must confirm demands per RULES GOVERNING PUBLIC WATER SYSTEMS, latest edition. Demand calculations must be done according to these standards, Division 2, Section 5.3.2, or in accordance with the demand listed in the Developer's Agreement with UTILITY, whichever is more stringent.

2. Well Sites

A. Location

1. Stormwater credits and/or allowances: For each individual well, whether multiple wells are located on the same lot or not, the developer shall place into ONSWC name/for its future use/ at ONWC's disposal adequate stormwater credits/permissions to construct up to a minimum net 7,850 square feet of impervious surface.

2. For approval, NCDENR and/or UTILITY rules require that **minimum** horizontal separation between public water supply wells and known potential sources of pollution be maintained as follows:

a. 100 feet from:

- Any sanitary sewage disposal system or sewer pipe.
- Any subsurface disposal area, disposal tank, leach field or filter backwash;
- Buildings, storage facilities, permanent structures, animal lots, or cultivated areas where chemicals are applied.
- Surface water;
- Chemical or petroleum fuel underground storage tanks with secondary containment.
- Any roads other than the well access road;
- Any other potential sources of pollution such as power transformers.

Well sites downgrade from individual septic tanks, near the 100' radius, are usually not accepted by NCDENR.

b. 200 feet from:

- A subsurface sanitary sewage treatment and disposal system designed for 3000 gpd or more.
-

c. 300 feet from:

- A cemetery or burial ground

d. 500 feet from:

- A septage disposal site;
- Chemical or petroleum fuel underground storage tanks without secondary containment; including underground pipelines for transmission of petroleum products (cross-country).

- A sanitary landfill or non-permitted non-hazardous solid waste disposal site.

e. 1000 feet from:

A hazardous waste disposal site

The well shall not be located in an area subject to flooding.

Note that the NCDEQ may require greater separation distances or impose other protective measures when necessary to protect the well from pollution (see RULES GOVERNING PUBLIC WATER SYSTEMS section .0203, Public Well Water Supplies for more detail).

3. Well sites with drainage ditches or low spots capable of holding water within the 100' radius will not be accepted by the UTILITY.

4. Well site shall be approved by NCDEQ and a UTILITY Representative prior to drilling. Final approval of well site shall be dependent upon satisfactory completion of any NCDEQ and UTILITY provisos.

5. A certified survey of the well lot shall be provided prior to the submittal for NCDEQ plan approval. The survey shall include topographic information. The coordinates of the well and County pin number shall be provided for each well drilled.

6. The well lot must be owned or controlled by the UTILITY. Developer shall provide Utility with an appropriate recorded deed of easement and/or general warranty deed which shall include well protective non-contamination provisions acceptable to UTILITY to ensure the required 100' radius is pollution-free. Said deed must be in the UTILITY's name and shall be recorded at the county's register of deed office prior to submittal for NCDENR plan approval and UTILITY accepting the well. A 20' utility and access easement shall also be granted to UTILITY.

3. Design Criteria for Pumps & Motors

A. Submersible Motors

1. Motors shall be manufactured by Franklin or Centri-pro and of the highest psi thrust bearing available. Any other manufacturer must be approved by UTILITY.

2. Three-phase power is required for sites. DEVELOPER and ENGINEER shall investigate the possibility of making three-phase power available before specifying a single-phase motor.

3. On anything less than 10 hp, UTILITY may allow single-phase power.

4. Three phase motors 15 hp – 25 hp shall have a No. 8 pig tail or motor connector. The size pig tail or motor connector for larger motors shall be determined by the manufacturer.

5. All motors shall be new; remanufactured motors shall not be accepted.

6. The ENGINEER shall design the proper size drop wire in accordance with the latest Franklin or Century installation guide or the one provided with an equivalent motor used.

7. After motor is set in place, an insulation test shall be performed to ensure there are no shorts or grounds in the drop wire or motor. If grounds or shorts are found, the contractor will replace the drop wire and/or motor at no cost to the owner.

8. There shall be at least 20' of drop cable left out of well.

9. The appropriate 3-phase motor protection shall be provided as specified by UTILITY for the area served.

B. Submersible Pumps

- 1.** Pumps shall be manufactured by Goulds or Grundfos (see Division 5, Section 1.2.2) unless otherwise designated by UTILITY.
- 2.** The pump size and type shall be designed by the ENGINEER and approved by the UTILITY.
- 3.** All pumps shall be set on galvanized pipe or approved equal, of the size approved by UTILITY, unless weight will not allow it. When galvanized drop pipe is not feasible Shur-Align PVC drop pipe shall be allowed upon engineering approval.
- 4.** An inline spring check valve shall be installed at the pump. A pump set 300' or more shall have a second check valve of the same type, installed halfway up the drop pipe.
- 5.** A 1/4"-1/2", black roll pipe of sufficient psi rating to overcome the static pressure shall be installed with pump. One end shall be just above the pump and the other end left out of well at least 30'. The tube shall be continuous with no couplings or cuts.
- 6.** A galvanized "tee" shall hold the pump on the well seal.
- 7.** A well seal of the proper size shall be used complete with an approved well vent of the steel type.
- 8.** If the drop pipe is 2 1/2" or larger, the well seal shall be steel and made with a solid top.
- 9.** The pump setting depth shall be based on fracture locations and stabilized pumping level and is to be reviewed by a Professional Geologist or ENGINEER.
- 10.** Install a 1" (minimum) PVC pipe from the top of the well down to the level of the pump for determining water drawdown depth by acoustic or manual sounding.

B. Booster Pumps and Motors

- 1.** Booster pumps shall be manufactured by Goulds or Grundfos (see Division 5, Section 1.2.3) unless otherwise designated by UTILITY. The pump size and type shall be designed and/or approved by UTILITY. It shall be designed to pump the specified amount of gallons per minute at the specified pressure.
- 2.** Motors for the pumps shall be of the manufacturer, horsepower, voltage, phase, and hertz as specified or approved by the UTILITY.
- 3.** Dual pumps with alternating, lead-lag and all necessary controls shall be installed.
- 4.** Pumps shall be mounted on concrete pedestals at least 4" in height, with 4" overhang from each side of the pump, out of 3000 psi concrete. Lag bolts of the proper size shall be inserted in the concrete to mount the pump with. An 8" rubber matting shall be installed between the concrete and the pump base.
- 5.** To prevent air-logging, each pump shall be equipped with an air release valve mounted on the highest point in the pump chamber. This air release will also have sanitary vent attached to it.
- 6.** Either a flange or union shall be used at both the inlet and discharge piping where it enters the pump.
- 7.** Each pump shall be equipped with a swing check valve of the specified type in the discharge side piping.
- 8.** A gate or ball valve shall be installed in both the inlet and outlet piping. Gate valves shall be a rising OS&Y valve.
- 9.** A tee with a 1/4 inch ball valve with WOG rating of 600 psi shall be installed on both the intake and discharge side of the pump.

4. Water Treatment

A. Chemical Equipment

- 1.** A chemical pumping system complete with chemical pumps, solution tanks, tubing, injectors and shelf shall be provided at each treatment location.
- 2.** Chemical pumps shall be 115 VAC of appropriate pressure and flow design requirements, or as specified by UTILITY, specified heads complete with foot valves and

injectors or equivalent. Manufacturers' specific recommendations for components designed for the application of all chemicals shall be followed.

3. Solution tanks shall be specified by the UTILITY.

4. Three tees will be installed in valve bank after the check valve to accommodate chemical feed points with an 18" minimum separation between the phosphate and caustic feeds and 5 feet of separation between the phosphate and chlorine feeds. If specified, the phosphate feed point and caustic feed point should be placed immediately after the check valve and the chlorine feed point should be placed past the master meter for the best results.

5. To achieve optimum corrosion control, UTILITY may specify pH adjustment above the state minimum pH of 6.5. Required safety features for wells with caustic feeds include caustic relays wired into the starter and a flow switch installed along a straight section of valve bank at least 12" from an ell. A low flow - flow switch is required on wells producing less than 15 gpm and flow switch will be used on wells producing in excess of 15 gpm.

6. The chemical shelf shall be wall mounted, a minimum size of 2" x 12" x 4', and made of chemical-resistant material with two 10" x 12" shelf brackets and mounted 42" above finished floor to the top or as specified by UTILITY.

7. A Separate chemical feeder shall be used for each chemical applied.

8. Three separate duplex GFCI outlets with separate individual feed circuits/wiring from the electrical control panel shall be provided for the chemical feeders. For Clarification See standard details – specifically W-32A Typical Well House Wiring Diagram. Each duplex outlet will be a GFI/GFCI outlet.

B. Filtration Requirements

1. All filtration/contaminant removal and/or waste disposal systems shall be designed by a licensed Professional Engineer, in cooperation with representatives of the UTILITY. These systems will be the sole discretion of the Utility and must be approved before installation and implementation.

2. When the raw water quality from a new well is within 60% or exceeds the EPA, State Maximum Contaminant Levels (MCL's), or as otherwise discussed within these specifications, provision shall be made, in the well house and lot design and construction, for the addition of physical treatment and, potential waste disposal if approved by the UTILITY (see Division 2, Section 4.3).

3. All water filtration facilities will be equipped with radio controls/telemetry and programmed logic controls (PLC). Radio controls/telemetry shall be provided by UTILITY.

4. Water softening Treatment will only be allowed when there is a receiving sewer with a wastewater treatment plant approved to receive the Water Softening Treatment backwash. When the receiving sewer is not owned or operated by the Utility (ONSWC), a flow acceptance letter must be provided for the discharge.

5. Waste Disposal Facilities: Recycle systems are required in accordance with all applicable laws including Federal, State and Local; but when not permissible: sewer, sub-surface, or stream discharge waste disposal methods are also acceptable, when permitted by the appropriate regulatory agencies. With the exception of onsite Recycle and Sludge disposal systems, all waste treatment facilities will be located outside of the well head protection radius and will be separated from the water treatment facilities by an air gap to prevent cross connection. Sub-surface disposal methods will require a repair area close enough to be dosed from the original waste treatment and disposal facilities.

a. When applicable, a flow equalization/settling tank will be installed prior to any sand bed filters. Tank capacity will be sufficient to contain, at least, two complete waste cycle discharge volumes. No "septic" type tanks set above surrounding grade will be allowed.

6. An Operation and Maintenance Manual for the water treatment facilities will be provided to the UTILITY. This Manual will document the basic operation and

maintenance issues and procedures for each equipment item and provide schedules for completion of routine tasks.

7. Start-up, Testing, and Operation: Project reports for treatment facilities will be provided to the UTILITY and must include schedules and performance standards for start-up, testing, and (initial) operation. Schedules should include the anticipated start-up date and proposed testing duration. Performance standards should include reference to applicable regulations and specific equipment capabilities.

C. Water Quality Parameters

1. Iron (Fe): For any concentration below 0.3 mg/L, a sequestering agent shall be required. The polyphosphate required will be at Utility specification.

2. Manganese (Mn): For any concentration below 0.05 mg/L a sequestrant shall be required. The polyphosphate required will be at Utility specification. At concentrations greater than 0.30 mg/L, Mn filtration or approved equivalent will be required.

3. If the Fe & Mn Combined Levels exceed 0.50 mg/L, or if the Mn levels are greater than .3 Mn filtration or approved equivalent for removal of iron and manganese will be required unless the Engineer submitting on behalf of the developer and/or ONSWC can justify and explain how sequestering will be successful. At minimum, the explanation will include dosing and chemical feed calculations and show how the insoluble portion of Fe and Mn will be less than the current sMCL. . If the engineer of record provides an explanation it is required to receive approval from NCDEQ-PWS Plan Review Section. Failure to receive NCDEQ_PWS approval will require filter installation. Under no circumstances will the Fe & Mn combined levels exceed 1.0 ppm without installation of iron and manganese filters.

4. Separate samples will be required for both soluble and insoluble Fe and Mn when concentrations are detected.

5. Sulfates: At or greater than 250 mg/l will require treatment and backwash permitting.

6. Total Dissolved Solids (TDS): At 500 mg/L or greater treatment shall be required.

7. Radionuclides levels are at 75% of the maximum contaminant levels, Filtration is required. An Alternative is to resampling at a schedule of four (4) hours, eight (8) hours, and twelve (12) hours at the permitted pumping rate. If these results are less than 75% of the maximum contaminant level, treatment will not be required.

5. Water Mains and Appurtenances

A. General Considerations

1. Type of Water Mains: UTILITY will approve PLANS for water supply mains and extensions only when such mains are designed and constructed in accordance with the criteria set forth in this MANUAL.

2. Design Period: Water mains shall be designed for the estimated ultimate tributary population. Water systems shall be designed to satisfy the domestic water demand requirements for the area.

3. Location: Water mains shall be located in dedicated rights-of-way or utility easements. When installed in rights-of-way, water mains shall, in general, maintain a consistent alignment with respect to the centerline of the road. All water mains located outside of dedicated rights-of-way shall require a minimum 20-foot easement with a 5' on either side of the main clear of any other parallel utilities. Additional easement widths shall be provided when the pipe size or depth of cover so dictate. If a water main is located adjacent to a road right-of-way, a minimum 10-foot easement shall be provided. Additional easement widths shall be provided, if the pipe size or depth-of-cover dictates. Water mains shall not be placed under **parking lots** retention ponds, tennis courts, or other structures. In addition, water mains shall not be located along side or rear lot lines.

4. Construction Easements: All construction easements must be shown on the PLANS.

B. Design Basis

1. Hydraulic Modeling: A hydraulic model utilizing WaterCAD or WaterGEMS will be required for all new systems containing 2 wells or more or for any system connecting to a master system. If the proposed system is to be connected to an existing system, the entire interconnected system shall be modeled.

a. If a hydraulic model already exists for the system being connected to, the DESIGNER, with the permission of the UTILITY, may provide a hydraulic model of the proposed system to be placed in the existing model. In this case, UTILITY shall provide pressure and flow data for the system being connected to.

2. Average Daily Flow and Peak Flows: Average daily water flow shall be calculated by referencing the Water-Table of Daily Flows for Various Occupancies (Section 1). Maximum daily water flow shall be calculated as two times the average daily water flow and the peak hourly water flow shall be calculated as four times the average daily water flow.

3. Engineer's Report and Design Calculations: DEVELOPER'S ENGINEER shall submit signed, sealed and dated Engineer's Report and design calculations with the PLANS for all water distribution projects. Calculation shall show the water mains will have sufficient hydraulic capacity to transport peak hourly flows while meeting the requirements of Section C-1(below). Head losses through meters and backflow devices shall also be included in calculations. The Engineer's Report shall comply with the forms and guidelines given in the RULES GOVERNING PUBLIC WATER SYSTEM (Section .0307, Engineer's Report, Water System Management Plan and Other Plans). Any Engineer's Report that does not follow these guidelines may be rejected by the UTILITY.

C. Details of Design and Construction

1. Pressure: All water mains shall be designed in accordance with Section 5. The system shall be designed to maintain a minimum pressure of 50 psi at all points in the distribution system under all conditions of flow. Higher pressures may be required at commercial, industrial and high-density residential areas. The minimal normal working pressure in the distribution system shall be approximately 65 psi, but in no case less than 40 psi on the customer side of a meter. For pressures greater than 90 psi special provisions may be required. Design Friction Loss calculations for water mains shall be submitted with plans. AWWA Diurnal and a hydraulic model will be required to prove these requirements are met.

2. Design of Wells: Residential well capacity shall be based on a minimum of 1.0 gpm per residential connection, unless stated otherwise in the developer's agreement. Well capacity within the Bayleaf Master Water System (NC0392373) shall be based on a minimum of 1.5 gpm per residential connection. If PWS requirements or if a greater amount is given in the Developer's Agreement, the more stringent amount shall be used instead.

3. Design of Hydropneumatic Storage: When calculating the required effective and total volume, the Tank size shall be based on the North Carolina Public Drinking Water Regulations.

4. Diameter: Four-inch through 54-inch diameter water mains shall be allowed. As a minimum, four (4) inch-looped systems shall be required in low-density, residential projects. Where looping of mains is not practical, minimum six (6) inch mains shall be required, unless detailed calculations are submitted to substantiate the sufficiency of a smaller main (four (4) inch mains are allowed on the last 400' of a dead-end line). In commercial, industrial, and high-density residential areas, a minimum of eight (8) inch looped mains shall be required.

5. Dead Ends: In order to provide increased reliability of service and reduce head loss, dead ends shall be minimized by making appropriate tie-ins whenever practical, as determined by UTILITY.

Where dead end mains occur, they shall be provided with a blow-off for flushing purposes hydrants or other approved flushing devices may be used if approved by

ONSWC. Flushing devices shall be sized to provide flows with a velocity of at least 3 feet per second in the water main being flushed. No flushing device shall be directly connected to any sewer or irrigation system. Calculations and a hydraulic model will be required to prove these requirements are met.

6. Valves: All Valves will be clockwise closed and counterclockwise open. Valves shall be provided on water mains so that sanitary hazards will be minimized during repairs. Valves shall be located at not more than 500-foot intervals in commercial, industrial, and high-density residential areas and at not more than 1,000-foot intervals in all other areas. Valving shall be placed at all areas where water mains intersect in such a way as to ensure effective isolation of water lines for repair, maintenance, or future extension.

7. Separation of Water Mains and Sewers: Refer to Division 3 of these SPECIFICATIONS for applicable requirements. No water pipe shall pass through or come in contact with any part of a sewer system. Extreme caution should be exercised when locating water mains at or near certain sites such as sewage treatment plants or industrial complexes. Individual septic tanks must be located and avoided.

8. Surface Water Crossings: UTILITY shall review and approve the PLANS on a case-by-case basis. All aboveground pipes shall be painted as specified in Division 3 for water mains.

9. Air Release Valves: Within 500 feet of the water entry point from a well to the distribution system and at all high points in water mains where air can accumulate, provisions shall be made to remove the air by means of automatic air release valves. At a minimum, air release valves should be placed where there is a change of pipe grade of 2 foot or more and spacing shall at least be one air release valve every 1,500 feet. Automatic air release valves shall not be used in situations where flooding of the manhole or chamber may occur. See details in STANDARD DETAILS.

10. Chamber Drainage: Chambers, pits or manholes containing valves, blow-offs, meters, or other such appurtenances to a distribution system shall not be connected directly to any storm drain or sanitary sewer, nor shall blow-offs or air relief valves be connected directly to any sewer. **All manholes and chamber structures shall have grveled interior bases to allow drainage.**

11. Disinfection Following Repair or Replacement: Any part of UTILITY water system which has direct contact with finished water and has been out of service for repair, alteration, or replacement shall be disinfected as outlined in Division 3 of these SPECIFICATIONS.

D. Water Services and Connections

1. Water services and connections shall conform to the applicable provisions of Section T-4 and the STANDARD DETAILS. Only 3/4", 1", 1-1/2", 2", 4", 6", 8" and 12" services will be allowed. Where water services greater than 12" are required, dual services shall be provided. Water services and connections to existing UTILITY systems up to 2" will be made by UTILITY. Services and connections to new water systems and to existing systems larger than 2" shall be made by the CONTRACTOR.

A UTILITY representative must be on site during any connections to existing UTILITY systems.

CONTRACTOR shall not provide water service to new systems/line extensions other than for flushing and testing until the NCDEQ has issued a "Letter of Final Approval." To comply with regulations, the new connection shall not be placed into service until the "Letter of Final Approval" from NCDEQ has been obtained.

2. For multiple connections to UTILITY existing water systems, the CONTRACTOR shall make the final connection upon UTILITY receipt of the NCDEQ "Letter of Final Approval" in accordance with the applicable AWWA in accordance with the applicable AWWA standard for disinfection of new water systems/ line extensions.

E. Water Metering

1. General: All water service connections shall be metered and be directly in front of the property **and at final grade level**. In general, gang meters are not accepted. The method of metering shall follow the guidelines listed below. However, the DEVELOPER'S ENGINEER must obtain approval before finalizing the design of the metering system.

2. Single Family Duplex and Multi-Family Subdivisions with Public Rights-of-Way: Each unit shall be individually metered. Single and double services shall be installed at property lines as indicated by the STANDARD DETAILS.

3. Single Family and Duplex Subdivisions with Private Streets: Individual meters may be permitted in accordance with Division 2, Section 5.5.2 if the private streets are designed to the applicable county standards and easements are dedicated over the entire private street common areas. In addition, sufficient area must be available outside of paved areas to locate water mains, services, and meters. If the above criteria cannot be met, the subdivision shall be metered pursuant to Division 2, Section 5.5.5.

4. Commercial, Industrial and Institutional Projects without Private Standby Water Lines: In general, each building shall be individually metered. Meter(s) shall be located in the public rights-of-way at the property line. If this is not practical, then the meter shall be located no closer than 5' from the front of the building.

5. Commercial, Industrial, Institutional, Multi-Family with Private Streets, Apartments and Condominium Projects with Private Standby Water Lines: In general, all such projects shall require installation of a RPZ check assembly on each dedicated standby water line. Where on-site standby water systems contain less than 75 feet of main, a dual system (separate domestic and standby water lines) may be considered. Dual systems shall require backflow prevention in accordance with UTILITY Backflow Prevention Policy, latest edition. Individual meters to each unit are required.

6. Shopping Centers: In general, shopping centers shall require installation of a RPZ check assembly on each dedicated standby water line. Individual meters to each unit are required.

7. Meter Installation: All meters greater than or equal to 2" in size shall be provided by and installed by the CONTRACTOR. Meters less than two inches in size will be installed by UTILITY after payment of applicable fees and charges. All meters less than two inches in size will be installed underground in an approved meter box. Meters two inch and larger shall be installed by the CONTRACTOR per UTILITY Comprehensive Meter Program and the STANDARD DETAILS. In general, meters larger than two inch shall be located in a meter easement located adjacent to the public right-of-way.

8. Meter Sizing: Size of all meters shall be approved by UTILITY. The DEVELOPER'S ENGINEER shall provide sufficient information on estimated peak flows and low flows. The developer's ENGINEER shall include head losses through metering devices when designing the water system.

9. Irrigation Meters: During the installation of the water system for a new development, UTILITY will require one (1) 1-inch service line to be installed between the water main and each lot. In the event that the builder and/or homeowner chooses to install an in-ground irrigation system, the 1-inch line can be retrofitted to include a 1" x 3/4" tee to accommodate both a 3/4" domestic meter and 3/4" irrigation meter.

a. A Reduced Pressure Zone (RPZ) backflow prevention device shall be installed behind the irrigation meter. The RPZ shall be one of the following models. With UTILITY permission, another manufacturer with equal specifications and workmanship may be used.

Cla-Val – RP2

Conbraco - 400

Febco – 825Y (D)

Watts – Series 009QT

Wilkins – WK 975XL-075

b. Before installing an in-ground irrigation system, reference the "ONSWC RESIDENTIAL IRRIGATION METER INSTALLATION" guidelines.

E. Material, Installation and Testing

Applicable provisions of Section T-4 and Section T-5 shall apply.

1. Meter Boxes

Meter Boxes for up to 1-inch meters will be NDS D1200 Standard Water Meter Boxes and lids. Alternatives only allowed if approved by the Utility Engineer in writing. The meter Box Body at a minimum will be tapered and have a minimum wall thickness of 0.25 inch, have a double wall at the top cover seat area with a minimum thickness of 0.187 inch. The cover seat area shall have 30 structural support ribs on the underside of the seat, each with a minimum thickness of 3/16 inch. The bottom body shall have a 1.0-inch flange. The meter box cover shall have a minimum thickness of 0.25 inch. Boxes and lids shall be injection molded of structural foam polypropylene with a melt index of 10-12. Meter Box Covers (lid) will be a drop-in type lid with a 2.0-inch remote reading hole port and a cast iron reader flap. Meter box and lids shall be manufactured by the same manufacturer and designed to fit as a unit.

Placement of any meter within traffic loading areas or pavement areas is not preferred. If such an installation is proposed, it must be approved by the Utility Engineer in writing. Meters and Meter Boxes/vaults larger than 1.0-inch will be approved on a case by case basis by the utility Engineer.

F. Location and Identification

A means for locating and identifying all water mains and valves shall be provided in accordance with Section T-4 and the STANDARD DETAILS.

G. Cross-Connection Control

1. Location and Installation: In general, all backflow prevention assemblies shall be located directly following the water meter on developer/owner's property. If no meter is present (such as a building dedicated fire line) the backflow device shall be located that the right-of-way, edge of easement or edge of property line, and ONSWC shall have no responsibility for the installation, operation or maintenance of the backflow device. Backflow prevention assemblies shall be installed aboveground to facilitate maintenance and testing and shall be operated with appropriate heat tracing for freeze protection. UTILITY's Cross Connection Control Policy shall be followed. It shall be the developer/owner's responsibility to purchase, install and maintain all backflow prevention assemblies. All cross-connection controls shall be tested and inspected by a North Carolina Department of Environmental Quality (NCDEQ) certified backflow prevention tester in accordance with state rules and regulations prior to acceptance by ONSWC. Testable backflow devices shall be tested in accordance with State, Federal, and Local laws on a prescribed frequency but at a minimum of annually by a certified backflow prevention tester. Results from these tests shall be provided to ONSWC. Any devices that are found to be defective shall be repaired immediately and follow-up test results provided to the UTILITY. Testing and maintenance of the backflow devices shall be the sole responsibility of the property owner. Failure to submit testing results and/or maintaining the devices in proper operational order could result in enforcement up to severance of service.

SECTION T-4 CONSTRUCTION

SPECIFICATIONS

General Construction Requirements

1. General

A. Grades, Survey Lines, and Protection of Monuments

- 1.** Grade: Benchmarks and base line controlling points shall be established prior to beginning work. Reference marks for lines and grades as the work progresses will be located so as to cause as little inconvenience to the prosecution of the work as possible. The CONTRACTOR shall place excavation and other materials as to cause no inconvenience in the use of the reference marks provided. CONTRACTOR shall remove any obstructions placed contrary to this provision.
- 2.** Surveys: The CONTRACTOR shall furnish and maintain, at his own expense, stakes and other such materials, and give such assistance, including qualified helpers, for setting reference marks to the satisfaction of UTILITY and the ENGINEER. The CONTRACTOR shall check such reference marks by such means as he may deem necessary and, before using this, shall call UTILITY's attention to any inaccuracies. The CONTRACTOR shall, at his own expense, establish all working or construction lines and grades as required from the reference marks, and shall be solely responsible for the accuracy thereof. The CONTRACTOR shall, however, be subject to the check and review of UTILITY.
- 3.** Monument Preservation: Property comers and survey monuments shall be preserved using care not to disturb or destroy them. If a property comer or survey monument is disturbed or destroyed during construction, whether by accident, careless work, or required to be disturbed or destroyed by the construction work, said property comer or survey monument shall be restored by a land surveyor registered in the State of North Carolina. All costs for this work shall be paid for by the CONTRACTOR.

B. Utility Coordination

- 1.** Location of Utilities: Prior to proceeding with trench excavation the CONTRACTOR shall contact all utility companies in the area to aid in locating their underground services. It shall be the contractor's responsibility to contact utility companies at least three (3) normal working days before starting construction. The CONTRACTOR shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground utilities may be determined. The CONTRACTOR shall take all reasonable precautions against damage to existing utilities. However, in the event of a break in an existing water main, gas main, sewer or underground cable, the CONTRACTOR shall immediately notify the responsible official of the organization operating the interrupted utility. The CONTRACTOR shall lend all possible assistance in restoring services and shall assume all cost, charges, or claims connected with the interruption and repair of such services.
- 2.** Deviations Occasioned by Structures or Utilities: Wherever obstructions are encountered during the progress of the WORK and interfere to such an extent that an alteration in the PLANS is required, the ENGINEER shall have the authority to order a deviation from the line and grade and the UTILITY shall have final approval authority. If a change in line or grade of a gravity sewer is necessary, UTILITY will require the addition of any manholes needed to maintain the integrity of the sewer system.
- 3.** Test Pits: Test pits for the purpose of locating underground pipeline, utilities, or structures in advance of the construction shall be excavated and backfilled by the

CONTRACTOR. Test pits shall be backfilled immediately after their purpose has been satisfied and maintained in a manner satisfactory to the applicable county and UTILITY. The costs for such test pits shall be borne by the CONTRACTOR.

4. Protection of Existing Facilities: Temporary support, adequate protection and maintenance of all underground and surface utility structures including sewers, manholes, hydrants, valves, valve covers, and miscellaneous other utility structures encountered in the progress of the WORK shall be furnished by the CONTRACTOR at his expense. Any such structures which may have been disturbed shall be restored upon completion of the WORK.

C. Construction in Easements and Rights-of-Way

1.3.1 Construction in Easements: In easements across private property, the CONTRACTOR shall confine all operations within the easement area and shall be responsible and liable for all damage outside of the easement area. Trees, fences, shrubbery or other type of surface improvements located in easements will require protection during construction. Precautions shall be taken by adequate sheeting or other approved method to prevent any cave-in or subsidence beyond the easement limits or damage to improvements within the easement. In general, the easement area is intended to provide reasonable access and working area for efficient operation by the CONTRACTOR. Where easement space for efficient operation is not provided, the CONTRACTOR shall be responsible for organizing his operations to perform within the restrictions shown on the PLANS.

1.3.2 Construction in NCDOT Right-of-Way: The CONTRACTOR shall conform to all requirements of the NCDOT where construction work is in a right-of-way under the jurisdiction of the State of North Carolina. CONTRACTOR is required to have a copy of the encroachment agreement on the site at all times.

1.3.3 Construction in County Right-of-Way: WORK shall be governed by the applicable county right-of-way utilization regulations.

D. Suspension of Work due to Weather

During inclement weather, all WORK which might be damaged or rendered inferior by such weather conditions shall be suspended. During suspension of the WORK from any cause, the WORK shall be suitably covered and protected so as to preserve it from injury by the weather or otherwise.

E. Cooperation with other Contractors and Forces

During construction progress, it may be necessary for persons employed by UTILITY to work in or about the site. UTILITY reserves the right to access to the construction site at such times as UTILITY deems proper. The CONTRACTOR shall not impede or interfere with and shall cooperate with UTILITY for proper execution of the WORK.

F. Subsurface Exploration

The CONTRACTOR shall conduct subsurface explorations as necessary to perform the WORK.

G. Salvage

Any existing UTILITY owned equipment or material including but not limited to pumps, motors, control panels, valves, pipes, fittings, couplings, etc. which are removed or replaced as a result of construction shall be designated as salvage by UTILITY. If considered as salvage, the material shall be carefully excavated if necessary and delivered to UTILITY at a location designated by UTILITY.

H. Shop Drawings and Samples

The CONTRACTOR shall submit one (1) hard copy and one electronic copy (PDF) of the shop drawings, signed by the DEVELOPER'S ENGINEER, to UTILITY for approval. The data shown on the shop drawings shall be complete with respect to

dimensions, design criteria, materials of construction and the like to enable review of the information as required.

The CONTRACTOR shall, if requested by UTILITY, furnish certificates, affidavits of compliance, test reports, or samples for check analysis for any of the materials specified in this MANUAL.

I. Refurbished Materials

All materials for construction shall be new materials. Any refurbished materials shall be allowed at the judgment and upon approval of the UTILITY Construction Coordinator.

2. Well Site Preparation

A. General

This Section covers the clearing, grubbing, stripping, grading, and any other work needed to prepare the construction site. The CONTRACTOR shall clear and grub all of the areas within the limits of construction as shown on the PLANS and approved by the COUNTY prior to the beginning of any WORK. All site work shall conform to the applicable site clearing, landscaping and tree ordinances of the applicable COUNTY or local governing jurisdiction.

B. Clearing and Grubbing

1. Clearing: The surface of the ground for the area to be cleared and grubbed shall be completely cleared of all timber, brush, stumps, roots, grass, weeds, rubbish and all other objectionable obstructions resting on or protruding through the surface of the ground. Protect trees, shrubs, vegetative growth and fencing which are not called out for removal. Clearing operations shall be conducted so as to prevent damage to existing structures, installations and to those under construction, so as to provide for the safety of employees and others.

2. Grubbing: Grubbing shall consist of the complete removal of all stumps, roots larger than 1-1/2 inches in diameter, matted roots, brush, timber, logs and any other organic or metallic debris not suitable for foundation purposes, resting on, under or protruding through the surface of the ground. All depressions excavated below the original ground surface for or by the removal of such objects shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.

3. Stripping: In areas so designated, top soil shall be stripped and stockpiled. Topsoil stockpiled shall be protected and seeded to protect from erosion until it is placed as specified. Any topsoil remaining after all WORK is in place shall be disposed of by the CONTRACTOR unless directed otherwise by UTILITY.

- 1.. Well site shall be sufficiently graded to allow access and set up of drilling equipment.
- 2.. Additional grading may be required for well testing equipment.

3 Grading

Access & Site Grading

- a. Well site shall be sufficiently graded to allow access and set up of drilling equipment.
- b. Additional grading may be required for well testing equipment.

1. Finished Grading

A. Well site shall be graded so that finished ground level of the well is at least 12" above the surrounding area within a 30' radius to ensure that surface water drains away from the well in all directions. A minimum of 20' of this radius shall be level within 3" for the construction of the house. No water shall be allowed to collect at any point within the 100' radius. The entire site shall be graded to provide for positive drainage away from the wellhead and so any storm water that enters the 100' radius shall drain to points outside the radius.

B. Only clean fill dirt shall be used to fill well sites. Fill dirt shall be compressed and compacted every 18" of fill. If UTILITY's

Representative is not satisfied with the compaction and the compaction is not sufficient to support the facility and storage tank, compaction tests may be required to be done by a qualified agency. If it is found that the site is not compacted properly, the CONTRACTOR shall pay to correct the problem.

C. No potential sources of contamination including fertilizers, chemical or petroleum substances shall be placed within the 100' radius of the well head.

D. All pushed up shrubs, trees, etc, shall be removed from well site during excavation and prior to the finish grading. **All Trees within 75' of the well shall be removed. Dead trees that may fall into this area must also be removed.** No burying of shrubs & trees shall be acceptable. In addition, no dumping shall be allowed on to the well site.

E. Prior to acceptance by Utility, the Owner shall be responsible for removal of all debris or non-permitted substances on well lot.

F. Final grading of the well site shall be smooth and ready for grassing and/or graveling.

4 Grassing

a. Well site shall be grassed.

b. Grassing:

1. Grass seed shall be applied evenly. Hydroseeding is permitted so long as no unapproved materials are used. Refer to the materials list for approved grass types.

2. Straw shall be applied over grass seed. Jute or coconut matting will be required for steeper slopes as needed and in areas where excessive erosion is noted. No fertilizers, chemicals or petroleum products shall be placed on the well site.

3. The contractor shall ensure a good stand of grass

5. Roads

a. There shall be an all-weather access road of at least 10' in width constructed within the recorded 20' easement to each well site with a 15'x25' turn around area of at the well adequate to accommodate complete turnaround of service vehicles, unless otherwise specified by local ordinances.

b. Access roads shall be graded with a minimum of 6" center crown in the road. If determined by the Inspector, side ditches to allow water to run off will also be required. At UTILITY Representative's discretion, rip rap may also be required on steep inclines.

1. All drainage ditches shall be lined with excelsior rolled erosion product to protect from erosion.

2. Road and side ditches shall be so constructed as to not direct or allow water runoff to drain toward the wellhead.

3. The finished access road shall be adequately compacted and covered with at least 6" of crush and run gravel **over a compacted subgrade** and extend from the street to the doors of the facility (including turn around area) and the slab surrounding the wellhead.

4. Culvert pipe shall be placed in all low areas of access road and sized to handle flow of 50-year flood.

5. Road shall be designed and constructed to allow access of large equipment and allow re-drilling of the well, if necessary.

6. Road shall not exceed 12% grade without written consent of UTILITY.

7. A controlled access acceptable to the UTILITY shall be provided at each well site and shall consist of a post and cable properly marked, a gate, or mallard. UTILITY's Representative shall determine which method shall be acceptable.

8. Graveling:

A. Well drive and turn around shall be graveled. The gravel shall be placed so as not to direct water towards the well and also not to block the access to the facility.

B. Gravel shall be 3/4" or smaller crush and run and shall be applied at least 6" thick. Alternatives may be considered (such as #57 or #67 stone or asphalt paving if approved by UTILITY) based on what is deemed suitable to the neighborhood and acceptable to the UTILITY.

C. Graveled areas shall include geotextile between gravel layer and compacted earth surface. Geotextile shall be designed for drainage and separation. Geotextile shall have a minimum grab tensile strength of 120 lbs or greater.

3. Wells

A. Grading

1. Access & Site Grading

a. Well site shall be sufficiently graded to allow access and set up of drilling equipment.

b. Additional grading may be required for well testing equipment.

B. General

1. An on-site meeting with a UTILITY Representative shall be held prior to drilling a well. UTILITY must be notified 1 week in advance prior to beginning drilling, setting the casing and beginning grouting.

2. Well shall be drilled at the specified well stake put in the ground by the surveyor, as approved by NCDENR, and in accordance with these specifications (see Section 1).

a. If the well is not drilled in staked location designated by the surveyor or does not have a minimum 100' radius approved by the State, the UTILITY shall not accept the well.

3. The well drilling contractor and/or DEVELOPER shall obtain any and all required permits needed to drill a well. Penalties assessed for not obtaining the required permits shall be the sole responsibility of the CONTRACTOR and/or DEVELOPER. UTILITY shall not be liable if the required permits are not obtained.

4. Well Diameter

a. Rock Wells: All rock wells shall be drilled with a minimum 8" well casing. UTILITY requires that the well hole from the bottom of the casing be drilled with a minimum 8" diameter for the full length of the well unless otherwise specified by the UTILITY. Exceptions must be approved by the Utility in writing.

b. Sand Wells: All sand wells shall be drilled with a minimum 8" well casing unless otherwise specified by the UTILITY.

5. Only potable water shall be used in the process of well drilling. Tanks and vessels carrying water for drilling purposes must be chlorinated to a minimum of 50 parts per million each time they are filled. All chlorine products must be free of sun inhibitors or sun stabilizers. Water from sources, such as unapproved wells, lakes, ponds, rivers, streams, etc, shall not be used.

6. All other drilling fluids and additives used shall comply with recognized industry standards and practices and be applied and used as prescribed by the manufacturer. Toxic and/or unapproved substances shall not be added to drilling fluid.

7. Wells shall be drilled straight and plumb the entire depth of the well. Crooked wells will not be accepted. If ONSWC determines the wells is not plumb, i.e unable to install a

temporary pump or permanent pump, ONSWC will require a new well to be drilled at others expense.

a. Rock Wells: The well driller shall attempt to drill to a depth at least fifty (50) feet beyond the last water-bearing fracture.

b. Sand Wells: Casing shall extend at least one (1) foot into the top of the water-bearing formation and in no case be less than 55 feet below ground level.

8. The well shall be constructed in accordance with all State and County regulations, AWWA standards and UTILITY specifications.

9. The well shall be thoroughly cleaned of all drill cuttings prior to the removal of the drilling equipment.

10. At the completion of drilling, the well drilling contractor shall chlorinate the well with granular and tablet chlorine such as HTH or equivalent to a tested level of 100 ppm for 24-hours in accordance with AWWA rule C654 and section .1002 of *The Rules Governing Public Water Supply Systems* (NCAC Title 15A, Subchapter 18C, Section 1002). All chlorine products must be free of sun inhibitors or sun stabilizers.

11. A signed and complete copy of the State and/or County required well drilling record/log shall be submitted to UTILITY showing the name of the Subdivision, well number, coordinates of well, well drilling company, date drilled, depth of well, depth of casing, drive shoe, depth of the grouting and placement method used, static water level, depth and yield at each water zone (including those zones cut off by the installation of the casing), total yield, etc. Well records without the above data will not be accepted.

C. Well Casing

1. Drive shoe (Rock Wells only) - A drive shoe must be installed on the end of the casing. The drive shoe shall be made of forged, high carbon, tempered seamless steel, and shall have a beveled, hardened cutting edge. This shoe shall be firmly driven into the rock at least 5' into competent bedrock to make a seal with 10' being preferred. **This should be documented on the signed well construction report.**

2. Casing material - new casing which bears mill markings and which conforms to standard specifications – carbon steel or approved equivalent for water well pipe shall be used. Casing shall be 8" inch heavy weight (0.322" wall thickness), carbon steel or ASTM F480 galvanized or approved equivalent for water well pipe unless otherwise specified. Thermoplastic casing will not be accepted on rock wells.

3. Casing length (Rock Wells only) - Where firm bedrock is encountered shallower than 55 feet, a minimum casing length of 55 feet below ground level will be required. Unless otherwise specified by the on-site Utility Representative, the well must be drilled a minimum of 5' into competent bedrock where the drive shoe and casing must be secured.

4. Method of joining - Casing lengths shall be joined in alignment and watertight by a method appropriate to the material used so that the resulting joint shall have the same structural integrity and protection as the casing itself. Threaded and coupled joints shall be API or equivalent and made up tight. Welding is acceptable.

5. Sanitary protection of the well - The well site shall be protected at all times during the drilling. The casing shall be sealed with a suitable flanged, threaded, welded cap, or compression seal upon completion. The top of the outside casing shall extend at least 12" above concrete finished floor level/elevation.

6. There shall be no openings in the casing wall below its top except for water level measurement access ports, vents, or grout nipples. Such openings shall be sealed watertight prior to leaving the well site.

7. An identification plate shall be attached to each public well immediately after drilling is completed. The well drilling contractor shall furnish a completed well identification plate as outlined below prior to leaving the job site. The well will not be accepted without this tag.

a. The identification plate shall be constructed of a durable, weatherproof, rustproof metal or equivalent material.

b. The identification plate shall be securely attached to the well casing where it is readily visible.

c. The identification plate shall be stamped with permanent markings to show the following information:

- • Drilling contractor and registration number.
- • Date well completed.
- • Total depth of well.
- • Casing: Depth (feet), Inside Diameter (inches).
 - Yield or specific capacity expressed in gallons per minute (gpm), or gallons per minute per foot of draw down (gpm/ft.dd).
- • Static water level and date measured.
- • Gravel and screen size (if applicable).

D. Well Grouting

1. Grouting materials - For all community wells, composition of grout must meet State requirements.

2. The entire length of the well casing shall be grouted completely before the driller leaves the site, i.e., in one pour.

3. The UTILITY may specify pressure grouting a well from the inside of the end of the casing out into the annular space; however tremie grouting is the preferred method. Or the UTILITY may specify grouting to the end of the casing within the annular space using two tremie pipes to ensure good distribution around the casing.

a. (Rock Wells only) Contractor shall not pour concrete. Well shall be grouted using the following method: grouting to the end of the casing within the annular space using tremie pipes to ensure good distribution around the casing, or pressure grouting.

4. Below are the specifications for using these types of grouting methods.

a. Grout material shall be placed by tremie pumped or forced injection after water or other drilling fluid has been circulated in the annular space sufficiently to clear all obstructions including rock chips in Type I wells.

b. In accordance with State regulations, there must be a minimum annular space equal to either one-third of the outside diameter of the casing or at a minimum two inches.

c. When emplacing the grouting material, the tremie pipe shall be lowered to the bottom of the zone to be grouted and raised slowly as the grout material is introduced.

d. The tremie pipe shall be kept full continuously from start to finish of the grouting procedure, with the discharge end of the tremie pipe being continuously submerged in the grout until the zone to be grouted is completely filled.

e. The grout must be allowed to properly cure at least 24 hours before construction may be resumed.

5. (Rock Wells only) For sanitary protection, the well should be grouted from the bottom of the casing secured in firm bedrock. Special care must be taken to set casing and grout into Piedmont crystalline rock and not just overlying isolated boulders or iron hardpan. Additional length of grout may be necessary in some cases to support the weight of the casing.

E. Well Screens (Sand Wells only)

1. The well shall be equipped with a screen that will adequately prevent the entrance of formation material into the well after the well has been developed and completed by the well contractor.

2. The well screen will be of a design to permit the optimum development of the aquifer with minimum head loss consistent with the intended use of the well. The openings shall be designed to prevent clogging and shall be free of rough edges, irregularities or other defects that may accelerate or contribute to corrosion or clogging. How this design is determined shall be included with the Engineer's submittal for approval. (i.e. were samples sent to the screen manufacturer to determine optimum screen size, etc.)

3. Multi-screen wells shall not connect aquifers or zones which have differences in water quality with would result in contamination of any aquifer or zone.
4. Under no circumstances will a well screen be set less than 55 feet below land surface.

F. Gravel and Sand Packed Wells (Sand Wells only)

1. In constructing a gravel or sand packed well:
 - a. The packing material shall be composed of quartz, granite, or similar rock material and shall be clean, of uniform size, water-washed and free from clay, silt, or other deleterious material.
 - b. The size of the packing material shall be determined from a grain size and of the formation material and shall be of a size sufficient to prohibit entrance of formation material into the well in concentrations above five (5) milliliters per liter of settleable solids and ten NTU's of turbidity as suspended solids as permitted under N.C.2C Rules.
 - c. The packing material shall be placed in the annular space around the screens casing by a fluid circulation method, preferable through a conductor pipe to insure accurate placement and avoid bridging.
 - d. The packing material shall be adequately disinfected.
 - e. Centering guides must be installed within five (5) feet of the top packing material to ensure even distribution of the packing material in the borehole.
2. The packing material shall not connect aquifers or zones which have differences in water quality that would result in deterioration of the water quality in any aquifer or zone.

G. Well Development

1. All water supply wells shall be properly developed by the well driller.
2. Development shall include removal of formation materials, mud, drilling fluids and additives such that the water contains no more than:
 - a. five (5) milliliters per liter of settleable solids; and
 - b. ten (10) NTUs of turbidity as suspended solids.

H. Testing

1. No well shall be accepted when the drawdown test results are less than 15 gallons per minute unless accepted and approved by the Utility in Writing. .
2. A UTILITY Representative shall be present at the start and completion of the drawdown. UTILITY must be provided 1 week notice prior to start of drawdown testing.
3. Test pump shall be set at the depth specified by UTILITY and shall be of sufficient size to determine the true well yield.
4. Perform a step test at a maximum of one hour, minimum of thirty minutes, or between as the production stabilizes (Step test with a minimum steps of 30 to 60 minutes). The steps should be performed in the following order: 50% production, 75% production, 100% production, and 125% production. The water level should be checked every one (1) minute and will be considered stable after ten (10) stable representative reads. If the production stabilizes quickly at 125% a similar test should be performed at 150% production.
Water level measurements shall be collected by hand or by acoustic monitoring.
5. A 24-hour test with a two-hour recovery shall be run without interruption. If the test is interrupted for any reason, it shall be the contractor's responsibility to re-run a complete test at no extra charge to the owner. Wells that have not been placed in service within two years of the date the well was drilled will require a current 24-hour well drawdown test to be completed.
6. Wells in close proximity to other community wells and/or private wells will be required to be tested simultaneously in accordance with State and Local Regulations.
7. This test shall be run in accordance to UTILITY's specifications, which are as follows:

a. GPM and Pumping Level –

- • Check every 5 minutes for 1st hour
- • Check every 10 minutes for 2nd hour
- • Check every 15 minutes for 3rd hour
- • Check every 30 minutes for 4th hour
- • Check every hour for remainder of test • 1st hour then,

b. Field Water Quality Parameters - Field water quality parameters (iron, manganese, hardness and pH) shall be tested as follows:

- 1st hour then,
- Every 4 hrs thereafter then,
- At the end of the test
- Field samples should be pulled more often if parameters are not within limits.

***The drawdown/capacity test will NOT be accepted unless the field water quality parameters are collected and the results recorded on the 24 hour drawdown report**

c. New well analysis samples shall be collected between the 10th to 12th hour of the 24 hour draw-down test.

d. After the 24-hour test is run, shut off the pump and start the recovery test as stated below.

e. Recovery Static Level –

1. Check every 1 minute for 1st 30 minutes
2. Check every 10 minutes for 2nd 30 minutes
3. Check every 15 minutes for 3rd 30 minutes
4. Check every 30 minutes for 4th 30 minutes

8. Water sample results must meet all regulatory and/or UTILITY water quality standards. The following contaminants will be sampled from every new well: bacteriological, inorganic chemical, including gross alpha and beta particles, uranium, radium 226 and 228, volatile organic chemicals, synthetic organic chemicals, Asbestos (as applicable), and any other regulated or unregulated contaminants as deemed necessary by the UTILITY. At least one copy of these analyses shall be submitted to UTILITY.

9. After the test pump is removed, the contractor shall re-chlorinate the well to at least 100 ppm for 24-hours as required by AWWA rule C654 and recap it.

10. At least one signed hard copy and one electronic (PDF) copy of the well drawdown test shall be submitted to UTILITY.

11. Test log shall include gallons per minute, static water level, pumping water level, above ground head, time, turbidity of water, depth of any noted cascading of water, and all field parameter testing results.

12. A videotape shall be made of the well and a copy presented to the UTILITY. Should the video indicate that well construction deficiencies exist, the owner of the well shall be responsible for all necessary construction modifications. Any additional drawdown tests or any water analyses required due to construction modifications will be at the well owner's expense.

13. The Available Yield of the well shall be considered to be 90 percent of the 24-hour draw down stabilized pumping rate. If the specific capacity of the well is greater than 1, then 100% of the pumping rate may be used. The 1 gallon per minute per connection will be based on the Available Yield of 90%. Unused Capacity available shall not exceed the 90% threshold and is subject to a new pump test at the time of the new request and at each request thereafter.

14. Resampling: When at the discretion of the UTILITY, sufficient cause exists to resample water quality parameters, then a modified draw down test shall be run for, at

least 3 volumes of the well or for the length of time as determined by the UTILITY, at the stabilized draw down pumping rate. The water quality samples for laboratory analyses shall be drawn at the end of the modified draw down test. If field parameter testing during the original draw down test indicated significant changes in water quality during the 24-hour test, then the resampling draw down test will run through the time of the changing concentrations, but no less than 3 hours. During the modified draw down testing, all field parameters shall be sampled at the above frequencies.

15. When well modifications are made to significantly alter the hydrologic or water quality conditions (i.e. a packer, liner, or concrete fill), or the well has not been activated within 2 years, then a complete draw down test shall be conducted on the modified well. Water samples to be pulled at the end of the test to determine the new sample results.

I. Well Abandonment

1. In the event that a well is not accepted by the Utility, it shall be abandoned in accordance with the North Carolina Administrative Code, Subchapter 2c, Section .0113 and Section .0114 and in accordance with County rules and regulations. A representative of the UTILITY shall be notified of the well abandonment 24-hours prior to completing the abandonment for Inspection purposes.

2. An official Well Abandonment Record on latest official form provided by the Division of Water Quality (Groundwater Section) shall be completed. A copy of this completed form shall be sent to the County Health Department, NCDENR, and UTILITY.

3. All unused wells must be abandoned to protect the integrity of the ground water supply. It shall be at the discretion of the UTILITY to allow a well not being used for the community water system to be kept for irrigation or other purposes.

3. Plumbing

A. Valve Bank

1. A valve bank shall be installed and sized in accordance with the approved plans and UTILITY's specifications. The valve bank shall be designed so that the maximum water velocity shall be 8 ft/sec. All Valves with be clockwise closed and counter clockwise open. All water valves within the Well House (whether main well house or satellite) shall be ¼ turn ball valves.

2. Only ASTM approved pipe shall be used above ground level as specified on the parts list.

3. Acceptable piping for below ground installations can be found on the materials list.

4. A turbine meter shall be installed on wells yielding more than 30 gpm water production. The turbine meter shall be capable of producing a 4-20 ma signal and shall also have a visual indicator showing the gallons per minute and total gallons pumped. Said meter size and model shall be specified by UTILITY.

5. A positive displacement meter of 1" size shall be used on wells producing 30 gpm or less. The meter shall be capable of producing a 4-20 ma signal and shall also have visual indicator showing the gallons per minute and total gallons pumped.

6. Each valve bank shall have a WYE strainer installed before the water enters the meter. The WYE strainer shall be equipped with a ball valve and be piped to discharge at least 40 feet from the building to a ditch or the lowest point on the well lot. This drain shall not be installed in such a manner to cause flooding or standing water on the well lot. An air gap shall be maintained at the discharge end of the pipe. A rodent screen and splash block shall also be provided at the discharge end of this pipe.

7. When the plumbing is complete, all inside pipes 1" or smaller shall be insulated with rubber tube insulation such as Rubatex. All outside pipes and appurtenances shall be heat traced and insulated with rubber insulating tape such as Rubatex tape to a minimum thickness of 7/8" and covered with PVC pipe sized as follows:

- 2" or Smaller Pipe - 2" Rubatex & 4" Sch. 40 PVC

- 4" or Smaller Pipe - 4" Rubatex & 6" Sch. 40 PVC

8. A ¼ inch ball valve with WOG rating of 600 psi shall be installed on all gauges.

9. Gauges of proper pressure rating as determined by UTILITY shall be oil filled.

10. Swing check valves, spring check valves, ball valves, and short stem gate valves shall meet a minimum of 200% of the operating systems pressure or the ASTM approved rating, whichever is greater.

11. A pressure switch shall be installed complete with 1/4" shut off, 1/4" drain and oil-filled gauge of the proper pressure.

12. One threaded hose bib equipped with a vacuum breaker shall be installed in the chemical feed equipment. An unthreaded sample tap shall be provided at the well head. One unthreaded sample tap shall be provided on the system side of the valve bank.

13. All blow off pipes shall be installed so that the water will drain to a ditch or the lowest area of the well lot. This drain shall not be installed in such a manner as to cause flooding or standing water on the well lot. An air gap and rodent screen shall be maintained at the discharge end of the pipe.

14. In compliance with *OSHA 29 CFR 1910.151(c), emergency dual head eye wash units piped to the valve bank on the system side of the check valve will be located within the well house near the chemical equipment and near the entrance to the building. Drench hoses shall remain in operable condition at all times. The emergency eye wash heads will be located between 4 and 5 feet above the floor and attached to the wall per manufacturer specifications.

15. Coatings and Linings: Where ductile iron pipe and fittings are installed below grade or installed in a casing pipe, a bituminous coating approximately 1.0 mil thick shall be applied in accordance with ANSI/AWWA A21.51/C151. Where ductile iron pipe and fittings are to be installed aboveground, pipe, fittings and valves shall be thoroughly cleaned and given one field coat (minimum 1.5 mils dry thickness) of rust inhibitor primer. Intermediate and finished field coats of Alkyd shall also be applied by the CONTRACTOR (minimum 1.5 mils dry thickness each coat). Primer and field coats shall be compatible and shall be applied in accordance with the manufacturer's recommendations. Final field coat shall be olive green for raw water and dark blue for finished water. All ductile iron pipe and fittings shall have an interior protective lining of cement-mortar with a seal coat of asphaltic material in accordance with ANSI/AWWA A21.4/C104

16. Distribution Pressure Relief Valve (PRV): On all systems containing hydropneumatic tanks as the storage and pressure regulating structure - A pressure relief valve shall be located within the well house and mounted on the piping such that it is exposed to the pressures as experienced by the distribution system. This PRV will be piped so that when activated it will discharge to the blow-off piping listed above. The PRV shall be factory set at 100 pounds per square inch and shall be a 2 inch flow model as manufactured by Kunkle with the capability of discharging water in a range from 19 gallons per minute (gpm) to 229 gallons per minute. The PRV shall be built as follows:

All Bronze with Pressure tight cap

Both inlet and outlet connections will be cast integral with body to permit easy inspection and servicing without disconnecting piping.

Beveled seats lapped for optimum performance.

Stainless Steel (SS) spring for optimum corrosion resistance

Working pressure rated from 1 to 300 psig

Temperature rated from -60 to 406 degrees Fahrenheit

If the well pump or pumps within the system have an approved capacity to exceed 200 gpm, then multiple valves or larger valves must be evaluated. The discharge capacity of the valve(s) must meet the well pump(s) approved pumping capacity. This valve will be installed behind a ¼ turn ball valve as shown in the details.

B. Hydropneumatic Tank

- 1.** The contractor will plumb in the hydropneumatic tank, including but not limited to, the supply line, discharge line, air compressor piping, pressure relief, vacuum breakers, etc., (in accordance with the utility drawing.) and shall provide protection from freezing for these items.
- 2.** The supply main will be of new ASTM approved pipe, complete with 90-degree ell, unions, etc. Where the tank is set on prefab saddles, a mechanical joint dresser coupling shall be provided ahead of tank connection to allow for settling.
- 3.** One Well System - A 2" blow-off assembly complete with square nut cast valve and a cut off valve between the blow-off assembly and the tank shall be installed. A 2" galvanized or brass coupling shall be left within 3" of the top of the blow-off valve box for future connections (in accordance with the Utility drawing).
- 4.** Multiple Tank Systems - A tank bypass of the proper size shall be installed on systems with more than one hydro-pneumatic tank and on potential elevated tank systems with hydro-pneumatic tank, complete with tank and main cutoff valves (in accordance with the Utility drawing).
- 5.** The relief valve shall be a side discharge of pressure rating and size as per UTILITY specifications and shall be mounted on the top of the tank and will insulated to prevent freezing.
- 6.** The vacuum breaker shall be a minimum 3/4" installed as shown in accordance to the utility drawing.
- 7.** A ball valve with 600 WOG rating and a ball valve with a locking device shall be installed between the tank and the pressure relief valve and vacuum breaker (in accordance with the Utility drawing).

5. Storage Tanks

A. Hydropneumatic Storage Tanks

- 1.** Hydropneumatic tank shall be constructed and stamped in accordance with the American Society of Mechanical Engineers (ASME) Pressure Vessel Code stamped with the ASME "U" symbol stamp and registered with the National Board of Boiler and Pressure Vessel Inspectors. These tanks must be inspected by the Department of Labor, Boiler and Pressure Vessel Division after installation but prior to operation. Tank shall be manufactured to UTILITY's specifications and have a rated working pressure of at least 125 psi. Size of tank with number and size of outlets will be specified by the UTILITY. The minimum size tank accepted by UTILITY for a community water system shall be 5,400-gallons.
- 2.** The contractor shall set tank complete with pedestals as per plans.
- 3.** Pedestals shall be excavated to solid compact ground (at least 36" below ground) and poured of 3,500 psi concrete (or 3,000 psi concrete with an additive) to form to the tank with a 12" dip at the center. Alternatively, steel saddles may be used to cradle the tank and shall sit firmly on top of the concrete pedestals. Pedestals shall be set on solid, compact ground with a minimum bearing capacity of 2500 psf. The first pedestal shall be no further than 10' from the house without UTILITY approval. The width shall be 2' with a length of 6' for 5,400-gallon tanks. The width shall be 30" with a length of 8' and a depth of 48" for 10,000-gallon tanks. Pedestals for other tank sizes shall be as specified by UTILITY. Forms shall be removed after 48 hours. Pedestal finish shall be smooth. The bottom of the tank shall be 18" above the finish elevation of the ground beneath it.
- 4.** Before setting the tank, the tank shall be painted with the appropriate finish and allowed to dry for 7 days. The two surfaces must be separated by a rubber or dense polypropylene material as specified by UTILITY. See Division 3 Section 7 for appropriate materials.
- 5.** The tank shall be air cured for a minimum of 14 continuous days before filling.
- 6.** The tank shall be thoroughly flushed to remove any sediment or foreign matter. A chlorine solution, in concentrations sufficient to produce a chlorine residual of at least 50-ppm, shall be introduced to overflow the tank. The chlorine solution shall remain in contact with the interior

surfaces for a period of 24 hours. The tank then shall be thoroughly flushed with the free chlorine residual solution not to exceed 2 ppm after flushing. The tank shall not be placed into service until bacteriological test results are found to be satisfactory.

B. Ground Level Storage Tanks

- 1.** Ground storage tank shall be installed in accordance with the design specifications completed by a licensed engineer in the State of North Carolina. Said design shall be approved by UTILITY and shall comply with all County, State, and Federal requirements. Ground Storage tanks shall be constructed in accordance with the American Society of Mechanical Engineers (ASME) Code. Tanks shall be manufactured to UTILITY specifications and size.
- 2.** Design and its fabrication must comply with AWWA Standards D 100 of the American Water Works Association, Inc. Foundations and support structures must comply with standard ACI 318. All accessory items installed shall be in full conformity with the current applicable OSHA safety regulations and the operating requirements of the structure. At a minimum if the tank is taller than 8 feet, a fixed ladder or form of access/egress must be installed in accordance with OSHA and AWWA standards and recommendations.
- 3.** The Contractor shall provide working drawings and design calculations for the tank and the foundation. Drawings shall show the size and location of all structural components and reinforcement, the required strength and grade of all materials and the size and arrangement of principle piping and equipment. The drawings and calculations shall bear the certification of a professional Engineer licensed in the State of North Carolina.
- 4.** A sanitary, screened vent and overflow of the proper size shall be installed on the top of the tank.
- 5.** Probes of 316 stainless steel and all necessary controls for operation and monitoring of the water levels shall be installed in accordance with the UTILITY specifications and/or the approved plans. The number and settings for these probes shall be determined by the UTILITY and/or the approved plans.
- 6.** The tank shall be all-welded construction of the most economical design. All members of structural steel shall be designed to safely withstand the maximum stresses to which they may be subjected during erection and operation.

6. Well House

A. Pad

- 1.** The well house pad at minimum shall measure 10' x 10' by 6-inches thick. The footer and the slab shall be a continuous pour. The pad and foundations shall meet the international building code and all state and local regulations as it pertains to the appropriate building structure, at a minimum it shall be constructed as shown in the Standard Details. The wellhead pad shall extend a minimum of 8' 6" from well house pad and allow for a continuous bond concrete extending three feet horizontally around the outside of the well casing as per plans.
 - a. The well house pad shall be a minimum of 6" thick with 12" X 12" footings and a 1/2" slope to the drains. Concrete shall have a compressive strength of 3,000 psi.
 - b. The wellhead concrete pad shall be 8" thick with 12" x 12" footings and join with the well grout. Forms shall be level and square.
- 2.** A 4" floor drain with pea-trap shall be installed in the center of the well house. The under-floor piping shall be Schedule 40 PVC. It shall be installed with a 0.5 % slope. The top of the pipe shall have a minimum of 12" of cover, and it shall extend a minimum of 20' away from the well house or as directed by UTILITY. No standing water shall be allowed. Necessary measures including ditching and riprap may be required depending in site conditions.
- 3.** Finished elevation of the pad shall be 3" to 4" above the surrounding ground and the site shall be graded so as not to allow runoff water to enter the building.
- 4.** The edges of the pad shall be smooth.

5. Concrete shall be poured and installed in accordance with industry standards.
6. After the pad is poured and has set for at least 24 hours, forms shall be dismantled and removed from the site.
7. No slab penetration shall be allowed except wellhead and drain. All additional piping shall be routed outside of building footprint prior to burying.

B. Block

1. A row of 6" block is required around the perimeter of the building complete with 3/8" anchor bolts as per plans for wood framed well houses or in accordance with local permitting standards.
2. Blocks and mortar joints shall be level and free of cracks and shall be filled with concrete.

C. Wood Building

1. The contractor shall build house complete with a 36", single, aluminum, powder coated, exterior door as per Well House Framing Detail (See Drawing W-31).
2. Pressure treated 2" x 6" lumber shall be used as the seal plate and bolted to the anchor bolts or in accordance with County standards.
3. Joists shall be on 16" centers.
4. Ceiling joists shall be a minimum of 8' above finished floor.
5. Siding shall be 5 1/4" x 8" x 5/16" fiber cement board (or approved equal), installed per manufacturer's recommendations. Color to be selected by UTILITY (see Division 3 Section 7.2). Alternatives will be submitted to UTILITY for approval.
6. The well cover house shall be 24" above finished block to the top of the wall. Well cover size shall not exceed 36" wide and 7' long. **The cover shall have a rail construction to allow sliding access.**
7. A gable vent or ridge vent shall be installed with a soffit vent for proper roof ventilation.
8. Two - 8" x 16" automatic foundation vents with wire security grating shall be installed 6" above the block on the back sides of the well house. Two 8" x 16" closing vents shall be installed in the front ceiling to allow heat to dissipate out through the roof in the summer.
9. Hasps shall be installed on well cover roof.
10. If building is to be built of any material other than wood, plans shall be approved by UTILITY in writing.
11. Interior Walls shall be backed with faced batt insulation and finished out with 1/2" plywood and painted white.
12. A well head protection sign (provided by UTILITY) shall be installed on each well house as well as a well identification number.

D. Roofs

1. A gable style roof shall be built with 4/12 pitch.
2. Covering shall be 1/2" OSB with 30# felt paper and (golden or autumn brown) architectural shingles with 20-year warranty.
3. Well cover roof shall be removable by sliding and flashed with 1.5" x 1.5" angle iron to house.
4. All eaves shall be boxed in. Fascia shall be constructed of fiber cement board.
5. Metal drip edge material shall be installed at all exposed edges of the roof decking.

E. Insulation

1. All wood houses shall be constructed with R-15 faced batt insulation in the walls and R-30 fiberglass insulation in the ceilings. Construction in Alleghany, Ashe, Avery, Mitchell, and Yancey counties require R-19 fiberglass insulation in walls.
2. All block houses shall have insulation poured to the top of the block in each block cavity.

F. Commercial Size Well Houses

1. If the structure is larger than 144 square feet, it shall comply with all local fire regulations (i.e. access road, address, fire extinguisher, etc.)

G. Satellite Well Houses

1. Installation of a satellite well house shall be at the discretion of the UTILITY.

2. Please refer to the Satellite Well House cut sheets attached to these specifications for complete construction details.

7. Painting

A. Paint Products

1. Materials specified are those that have been approved by the UTILITY. Products of the Sherwin Williams Company and the Tnemec Company are listed to establish a standard of quality. Equivalent materials of other manufacturers may be substituted on written approval of the UTILITY.

2. Requests for substitution shall include manufacturer's literature for each product giving the name, product number, generic type, descriptive information, solids by volume, recommended dry film thickness, and manufacturer's color charts.

3. Requests for substitution shall be submitted for approval at least 30 days prior to paint application.

B. Houses

1. Wood houses shall have at least two coats of Sherwin Williams A-100, latex flat exterior Plantation Brown paint applied to house and the trim.

2. Blockhouses shall be sealed and then have two coats of Sherwin Williams latex flat exterior A-100 Plantation Brown 90224.

C. New Hydro-pneumatic Tanks

1. Interior - Epoxy

a. Surface Preparation: Steel Structures Painting Council (SSPC) SP10, Near White Metal Blasting Cleaning. After surface preparation and prior to painting, all un-welded seams will be filled with Tnemec Series 63-1500 Filler and Surfacer.

b. 1st Coat: Tnemec Series N140F-1255 Beige Pota-Pox primer at 4 dry mils per manufacturer's recommendation.

c. 2nd Coat: Tnemec Series N140F-00 Tank White Pota-Pox finish at 5 dry mils per manufacturer's recommendation. After installation of final coat, interior shall be force cured for a minimum 24 hours with heated air.

d. A minimum of fourteen (14) days cure time shall be allowed before being placed into service.

e. Manufacturer approved thinners for specific Series and applications shall be used. Total dry film thickness shall be a minimum of 9 dry mils per SSPC dry film thickness measuring standards.

2. Exterior - Epoxy / Polyurethane

a. Surface preparation: Steel Structures Painting Council (SPCC) SP10, Near White Metal Blast Cleaning.

b. 1st Coat: Tnemec Series N14F-1255 Beige Pota-Pox Primer at 3.0 dry mils.

c. 2nd Coat: Tnemec Series 1074 Endura-Shield (Color 84BR Weathered Bark) at 4.0 dry mils.

d. 3rd Coat: Tnemec Series 1074U Endura-Shield (Color 84BR Weathered Bark) at 3.0 dry mils.

e. A minimum of seven (7) days cure time shall be allowed before placing into service.

f. Manufacturer approved thinners for specific Series and applications shall be used. The total dry film thickness of the new system shall be a minimum of 10 dry mils.

3. Cathodic Separation protection

Cathodic Protection Material of 3/4 inches minimum thickness shall be placed between the tank and the pedestals. This material will be wide enough and long enough to cover any areas that the tank and pedestals could possibly come into contact with each other.

4. Disinfection

All Hydro-pneumatic tanks shall be disinfected in accordance with North Carolina State Regulations and pass a bacteriological test.

A VOC sample may be collected by the UTILITY at its discretion.

8. Electrical

A. Maintenance Employee Safety is of the utmost importance. When devices are engineered and available that could limit incidents such as Arch-Flash, then equipment, panels, and boxes with design features built into them will be specified and used.

B. All electrical work shall be installed under a licensed electrician and shall pass all local and State inspection requirements.

C. Services

1. All new installations shall be equipped with a power service.

2. Only copper conductors will be accepted for the service.

3. A grounding electrode of adequate size shall be connected to the well casing with two (2) driven electrode rods of 3/4" Minimum diameter. Driven grounding Rods shall be at least ten (10) feet apart. A ground test shall be performed and data presented to the UTILITY to insure adequate grounding is achieved.

4. All services shall have a minimum 200-amp meter base.

D. Panels

1. All control panels, transfer switches, meter, bases, branch circuit panels, electric boxes, motor control boxes, etc shall be NEMA rated as follows:

Located/mounted in the interior of a wellhouse/building shall be NEMA 4X

Located/mounted on the exterior of a wellhouse/building/remote well site (even if under a shed or building roof overhang) shall be NEMA 4X

2. Main well house panel shall be as specified by the UTILITY in Section 5, and shall be interior, surface mounted with a main breaker of specified size with a minimum of 16 circuits. Panels shall be a minimum of 200 Amp rated and include a NEMA 4X enclosure as specified above. Panels shall be ITE with copper busway.

Remote well house panels shall be identical to above in amp size, ITE with copper busway and minimum circuit rating. It shall be mounted in according to the Standard details and shall be NEMA Rated as listed above.

3. Each panel shall be provided with lightning arresters, Cutler Hammer CHS-A01 or equal.

4. When wiring is finished, the panel shall be labeled as to which breaker feeds what load.

5. Wiring loads shall be balanced in panels.

6. One 20 ample single pole breaker shall be installed as a spare in each panel.

7. All electrical outlets shall be protected by GFI breakers.

E. Magnetic Starters

1. As specified in Section 5, NEMD standard, with hand off/automatic (HOA) and an indicator light shall be used unless otherwise approved by the UTILITY. An Intermatic

Model FF5M spring wound 5 minute timer switch shall be installed with a permanently marked cover to control the “auto-on” of the pump.

2. Each starter shall have two sets of normally open auxiliary contacts provided.

3. An adequate thermal overload shall be provided in each leg of the starter, as specified in the pump and motor manufacturer’s specification book or attached chart.

4. Size of the starter will be determined by UTILITY.

5. Magnetic starts shall be Allen Bradley, NEMA 3R with 120 VAC coil.

F. Pressure Switches

If required, an Allen Bradley 835T-T253J (or UTILITY-approved equivalent) pressure switch will be installed. Pressure switch must have an adjustable “on-off” option.

G. Indicating Controls

An elapsed time meter and an impulse counter shall be mounted and wired by the contractor. Said elapsed time meter and impulse counter shall be selected from the attached materials list.

H. Telemetry/Radio Controls

1. If required, telemetry and/or radio controls will be designed and installed as approved by UTILITY at UTILITY’s cost.

2. UTILITY will pay for any SCADA equipment required.

I. Air Compressor

Where a hydro-pneumatic tank is installed, a compressor and controls shall be installed. Said compressor shall be selected from the attached parts list specified by UTILITY.

J. Chemical Receptacle

Three discrete circuit 115 VAC duplex GFI/GFCI receptacles shall be installed as shown in the Standard Details or as specified by the UTILITY. These receptacle outlets shall be permanently marked as “chemical”.

K. Utility Receptacles

Two 115 VAC utility receptacles that are energized constantly and protected by a ground fault interrupter in addition to the breaker shall be installed. These receptacle outlets shall be permanently marked as "utility". One shall be located on the chemical panel side of house, and one shall be located on the electrical panel side of house.

L. Lights

One LED vapor-tight ceiling mount fixture manufactured by LSI industries, model EG34SLEDHOCWUSEL, or equal, is required in each well house and shall be controlled from a wall switch at the entrance.

M. Heating

1. For a standard 10 X 10 well house, there shall be one four-foot 1,000-watt 240 volts AC baseboard heater mounted 6” above block on the interior wall. If the building is larger, then additional heating may be required.

2. The baseboard heater shall be controlled by a remote bulb thermostat. Thermostat shall be manufactured by White-Rodgers, Model #2B61-186.

3. If more than one baseboard heater is required baseboard heaters shall be substituted with one 3.3 kW unit heater.

N. Wire

1. All wire shall be copper of THW or THHN type and of adequate size.

O. Raceways

1. All raceways underground shall be minimum 2” schedule 40 PVC.

2. All exposed conduit shall be sized according to conduit fill with exception of service masts which shall be of 2" rigid conduit.
3. Liquid tite flex or Carflex with the proper fittings shall be used from the well to the junction boxes, etc.
4. One hole or minerallic straps shall be used on all raceways in accordance with the N.E.C.
5. All building interior conduit shall be PVC

P. Fittings

1. PVC FS switch boxes shall be used for receptacles and switches.
2. Boxes and Fittings used with PVC pipe shall be of the PVC type.

Q. Manual Transfer Switch

1. Equipment (including outlets) shall conform to the requirements of NFPA 70.
2. Products shall be listed and classified by UL or other North Carolina Recognized Third Party Testing Agency.
3. Equipment shall be NEMA ICS 10, manual transfer switch suitable for use as service equipment. Load side lugs shall be suitable for connection of two conductors per phase. The second set of conductors will be #6 AWG for connection to a surge protective device.
4. Ratings shall be for 480 volts, three phase, four wire, 60 Hz. 400A continuous rating or greater.
5. Enclosure shall be NEMA ICS 6, Type 3X.
6. Generator connections shall be installed in the base of the transfer switch. The connectors shall be Hubbell Single Pole Receptacles meeting the following:
 - 400-amp panel mount
 - Mates with 300 or 400-amp plugs
 - Rated to 600 volts
 - Contact material shall be brass
 - Color sequence AND receptacle designations shall be as follows – Left to Right facing the transfer switch:
 - Single Phase installations:
 - Blue Male Receptacle, Black Male Receptacle, Green FEMALE Receptacle
 - Three Phase Installations:
 - Blue Male Receptacle, Orange Male Receptacle, Black Male Receptacle, Green FEMALE Receptacle

9. Excavation, Backfill, Compaction, Grading, & Restoration

A. General

This Section covers excavation, backfill, compaction, grading and restoration associated with utility trench and structural construction. All such WORK shall be performed by the CONTRACTOR concurrently with the WORK specified in these SPECIFICATIONS. The CONTRACTOR shall furnish all labor, materials, equipment, and incidentals necessary to perform all excavation, backfill, fill, compaction, grading and slope protection required to complete the WORK shown on the DRAWINGS and specified herein. The WORK shall include, but not necessarily be limited to pump stations, manholes, vaults, conduit, pipe, roadways and paving; all backfilling, fill and required borrow; grading; disposal of surplus and unsuitable materials; and all related WORK such as sheeting, bracing and water handling.

B. Soil Borings and Subsurface Investigations

Subsurface exploration and geotechnical engineering evaluation where provided is for the CONTRACTOR'S information only. Data on indicated subsurface conditions are not intended as representations or warranties of accuracy or continuity between soil borings.

The CONTRACTOR shall examine the site and undertake additional subsurface investigations including soil borings, if so desired, before commencing the WORK. UTILITY will not be responsible for presumed or existing soil conditions in the WORK area.

C. Existing Utilities

CONTRACTOR shall locate existing utilities in the areas of WORK. If utilities are to remain in place, the CONTRACTOR shall provide adequate means of protection during earthwork operations. Should uncharted or incorrectly charted piping or other utility conflicts encountered during excavation, the CONTRACTOR shall consult the owner of such piping or utility immediately for directions. Payment for damage and repair to such piping or utilities is the contractor's responsibility.

UTILITY shall not be responsible for uncharted or incorrectly charted water and wastewater mains or other utilities. It is the contractor's responsibility to ensure that such facilities exist at the presumed point prior to commencing construction.

D. Materials

1. General: Materials for use as bedding and backfill, whether in-situ or borrow, shall be as described under this Section. The CONTRACTOR shall upon request by UTILITY, make an appropriate sample of this material available for testing by UTILITY or its designated representative.

2. Structural Fill: Materials for structural fill shall be bedding rock or select common fill as specified herein or other suitable material as approved by UTILITY.

3. Common Fill: Common fill shall consist of material substantially free of organic material, loam, wood, trash and other objectionable material which may be compressible or which cannot be compacted properly. Common fill shall not contain stones larger than 4 inches in any dimension, asphalt, broken concrete, masonry, rubble, or other similar materials. It shall have physical properties such that it can be readily spread and compacted during filling. Additionally, common fill shall be no more than 12 percent by weight finer than the No. 200 mesh sieve unless finer material is approved for use in a specific location by UTILITY.

4. Select Common Fill: Select common fill shall be as specified above from common fill, except that the material shall contain no stones larger than 1-1/2 inches in largest dimension and shall be no more than 5 percent by weight finer than the No. 200 mesh sieve.

5. Bedding Rock: Bedding rock shall be 3/16 inch to 3/4 inch washed and graded stone (NCDOT #57). This stone shall be graded so that 90 to 100 percent will pass a 3/4 inch screen and 95 to 100 percent will be retained on a No. 8 screen. No stones larger than 1 inch in any dimension shall be accepted.

E. Dewatering, Drainage and Flotation

1. General: The CONTRACTOR shall excavate, construct and place all pipelines, concrete work, fill, and bedding rock, in-the-dry. In addition, the CONTRACTOR shall not install the final 24-inches of excavation until the water level is a minimum of one foot below the proposed bottom of excavation. For purposes of these SPECIFICATIONS, "in-the-dry" is defined to be within 2% of the optimum moisture content of the soil.

UTILITY reserves the right to ask the CONTRACTOR to demonstrate that the water level is a minimum of one foot below proposed bottom of excavation before allowing the construction to proceed.

Discharge from dewatering shall be disposed of in such a manner that it will not interfere with the normal drainage of the area in which the WORK is being performed, create a public nuisance, or form ponding. No flooding of streets, driveways or private property will be permitted. The operations shall not cause injury to any portion of the WORK completed, or in progress, or to the surface of streets, or to private property. The dewatering operation shall comply with the requirements of appropriate regulatory agencies. Additionally, where private property will be involved, advance permission shall be obtained by the CONTRACTOR. Engines driving dewatering pumps shall be

equipped with residential type mufflers. Where feasible, electrical "drops" shall be used in lieu of portable generators.

2. Additional Requirements: The CONTRACTOR shall, at all times during construction, provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavations. The CONTRACTOR shall keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill, structure, or pipelines to be built thereon have been completed.

Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the subgrade soils at the proposed bottom of the excavation.

It is expected that wellpoints will be required for pre-drainage of the soils prior to final excavation for some of the deeper in-ground structures or piping and for maintaining the lowered groundwater level until construction has been completed to such an extent that the structure, pipeline, or fill will not be floated or otherwise damaged. Wellpoints shall be surrounded by suitable filter sand and negligible fines shall be removed by pumping. The CONTRACTOR shall furnish all materials and equipment and perform all work required to install and maintain the drainage systems for handling groundwater and surface water encountered during construction of structures, pipelines and compacted fills.

If required during backfilling and construction, water levels shall be measured in observation wells located as directed by UTILITY.

Continuous pumping will be required as long as necessary until completion of below grade activity.

F. Excavation

1. Excavation for Structures: All such excavations shall conform to the elevations and dimensions shown on the DRAWINGS within a tolerance of plus or minus 0.10 feet and extending a sufficient distance from footings and foundations to permit placing and removal of formwork, installation of services and other construction, inspection or as shown on the DRAWINGS. In excavating for footings and foundations, care shall be exercised not to disturb the bottom of the excavation. The bottom of excavations shall be rendered firm and dry before placing any structure or concrete.

2. Trench Excavation: Excavation for all trenches required for the installation of utility pipes shall be made to the depths indicated on the DRAWINGS and in such manner and to such widths as will give suitable room for installing the pipe within the trenches, for bracing and supporting and for pumping and drainage facilities.

The bottom of the excavations shall be firm and dry and, in all respects, acceptable to UTILITY.

Excavation shall not exceed normal trench width or depth as specified in the STANDARD DETAILS. Any excavation which exceeds the normal trench depth shall require special backfill requirements as determined by UTILITY.

Where pipes are to be installed on bedding rock, select common fill, or encased in concrete, the trench may be excavated by machinery to or just below the designated subgrade provided that the material remaining in the bottom of the trench is no more than slightly disturbed.

Where pipes are to be installed directly on the trench bottom, the lower part of the trenches shall not be excavated to grade by machinery. The last of the material being excavated shall be done manually in such a manner that will give a shaped bottom, true to grade, so that pipe can be evenly supported on undisturbed material, as specified in the STANDARD DETAILS. Bell holes shall be made as required.

G. Bedding and Backfill

1. General: Material placed in fill areas under and around structures and pipelines shall be deposited within the lines and to the grades shown on the DRAWINGS or as directed by UTILITY, making due allowance for settlement of the material. Fill shall be placed only on properly prepared surfaces which have been inspected and approved by UTILITY. If

sufficient select common or common fill material is not available from excavation on site, the CONTRACTOR shall provide fill as may be required.

Fill shall be placed and spread in layers by a backhoe or other approved method, unless otherwise specified. Prior to the process of placing and spreading, all materials not meeting these specifications shall be removed from the fill areas. The CONTRACTOR shall assign a sufficient number of men to this WORK to ensure satisfactory compliance with these requirements.

All fill materials shall be placed and compacted "in-the-dry." The CONTRACTOR shall dewater excavated areas as required to perform the work and, in such a manner, as to preserve the undisturbed state of the natural inorganic soils.

Prior to filling, the ground surface shall be prepared by removing vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials. CONTRACTOR shall plow strip or break up sloped surfaces steeper than one vertical to four horizontal so that fill material will bond with the existing surface. When existing ground surface has a density less than that specified under Section T-4, 12, I for the particular area classification, CONTRACTOR shall break up the ground surface, pulverize, moisture-condition to the optimum moisture content and compact to required depth and percentage of maximum density.

Before compaction, material shall be moistened or aerated as necessary to provide the optimum moisture content. Material which is too wet shall be spread on the fill area and permitted to dry, assisted by harrowing if necessary, until the moisture content is reduced to allowable limits. If added moisture is required, water shall be applied by sprinkler trucks or other sprinkler systems, which will ensure uniform distribution of the water over the area to be treated and give complete and accurate control of the amount of water to be used. If too much water is added, the area shall be permitted to dry before compaction is continued. The CONTRACTOR shall supply all hose, piping, valves, sprinklers, pumps, sprinkler trucks, hauling equipment and all other materials and equipment necessary to place water on the fill in the manner specified. CONTRACTOR shall compact each layer to required percentage of maximum dry density or relative dry density in accordance with SECTION T-4, 9, Backfill or fill material shall not be placed on surfaces that are muddy, frozen or contain frost or ice.

2. Bedding and Backfill for Structures: Bedding rock shall be used for bedding under all structures as indicated in the STANDARD DETAILS. The CONTRACTOR shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion or loosening of this bed. Structural fill shall be used as backfill against the exterior walls of the structures. Fill shall be compacted sufficiently in accordance with of these SPECIFICATIONS. If compaction is by rolling or ramming, material shall be wet down as required.

Backfilling shall be carried up evenly on all walls of an individual structure. No backfill shall be allowed against walls until the walls and their supporting slabs, if applicable, have attained sufficient strength.

In locations where pipes pass through building walls, the CONTRACTOR shall take precautions to consolidate the fill up to an elevation of at least one (1) foot above the bottom of the pipes. Structural fill in such areas shall be placed for a distance of not less than three (3) feet either side of the center line of the pipe in level layers not exceeding eight (8) inches in depth.

The surface of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the DRAWINGS. No soft spots or uncompacted areas will be allowed in the WORK.

Temporary bracing shall be provided as required during construction of all structures to protect partially completed structures against all construction loads, hydraulic pressure and earth pressure. The bracing shall be capable of resisting all loads applied to the walls as a result of backfilling.

3. Bedding and Backfill for Pipes: Bedding for pipe shall be as shown on the PLANS and detailed in the STANDARD DETAILS. The CONTRACTOR shall take all precautions

necessary to maintain the bedding in a compacted state and to prevent washing, erosion or loosening of this bed.

Backfilling over and around pipes shall begin as soon as practicable after the pipe has been installed, jointed, and inspected. All backfilling shall be prosecuted expeditiously and as detailed in the STANDARD DETAILS.

Any space remaining between the pipe and sides of the trench shall be carefully backfilled and spread by hand or approved mechanical device and thoroughly compacted with a tamper as fast as placed, up to a level of one (1) foot above the top of the pipe. The filling shall be carried up evenly on both sides. Compaction shall be in accordance with the STANDARD DETAILS.

The remainder of the trench above the compacted backfill (as just described above) shall be filled and thoroughly compacted in uniform layers. Compaction shall be in accordance with the STANDARD DETAILS.

H. Compaction

1. General: The CONTRACTOR shall control soil compaction during construction to provide the percentage of maximum density specified. The CONTRACTOR shall provide UTILITY copies of all soils testing reports prepared by a GEOTECHNICAL/SOILS ENGINEER, demonstrating compliance with these SPECIFICATIONS.

When the existing trench bottom has a density less than that specified, the CONTRACTOR shall break up the trench bottom surface, pulverize, moisture-condition to the optimum moisture content and compact to required depth and percentage of maximum density.

2. Percentage of Maximum Density Requirements: Fill or undisturbed soil from the bottom of the pipe trench to 1 foot above the pipe shall be compacted to a minimum density of 95% of the maximum dry density as determined by AASHTO T-180.

Non-Paved Areas: Backfill from 1 foot above utility pipe to grade shall be compacted to a minimum density of 95% of the maximum dry density as determined by AASHTO T-180.

Paved Areas: Backfill from 1 foot above utility pipe to bottom of subgrade shall be compacted to a minimum density of 98% of the maximum dry density as determined by AASHTO T-180.

Fill under and around structures, and to the extent of the excavation shall be compacted to a minimum density of 95% of the maximum dry density as determined by AASHTO T-180.

3. Compaction Tests: If the UTILITY deems it necessary, compaction tests can be required. The locations of compaction tests within the trench shall be in conformance with the following schedule, as determined by the UTILITY:

If based on GEOTECHNICAL/SOILS ENGINEER testing reports and inspection, fill which has been placed is below specified density, CONTRACTOR shall provide additional compaction and testing prior to commencing further construction.

I. Topsoil

1. Strip topsoil from within limits of earthwork operations as specified. Topsoil shall be a fertile, friable, natural topsoil of loamy character and characteristic of locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by Resident Engineer. Eliminate foreign materials, such as weeds, roots, stones, subsoil, frozen clods, and similar foreign materials larger than 1/2 cubic foot in volume, from soil as it is stockpiled. Retain topsoil on station. Remove foreign materials larger than 50 mm (2 inches) in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work shall not, under any circumstances, be carried out when soil is wet so that the composition of the soil will be destroyed.

2. Topsoil shall be uniformly redistributed in a 4-8-inch layer and lightly compacted to a minimum thickness of 4 inches. Any irregularities in the surface resulting from topsoiling

or other operations shall be corrected in order to prevent formation of depressions or water pockets. Topsoil shall not be placed while in frozen or muddy condition, when subsoil is excessively wet or in and condition detrimental to proper grading.

3. Erosion and sedimentation controls must be maintained when applying topsoil.

J. Grading

All areas within the limits of construction, including transition areas, shall be uniformly graded to produce a smooth uniform surface. Areas adjacent to structures or paved surfaces shall be graded to drain away from structures and pavement. Ponding shall be prevented. After grading, the area shall be compacted to the specified depth and percentage of maximum density.

No grading shall be done in areas where there are existing pipelines that may be uncovered or damaged, until such lines have been relocated.

K. Maintenance

CONTRACTOR shall protect newly graded areas from traffic and erosion and keep them free of trash and debris. CONTRACTOR shall repair and reestablish grades in settled, eroded and rutted areas.

Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, CONTRACTOR shall scarify surface, reshape, and compact to required density prior to further construction.

L. Inspection and Quality Assurance

1. Inspection: CONTRACTOR shall examine the areas and conditions under which excavating, filling, and grading are to be performed, and not proceed with the WORK until unsatisfactory conditions have been corrected.

CONTRACTOR shall examine existing grade prior to commencement of WORK and report to UTILITY if elevations of existing grade vary from elevations shown on DRAWINGS.

2. Quality Assurance: All work shall be performed in compliance with applicable requirements of governing authorities having jurisdiction.

The CONTRACTOR, at his expense, shall engage soil testing and inspection services for quality control testing during earthwork operations. The testing and inspection service shall be subject to the approval of UTILITY.

Quality control testing shall be performed during construction to ensure compliance with these SPECIFICATIONS. CONTRACTOR shall allow the testing service to inspect and approve fill materials and fill layers before further construction is performed. The CONTRACTOR shall give copies of all test results in a report form to UTILITY to demonstrate compliance with compaction requirements stipulated in this MANUAL.

10. Boring and Jacking

A. General

The installation of a casing pipe by the method of boring and jacking shall be covered by these SPECIFICATIONS. The overall work scope shall include, but not be limited to, boring and jacking pits and equipment, sheeting, steel casing pipe, spacers, coatings, location signs as required, miscellaneous appurtenances to complete the entire WORK as shown on the STANDARD DETAILS, and restoration. Applicable provisions of Division 3 shall apply concurrently with these SPECIFICATIONS. Boring and jacking operations shall be performed within the right-of-way and/or easements shown on the DRAWINGS.

B. Pipe Material

1. Steel Casing: Steel casings shall conform to the requirements of ASTM Designation A 139 (straight seam pipe only) Grade "B" with minimum yield strength of 35,000 psi. The casing pipes shall have the minimum nominal diameter and wall thickness as shown on the following table.

| Carrier Pipe Nominal Diameter | Casing Outside Diameter | Casing Wall Thickness (Hwy) | Casing Wall Thickness (RR) |
|---|-------------------------|-----------------------------|----------------------------|
| 4" | 14" | .250" | .250" |
| 6" | 16" | .250" | .250" |
| 8" | 18" | .250" | .312" |
| 10" | 22" | .250" | .375" |
| 12" | 24" | .250" | .375" |
| 14", 16" | 30" | .312" | .500" |
| 18", 20" | 36" | .375" | .563" |
| 24" | 48" | .500" | .625" |
| The inside diameter of the casing pipe shall be a minimum of 3 inches greater than the outside diameter of the carrier pipe bell or coupling. | | | |

Field and shop welds of the casing pipes shall conform to the American Welding Society (AWS) standard specifications. Field welds shall be complete penetration, single-bevel groove type joints. Welds shall be airtight and continuous over the entire circumference of the pipe and shall not increase the outside pipe diameter by more than 3/4 inch.

Casings shall extend a minimum of 5 feet beyond paved areas.

2. Carrier Pipe: The carrier pipe shall be minimum class 50 ductile iron pipes with restrained joints. Ductile iron pipe shall comply with the specification outlined in Division 3, Section 1 of these SPECIFICATIONS.

3. Inspection: All casing pipe to be installed may be inspected at the site of manufacture for compliance with these SPECIFICATIONS by an independent laboratory selected and paid for by UTILITY. The manufacturer's cooperation shall be required in these inspections.

All casing pipes shall be subjected to a careful inspection prior to being installed. If the pipe fails to meet the specifications, it shall be removed and replaced with a satisfactory replacement at no additional expense to UTILITY.

C. Pipe Handling

Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe shall not be dropped. All pipes shall be examined before installation, and no piece shall be installed which is found to be defective. Any damage to the pipe or coatings shall be repaired to the satisfaction of UTILITY.

D. Construction Requirements

1. Work Coordination: It shall be the contractor's responsibility to perform the boring and jacking work in strict conformance with the requirements of the agency in whose right-of-way or easement the work is being performed. Any special requirements of the agency such as insurance, flagmen, etc., shall be strictly adhered to during the performance of WORK. The special requirements shall be performed by the CONTRACTOR at no additional cost to UTILITY.

2. Dewatering: Dewatering through the casing during construction shall not be permitted. All dewatering methods shall be approved by UTILITY before construction work begins.

3. Carrier Pipe Support: The carrier pipes shall be supported within the casing pipes so that the pipe bells do not rest directly on the casing. The load of the carrier pipes shall be distributed along the casing by casing spacers. Casing spacers shall be bolted on style split shell metal spiders with bituminous coating or approved equal. All nuts and bolts shall be stainless steel. Runners shall be made of a high molecular weight polymer with inherent high abrasion resistance and a low coefficient of friction.

4. Jacking Pits: Excavation adjacent to the roads shall be performed in a manner to adequately support the roads. Bracing, shoring, sheeting, or other supports shall be installed as needed. CONTRACTOR shall install suitable reaction blocks for the jacks as required. Jacking operations shall be continuous, and precautions shall be taken to avoid interruptions which might cause the casing to "freeze" in place. Upon completion of jacking operations, the reaction blocks, braces, and all other associated construction materials shall be completely removed from the site.

5. MISCELLANEOUS REQUIREMENTS: Correct line and grade shall be carefully maintained. Earth within the casing shall not be removed too close to the cutting edge in order to prevent the formation of voids outside the casing. If voids are formed, they shall be satisfactorily filled with grout by pumping.

The sections of steel casing shall be field welded in accordance with the applicable portions of AWWA C206 and AWS D7.0 for field welded pipe joints. CONTRACTOR shall wire brush the welded joints and paint with **Inertol Quick-Drying Primer 626 by Koppers Company** or approved equal. After completion of jacking, CONTRACTOR shall clean the interior of the casing of all excess material.

The annular space between the carrier pipe and casing shall be filled with clean sand, if required in the Bore and Jack permit. Masonry plugs shall be installed at each open end of the casing. Plugs shall be 12" thick and suitable for restraining the earth load while allowing drainage of the casing.

11. Pressure Pipe Restraint

A. General

Pressure pipe fittings and other items requiring restraint shall be braced with restraining assemblies as specified in this Section.

B. Restrained Joint Construction

Sections of piping requiring restrained joints shall be constructed using pipe and fittings with restrained "Locked-type" joints manufactured by the pipe and fitting manufacturer and the joints shall be capable of holding against withdrawal for line pressures of a minimum 150 psi.

Mechanical joint ductile iron pipe retainer glands shall not be permitted. Any restrained joints that allow for elongation upon pressurization will not be allowed in those locations where the pipe comes out of the ground.

Restrained pipe joints that achieve restraint by incorporating cut out sections in the wall of the pipe shall have a minimum wall thickness at the point of cut out that corresponds with the minimum specified wall thickness for the remainder of the pipe.

The minimum number of restrained joints required for resisting forces at fittings and changes in direction of pipe shall be determined from the length of restrained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil.

The required lengths of restrained joint ductile iron pipe and PVC pipe shall be determined by the ENGINEER and shown in a tabular form as depicted on the "Restrained Joint Detail" in the STANDARD DETAILS.

Wherever 2-45° bends are used in place of a 90° bend and the minimum length of restrained pipe required from one 45° bend extends beyond the other 45° bend, the 2-45° bends will be considered as though a 90° bend were located midway between the 2-45° bends. No use of 90 degree bends is allowed unless approved by the UTILITY in writing.

C. Mechanical Restraining Devices

1. General: Mechanical Restraining Devices as specified herein may be substituted for the restrained "Locked-Type" joints. The length of the pipe to be restrained shall be based on the "Restrained Joint Detail" in the STANDARD DETAILS.

2. Joint Restraint Device: Mechanical joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism which, when actuated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. Flexibility of the joint shall be maintained after burial. Glands shall be manufactured of ductile iron conforming to ASTM A536. Restraining devices shall be of ductile iron heat treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI A11.11 and ANSI/AWWA C153/A21.53. Twist-off nuts shall be used to insure proper actuating of the restraining devices.

The mechanical joint restraint device shall have a working pressure of at least 150 psi with a minimum safety factor of 2:1 (this will be shown on the PLANS).

12. Connections to Pressure Mains

A. General

Installations of pressure connections 2" and larger shall be made in accordance with this Section.

B. Tapping Sleeves

1. General: Tapping sleeves shall be mechanical joint sleeves or fabricated steel sleeves as specified below. All pressure connections to asbestos cement pipe and all "size on size" taps shall utilize mechanical joint sleeves.

2. Mechanical Joint Sleeves: Sleeves shall be cast of gray-iron or ductile-iron and have an outlet flange with the dimensions of the Class 125 flanges shown in ANSI B16.1, properly recessed for tapping valve. Glands shall be gray-iron or ductile iron. Gaskets shall be vulcanized natural or synthetic rubber. Bolts and nuts shall comply with ANSI/AWWA C111/A21.11. Sleeves shall be capable of withstanding a 200-psi working pressure.

3. Steel Tapping Sleeves: Sleeves shall be fabricated of a minimum of 3/8" carbon steel meeting ASTM A285 Grade C. Outlet flange shall meet AWWA C-207, Class "D" ANSI 150 lb. drilling and be properly recessed for the tapping valve. Bolts and nuts shall be high strength low alloy steel to AWWA C111 (ANSI A21.11). Gasket shall be vulcanized natural or synthetic rubber. Sleeves shall have manufacturer-applied fusion bonded epoxy coating, minimum 12 mil thickness.

4. Tapping Valves: Tapping valves shall meet the requirements of Section 22.2 except that units shall be flange by mechanical joint ends. Valves shall be compatible with tapping sleeves as specified above and specifically designed for pressure connection operations.

C. NOTIFICATION AND CONNECTION TO EXISTING MAINS

TO AVOID THE POSSIBILITY OF ISOLATION VALVES BEING LEFT OPEN - All connections to existing mains shall be made by the CONTRACTOR only after the connection procedure and his work scheduling has been reviewed and approved by UTILITY. All connections to existing piping will be such that the connection is made through a wet tap with tapping valve, or the connection is started with a gate valve. This is to ensure that the existing system's cleanliness and sanitation is maintained until the new piping system has satisfactorily passed all test and has been disinfected. The CONTRACTOR shall submit a written request to UTILITY a minimum of one (1) week prior to scheduling said connections. In his request he shall outline the following:

1. Points of connection, fittings to be used, and method of flushing and disinfection if applicable.

2. Estimated construction time for said connections.

UTILITY shall review the submittal within one (1) week after receiving it and inform the CONTRACTOR regarding approval or denial of his request. If his request is rejected by UTILITY, the CONTRACTOR shall resubmit his request modifying it in a manner acceptable to UTILITY.

All connections shall only be made on the agreed upon date and time. If the CONTRACTOR does not initiate and complete the connection work in the agreed upon manner, he shall be required to reschedule the said connection by following the procedure outlined above.

The CONTRACTOR shall not operate any valves in the system.

D. Installation

1. Excavation, Backfill, Compaction and Grading: The applicable provisions shall apply.

2. Construction Details: Sufficient length of main shall be exposed to allow for installation of the tapping sleeve and valve and the operation of the tapping machinery. The main shall be supported on concrete pedestals or bedding rock at sufficient intervals to properly carry its own weight, plus the weight of the tapping sleeve valve and machinery. Any damage to the main due to improper or insufficient supports shall be repaired at the contractor's expense.

The inside of the tapping sleeve and valve, the outside of the main, and the tapping machine shall be cleaned and swabbed or sprayed with 10% liquid chlorine prior to beginning installation for water system pressure connections.

After the tapping sleeve has been mounted on the main, the tapping valve shall be bolted to the outlet flange, making a pressure tight connection. Prior to beginning the tapping operation, the sleeve and valve shall be pressure tested at 150 psi to ensure that no leakage will occur.

For pressure connections 12" diameter or less, the minimum diameter cut shall be 1/2" less than the nominal diameter of the pipe to be attached. For 14" through 20" installations, the minimum diameter shall be 1 1/2" less; for larger taps, the allowable minimum diameter shall be 2" to 3" less than the nominal diameter of the pipe being attached. After the tapping procedure is complete, the CONTRACTOR shall submit the coupon to UTILITY.

Adequate restrained joint fittings shall be provided to prevent movement of the installation when test pressure is applied. Provisions of these specifications shall apply.

13. Pipe Material for Water Mains and Service Connections

A. General

These SPECIFICATIONS cover the pipe, fittings, and accessory items used for water distribution systems.

Pipe used in water distribution systems shall be either polyvinyl chloride (PVC), or ductile iron pipe (DIP).

The CONTRACTOR shall be responsible for all materials furnished and storage of same, until the date of substantial completion. He shall replace at his expense all materials found to be defective or damaged in handling or storage. The CONTRACTOR shall, if requested by UTILITY, furnish certificates, affidavits of compliance, test reports, or samples for check analysis for any of the materials specified herein. All pipes delivered to project site for installation is subject to random testing for compliance with the designated specifications.

All water main materials, including pipe and fittings, shall meet NSF/ANSI 61 standards per rule .0406 of the Rules Governing Water Systems.

B. PVC Pipe

1. PVC Pipe: All PVC pipe of nominal diameter three (3) through twelve (12) inches shall be manufactured in accordance with AWWA Standard C900, latest edition. The PVC pipe shall have a minimum working pressure rating of 200 psi and shall have a dimension ratio (DR) of 14. Pipe shall be the same O.D. as ductile iron pipe. PVC pipe smaller than three (3) inches shall be SDR 21 Class 200.

2. Joints: PVC pipe shall have integral bell push-on type joints conforming to ASTM D3139.

3. Fittings: Fittings used with C900 PVC pipe shall be mechanical joint ductile iron or gray iron conforming to ANSI/AWWA A21.10/C110, 250 psi minimum pressure rating, or ductile iron compact fittings four (4) through twenty-four (24) inches in accordance with ANSI/AWWA A21.53/C153.

Fittings used with 3" and smaller PVC pipe shall be manufactured from virgin rigid PVC (polyvinyl chloride) compounds with a Cell Class of 12454 as identified in ASTM D 1784. All fitting shall be threaded unions Bell and spigot with elastomer gaskets, or compression type – no glue joints are to be used.

C. Ductile Iron Pipe & Fittings

1. Ductile Iron Pipe: All ductile iron pipe of nominal diameter (3) through fifty-four (54) inches shall conform to ANSI/AWWA A21.50/C150 and ANSI/AWWA A21.51/C151. A minimum of Class 50 pipe shall be supplied for all sizes of pipe unless specifically called out in the DRAWINGS or required by UTILITY.

2. Fittings: Any fittings required shall be mechanical joint ductile iron or gray iron conforming to ANSI/AWWA A21.10/C110, 250 psi minimum pressure rating, or ductile iron compact fittings three (3) through twenty-four (24) inches in accordance with ANSI/AWWA A21.53/C153.

3. Joints: Joints for ductile iron pipe and fitting joints shall be push-on or mechanical joints conforming to ANSI/AWWA A21.11/C111. Where called for in the plans, restrained or flanged joints shall be provided. Flanged joints shall conform to ANSI Standard B 16.1-125 LB. Restrained joints shall conform to these specifications.

4. Polyethylene Encasement: The pipe shall be polyethylene encased (8 mil) where shown on the DRAWINGS or required by UTILITY in accordance with ANSI/AWWA A21.51/C105.

D. Service Pipe, Stops, Fittings, and Service Saddles

1. Service Pipe: All service lines shall be 3/4", 1", 1-1/2" or 2" blue polyethylene tubing conforming to specifications in AWWA C800 and AWWA C901. One and one-half inch (1-1/2") and larger shall be sized in accordance with the Iron Pipe Sizing Standard (IPS); 3/4 "and 1" shall be the Copper Tube Sizing Standard (CTS)

2. Stops: Corporation stops shall be 3/4", 1", 1-1/2" or 2" brass, equipped with connections compatible with the polyethylene tubing and threaded in accordance with specifications in AWWA C800 and AWWA C901. Curb stops shall be sized to match the meter size and conform to the specifications in AWWA C800 and AWWA C901. There will be one corporation stop at the main tap and start of the service line. There will be a second corporation stop type of ball valve placed at the end of the service line and prior to the meter yoke so that the meter yoke can be isolated. The second ball corporate stop shall be accessible from inside of the meter box.

3. Fittings: Fittings shall be brass, cast and machined in accordance with specifications in AWWA C800 and AWWA C901, with compatible polyethylene tubing connections.

4. Service Saddles: A service saddle shall be used for all service line taps. Service saddles shall be double strap, anchored by a minimum four (4) bolt pattern on a ductile iron saddle body. Service saddles for PVC pipe shall have double strap sized exactly to the pipe outside diameter. Sealing gaskets shall be BUNA-N rubber and straps shall be corrosion resistant alloy steel. Note, all bolts shall be stainless steel.

UTILITY may require a stainless-steel strap and fusion epoxy, or nylon coated ductile iron body with stainless steel hardware in areas designated as corrosive.

5. All services shall be sleeved with 2" schedule 40 PVC or greater under paved areas.
Paved areas includes driveways and concreted areas.

14. Water Main Installation, Disinfection and Pressure Testing

A. General

Pipe shall be installed in accordance with the manufacturer's specifications and instructions for the type of pipe used and applicable AWWA standards, such as C600 and C603, unless otherwise stated in these SPECIFICATIONS.

B. Pipe Handling

All types of pipe shall be handled in such manner as to prevent damage to the pipe or coating. Accidental damage to pipe or coating shall be repaired to the satisfaction of UTILITY or be removed from the job. When not being handled, the pipe shall be supported on timber cradles or on properly prepared ground, graded to eliminate all rock points and to provide uniform support along the full length. When being transported, the pipe shall be supported at all times in a manner which will not permit distortion or damage to the lining or coating. Any unit of pipe that, in the opinion of UTILITY, is damaged beyond repair by the CONTRACTOR shall be removed from the site of the work and replaced with another unit.

Joint gaskets shall be stored in clean, dark, dry location until immediately before use.

Dirt or other foreign material shall be prevented from entering the pipe or pipe joint during handling or laying operations and any pipe or fitting that has been installed with dirt or foreign material in it shall be removed, cleaned and reinstalled. At times when pipe installation is not in progress, the open ends of the pipe shall be closed by a watertight plug or by other means approved by UTILITY to ensure absolute cleanliness inside the pipe.

C. Separation of Water Mains and Sewers

1. General: Water mains that are installed in the vicinity of pipelines designated to carry raw wastewater or reclaimed water (wastewater effluent) shall meet the horizontal and vertical separations specified below.

2. Horizontal Separation: A minimum horizontal separation of ten feet, outside of pipe to outside of pipe, shall be maintained between potable water piping and domestic wastewater gravity piping or storm water piping.

A minimum horizontal separation of ten feet, outside of pipe to outside of pipe, shall be maintained between potable water piping and reclaimed water piping carrying unrestricted public access reuse water.

Where it is not possible to maintain the required horizontal separation, the potable water main may be laid in a separate trench or on an undisturbed earth shelf located on one side of the wastewater gravity piping, storm water piping or reclaimed water piping and at such an elevation that the bottom of the water main is at least eighteen inches above the top of the other pipe.

If the minimum allowable ten feet of horizontal separation or eighteen inches vertical separation in a separate trench cannot be maintained, the water pipe shall be ductile iron if the other pipe is a storm water pipe that may not be possibly upgraded in material and joint type.

If the minimum allowable ten feet of horizontal separation or eighteen inches vertical separation in a separate trench cannot be maintained, the water pipe and sanitary sewer pipe shall be ductile iron.

If the other pipe is a reclaimed water pipe and the above separation requirements are not met, the reclaimed water pipe shall be ductile iron.

Deviations from these requirements and other alternatives may be considered on a case-by-case basis if supported by data from the design engineer and must receive specific approval by the Department prior to implementation.

There shall be at least a 10-foot horizontal separation between potable water piping and sanitary sewer force mains without exception. Field conditions not allowing the minimum

separation being achieved shall be reported to the engineer. Specific solutions to separation problems as proposed by the engineer must be accepted by the Department prior to implementation.

No water main shall pass through or come in contact with any part of a sanitary sewer manhole or storm sewer structure.

3. Vertical Separation: A minimum vertical separation of eighteen inches, outside of pipe to outside of pipe, shall be maintained between potable water piping, wastewater gravity piping, storm water piping or reclaimed water piping.

When there is less than eighteen inches of net vertical clearance between the potable water pipe and storm water pipe, the water piping shall be ductile iron. One full length of pipe shall be centered at the point of crossing.

If the minimum allowable ten feet of horizontal separation or eighteen inches vertical separation in a separate trench cannot be maintained, the water pipe and sanitary sewer pipe shall be ductile iron.

If the other pipe is a reclaimed water pipe and the above vertical separation requirements are not met, the reclaimed water pipe shall be ductile iron.

Special structural support or concrete saddles may be necessary at the pipe crossing location.

It is preferable to install the potable water pipe above the domestic wastewater, storm water or reclaimed water pipe at crossings.

Deviations from the separation requirements and other alternatives may be considered on a case-by-case basis if supported by data from the design engineer and must receive specific approval from the UTILITY and PWS prior to implementation.

There shall be a minimum of eighteen inches of net vertical separation between water mains and sanitary sewer force mains without exception. Situations where it is not possible to maintain the required vertical separation shall be reported to the engineer. Specific solutions as proposed by the engineer must be accepted by the UTILITY and PWS prior to implementation.

4. Crossing a Water Main over a Sewer: Whenever it is necessary for a water main to cross over a sewer, the water main shall be laid at such an elevation that the bottom of the water main is at least eighteen inches above the top of the sewer, unless local conditions or barriers prevent an eighteen inch vertical separation – in which case both the water main and sewer shall be constructed of ferrous materials and with joints that are equivalent to water main standards for a distance of ten feet on each side of crossing.

5. Crossing a Water Main under a Sewer: Whenever it is necessary for a water main to cross under a sewer, both the water main and the sewer shall be constructed of ferrous materials and with joints equivalent to water main standards for a distance of ten feet on each side of the point of crossing. A section of water main pipe shall be centered at the point of crossing.

D. Trench Preparation and Pipe Bending

1. Trench Preparation and Pipe Bedding: Applicable provisions of these specifications shall apply. Also refer to STANDARD DETAILS.

2. Pipe Preparation and Handling: All pipe and fittings shall be inspected prior to lowering into trench to insure no cracked, broken, or otherwise defective materials are being used. CONTRACTOR shall clean ends of pipe thoroughly and remove foreign matter and dirt from inside of pipe and keep clean during and after installation. CONTRACTOR shall use proper implements, tools, and facilities for the safe and proper protection of the WORK. CONTRACTOR shall lower pipe into the trench in such a manner as to avoid any physical damage to the pipe and shall remove all damaged pipe from the job site. Care shall be taken not to drop or dump pipe into trenches under any circumstances.

3. Trench Dewatering and Drainage Control: Specifications from Section T-4, I shall apply. CONTRACTOR shall prevent water from entering the trench during excavation and pipe installation operations to the extent required to properly grade the bottom of the

trench and allow for proper compaction of the backfill. Pipe shall not be installed in water.

4. Survey Line and Grade: Pipe shall be installed to the lines and grades shown on the PLANS. The CONTRACTOR shall provide line and grade stakes at a 1,000-foot maximum spacing and at all line and/or grade change locations. CONTRACTOR shall provide Temporary Bench Marks at maximum 1,000-foot intervals. The minimum pipe depth shall be three (3) feet below the finished grade surface or three (3) feet below the elevation of the edge of pavement of the road surface whichever is greater.

5. Pipe-laying in Trench: CONTRACTOR shall prevent foreign material from entering the pipe while it is being placed in the trench. CONTRACTOR shall remove all foreign material from the pipe or joint ring before the next pipe is placed. If the pipe-laying crew cannot put the pipe into the trench, and in place, without getting soil into the pipe, UTILITY may require that snugly-fitted, tightly-woven canvas bags be placed over each end before lowering the pipe. The bags shall be left in place until the connection is to be made to the adjacent pipe. During laying operations, CONTRACTOR shall keep debris, tools, clothing, or other materials out of the pipe.

6. Installing PVC Pipe: All PVC pipe shall be installed in accordance with standards set forth in the UNI-BELL "Handbook of PVC Pipe Design and Construction" unless such standards conflict with this MANUAL in which case this MANUAL shall apply.

7. Installing Ductile Iron Pipe: All ductile-iron pipe shall be installed in accordance with AWWA C600 unless such standards conflicts with this MANUAL in which case this MANUAL shall apply. CONTRACTOR shall cut pipe only as necessary to comply with alignment shown on the PLANS. Flame cutting of pipe shall not be allowed.

CONTRACTOR shall provide special tools and devices, such as special jacks, chokers, and similar items required for proper installation. Lubricant for the pipe gaskets shall be furnished by the pipe manufacturer, and no substitutes shall be permitted under any circumstances.

The pipe shall be polyethylene encased (8 mil) where shown on the DRAWINGS in accordance with ANSI/AWWA A21.51/C105.

8. Installing Pipes on Curves: Long radius curves, either horizontal or vertical, may be installed with standard pipe by deflections at the joints. Maximum deflections at pipe joints and laying radius for the various pipe lengths shall be as recommended by the pipe manufacturer.

9. Pipe Restraining: Requirements specified in Section T-4, K shall apply.

10. Bedding and Backfill for Pipes: Requirements specified in Section T-4, I shall apply.

E. Hydrostatic Tests

1. General: Hydrostatic tests shall consist of pressure test and leakage test. Hydrostatic tests shall be conducted on all newly installed pressure pipes, joints and valves including all service lines to the curb stops. **A second hydrostatic test shall be performed after service lines have been connected.** Air testing of pressure pipes will not be permitted under any circumstance. Tests may be made on sections not exceeding 2,000 feet, when this procedure is acceptable to UTILITY. CONTRACTOR shall furnish all necessary equipment and material, make all taps, and furnish all closure pieces in the pipe as required. Equipment to be furnished by the CONTRACTOR shall include graduated containers, pressure gauges, hydraulic force pumps, and suitable hoses and piping. UTILITY will monitor and approve a satisfactory test.

When filling and/or flushing a new water line extension that is connected to an existing system, the valve between the two shall always stay closed. Filling and/or flushing shall be accomplished through and adequately sized "jumper". The jumper shall consist of a tap onto the existing water line, a valve, a Reduced Pressure Zone (RPZ) backflow preventer, a valve, and a tap into the new extension. Filling and flushing of the new water line shall be accomplished through this tap. At no time shall the RPZ be removed until written authorization has been received from the UTILITY. The operation of the valves shall be coordinated with the UTILITY.

ONCE THE NEW WATER LINE EXTENSION IS ACCEPTED BY THE UTILITY, ALL TEMPORARY TAPS, PIPING AND RPZs SHALL BE REMOVED 9TAPS CAN BE ABANDONED IN PLACE.

The CONTRACTOR may conduct hydrostatic tests after the trench has been partially backfilled with the joints left exposed for inspection for his informational purposes only. The hydrostatic tests for acceptance shall only be conducted after the trenches have been completely backfilled and compacted as specified. Where any section of pipe is provided with concrete thrust blocking, pressure test will not be made until at least five days have elapsed after the thrust blocking is installed.

The CONTRACTOR is to provide UTILITY 48 hour notice before any pressure testing is to begin.

2. Testing Criteria: All pipe sections to be pressure tested shall be subjected to a hydrostatic pressure of 150 psi. The duration of each pressure test shall be for a period of 2 hours. If during the test, the integrity of the tested line is in question, UTILITY may require a 6-hour pressure test. The basic provisions of AWWA C-600 and C-605/M23 shall be applicable.

3. Procedure for Pressure Test: Each section of pipe to be tested, as determined by UTILITY, shall be slowly filled with water and the specified test pressure shall be applied by means of a pump connected to the pipe in a satisfactory manner. Before applying the specified test pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made, and appropriate valves installed to ensure bleeding of all air from the main. If defective pipes, fittings, valves, or hydrants are discovered in consequence of this pressure test, all such items shall be removed and replaced by the CONTRACTOR with sound material and the test shall be repeated until satisfactory results are obtained. Provisions of AWWA C600 and C605/M23, where applicable, shall apply.

4. Procedure for Leakage Test: After completion of the pressure test, a leakage test shall be conducted to determine the quantity of water lost by leakage under the specified test pressure. Applicable provisions of AWWA C600 and C605/M23 shall apply. Allowable leakage in gallons per hour for pipeline shall not be greater than that determined by the formula:

$$L = \frac{SD(P)^{1/2}}{148,000}$$

L = Allowable leakage in gallons per hour.

S = Length of pipe tested, in feet.

D = Nominal diameter of the pipe in inches.

P = Average test pressure during leakage test in pounds per square inch gauge.

Leakage is defined as the quantity of water to be supplied in the newly installed pipe or any valve section under test which is necessary to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled. Should any test of pipe installed disclose leakage greater than that allowed, CONTRACTOR shall locate and replace or repair the defective joints, pipe or valve until the leakage from subsequent testing is within the specified allowance.

In accordance with Section T-2 B, the engineer of record shall submit a certifying statement/report on the results of the testing with the Final Certification Package.

F. Disinfection of Water Mains

1. General: Before being placed in service, all new water mains shall be chlorinated in accordance with the specifications below and the procedures outlined in AWWA C651 "Standard Procedure for Disinfecting Water Mains." , section 4.4.3, the Continuous Feed Method, and section .1003 of *The Rules Governing Public Water Supply Systems*.

2. Flushing: Sections of pipe to be disinfected shall first be directionally flushed (full diameter) to remove any solids or contaminated material that may have become lodged in

the pipe. If no hydrant is installed at the end of the main, then a blow-off valve shall be provided large enough to develop a velocity of at least 2.5 feet per second in the main. A Disinfection plan must be presented to the UTILITY prior to disinfection/flushing. If additional valves and/or blow-offs/hydrants are required to achieve a directional flushing, they will be provided by the Contractor as part of the construction. All taps required for chlorination or flushing purposes or for temporary or permanent release of air shall be provided for by the CONTRACTOR as a part of the construction of water mains. After the disinfection, all such taps shall be sealed to the satisfaction of UTILITY.

3. Disinfection Criteria: Before being placed into service, all new mains and repaired portions of, or extensions to existing mains shall be chlorinated so that the initial chlorine residual is not less than 50 mg/l.

4. Form of Applied Chlorine: Chlorine may be applied as liquid chlorine (gas-water mixture), or a mixture of water and high-test calcium hypochlorite. CONTRACTOR shall assume responsibility for safe handling of chlorine and shall meet requirements of OSHA and other regulatory agencies for safe handling of chlorine.

5. Point of Application: The preferred point of application of the chlorinating agent is at the beginning of the pipeline extension or any valved section of it, and through a corporation stop inserted in the pipe. The water injector for delivering the chlorine-bearing water into the pipe should be supplied from a tap made on the pressure side of the gate valve controlling the flow into the pipeline extension. Alternate points of applications may be used when approved or directed by UTILITY.

6. Operation of ONSWC Valves: Valves shall be manipulated by UTILITY personnel so that the strong chlorine solution in the line being treated will not flow back into the line supplying the water.

7. Retention Period: Treated water shall be retained in the pipe at least 24 hours.

8. Chlorinating Valves and Hydrants: In the process of chlorinating newly installed pipe, all valves or other appurtenances shall be operated while the pipeline is filled with the chlorinating agent and under normal operating pressure.

9. Final Flushing and Testing: Following chlorination, all treated water shall be thoroughly flushed from the newly installed pipe at its extremity until the replacement water throughout its lengths shows upon test, a free chlorine residual not in excess of 1 ppm after flushing.

After flushing, water samples, as directed by UTILITY, shall show acceptable bacteriological results. All bacteriological testing shall be performed by a private laboratory. All such bacteriological analysis must be performed by a laboratory certified by the State of North Carolina.

Proper chain of custody procedures must be followed, and samples shall only be collected by certified laboratory personnel in the presence of UTILITY'S personnel.

Copies of testing results and all related correspondence with the NCDENR shall be submitted to UTILITY.

10. Repetition of Flushing and Testing: Should the initial treatment result in an unsatisfactory bacterial test, the original chlorination procedure shall be repeated by the CONTRACTOR until satisfactory results are obtained. The water lines shall not be placed into service until bacteriological test results are found to be satisfactory by a state-approved laboratory.

G. Notification and Connection to Existing Mains

Requirements specified in Section T-4 L shall apply.

H. Cross-Connection Control

1. Inspection and Testing: Backflow prevention assemblies shall be tested by a certified cross-connection control technician in the presence of a UTILITY representative. All backflow prevention assemblies shall be inspected and approved by UTILITY prior to project acceptance and service being provided.

I. Water Service Piping and Connection

Water service piping and connection shall be installed as indicated in the STANDARD DETAILS. The location of all service lines shall be as shown on the DRAWINGS and shall be either single or dual service. On curbed streets, the exact location for each installed service shall be marked by etching or cutting a "W" in the concrete curb. Where no curb exists, locations shall be adequately marked by a method approved by UTILITY.

J. Location and Identification

All PVC water mains shall be a solid blue color. All water mains shall have an "Early Warning" protection tape installed continuously along the alignment. The protection tape shall be installed during backfilling 8 to 12 inches below finished grade directly over the pipe and be continuously marked "Caution, Water Main Buried Below." The tape shall have a metallic detectable strip included and be blue in color. All protection tape shall be as Terra-Tape or equal. See STANDARD DETAILS. In addition to the warning tape there shall be installed a 12 gage THNN location wire. Concurrent Ends of this location wire shall be physically connected utilizing a protective corrosion resistant connector as approved by the UTILITY.

All ductile iron water mains shall either be marked with a continuous 2-inch wide blue stripe located within the top 90 degrees of the pipe or wrapped in blue polyethylene bags. Backfill shall not be placed for 30 minutes following paint application.

15. Valves, Hydrants & Accessories

A. General

All valves and appurtenances shall be products of well-established firms who are fully experienced and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these SPECIFICATIONS as applicable.

B. Resilient Seat Gate Valves

1. General: All gate valves twenty-four (24) inches and smaller shall be resilient seat gate valves. All Valves with be clockwise closed and counterclockwise open Such valves shall be resilient seated, manufactured to meet or exceed the requirements of AWWA C509, latest revision, and in accordance with the following SPECIFICATIONS. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the pipe.

2. Material: The valve body, bonnet, and bonnet cover shall be cast iron ASTM A126, Class B. All ferrous surfaces inside and outside shall have a fusion-bonded epoxy coating. A 2" wrench nut shall be provided for operating the valve in a buried installation. All valves shall be tested in strict accordance with AWWA C509. All valves are to open counterclockwise.

3. Miscellaneous Requirements: The valves shall be right hand open, non-rising stem with the stem made of cast, forged, or rolled bronze as specified in AWWA C509. Two stem seals shall be provided and shall be of the o-ring type. The stem nut must be independent of the gate.

The resilient sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.

C. Butterfly Valves

1. General: All shut-off valves sixteen (16) inches and larger shall be butterfly valves. Butterfly valves and operators shall conform to the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designation C504, except as hereinafter specified. Valves, except as specified hereinafter, shall be Class 150A or B. All Valves with be clockwise closed and counter clock-wise open

2. Material: The valve body shall be constructed of close grain cast iron per ASTM A126, Class B or equivalent material. All retaining segments and adjusting devices shall be of

corrosion resistant material. Valve seats shall be a natural rubber or synthetic rubber compound. Valve seats 30 inches and larger shall be field adjustable and replaceable without dismounting operator disc or shaft and without removing the valve from the line. All retaining segments and adjusting devices shall be of corrosion resistant material. Valves 24 inches and smaller shall have bonded or mechanically restrained seats as outlined in AWWA C504.

3. Face-to-Face Dimension: The face-to-face dimensions of valves shall be in accordance with above mentioned AWWA Specification for short-body valve.

4. Valve Shaft: The valve shaft shall be turned, ground, polished and constructed of 18-8 stainless steel and designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque. Shaft shall be of either a one-piece unit extending full size through the valve disc and valve bearing or it may be of a stub shaft design.

5. Valve Operator: In general, the butterfly valve operators shall conform to the requirements of AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designation C504, insofar as applicable

D. Valve Installation

All valves shall be inspected upon delivery in the field to insure proper working order before installation. They shall be set and jointed to the pipe in the manner as set forth in the AWWA Standards for the type of connection ends furnished. All valves and appurtenances shall be installed true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of UTILITY before they are installed.

Valves shall be installed in a vertical position and be provided with a standard valve box so arranged that no shock will be transmitted to the valve. The box shall be vertically centered over the operating nut, and the cast iron box cover shall be set flush with the roadbed or finished surface.

After installation, all valves shall be subjected to the field test for piping as outlined in Division 3, Section 14 of these SPECIFICATIONS. Should any defects in materials or workmanship appear during these tests, the CONTRACTOR shall correct such defects to the satisfaction of UTILITY. Flanged joints shall be made with hot dipped galvanized bolts, nuts, and washers. Mechanical joints shall be made with mild corrosion resistant alloy steel bolts and nuts. All exposed bolts shall be painted the same color as the pipe. All buried bolts and nuts shall be heavily coated with two (2) coats of bituminous paint.

E. Valve Boxes

All buried valves shall have cast-iron three-piece valve boxes. Valve boxes shall be provided with suitable heavy bonnets and [shall extend to such elevation at the finished grade surface](#) as directed by UTILITY. The barrel shall be two-piece, sliding type, having 5-1/4 inch shaft. The upper section shall have a flange at the bottom having sufficient bearing area to prevent settling and shall be complete with cast iron covers. Covers shall have "WATER" cast into the top for all water mains. The actuating nuts for deeper valves shall be extended to come up to 4-foot depth below finished grade.

Care shall be taken while constructing valve boxes to ensure that valve stems are vertical, and the cast iron box has been placed over the stem with base bearing on compacted fill and top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. CONTRACTOR shall remove any sand or undesirable fill from valve box prior to final inspection.

All valve boxes shall be equipped with concrete collars.

F. Air Release Valves

The air release valves for use in water mains shall be installed as shown on the STANDARD DETAILS. Valves used for 6 inch water lines and larger shall have a cast-iron body or bronze body, cover and baffle, stainless steel float, bronze water diffuser, Buna-N or Viton seat and stainless-steel trim. Valves used on water lines smaller than six inches shall have a cast iron body with a stainless-steel float and trim, Buna-N valve with a stainless steel seat. Valves shall be

provided with a vacuum check to prevent air from re-entering the line. The fittings shall be threaded (NPT).

G. Hydrants

1. Material: Hydrants shall have a 5-1/4 inch valve opening and shall comply with AWWA Standard C502 for hydrants for water works service, unless in conflict with MANUAL, in which case this MANUAL shall apply. Each hydrant shall have a 6-inch mechanical joint ends with harnessing lugs ("dog ears") and shall open by turning to the left (counter-clockwise). Hydrant shall be of ample length for 3-1/2 foot depth of bury. It shall be provided with two 2-1/2 inch hose nozzles and one 5 1/4 inch pumper nozzle, all having National Standard hose threads. Nozzles shall have caps attached by chains. Operating nuts shall be AWWA Standard (pentagonal, measuring 1-1/2 inch point to flat). Hydrants shall be equipped with "O-Ring" packing.

2. Painting: All iron parts of the hydrant both inside and outside shall be painted, in accordance with AWWA C502. All inside surfaces and the outside surfaces below the ground line shall be coated with asphalt varnish. They shall be covered with the two coats, the first having dried thoroughly before the second is applied.

The outside of the hydrant above the furnished ground line shall be thoroughly cleaned and thereafter painted with one coat of paint of a durable composition.

3. Construction Details: Hydrants shall be plumb and shall be set so that the lowest hose connection is, at least, eighteen (18) inches above the surrounding finished grade. All hydrants shall be inspected in the field upon delivery to the job to insure proper operation before installation. The resetting of existing hydrants and moving and reconnecting of existing hydrants shall be handled in a manner similar to a new installation. Hydrant shall be constructed in accordance with the STANDARD DETAILS.

4. Location: Hydrants shall be located in the general location as shown on the DRAWINGS. All hydrants shall be located no less than five (5) and no more than ten (10) feet from the edge of pavement of the adjacent roadway and no less than five (5) feet from any physical feature which may obstruct access or view of any hydrant, unless otherwise approved by the applicable county and UTILITY.

SECTION T-5 LIST OF MATERIALS AND APPROVED MANUFACTURERS

1. North Carolina

A. Well Sites

1. Grassing: Centipede grass seed mixed with "Contractus".

2. Graveling: 4" thick, compacted, crush and run gravel.

B. Pumps and Motors

1. Submersible Motors: Motors shall be manufactured by Franklin or Centri-pro and of the highest psi thrust bearing available. Any other manufacturer must be approved by UTILITY.

2. Submersible Pumps

a. **Goulds or Grundfos** are acceptable; design shall be for the most efficiency.

b. 1.5", 2" & 3" sizes acceptable, larger sizes may be approved as required (Drop Pipe).

c. **Strataflo, series 300, full port, NPT**, spring check valve. Two (2) are required if setting is 300 plus feet deep.

3. Booster Pumps and Motors

a. Booster pumps shall be designed by, or approved, by Utility to meet 12hr demand with submersible pumping and storage capacity. The pumps and the tank(s) shall also meet Peak demand. All pumps shall be approved by Utility.

b. Booster Pumps of the series specified and shall be manufactured by either:

- **Goulds**

Low pressure up to 60psi, Centrifugal, Series “S”, “LH”, “M” or “L” close coupled, 230VAC, single or 3 phase, depending on circumstances.

High pressure over 60psi, Multi-stage, Series “SSV”, configuration SVB, SVD, or SVC, vertical, 230VAC, single or 3 phase, depending on circumstances.

In certain instances, as specified by the Utility, Variable speed pumps may be used and would be of the “Aquavar” series.

- **Grundfos**

Low pressure up to 60psi, Centrifugal, Series “SR” or SF, close coupled, 230VAC, single or 3 phase, depending on circumstances.

High pressure over 60psi, Multi-stage, Series “CR”, “CRI” or CRN with a flanged inlet and outlet configuration, 230VAC, single or 3 phase, depending on circumstances.

In certain instances, as specified by the Utility, Variable speed pumps may be used and would be of the “BoosterpaQ” system.

4. Control: Only dual pumps with alternating, lead-lag, bypass and step interlock and all necessary controls shall be installed.

5. Air release shall be Watts, 1/4” bronze model FV -4M1(Dayton 4A821).

6. Swing check valve (horizontal piping only): Nibco, Bronze, Industrial, NPT, WOG minimum 200psi. Spring check valve (vertical piping only): Strataflo, series 300 spring.

7. Gate valve: Nibco, Bronze, Industrial, short stem, NPT, WOG 300psi, series T-133.

8. Ball valve (1/4”): Apollo, Bronze, NPT, series 70-100, WOG 600psi.

Gauge: liquid filled 100psi w 1/4” NPT stem - Campbell PG11T-1.

liquid filled 200psi w 1/4” NPT stem – Campbell PG13T-L

C. Plumbing

1. Valve Bank

a. Above ground pipe: galvanized steel, cast Brass or Stainless.

b. 2 Below ground pipe: PVC, , Ductile Iron, Brass or Stainless.

c. Water Meter: Sensus Omni or Hersey MVR Pulsar Flow provided by UITLETY.

d. Wye Strainer: Watts, bronze, series 777 or 77s, WOG 400psi

Ball valve (1” up): Apollo series 77-100, Bronze, threaded, Full Port with WOG of 600psi.

Pipe (above ground): galvanized, brass or stainless steel with braided poly pipe to Strainer.

e. Rubatex insulation only.

f. 1/4” ball valve: Apollo, bronze, series 70-100, WOG 600psi.

g. Gauges: liquid filled 100psi w 1/4” NPT stem - Campbell PG11T-1.

liquid filled 200psi w 1/4” NPT stem – Campbell PG13T-L.

h. Swing check valves (1” up): Nibco, Lead Free bronze, threaded with WOG 200psi.

Ball valves (1” up): Apollo series 77-100, Bronze, threaded, Full Port with WOG of 600psi.

Gate valves: Nibco, Lead Free Bronze, non-rising stem, Series T-113 with WOG 300 psi

i. Pressure Switch: Allen Bradley, Model 836T-T253J.

Ball Valves: Apollo, bronze, series 70-100, WOG 600psi.

j. Hose bib:

Threaded: Nibco, Lead Free, bronze, NPT with WOG 200psi.

Non-threaded: Nibco, industrial, bronze, NPT with WOG 200psi.

k. Eyewash: Guardian, model G5026.

1. Distribution Pressure Relief Valve – 2 inch Kunkle Model 0020-H01-MG Factory set at 100 psig – all bronze
2. Hydro Pneumatic tank
 - a. Dresser sleeve shall be MJ, cast type such as manufactured by UFCO or equal.
 - b. MJ valve: valves shall comply with AWWA C-500 and be iron body, parallel seat type, bronze fitted with resilient rubber coated wedge. Model # Kennedy 15TIX, Mueller A2360 or equivalent.
Valve Box: cast iron, adjustable screw type Part #.
Valve Box Ring: Brooks 24” valve collar.
 - c. MJ valve: valves shall comply with AWWA C-500 and be iron body, parallel seat type, bronze fitted with resilient rubber coated wedge. Model # Kennedy 15TIX, Mueller A2360 or equivalent.
 - d. Valve Box: cast iron, adjustable screw type, such as manufactured by UFCO or equal.
Valve Box Ring: Brooks 24” valve collar.
3. Distribution line:
 - a. SDR 21, Class 200 PVC, acceptable within subdivision up to 2” unless otherwise directed by UTILITY.
 - b. DR 18, C900 PVC, acceptable within subdivision, state, county, or federal roads, under culverts and under creeks (when cased).
 - c. Class 50, Ductile Iron, minimum pressure rating 200psi, acceptable within subdivision, state, county or federal roads, under culverts and under creeks (when cased).
 - d. HDPE pipe of the specified size and pressure rating of not less than 200psi, shall be used under wetlands or stream crossings. Proper size and type fittings shall be installed. Once the pipe is installed, if direct bored, it shall have a waiting period of 7days, to allow for shrinkage before tying on to other pipe.
4. Restraint Fittings
 - a. MJ fittings, where the restraining system is built in, shall be acceptable on all types of pipe without further blocking.
 - b. Megalug restraint collars systems shall not be allowed on SDR 21, Class 200 PVC. Types with minimum of 6 lugs, are acceptable on all other pipes listed under (5) above.
5. Relief Valve: bronze, NPT, ASTM and Boiler rated, steam rated, valve, set at the tested or approved tank pressure, Kunkle Valve, Model 6010eem01-km0(xxx) (psi).
6. Vacuum Breaker: Strataflo, series 300, inverted spring check valve with mushroom vent.
7. Locking Ball Valve: Apollo ball valve, model 75 -105 with 600 WOG rating and a four position locking device. All Valves with be clockwise closed and counter clockwise open
8. Air Compressor
 - a. Whitewater, Model 1/6hp, 120VAC.
 - b. Probes and pressure switch Included with (1).
9. Chemical Barrels: Pulsafeeder chemical barrel (55 gal).

D. Distribution mains

1. Mains
 - a. same as Distribution Line.
 - b. same as Restraint Fittings.
 - c. Other Fittings: Tees, bend, etc. MJ cast (Mueller or equal) or compression (as made by “One Bolt, Inc.”).
 - d. MJ Gate Valves (Square nut): Kennedy 15TIX, Mueller A-2360 or equivalent.
 - e. Valve Box: cast iron, adjustable screw type, such as manufactured by UFCO or equal.
 - f. Valve Box Ring: Brooks 24” valve collar.
 - g. Air Relief Valve: automatic blow-off – For 6 inch and large water lines, the air relief valve shall be APCO #200, Crispin PL 20 (2inch) or equivalent. For water lines smaller than 6 inch the air relief valve shall be the Crispin AR10 (1 inch), APCO #50 (1 inch), or equivalent.
 - h. Mains: Last 400’ on cul-de-sacs – minimum size 4”.
2. Services
 - a. Meter Box: NDS D1200 meter box with hinge lid.

- b.** Meter setter: Ford Model VHH-72-7W or Mueller 1404-2 Yoke or
 - c.** Strap Saddles: Bronze, double strap made by Mueller, Ford or Equal.
 - d.** Compression Fittings: Mueller, Ford or equal.
 - e.** Chaseways: schedule 40, PVC, electrical conduit, or plumbing pipe.
 - f.** Meters: Provided by UTILITY.
 - g.** All service lines shall be ¾" 1", 1-1/2" or 2" blue polyethylene tubing conforming to specifications in AWWA C800 and AWWA. One and one-half inch (1-1/2") and larger shall be sized in accordance with the Iron Pipe Sizing Standard (IPS); ¾ "and 1" shall be the Copper Tube Sizing Standard (CTS)
- 3.** Backflow and Cross Connection
- a.** Backflow Prevention Device:
Severe Hazard: Bronze RPZ – Cla-Val-RP2, Watts Series 009QT, Wilkins WK975XL-075, Febco 825Y (D), Conbraco 400, or approved equal
Moderate Hazard: Bronze, Double Check Valve Assembly, part # 40-104-997
- 4.** Hydrants
- a.** Kennedy K81-D2 5 1/4", Mueller Centurion A421 5 1/4", or utility-approved equal.

E. Water Treatment

- 1.** Chemical Equipment.
- a.** Chemical Pump: Pulsafeeder, model LE Series of appropriate pressure and flow design requirements, or as specified by UTILITY.
14gpd @ 100psi: LEK3SA-VHC-xxx
24gpd @ 100psi: LE14SA-VHC-xxx
6gpd @ 150psi: LE2SA-VHC-xxx
22gpd @ 150psi: LEK34SA-VHC-xxx
 - b.** Chemical Vat: NSF Approved- Snyder or approved equivalent.
 - c.** Safety Components
Flow Switch, Low Flow (below 15gpm): ITT, McDonnell & Miller Model FS7-4.
Flow Switch, Full Flow (over 15gpm): ITT, McDonnell & Miller Model FS4-3.

F. Tanks

- 1.** Hydro Pneumatic Tanks
- a.** Tank shall be National Board stamped ASME approved, as manufactured by RECO USA or Ramco Tank Manufacturers. Other tank manufacturers to submit plans for approval to UTILITY before construction on the tank begin.
 - b.** Pedestals shall be poured with 12" dip for tank and a minimum of 3/8" thick rubber shall be installed between the tank and the pedestal.
- 2.** Ground Storage Tanks
- a.** Probes shall be manufactured by WARRICK CONTROLS and of the configuration specified by Utility.

G. Well House

- 1.** Building
- a.** Door: 36" minimum single door, steel of (min) 16 Gauge, painted with Epoxy Paint or a semi solid or solid fiberglass door.
 - b.** Automatic Foundation Vents: 8"x16".
Closing Vents: 8"x 16", part #.

H. Electrical

- 1.** Panels
- a.** Panel 230VAC, ITE, with copper busway.
Nema 4X Inside and Outside
Part Number Single Phase
Part Number Three Phase
- 2.** Magnetic Starters
- a.** Starter: Allen Bradley, Nema 3R, , three pole with 120VAC coil.

- b. Timer: Intermatic Model FF5M spring wound 5-minute timer (also works for hand switch).
- c. Auxiliary Contacts: Two Normally open required
- d. Thermal Overloads: Allen Bradley – series “J”.
- 3.** Pressure Switch: Allen Bradley – 835T-T253J or Square D
- 4.** Indicating Controls
 - a. Elapsed Time Meter: Vender-Root 7795.
 - b. Impulse Counter: Durant 6-Y-41345.
- 5.** Telemetry / Radio Controls
 - a. Telemetry: provided by UTILITY.
 - b. Radio Control: provided by UTILITY.
- 6.** Air Compressor: Whitewater, Model 1/6hp, 120vac, Model # 1HAB-44-M100X 115 volt 1/6HP 0.12 KW 60 Hz, or McDonnell & Miller Tank Level Controller.
- 7.** Heating
 - a.** Base Board Heater:
 - 4’: 1,000-watt, 240 volts AC, part # Dayton 3UG84D.
 - b.** Remote Thermostat: White-Rodgers, Model #2B61-186.
- 8.** Auto-Off Timers: Intermatic FF Series, Commercial Series.

SECTION T-6 STANDARD DETAILS

See Details Manual

THIS NEEDS TO BE CORELATED TO ONSWC DETAILS

Figure No. Title

- 1 Bore & Jack Detail Casing
- 2 Pavement Crossing
- 3 Standard Roadway Open-Cut Detail
- 4 Utility Separation Details
- 5 Typical Conflict Resolution by Deflection or Fittings
- 6 Restrained Joint Detail
- 7 Service Connection
- 7A Typical 1.5 to 2 Inch Water Service
- 7B Standard Meter Box and lid – 1 inch meter and smaller
- 8 Tapping Sleeve (1 of 2)
- 9 Tapping Sleeve (2 of 2)
- 10 Gate Valve and Extension
- 11 Hydrant Detail
- 12 Blow-off Detail for Hydropneumatic Tanks
- 12A Standard Automatic Flushing Device
- 13 Air Release Valve Detail
- 14 Trench Detail
- 15 Guard Post Detail
- 16 Typical Thrust Block Detail
- 17 Reduce Pressure Backflow Preventer
- 18 Reduced Pressure Backflow Device Detail, 2 inch Services and Smaller
- 19 Service Connections for Compound Meters and Backflow Preventer Assembly 3”, 4”, 5”, 8” and 10”
- 20 Typical Water System Layout With Gravity Sewer in the Cul-de-sac
- 20A Typical Water System Layout Without Gravity Sewer in the Cul-de-sac
- 21 8” Well Detail

22 Well House Foundation
23 Well Piping Details
23A Satellite Well Piping details
24 Chemical Details
25 Well w/ Tank Piping Details
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26A Air Piping & Tank Piping Detail – Whitewater Layout
27 Hydropneumatic Tank
28 Hydropneumatic Tank Details for Standard Replacement
29 Hydropneumatic Tank Details for Standard Replacement 2
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31 Well House Exterior Details
32 Well House Electrical Layout
32A Typical Well House Wiring Diagram
33 Three Phase Panel Layout
34 Single Phase Panel Layout
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36 Typical Satellite Well Electrical Panel Cover