

1 General

.1 Codes and Standards

- .a Designs, clearances, construction, workmanship and material, unless specifically indicated, shall be in accordance with the following:
 - i. North Carolina Building Code in effect at the time of permitting.
 - ii. Compliance with authority having jurisdiction at location of site.
 - iii. Occupational Safety and Health Administration (OSHA).

2 Earthwork - General

.1 Grading

- .a Shall allow for storm drainage away from building, parking areas and driveways. Consider flow of concentrated storm drainage, design to slow down velocity. Concentrated drainage across walks shall not be allowed, nor will ponding be allowed. Discharge from canopies shall be directed away from walks and tied into underground storm drain line system. All drainage shall be directed into approved storm water control measures.
- .b Top of finish grade next to exterior walls shall be set a minimum of 8 in. below top of finish floor except at building entrance locations. Weeps are not to be covered once final landscaping is installed.
- .c All maintainable slopes shall be less than 1 in 3.
- .d All paved surfaces are to ensure positive drainage off surface.
- .e Do not stockpile excavations permanently on site unless approved by owner.
- .f All cleaned topsoil shall be stockpiled for site use or other use by WC.
- .g Site designers shall use a 10 year storm factor when calculating site water flow rates unless there is a critical situation such as flooding the building or adjacent properties. Site designers shall be required to notify the Owner in writing of any and all critical situations.
- .h Storm water flow from adjacent developed properties should not be accepted onto Wake County properties in a manner that causes inundation of the site storm water plan or devices.

.2 Manholes

- .a Covers of storm drainage manholes shall be set flush with top of surrounding paving or finish grade. Where required by local zoning ordinances mount covers of sanitary sewer manholes 12 in. above finish grade at lawn or planted areas.

.3 Cleanouts

- .a A concrete pad shall be provided around all cleanouts. Size of pad to be 24 in. x 24 in. x 4 in. thick. Top of pad to be flush with finished grade. Cleanouts shall be installed within 10 ft. of building wall or downspout location at all underground storm drainage lines.

.4 Stabilization

- .a Permanently protect stabilized areas prior to the removal of protective devices.
- .b After the final establishment of permanent stabilization and approval by inspector/owner, remove temporary sediment control measures. Respread accumulated sediments as specified.

.5 Geotextiles

- .a Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, proposed by Consultant to meet site requirements and to be approved by owner.
- .b Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, proposed by Consultant to meet site requirements and to be approved by owner.

.6 Controlled Low-Strength Material

- .a Controlled Low-Strength Material: Self-compacting, flowable concrete material proposed by Consultant to meet site requirements and to be approved by owner.

.7 Accessories

- .a Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, including metallic band for above ground detection, colored as follows:
 - i. EARTHWORK
 - (a) Colors: To match 811 color codes for marking of utilities.

.8 Excavation

- .a Unclassified Excavation:
 - i. Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation, unsatisfactory soils, or removal of obstructions.
- .b Excavation For Structures
 - i. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
 - ii. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.
- .c Excavation For Walks & Pavements
 - i. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.
- .d Excavation For Utility Trenches
 - i. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - ii. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
 - iii. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated. Clearance: As indicated on contract drawings.
 - iv. All trenches deeper than 4'-0" shall follow OSHA requirements and be supervised by an OSHA qualified person.
 - v. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - vi. Dewater as needed prior to backfill. Provide photographs of trenched utilities after final inspection and prior to backfilling.

.e Storage Of Soil Materials – General

- i.** Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- ii.** Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

.9 Backfill

.a Place and compact backfill in excavations promptly, but not before completing the following:

- i.** Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
- ii.** Surveying locations of underground utilities for Record Documents.
- iii.** Testing and inspecting underground utilities.
- iv.** Removing concrete formwork.
- v.** Removing trash and debris.
- vi.** Removing temporary shoring and bracing, and sheeting.
- vii.** Installing permanent or temporary horizontal bracing on horizontally supported walls.

.b Place backfill on subgrades free of mud, frost, snow, or ice.

.10 Utility Trench Backfill

.a Place backfill on subgrades free of mud, frost, snow, or ice.

.b Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Assure all pipe haunches are properly compacted.

.c Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings.

.d Backfill voids with satisfactory soil while removing shoring and bracing.

.e Place and compact initial backfill of sub base material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.

.f Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

.g Compact soil materials to percentages as proposed by Consultant to meet site conditions.

.11 Grading

.a Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

.b Provide a smooth transition between adjacent existing grades and new grades.

.c Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

.12 Site Rough Grading:

.a Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

i. Turf or Unpaved Areas: Plus or minus 1 inch.

ii. Walks: Plus or minus 1/4 inch (13 mm).

iii. Pavements: Plus or minus 1/4 inch.

iv. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

.13 Subsurface Drainage

- .a Subdrainage Drain:
 - i. Place subsurface drainage geotextile around perimeter of subdrainage trench.
 - ii. Place filter material as proposed by Consultant and approved by owner on subsurface drainage geotextile to support subdrainage pipe.
 - iii. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 - iv. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D698.

.14 Protecting Graded Areas:

- .a Protect newly graded areas from traffic, and erosion. Keep free of trash and debris.
- .b Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

.15 Under Facility Soil Treatment

- .a Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation.
- .b Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.
- .c Service Life of Treatment:
 - i. Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

3 Erosion Control

.1 Soil Amendments & Seed

- .a Consultant proposed, owner approved.

.2 Protective Measures

- .a Protective measures shall conform to all State and Local requirements.
- .b Construction and maintenance of sediment and erosion control measures shall be in accordance with all applicable laws, codes, ordinances, rules and regulations.
- .c Silt Fence: Wire mesh fastened to posts per North Carolina Department of Transportation Standard, and covered with silt fabric.
- .d Berms and Diversion Ditches: These shall be graded channels with a supporting ridge on the lower side constructed across a sloping land surface. Diversion ditches and berms shall be planted in vegetative cover as soon as completed.
- .e Mulching: Mulching shall be used to prevent erosion and to hold soil and seed in place during establishment of vegetation.
- .f Matting: Temporary matting shall be used for temporary stabilization during the established of seeded cover in all grassed ditches, channels, long slopes, and steep banks (6:1 or greater) as indicated on plans. Matting shall be installed on any area on site as needed to provide temporary stabilization whether or not matting is indicated on the plan.
- .g Build Berms, Pits and Gravel Filter as shown on Drawings. Maintain during construction to keep erosion and sedimentation to a minimum. When is necessary to remove benn, pits and gravel, return to area to required profiles and condition.

- .h Maintain all ingress/egress points to prevent tracking of soil onto the Owner's public or private roads. Any soil that is tracked onto the roads shall be removed immediately.
- .i Riprap: Stone shall be graded so that the smaller stones are uniformly distributed throughout the mass. Stone may be placed by mechanical methods, augmented by hand placing where necessary, provided that when the riprap is completed it forms a properly graded, dense, neat layer of stone.
- .j Other Measure: Other methods of protecting existing structures and facilities, such as vegetative filter strips, diversions, riprap, baffle boards, and ditch checks used for reduction of sediment movement and erosion, may be used at the option of the Contractor when approved by the appropriate State or Local authorities.

.3 Miscellaneous

- .a Gravel for Stone Filters: Washed No 57 stone or as indicated by consultant.
- .b Silt Fabric: Synthetic filter fabric or a pervious sheet of polypropylene, nylon, polyester, or polyethylene yarn, certified by manufacturer or supplier as proposed by Consultant to meet site requirements and to be approved by owner.
- .c Filter Fabric (for installation under riprap): Woven geotextiles fabric proposed by Consultant to meet site requirements and to be approved by owner.
- .d Manufactured Inlet Sediment Control Device: Storm drainage inlet sediment control device shall be manufactured from woven polypropylene geotextile to fit the opening of a catch basin or drop inlet to filter sediment from runoff entering inlet. The device shall be a High Flow Silt sack. Device shall be provided with an integral curb deflector if installed at a catch basin with a vertical opening adjacent to a horizontal grate.
- .e Polyacrylamide (PAM) Turbidity Control Log: Soil specific tailored, solid form PAM product containing blends of water treatment components and polyacrylamide co-polymer for water clarification (25 NTU max. at outlet of sediment basin) and erosion control. Product shall be designed for site specific soil and water conditions.
- .f Dewatering Silt Bag: Permeable, non-woven geotextile bag manufactured to accept and filter pumped, sediment-laden water from dewatering activities. Silt bag shall be sized as appropriate for the dewatering pump discharge rate and shall be fitted with a fill spout large enough to accommodate the discharge piping of the dewatering pump.

.4 Channel And Slope Protection

- .a Jute Netting: Provide heavy, uniform; woven of single jute yarn. Install netting over straw mulch and anchor according to manufacturer's recommendations.
- .b Manufactured Mats and Blankets: Erosion Control Blankets shall be a machine-produced mat of agricultural straw, a straw and coconut fiber combination, or curled wood fiber (excelsior) as specified below or on the drawings. The blanket shall be of consistent thickness with the fiber evenly distributed over the entire area of the mat. The blanket shall be covered with a photo-degradable plastic netting secured to the fiber mat.
- .c Mat or blanket to be utilized must be approved by owner prior to use.
- .d Wire Staples: Utilize 16 G. Wire staples with min.3" top and 6" long legs. 1.75 staples per square yard of matting min.

.5 RipRap

- .a Provide as selected and specified by consultant, and approved by owner.

.6 Other Erosion Control Measures

- .a Other measures of erosion control are available. Consultant is to propose system applicable to site, and owner will review. Owner must approve prior to installation.

4 Water Systems

.1 General

- .a The proposed utility construction shall meet the applicable requirements of the authority having jurisdiction and/or NCDOT's "Standard Specifications for Roads and Structures". The edition/revision of the referenced publications shall be the latest date as of the date of the Contract Documents, unless otherwise specified.

.2 Pipes

- .a Ductile-Iron Pipe: AWWA C150 and C151, Pressure Class 350. All ductile-iron pipe shall be listed by ANSI/NSF Standard 61 for potable water contact.
- .b Copper Tube: ASTM B 88, Type K, seamless water tube, annealed temper. All copper pipe shall be NSF Listed for potable use.
- .c PVC Pipe (1-1/2" – 3"): ASTM D 2241, SDR 21, gasket joints or ASTM D 1785, Sch-40, gasket joints. All PVC pipe shall be NSF Listed for potable use.
- .d Steel Encasement Pipe: ASTM A139 and A283, longitudinally welded of smooth-wall seamless, grade "B" steel, Minimum yield strength of 35,000-psi.
 - i. Thickness: Per NCDOT encroachment agreement but no less than 0.375-in. Ends shall be beveled and prepared for field welding at the circumferential joints.
 - ii. Coatings: Inside and outside, AWWA C203, ASTM 3034-12454 B and any additional requirements of NCDOT.
 - iii. Pipe Support: A minimum of one metal 'spider' device shall be provided for each joint of pipe.
 - iv. Size: The inside diameter of the encasement pipe shall be 8-in greater than the nominal inside diameter of the carrier pipe.
 - v. Pipe Ends: Pipe ends shall be right-angled and shall be compatible to receive a "Dresser style 62" – Type I or approved equal mechanical transition coupler.

.3 Pipes Fittings

- .a Ductile-Iron and Cast-Iron Pipe Fittings: AWWA C110, ductile-iron or cast-iron, 250-psig minimum pressure rating; or AWWA C153, ductile-iron compact fittings, 350-psig pressure rating. All ductile-iron fittings shall be listed by ANSI/NSF Standard 61 for potable water contact.
- .b Copper Tube Fittings: AWWA C800, flared copper type or compression type brass fittings. No joints or couplings shall be allowed within the public right-of-way. All copper fittings shall be NSF Listed for potable use.
- .c PVC Plastic Fittings (1-1/2" – 3"): ASTM D 2466, Sch-40. All PVC fittings shall be NSF Listed for potable use.

.4 Valves

- .a Non-rising Stem Gate Valves, 2 Inches and Smaller: MSS SP-80; body and screw bonnet of ASTM B 62 cast bronze; with Class 125 threaded ends, solid wedge, non-rising copper-silicon alloy stem, brass packing gland, polytetrafluoroethylene (PTFE)-impregnated packing, and malleable-iron handwheel.
- .b Non-rising Stem Gate Valves 3 Inches and Larger: AWWA C509 or C515, resilient seated; bronze stem, cast-iron or ductile-iron body and bonnet, stem nut, 200-psig working pressure, mechanical joint ends.
- .c Rising Stem Gate Valves 3 Inches and Larger for installation in vaults or other enclosure: AWWA C509 or C515, resilient seated; OS&Y, bronze stem, cast-iron or ductile-iron body and bonnet, stem nut, 200-psig working pressure, flanged ends.
- .d Post Indicator Valves: NRS, UL 262, FM approved, iron body and bonnet with flange for indicator post, bronze seating material, inside screw, 175-psig working pressure, mechanical joint ends.
- .e Valve Boxes: Cast-iron box having top section and cover with lettering "WATER," bottom section with base of size to fit over valve and barrel approximately 5 inches in diameter, and adjustable cast-iron extension of

length required for depth of bury of valve. AASHTO H-20 load rating. Total valve box weight shall be a minimum of 85-lbs and shall have a minimum lid weight of 25-lbs.

- i.** Provide a steel tee-handle operating wrench with each valve box. Wrench shall have tee handle with one pointed end, stem of length to operate valve, and socket-fitting valve-operating nut.
- .f** Indicator Posts: UL 789, FM-approved, vertical type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of bury of valve. Post indicator valves (PIVs) on fire protection systems shall be equipped with a supervisory switch.
- .g** Tapping Sleeve and Tapping Valve: Complete assembly, including tapping sleeve, tapping valve, and bolts and nuts. Use sleeve and valve compatible with tapping machine.
 - i.** Tapping Sleeve: One hundred percent stainless steel sleeves may also be used, provided that all metallic parts of the sleeves are 100% stainless steel including bolts and nuts. All sleeves shall have a minimum of 150 psi working pressure. All taps shall be machine drilled, no burned taps will be allowed.
- .h** Service Saddles and Corporation Stops: Complete assembly, including service saddle, corporation stop, and bolts and nuts. Use service clamp and stop compatible with drilling machine.
 - i.** Service Saddle: All bronze with double bronze straps and with a neoprene "O" ring gasket attached to the body. The clamp shall have corporation cock threads.
 - ii.** Corporation Stops: Bronze body and ground key plug, with AWWA C800 threaded inlet and outlet matching service piping material.
 - iii.** Curb Stops: Bronze ball valve installed in a valve box located 2-ft from meter on street side.
- .i** Curb Stops: Bronze body, ground key plug or ball, and wide tee head, with inlet and outlet to match service piping material. Curb stops shall be installed in an approved service box located 2-ft from the meter box on the street side.
 - i.** Service Boxes for Curb Stops: Cast-iron box with telescoping top section of length required for depth of bury of valve. Include cover having lettering "WATER," and bottom section with base of size to fit over curb stop and barrel approximately 3 inches in diameter.

.5 Water Meters

- .a** Domestic and/or Irrigation Water Meters: Meters shall be set by the authority having jurisdiction. The Contractor shall coordinate purchase and installation directly with the authority having jurisdiction. Contractor is responsible for all meter costs and installation fees.
- .b** Detector-Type Water Meter: Refer to backflow preventer specification.
- .c** All meter boxes shall be constructed of cast iron, precast concrete, concrete block, or cast-in-place concrete as detailed on the drawings.

.6 Vaults

- .a** Concrete: Portland cement mix, 3000 psi.
- .b** Reinforcement: Steel conforming to the following:
- .c** Ladder: ASTM A 36, steel or polyethylene-encased steel steps.
- .d** Hatch: Per details on drawings.
- .e** Drain: ASME A112.21.1M, cast-iron area drain, of size indicated. Include body anchor flange, light-duty cast-iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.

.7 Fire Hydrants

- .a** General: Cast-iron body, compression-type valve, opening against pressure and closing with pressure, 6-inch mechanical joint inlet, 150-psig working pressure, break-away impact type. Hydrants shall be as manufactured for authority having jurisdiction. The Centurion shall include a center punch mark on the lower stem for identification and inclusion of a vertical shoe for a 4-1/2-inch valve opening.
- .b** Outlet Threads: NFPA 1963, external hose nozzles with Raleigh Standard Threads. Include cast-iron caps with steel chains.
- .c** Operating and Cap Nuts: Pentagon 1-1/2 inch point to flat.

- .d Direction of Opening: Open hydrant valve by turning operating nut to the left, or counterclockwise.
- .e Finish: Red exterior alkyd gloss enamel paint.
- .f Dry-Barrel Fire Hydrants: AWWA C502, two 2-1/2-inch and one 5-inch Storz outlets, 4-1/2-inch main valve, drain valve, and 6-inch mechanical joint inlet. Bronze to bronze threads shall be provided between the hydrant seat or seat ring and the seat attaching assembly. All hydrants shall include cast or ductile epoxy lined shoe, rubber drain seals and positive, protective valve stop device.

.8 Fire Department Connections

- .a Exposed, Sidewalk Fire Department Connections: 5-in x 4-in with 30-deg turndown, 5-in Storz connection inlet, 4-in female NPS outlet. Include cap and chain; fixed (no swivel) connection. Connect to galvanized steel elbow and FDC pipe; and round sidewalk escutcheon plate marked "AUTO SPRKLR". Provide 1-in, ¼ (quarter) turn valve tapped into FDC pipe at 12-in above finish grade.
- .b Wafer Check Valve: UL Listed/FM Approved, ductile iron body, bronze clapper and seat ring, 'O' ring seals, stainless spring closure, with ½" ball drip valve below seat to allow valve to drain water from FDC.
- .c Signage: Approx. 18"x10", steel, white background with min. 6" red lettering, marked FDC, mounted on a galvanized steel pole with concrete footing. Mounting height to bottom of sign: 5-ft. min.

.9 Backflow Preventers

- .a General: As listed as approved by the Public Utilities Handbook of the City of Raleigh Public Utilities Department.
- .b Double-Check Assembly (DCVA) Backflow Preventers – ¾" thru 2": ASSE 1015, AWWA C510, CSA B64 Certified and USC Foundation for Cross Connection Control and Hydraulic Research approved with full port, resilient seated ball valve shut-off valves and four ball valve test cocks. Include 2 spring loaded, center guided check assemblies.
- .c Reduced Pressure Detector Assembly (RPDA) Backflow Preventers – 2-1/2" thru 10": ASSE 1047, USC Foundation for Cross Connection Control and Hydraulic Research approved, FM approved and UL listed, with OS&Y gate valves on inlet and outlet, and strainer on inlet. Include test cocks and pressure-differential relief valve with ASME A112.1.2 air gap fitting located between 2 positive-seating check valves and test cocks, and bypass with displacement-type water meter, valves, and reduced pressure backflow preventer, for continuous-pressure application. Assembly shall be of a compact design utilizing a flow orientation of inlet flow vertical up, outlet flow vertical down at the direct outlet of the gate valves. Wilkins Model 475DA or approved equal. Gate valves on backflow preventers on fire protection systems shall be equipped with supervisory switches.

.10 Protective Enclosures

- .a General: Manufactured, ASSE 1060 certified, weather-resistant enclosure designed to protect aboveground water piping equipment or specialties. Enclosures shall be sized as required for access and service of protected unit. Enclosures for compact design backflow preventers shall be no larger than 64"(L)x60"(W)x60"(H) Enclosures shall be as manufactured by Hot Box or approved equal.
 - i. Housing: Reinforced-aluminum or reinforced-fiberglass construction with factory applied paint. Paint color to be selected by Designer from manufacturer's standard color choices. Unpainted aluminum exterior will not be allowed.
 - ii. Drain opening: Sized to alleviate a full release by the backflow preventer.
 - iii. Access doors with locking device.
 - iv. Insulation inside housing.
 - v. Thermostatically controlled electric heater (for 2-1/2" or larger backflow preventers) or plug-connected self-limiting temperature control pipe heating cable (for 2" and smaller backflow preventers) and connection to power supply. Heating equipment shall be designed and furnished by the enclosure manufacturer.

- vi. Concrete base slab: 4 inch thick of dimensions required to extend at least 6 inches beyond edges of housing. Provide PVC sleeves at pipe penetrations of slab.
- vii. Anchoring devices to attach housing to base with stainless steel mounting hardware.

.11 Alarm Devices

- a Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.

.12 Anchorages

- a Clamps, Straps, and Washers: ASTM A 506, steel.
- b Rods: ASTM A 575, steel.
- c Rod Couplings: ASTM A 197, malleable iron.
- d Bolts: ASTM A 307, steel.
- e Cast-Iron Washers: ASTM A 126, gray iron.
- f Concrete Reaction Backing: Portland cement concrete mix, 3000 psi.

.13 Identification

- a Metallic-Lined Plastic Underground Warning Tapes: Polyethylene plastic tape with metallic core, 6 inches wide by 4 mils thick, solid blue in color with continuously printed caption in black letters "CAUTION - WATER LINE BURIED BELOW."

5 Sanitary Sewer

.1 Pipes & Fittings

- a Ductile-Iron Pipe: AWWA C150 and C151, Pressure Class 250, for push-on joints per AWWA C111. Pipe shall be designed for an 8-foot minimum cover and a Type 1 laying condition.
- b Polyvinyl Chloride (PVC) Sewer Pipe and Fittings: ASTM D 3034, SDR 35, for solvent-cemented or gasketed joints.

.2 Special Pipe Couplings & Fittings

- a Sleeve-Type Pipe Couplings: Rubber or elastomeric sleeve and band assembly fabricated to match outside diameters of pipes to be joined, for non-pressure joints.

.3 Cleanouts

- a Description: ASME A112.36.2M, round, cast-iron housing with clamping device and round, secured, scoriated, cast-iron cover. Include cast-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:
 - i. Light Duty: In earth or grass, foot-traffic areas.
 - ii. Medium Duty: In paved, foot-traffic areas.
 - iii. Heavy Duty: In vehicle-traffic service areas.
 - iv. Extra Heavy Duty: In roads.
- v. Spacing: Maximum distance shall be no more than 100' between cleanouts. Shorter distances between cleanouts as proposed by Consultant to meet site requirements may be utilized.

.4 Manhole Accessories

- .a Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

.5 Concrete

- .a General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:
- .b Structures: Portland-cement design mix, 4000 psi minimum, with 0.45 maximum water-cement ratio.
- .c Structure Channels and Benches: Factory or field formed from concrete. Portland-cement design mix, 4000 psi minimum, with 0.45 maximum water-cement ratio.

6 Storm Drainage

.1 Pipes & Fittings

- .a Ductile-Iron Pipe: ANSI/AWWA C150/A21.50 and C151/A21.51, minimum pressure class 250.
- .b Polyvinyl Chloride (PVC) Sewer Pipe and Fittings: ASTM D-1785, PVC for solvent-cemented or gasketed joints.
- .c Reinforced-Concrete Sewer Pipe and Flared End Sections: ASTM C 76, Class III.
- .d High Density Polyethylene (HDPE) Pipe and Fittings: AASHTO M252, M294, MP6, or MP7. Smooth interior and corrugated exterior. All sizes shall conform to the AASHTO classification Type S or D.

.2 Special Pipe & Couplings

- .a Connection from roof downspout to underground storm pipe.
 - (a) Vertical stainless steel downspout adapter with sch. 40 PVC pipe outlet sized to fit over downspout and underground piping. Adapter shall have a self-cleaning debris trap consisting of a hinged cover and removable debris screen. Powder-coat color to be selected by Owner from manufacturer's full range of colors.
 - (b) Manufactured fitting of material similar to downspout sized to connect to standard round pipe shape of underground piping.

.3 Drainage Inlets

- .a Catch Basins and Drop Inlets: Block/brick and mortar, of depth, shape, and dimensions indicated. Precast concrete basins may be used in lieu of brick upon approval by the Architect. All structures shall be designed to withstand AASHTO H-20 loads.

.4 Frames & Grates:

- .a ASTM A48, Class 35B, cast iron, H-20 loading. Include flat grate with small square or short-slotted drainage openings as indicated on the drawings. Provide grate with openings compliant with ADA standards when located within sidewalk or other pedestrian walking areas or where specifically indicated on drawings.
 - i. Floor Drains:
 - (i) 12-inch diameter top drain, Dura-Coated cast iron body with 6-inch bottom outlet, seepage pan, adjustable extension frame and medium duty slotted grate. Top shall be polished nickel bronze and secured with slotted screws.

.5 Landscape Drains:

- i. Round, ductile-iron, domed-top drain designed to be attached with a watertight connection to vertical PVC pipe.

.6 Manholes:

- i. Precast Concrete Storm Drainage Manholes: ASTM C-478 precast reinforced concrete, eccentric cone. All structures shall be designed to withstand AASHTO H-20 loads.
 - (a) Base, Channel, and Bench: Concrete.
 - (b) Joint: Preformed flexible plastic gaskets complying with Fed. Spec. SS-S-210A.
 - (c) Size: As required to accommodate proposed pipes indicated on the drawings, 4-ft diameter minimum.
- ii. Frames & Covers:
 - (a) ASTM A48, Class 35B, heavy-duty cast iron. Include flat, round grate with 1-1/2" wide slotted drainage openings with a minimum total open area of 150-sq.in.
- .b Concrete:
 - (a) General: Cast-in-place concrete according to ACI 318, ACI 350R.
 - (b) Structures: Portland-cement design mix, 4000 psi minimum, with 0.45 maximum water-cement ratio.

.7 Foundation Drain Piping

- i. Foundation and Under Slab Drain Pipe and Fittings: ASTM D-1785, SCH 40 PVC with slotted perforations located in bottom half of pipe. Minimum 4-inch diameter unless otherwise indicated on the drawings
 - (a) Filter Fabric: Non-woven geotextile drainage fabric per Division 31, Section "Earth Moving."

.8 Cleanouts

- i. Description: ASME A112.36.2M, round, cast-iron housing with clamping device and round, secured, scoriated, cast-iron cover. Include cast-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Use units with top-loading classifications according to the following applications:
 - (a) Light Duty: In earth or grass, foot-traffic areas.
 - (b) Medium Duty: In paved, foot-traffic areas.
 - (c) Heavy Duty: In vehicle-traffic service areas.
 - (d) Extra Heavy Duty: In roads.