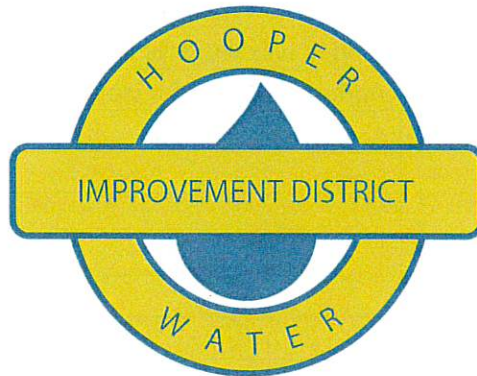


Hooper Water Improvement District

2025 Construction Specifications

Revision 1, 06/11/26




District Manager

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Prepared By



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SECTION 5 – SITE WORK REQUIREMENTS

SECTION 5.1 PIPELINE TRENCH EXCAVATION AND BACKFILL

5.1.1 DESCRIPTION:

The CONTRACTOR shall furnish all labor, materials, tools and equipment, and perform all work necessary to complete required excavations and backfills. Work shall also include required grading for completion of water lines and associated appurtenances all in accordance with the plans and these specifications.

The work shall include: clearing the site; loosening, loading, removing, transporting and disposing of materials, wet and dry, necessary for construction; sheeting and bracing; draining and dewatering; backfill of trenches, excavations, and pits; compaction, compaction testing, leveling, signing, detours, mobilization, and clean up.

5.1.2 MATERIALS:

5.1.2.1 PIPE FOUNDATION MATERIAL:

Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load, where water must be drained to maintain a dry bottom for pipe installation, or where solid rock intrudes into the bottom of the trench, the subgrade shall be excavated to a minimum depth of 6 inches below pipe bedding and replaced with crushed rock or pit run gravel.

Gravel for pipe stabilization material shall be clean crushed rock or pit run gravel conforming to the following gradation:

<u>Screen</u>	<u>Percent Passing</u>
3"	100
3/4"	5

The gravel material shall be deposited over the entire trench width and compacted by tamping, rolling, or other suitable methods. In addition, the material shall be graded to produce a uniform and continuous support for pipe bedding material or installed pipe as specified.

5.1.2.2 PIPE BEDDING MATERIAL:

Pipe bedding is fill material in the pipe zone. The pipe zone is defined as the envelope area 6 inches below the bottom of the pipe to 12 inches above the top of the pipe, and any lateral area within 9 inches of any pipe, pipeline structure or appurtenance.

Pipe bedding material may be excavated or imported material consisting of loose earth and sand or gravel conforming to the following gradation specifications:

- PIPE BEDDING MATERIAL

- **BLASTING EXPERTS:** Blasting shall be done only by experienced, qualified blasters. Blasting shall be done in accordance with the recommendations for best practice in Section 9 of AGC Manual of Accident Prevention in Construction and in accordance with the recommendations for best practice of the Institute of Makers of Explosives. Blasting shall comply with State and OSHA requirements.
- **COVERED BLASTING:** All blasting near dwellings must be covered with heavy mats to prevent flying rock fragments. No blasting shall be done within 15 feet of completed work.
- **SAFETY RULES:** The CONTRACTOR shall observe all safety rules for the handling of explosives, and in no case shall blasting caps be stored near the explosives. No blasting shall be done outside the regular working hours except with special approval.
- **BLASTING NOT BID ITEM:** Solid rock excavation is not a bid item. Should the CONTRACTOR choose to blast, the cost will be negotiated through a work directive and change order.

5.1.3.3 TRENCH WIDTH:

The trench shall be excavated such that the new pipe is always centered in the trench. The clear trench width at the horizontal diameter of the pipe must not be less than the outside diameter of the pipe plus 18 inches. The maximum clear width of trench at the top of the pipe must not be more than the outside diameter of the pipe plus 24 inches.

Backfill with earth under structures or valves will not be permitted. Any unauthorized excess excavation below the elevation indicated for foundation of any structures shall be backfilled in accordance with these specifications for "Select Backfill Material" and "Pipe Foundation Material", as appropriate, at the CONTRACTOR's expense.

5.1.3.4 SHEETING, BRACING AND SHORING OF EXCAVATIONS:

Excavations shall be sheeted, braced, and shored as required to support the walls of the excavations, to eliminate sliding and settling and as may be required to protect the workmen, the work in progress, and existing utilities, structures and improvements. All such sheeting, bracing, and shoring shall comply with the requirements of the Utah State Industrial Commission, Occupational Safety and Health Act (OSHA), and accident prevention and safety provisions of the contract.

The CONTRACTOR shall be fully responsible for the adequacy of methods and materials used in trench sheeting, bracing, shoring, and/or other systems provided to protect workmen. Injury to or death of workmen resulting from inadequate trench safety measures shall be the full and complete responsibility of the CONTRACTOR.

All damages resulting from lack of adequate sheeting, bracing and shoring shall be the responsibility of the CONTRACTOR, and the CONTRACTOR shall complete all necessary repairs or reconstruction at his own expense resulting from such damage.

material. No separate compensation will be made to the CONTRACTOR for disposal of excess excavated material.

Excavated material shall be piled in a manner that will not endanger the work and will avoid obstructing sidewalks and driveways. Gutters and irrigation ditches shall be kept clear or other satisfactory provisions made for street drainage.

Grading of the area surrounding the trenches, including excavated materials, shall be performed as necessary to prevent surface water from flowing into trenches, or other excavations.

5.1.3.8 COMPACTION:

Compaction shall be the responsibility of the CONTRACTOR. He shall select the methods to be used and carefully perform the work of backfilling and compaction so as to prevent damage to new or existing piping. Any new or existing piping damaged during the CONTRACTOR's work shall be replaced as directed by the ENGINEER with new piping.

5.1.3.9 COMPACTION TESTING:

Compaction testing requirements called for herein are only minimum and are required for the purpose of indicating, during construction, the quality of materials and compaction. Dips or uneven surface caused by post settlement of any trenches, excavation, fill, or embankment that show up within the 1 year warranty period shall be repaired by the CONTRACTOR at no additional cost to the OWNER.

- **MAXIMUM DENSITY:** Maximum density as used in these specifications shall be defined as the maximum density obtained in the laboratory by an AASHTO T-180 test. In place density of compacted backfill will be determined by use of nuclear density determining equipment.
- **COMPACTION PERCENTAGE:** Unless otherwise specified, fills shall be compacted as indicated in the following tabulation:

<u>Location</u>	<u>Percent of Maximum Density</u>
Backfill adjacent to structure	90
Fill under structure	95
Fill areas for pipeline construction	95
Pipe bedding	90
Trench backfill (Outside roadway right-of-way)	90
Trench backfill (Inside roadway right-of-way)	97

- **COMPACTION CONFIRMATION:** It shall be the responsibility of the CONTRACTOR to accomplish the specified compaction for backfill, fill, etc., and to control all earthwork operations by tests or other means approved by the ENGINEER to verify and confirm that the CONTRACTOR is complying at all times with the requirements of the specifications.
- **INDEPENDENT TESTING:** Material tests are required and shall be made by an independent testing laboratory hired and paid for by the entity commissioning the

as to do the least damage to adjacent grassed areas, or fences, regardless of whether these are on private property or public rights-of-way. All excavated materials shall be removed from grassed and planted areas and these surfaces shall be left in conditions equivalent to their original surface and free from all rocks, gravel, boulders, or other foreign materials.

The roadway including shoulders, slopes, ditches, and borrow pits shall be smoothly trimmed, and shaped by machinery, or other satisfactory methods, to the lines, grades and cross-sections, as established, or to equal or better condition than that which existed before construction efforts started, and shall be so maintained until accepted. Any surplus material not suitable for spreading along the road to widen the existing shoulder or raise the grade shall be hauled away or disposed of.

5.1.3.11 CONTRACTOR'S RESPONSIBILITY:

The CONTRACTOR will be responsible to see that the backfilling, consolidation and compaction are properly and adequately done. Settlement of trenches within a period of one year after final acceptance of the project, or longer period, if so required by the entity from whom excavation/cut permits were obtained for completion of the Work, shall be considered incontrovertible evidence of inadequate compaction, and the CONTRACTOR shall be responsible for correcting the condition in accordance with the provisions of these Specifications, including the replacement of the surface materials.

5.1.4 MEASUREMENT AND PAYMENT:

As specified in Section 1.4 of the Contract Documents.

End of Section

5.2.2.2 UNTREATED BASE COURSE:

Untreated base course shall be in accordance with Utah Department of Transportation Standard Specifications, 2012, Section 02721, Table 2:

Table 2

Gradation Limits		
Sieve Size	Job Mix Gradation Target Band	Job Mix Gradation Tolerance
1½ inch	100	
1 inch	90 - 100	±9.0
¾ inch	70 - 85	±9.0
½ inch	65 - 80	±9.0
⅜ inch	55 - 75	±9.0
No. 4	40 - 65	±7.0
No. 16	25 - 40	±5.0
No. 200	7 - 11	±3.0

5.2.2.3 SUBBASE MATERIAL:

Subbase material gradation shall be in accordance with Utah Department of Transportation Standard Specifications, 2012, Section 02741, GRANULAR BORROW

- A. Classification A-1-a. Refer to AASHTO M 145.
- B. Non-plastic, well-graded, 3 inch maximum.

5.2.2.4 BITUMINOUS SURFACE COURSE:

Bituminous surface course gradation shall be in accordance with Utah Department of Transportation Standard Specifications, 2012, Section 02056, Table 6:. Actual gradation to be used shall be approved by the ENGINEER.

Table 6

Aggregate Gradations (Percent Passing by Dry Weight of Aggregate)					
Sieve Size		1 inch	¾ inch	½ inch	⅜ inch
Control Sieves	1½ inch	100.0			
	1 inch	90.0 - 100.0	100.0		
	¾ inch	<90	90.0 - 100.0	100.0	
	½ inch		<90	90.0 - 100.0	100.0
	⅜ inch			<90	90.0 - 100.0
	No. 4				< 90
	No. 8	19.0 - 45.0	23.0 - 49.0	28.0 - 58.0	32.0 - 67.0
	No. 200	1.0 - 7.0	2.0 - 8.0	2.0 - 10.0	2.0 - 10.0

of 4 inches. The gravel shall be placed in the trench at the time it is backfilled. The surface shall be maintained by blading, sprinkling, rolling, adding gravel, etc., to maintain a safe, uniform surface satisfactory to the ENGINEER. Excess material shall be removed.

5.2.3.3 SUBBASE:

- A. Finish granular borrow surface within ± 0.1 ft of line and grade.
- B. Compact borrow and backfill material in 6 inch layers to the specified density, 97% AASHTO T-180 unless noted otherwise on the Drawings.

5.2.3.4 BASE COURSE AND TEMPORARY GRADED SURFACE:

On paved areas, base course shall be placed in the top of the trench to a depth such that the final compacted thickness of the base course below the bottom of the pavement shall be equal to the existing base course but not less than 10 inches. This base course layer shall be brought flush with the paved surface and maintained in a smooth, rut free condition until time for the pavement to be placed.

5.2.3.5 TACK COAT:

Tack coat shall be applied at the rate of 0.05 to 0.15 gal/SY. A hand sprayer or brush shall be used to apply tack coat to vertical faces of previously constructed bituminous pavement (over 1/2 hour hence) prior to placing an adjacent or parallel pass, curbs, gutters, slab edges, and all structures to be in actual contact with the bituminous pavement. Tack coat shall also be applied uniformly at the same rate to the horizontal top surface of each lift of bituminous pavement prior to placing the next lift of bituminous pavement to promote a bond between the two courses of pavement. None of the material shall penetrate into the pavement and for this reason the application should be limited.

Prior to applying the material, the surface to be treated shall be swept or flushed free of dust or other foreign material. Protect all surfaces not required to receive tack coat from any inadvertent application.

The temperature range of the tack coat at the time of application shall be such that the viscosity will be between 50 and 100 centistokes as determined in accordance with ASTM Designation D-2710.

Under no circumstances shall traffic be permitted to travel over the tacked surface. If detours cannot be provided, restrict operation to a width that will permit at least one-way traffic over the remaining portion of the roadbed. If one-way traffic is provided, the traffic shall be controlled in accordance with governing authority.

After application of tack coat, sufficient time shall be given to allow for complete separation of asphalt and water before paving operations begin. The tack coat shall be applied on only as many surfaces as will be paved against in the same day.

5.2.3.9 SPRINKLING SYSTEMS:

Restore all sprinkling systems disturbed, removed, or damaged by construction operations in a condition at least equal to that prior to construction.

5.2.3.10 MISCELLANEOUS IMPROVEMENTS:

All other improvements interrupted or removed to permit the construction specified herein shall be restored. Miscellaneous improvements to be restored shall include, but shall not be limited to, the following:

- Traffic Signs
- Mail Boxes
- Drainage and Irrigation Ditches
- Culverts
- Canals and Canal Structures
- Bridges and Bridge Abutments
- Fences

5.2.3.11 PROTECTION:

Protect all restored improvements from damage in accordance with these specifications, unless otherwise required by local jurisdiction having authority.

End of Section

5.3.2 MATERIALS:

5.3.2.1 PVC C-900 PIPE:

(Refer to Sec. 5.5, "PVC AWWA C-900 Water Pipe").

5.3.2.2 DUCTILE IRON PIPE:

(Refer to Sec. 5.6, "Ductile Iron Pipe ").

5.3.2.3 HDPE PIPE:

(Refer to Sec. 5.7, "AWWA C-906 Fused HDPE Piping for Potable Water").

5.3.2.4 FIRE HYDRANTS:

Fire hydrants shall be of a "traffic model" type design conforming to AWWA C-502 Specifications. Hydrants shall be supplied with two 2-1/2-inch and one 4-1/2-inch nozzles. All nozzles shall have national standard threading. A one cubic yard gravel sump shall be provided at each hydrant for drainage. Fire hydrants shall be Mueller Super Centurion or District-approved equal.

5.3.2.5 ISOLATION VALVES:

All main line isolation valves shall conform to Standard AWWA C509 or C515 for Resilient-Seated Gate Valves in line sizes up through 10" or C504 for Rubber-Seated Butterfly Valves in line sizes 12" or larger, unless noted otherwise. All valves shall be designed for 150 psi working pressure or above. The valves shall be mechanical joint unless otherwise indicated on the plans.

5.3.2.6 AIR VALVES:

Unless noted otherwise on the plans, air relief valves in the distribution system shall be combination air/vacuum release valves conforming to AWWA C512, Air-Release, Air/Vacuum, and Combination Air Valves for Water and Wastewater Service. Air valves shall be manufactured by A.R.I., USA, San Diego, California, Val-Matic Valve & Mfg. Corp., Elmhurst, Illinois, or approved equal.

5.3.2.7 VALVE BOX AND COVER:

All buried valves shall be installed complete with two-piece, cast iron, slip type, 5-1/4-inch shaft valve box with adjustable height to bring the top of the valve box flush with the ground surface. The valve box and top section shall be from the same manufacturer, intended for use together and within the published dimension tolerances. The valve box shall not be less than 5 inches in diameter and shall have a minimum thickness of 3/16 inch. Valve boxes shall be "Tyler" or equal.

All valve boxes shall be provided with suitable base cover. The word "WATER" shall be cast on the cover. An extra deep cover shall have a minimum shaft length of 4", total minimum depth of 6" and a total minimum weight of 24 lbs. The extra deep valve box cover shall be P/N 06800045 by EJ, model M-8045 by D&L Foundry or similar approved equal.

box or a concrete meter box of the same dimensions. Mueller Thermal Shell catalog number SV1836, Hancor meter pit product code MP NL1 18 0003, or approved equal.

Meter boxes for services in areas susceptible to vehicular traffic (roads, driveways, gravel or asphalt parking areas or others as determined by the District Inspector in the inspector's sole discretion) shall be concrete. The meter box lid shall be centered in a 4'x4'x(min.)4" thick, min. 3,500 PSI concrete collar.

Lids for meter boxes shall come with a with a recess for a Neptune-system antenna and a 2" hole to accommodate meter reading ("universal" lids are not acceptable and will be rejected) and shall be cast iron with a lifter worm lock, operated by a large pentagon head bolt. Meter box lids in a non-traffic area shall be D&L L-2240-15 or approved equal.

Meter box lids in areas susceptible to vehicular traffic shall be flat, D&L B-5018-15 or approved equal.

All meter boxes shall be installed and inspected in accordance with the approved drawings.

5.3.2.15 THRUST RESTRAINT:

The material for thrust blocks shall be concrete which shall have a compressive strength of no less than 2,000 psi in 7 days. Rebar for valve and vertical elbow tie-downs shall be 60-ksi steel. Mechanical joint restraints shall be compatible with the pipe material on which they will be installed, and of standard manufacture by EBAA Iron, ROMAC or approved equal. Fluoropolymer-coated hardware.

5.3.2.16 UNDERGROUND WARNING TAPE AND LOCATION WIRE:

The tape shall be a 2-inch metallic core with a polyethylene cover, blue in color, and have the words "Caution Water Line Buried Below" imprinted on it. The tape shall be Style No. 2WAT as manufactured by Seton Name Plate Company of New Haven, Connecticut, or approved equal. Copper location wire shall be at least #14 plastic coated solid wire.

5.3.2.17 CHECK VALVES:

Check valves shall prevent reverse flow in the pipelines. The check valves shall have steel or ductile iron body with bronze trim, stainless steel spring, and resilient seat. The valves shall be Class 125 or better. The check valve shall be manufactured by Val-Matic or approved equal.

5.3.2.18 CONNECTION HARDWARE:

Except where otherwise shown or specified, acceptable bolts and nuts are:

- 1) Below grade or subject to high humidity or non-potable submergence: Carbon steel:
 - a) Conforming to the requirements of ASTM A307 Grade A or higher yield and tensile strengths. The corresponding nuts shall conform to ASTM A563 Grade A or higher yield and tensile strengths.
 - b) All bolts and nuts shall be coated with fluoropolymer, TRIPAC 2000 coating system, or approved equal. Anti-seize compound shall not be utilized with the blue nuts.
- 2) Submerged service, potable: Stainless steel:
 - a) Conforming to the requirements of ASTM F593. The corresponding nuts shall conform to ASTM F594.

5.3.2.22 CASINGS:

Casings will be required on a case-by-case basis, as well as be required in various situations but not limited to: crossing of ROW, Easement, specific utilities, non-perpendicular utility crossings, and to meet non-standard utility separation requirements. Coordinate all casing installation applications with the district prior to installation.

5.3.2.22.1 Materials:

Acceptable materials of casing are: Epoxy Coated Steel and HDPE Seamless Fusion Welded.

Epoxy Coated Steel: Shall meet ASTM 252 Grade 3 or greater. Size shall be determined on carrier pipe/conduit size, it shall be of a casing common size nearest to double the pipe size. For example, 12" pipe will require a 24" casing, 14" will require 24", 16" will require the next most common size above 24" casing. For single pipe length casings, the standard wall thickness shall be 0.375", for two pipe length casings wall thickness shall be 0.500", for all other lengths the wall thickness shall be calculated in coordination with a Geotechnical Report (see 5.3.2.19.2).

HDPE: Shall be DR21 or greater in dimension. It shall be fusion welded with virgin pipe with no seams in nonstandard length. HDPE casing/carrier combo pipe shall be pressure tested before installation and does not relieve the pipe from being pressure tested with the combination of length of pipe post installation. The casing is also required to meet the requirement of "SECTION 5.7 AWWA C-906 FUSED HDPE PIPING FOR POTABLE WATER".

5.3.2.22.2 Installation:

All casing installations:

Vertical separation to follow HWID Standard Detail 17. On designed crossings greater than 6ft in depth there shall be an added design consideration for casing length and horizontal separation from crossing. Every foot deeper below 6ft will be an additional 1ft greater in length required from each casing end to follow a 1:1 ratio of depth to extension length, 6ft and above will require standard 10ft horizontal separation beyond obstruction/crossing. i.e. 0-6ft is 10ft, 7ft is 11ft, 8ft is 12ft and so on for the crossing horizontal separation distance.

For utility/pipe crossings: The casing shall extend 10ft beyond the utility crossings nearest edge measured along the casing's alignment. The casing shall be installed with a minimum vertical separation of 1ft from the nearest edge of the utility/pipe crossing to the casing O.D. HWID is to approve of lesser design separation crossings

For ROW/Easement Crossings: The casing shall extend at least 5ft beyond the easement /ROW line measured from casing end perpendicular to the ROW/Easement line.

Pipe Joint Restraints: Pipe joint restraints will be required on every pipe joint that will fall within the casing and also every joint not further than 5ft outside of the casing ends. They are to be self-securing Reiber Lok gaskets or mechanical joint restraints.

Casing Spacers: Casing spacers will be required on every carrier pipe section, spacers amount per pipe length is to be determined by the casing spacer manufacturer. Preference is a stainless steel spacer band and base material with plastic casing guides

5.3.3 CONSTRUCTION:

5.3.3.1 PVC C-900 PIPE:

(Refer to Sec. 5.5, "PVC AWWA C-900 Water Pipe").

5.3.3.2 DUCTILE IRON PIPE:

(Refer to Sec. 5.6, "Ductile Iron Pipe ").

5.3.3.3 HDPE PIPE:

(Refer to Sec. 5.7, "AWWA C-906 Fused HDPE Piping for Potable Water").

5.3.3.4 DELIVERY, STORAGE AND HANDLING:

Load and unload pipe, fittings, specials, valves, and accessories by lifting with hoists or skidding so as to avoid shock or damage. Do not skid or roll pipe on skidways against pipe already on the ground. Lifting of pipe during unloading and placing into the trench shall be done using two nylon slings placed at the quarter points of the pipe sections. The slings shall bear uniformly against the pipe. Under no circumstances shall the pipe or accessories be dropped into the trench. When not being handled, the pipe shall be supported on timber cradles or on properly prepared ground, graded to eliminate all rock 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 the ENGINEER, is damaged beyond repair by the CONTRACTOR shall be removed from the site of the work and replaced with another unit. No payment will be made for damaged pipe or for repairs to such damaged pipe. The use of chains or cables for handling the pipe is not permitted.

Each length of pipe shall be unloaded opposite or near the place where it is to be laid in the trench.

5.3.3.5 CONNECTIONS TO EXISTING MAINS:

Connections to existing mains shall be made where indicated on the plans. The CONTRACTOR shall determine the exact pipe size and material and provide applicable valves, fittings, and couplings to make a smooth and straight transition into the existing pipeline(s). All connections shall be made and visually inspected by the District for leakage with the line under pressure prior to backfilling. Connections will normally be made with a tee, cross, or other similar type connector.

The CONTRACTOR must uncover the connection area and determine the needs for the connection prior to turning off the water. The water may be turned off Monday through Friday between the hours of 9:00 am and 4:00 pm only, with planned shutdowns starting only on Monday through Thursday. The OWNER must be given 24 hours notice prior to turning off the water to any portion of the system. The CONTRACTOR must make reasonable efforts to avoid disruption of water service.

No interconnection with another drinking water system shall be made without District and State approval.

At tees and crosses, a valve shall be installed in each main line, out of the intersection, at the extension of property lines.

An exception to the number of valves may be made by the District when following the standard will put main line valves within 250' of each other.

An isolation valve shall be installed in main lines on each end of an easement through private property.

5.3.3.9 AIR VALVES:

Air valves shall be located in the main line to evacuate entrapped air, at local high points, or as otherwise called for on the plans. Valves shall be connected to the main line through a tapping saddle. **Air relief valve structures shall be collared whether in the roadway or not.** Refer to the District's standard drawings for a typical air valve installation detail.

5.3.3.10 VALVE BOX AND COVER:

All buried valves shall be installed complete with two-piece, cast iron, 5-1/4-inch shaft valve box with locking lid. The lid shall have the work "WATER" cast in the metal.

Valves and valve boxes shall be installed where shown on the drawings. Valves and valve boxes shall be set plumb. Valve boxes shall be centered directly over the valve. Valves shall be aligned with property lines where possible. Earth fill shall be carefully tamped around the valve box to a distance of 4 feet on all sides of the box, or to the undisturbed trench face if less than 4 feet. Valve boxes shall have the interiors cleaned of all foreign matter before installation.

All valve boxes located in streets shall be installed as nearly to grade as possible. After the pavement is in place, the valve boxes shall be raised to grade, the surrounding asphalt shall be neatly cut to form a circular opening 2 feet and 6 inches in diameter with the valve box centered, and a concrete collar shall be cast around the box. Valve boxes and collars in off-road areas shall extend 2 inches above grade. **Where applicable valve boxes shall be marked with a 6.5' t post painted with blue oil based paint marked adjacent to the valve box and mainline below it for field locating.**

When the valve box is in a roadway with posted speeds over 40 MPH, an extra deep valve box cover shall be installed.

5.3.3.11 FITTINGS:

Bends, tees, reducers, flange adapters, and adaptor couplings shall be inspected, cleaned, and jointed to pipe as specified by the manufacturer. Reaction or thrust blocking shall be applied at bends of 11-1/4 degrees and more, at plugs, caps, and at tees.

The block shall, unless otherwise shown or directed, be so located as to contain the resultant thrust force and so that the pipe and fitting joints will be accessible for repair.

Mechanical thrust restraints shall also be used at all locations where thrust blocks are called for.

Mechanical thrust restraints, fittings and connection hardware shall be securely wrapped with 8 mil or greater polywrap and taped to prevent contact with concrete.

5.3.3.15 UNDERGROUND WARNING TAPE AND LOCATION WIRE:

The CONTRACTOR shall furnish and install an underground warning tape as the trench is backfilled. The tape shall be placed directly over the waterline and to a depth of 24 inches below the finished ground surface.

A copper trace wire shall be in the bottom of the main line or service lateral pipe trench (when a new service lateral is pulled through an existing lateral, a tracer wire shall also be pulled with the new lateral) and accessible from the surface at each valve box (bring the wire up the outside of the bottom of each box and bring it inside the top section) and adjacent to each fire hydrant and blowoff. At fire hydrants and blowoffs, a "Snake Pit" LD14BTP by Copperhead Industries, LLC, or approved equal (model CD14BTP if the "Snake Pit" must be installed in a vehicular traffic area) shall be the method of termination. Snake pits are to be installed centered in a 12" diameter x 6inch thick concrete collar, flush with design/existing surface grade.

All mainline trace wires must be interconnected in intersections, at mainline tees and mainline crosses. At tees, the three wires shall be joined using a single 3-way lockable connector. At crosses, the four wires shall be joined using a 4-way connector. Use of two 3-way connectors with a short jumper wire between them is an acceptable alternative. Direct bury wire connectors – shall include 2- and 3-way lockable connectors and mainline to lateral lug connectors specifically manufactured for use in underground trace wire installation. Connectors shall be dielectric silicon filled to seal out moisture and corrosion and shall be installed in a manner to prevent any uninsulated wire exposure. Non- locking friction fit, twist on or taped connectors are prohibited.

5.3.3.16 SEPARATION OF WATER MAINS FROM SANITARY SEWER:

The horizontal distance between pressure water mains and sanitary sewer lines shall be at least ten feet. Where a water main and a sewer line must cross, the water main shall be at least 18 inches above the sewer line. Separation distances shall be measured edge-to-edge (i.e. from the nearest edges of the facilities). Water mains and sewer lines shall not be installed in the same trench. Where local conditions make it impossible to install water or sewer lines at the separation distances required above, an exception to the standard may be possible. The entity seeking the exception shall initiate and pursue a request for a separation exception with the State Division of Drinking Water, in accordance with R309-550-7 of the State of Utah Administrative Rules.

SECTION 5.4 DISINFECTION AND TESTING OF WATER LINES

5.4.1 DESCRIPTION:

Except as otherwise provided herein, the CONTRACTOR shall furnish all equipment, labor, and materials required for testing and disinfecting hydraulic structures and pipelines as specified. Water for testing and disinfecting will be furnished by the OWNER; however, the CONTRACTOR shall be responsible for coordinating with the OWNER the acquisition and use of the water for testing and disinfection procedures.

Disinfection shall be accomplished by chlorination in accordance with AWWA standard C-651. Each completed section shall be disinfected and tested prior to introduction into the drinking water system. Release of water from structures and pipelines, after completion of testing and disinfection, shall be in conformance with AWWA standard C-651.

5.4.2 PROCEDURES:

5.4.2.1 PRELIMINARY CLEANING AND FLUSHING:

Prior to both testing and disinfecting, all pipelines shall be thoroughly washed, flushed or blown out, under the direction of the OWNER. Flushing shall be accomplished through hydrants, valves, blow-offs, or other means provided by the CONTRACTOR and approved by the OWNER sufficient to provide for a 3.0 foot per second (FPS) flushing velocity in the pipeline. Where the OWNER determines that a 3.0 FPS flushing velocity is not practical, the greatest feasible flow for 2-3 volumes shall be achieved.

5.4.2.2 HYDROSTATIC TESTS:

Prior to testing, all piping shall be flushed or blown out as appropriate. The CONTRACTOR shall test all piping either in sections or as a unit. Mortar-lined piping shall not be tested before the mortar lining has attained an age of 14 days. The test shall be made by placing temporary bulkheads in the pipe and filling the line slowly with water. Care shall be taken to see that air vents are installed at appropriate locations to evacuate air, and that all air vents are open during filling. After the piping or section thereof has been filled, it shall be allowed to stand under a slight pressure for a sufficient length of time to allow the mortar lining to absorb what water it will and to allow the escape of air from any air pockets. During this period, bulkheads, valves, and connections shall be examined for leaks. If any are found, corrective measures satisfactory to the OWNER shall be taken. The test shall consist of holding a minimum pressure of 150 psi on the section being tested for a minimum period of 2 hours. The test pressure shall be maintained within 5 PSI without the addition of makeup water for the duration of the test.

In the case of pipelines that fail to pass the prescribed leakage test, the CONTRACTOR shall determine the cause of the excessive leakage, shall take corrective measures necessary to repair the leaks, and shall again test the pipelines, all at no additional cost to the OWNER.

5.4.2.3 DISINFECTING PIPELINES:

- **CHLORINATION:** A chlorine-water mixture shall be applied by means of a solution-feed chlorinating device. The chlorine solution shall be applied at one end of the piping or pipeline through a tap in such manner that as the pipeline is filled with water, the dosage applied to the water entering the pipe shall be approximately 50 ppm. Care shall be taken

third and final sample pulled and tested; if the third sample returns a negative result, the section of pipeline will be accepted (this does not pertain to any surface improvements that may be needed).

5.4.3 MEASUREMENT AND PAYMENT:

Payment for cleaning, pre-flushing, hydrostatic testing, disinfecting, and final flushing shall be included in the lineal foot price of installed pipe.

End of Section

5.5.3 CONSTRUCTION:

5.5.3.1 INSTALLATION:

The trench bottom shall be stable, smooth and free of frozen material, clodded dirt, and stones over 3/4 inch in diameter. Bell holes should be provided at each joint for easier assembly and uniform support. Large rocks must be removed to provide 6 inches clearance in all directions from pipe and accessories. The pipe shall be installed with proper bedding providing uniform support under the pipe. Backfill materials shall be worked under the pipe to provide adequate haunching. Initial backfill material should be placed to a minimum of 12 inches over the pipe. All pipe embedment material shall be selected and placed carefully, avoiding stones over 3/4-inch, frozen lumps, and debris.

5.5.3.2 UNDERGROUND WARNING TAPE AND LOCATION WIRE:

See 5.3.3.11.

5.5.3.3 GRAVEL FOUNDATION FOR PIPE:

See also 5.1.3.6. Wherever the subgrade material does not afford a sufficiently solid foundation to support the pipe and superimposed load, and where groundwater must be drained, the subgrade shall be excavated to such depth as may be necessary and replaced with crushed rock or gravel compacted into place.

5.5.4 MEASUREMENT AND PAYMENT:

Section 1.4.9 takes precedence over the following if there is a discrepancy between the two sections.

5.5.4.1 PVC AWWA C-900 WATER PIPE:

PVC pipe measurement shall be per lineal foot installed piping of the type, size and class shown on the drawings and in the bidding schedule (payment shall be made as part of another Bid Item if PVC pipe is not specifically included as a bid item). Measurement shall be along the centerline of the pipe as measured in the field following construction. No deduct in length for payment will be made for valve & fittings.

Payment will be made per Bid Item only after the surface restoration, including, but not limited to, gravel and asphalt restoration, has been completed and accepted.

Payment to install pipelines shall be at the unit price in the Bid Schedule. Payment shall be full compensation for mobilization, cutting asphalt pavement; unclassified excavation; imported material for pipe bedding; trench backfill, location tape; tracer wire, storing and installing the pipe, fittings, elbows and couplings not specifically identified as a separate bid item; removal and disposal of excess or rejected excavated materials; compaction; thrust blocks; pressure testing; disinfecting, dechlorination, flushing and other materials, equipment and labor related to placing the line into service. Payment shall also include compensation for restoration of miscellaneous improvements damaged during construction.

End of Section

- **COMPRESSION JOINTS:** Compression joints shall be mechanical joint cast iron sleeve with armor guard gaskets, Rockwell 441 or Flange adaptor Rockwell Type 900 or approved equal, as specified on approved drawings.

5.6.2.3 FITTINGS:

- **MECHANICAL JOINT FITTINGS:** Mechanical Joint Fittings shall conform to ANSI A 21.10, "American National Standard for Ductile Iron and Gray Iron Fittings."
- **PUSH-ON FITTINGS:** Push-on fittings shall conform to ANSI A 21.10 with bells, sockets, and plain ends per ANSI A 21.11.
- **FLANGED FITTINGS:** Flanged fittings shall conform to ANSI 21.10.

All flanges shall be faced and drilled. Where cap screws or stud bolts are needed, flanges shall be tapped to support cap screws or stud bolts as per approved drawings.

5.6.2.4 CEMENT MORTAR LINING:

Ductile iron pipe and fittings shall be lined with cement mortar in accordance with the requirements of the "American National Standard for Cement Mortar Lining for Cast Iron and Ductile Iron Pipe and Fittings for Water" (ANSI A21.4 AWWA C104).

5.6.2.5 ASPHALTIC COATING:

Ductile iron pipe shall be supplied with an exterior asphaltic coating approximately 1 mil thick per applicable AWWA standards for ductile iron pipe and fittings, EXCEPT THAT all pipe and fittings installed above grade or in pipe galleries shall be supplied without an asphaltic coating or otherwise prepared for a primer and 2 coats of durable epoxy coating.

5.6.2.6 INTERIOR PIPING COATING:

All interior piping shall be prepared for and coated with a suitable primer and at least 2 coats of liquid epoxy to a DFT of at least 10 mil. TNEMEC N140 or equal. Color as determined by Owner.

5.6.2.7 COATING OF PIPES INSIDE STORAGE TANKS:

Pipe inside storage tanks shall NOT have a coal tar coating on the exterior, but shall be externally coated with a two-part epoxy at least 12 mil DFT, meeting the requirements of NSF Standard 61. TNEMEC N140 or equal. Interior lining shall be the same as specified in 5.6.2.4 above.

5.6.3 CONSTRUCTION:

5.6.3.1 INSTALLATION:

Ductile iron pipe shall be installed in accordance with the "Installation of Ductile Iron Mains and Their Appurtenances" (ANSI/AWWA C600).

5.6.4.1 Ductile iron pipe:

Ductile Iron Pipe measurement shall be per lineal foot installed piping of the type, size and class shown on the drawings and in the bidding schedule. Measurement shall be along the centerline of the pipe as measured in the field following construction. No deduct in length for payment will be made for valve fittings, manholes or structures.

Payment will be made per Bid Item only after the surface restoration, including gravel and asphalt restoration, has been completed and accepted.

Payment to install pipelines shall be at the unit price in the Bid Schedule. Payment shall be full compensation for mobilization, traffic control signs, devices and flag persons; cutting asphalt pavement; unclassified excavation; imported material for pipe bedding; trench backfill; location tape; storing and installing the pipe, fittings, elbows and couplings; removal and disposal of excess or rejected excavated materials; compaction; thrust blocks; pressure testing; and disinfecting, flushing and placing the line into service. Payment shall also include compensation for restoration of miscellaneous improvements damaged during construction.

No classification of excavated materials shall be made other than solid rock requiring blasting (refer to Section 5.2, "Pipeline Trench Excavation and Backfill"). Excavation shall include the removal and subsequent handling of all water, earth, shale, loose or cemented gravel, loose rock, and other materials of whatsoever nature excavated or otherwise removed in the performance of contract work.

End of Section

5.7.2.1 Qualification of Manufacturers.

The Manufacturer shall have manufacturing and quality assurance facilities capable of producing and assuring the quality of the pipe and fittings required by these Specifications. The Manufacturer's production facilities shall be open for inspection by the Owner or his Authorized Representative. The ENGINEER shall approve qualified Manufacturers.

5.7.2.2 Materials.

Black PE materials used for the manufacture of polyethylene pipe and fittings shall be PE 3408 or 4710 high density polyethylene meeting ASTM D 3350 cell classification 345464C or 445574C, respectively, and shall be listed in the name of the pipe and fitting Manufacturer in PPI (Plastics Pipe Institute) TR-4 with a standard grade HDB rating of 1600 psi at 73°F. Color material, when used, shall be the same except for meeting ASTM D 3350 cell classification 345464E. The material shall be listed and approved for potable water in accordance with NSF Standard 61. When requested on the order, the Manufacturer shall certify that the materials used to manufacture pipe and fittings meet these requirements.

The pipe shall be a minimum SDR21 or thicker wall for main line installation. For use as a casing/carrier combo refer to Section 5.3.2.22 Casings.

5.7.2.3 Interchangeability of Pipe and Fittings.

The same Qualified and Approved Manufacturer shall produce polyethylene pipe and fittings. Products such as fittings or flange adapters made by sub-contractors or distributors are prohibited.

5.7.2.4 Polyethylene Pipe.

Polyethylene pipe shall be manufactured in accordance with AWWA C901-96 for sizes 1-1/4" thru 3" IPS diameters and to the requirements of ASTM D3035. Pipe 4" IPS and DIPS sizes 4" and above shall be manufactured to the requirements of ASTM F714 and AWWA C906-99.

5.7.2.5 Optional Service Identification Stripes for IPS Sized Pipe.

IPS pipes shall be black. When requested as an option, IPS pipes shall have four, equally spaced, blue color stripes co-extruded into the pipe outside surface. Stripes printed on the pipe outside surface shall not be acceptable.

5.7.2.6 Service Identification Stripes for DIPS Sized Pipe.

DIPS sized pipes shall have three equally spaced pairs of longitudinal blue color stripes co-extruded into the pipe outside surface. Stripes printed on the outside surface shall not be acceptable.

5.7.2.7 Optional Color Shell.

When requested as an option, a blue color shell co-extruded into the pipe outer surface shall permanently identify IPS or DIPS pipes.

5.7.3 Joining

5.7.3.1 Heat Fusion Joining.

Joints between plain end pipes and fittings shall be made by butt fusion. Joints between the main and saddle branch fittings shall be made using saddle fusion. The butt fusion and saddle fusion procedures used shall be procedures that are recommended by the pipe and fitting Manufacturer. The Contractor shall ensure that persons making heat fusion joints have received training in the Manufacturer's recommended procedure. The Contractor shall maintain records of trained personnel, and shall certify that training was received not more than 6 months before commencing construction. External and internal beads shall not be removed.

5.7.3.1.1 Butt Fusion of Unlike Wall Thickness.

Butt fusion shall be performed between pipe ends, or pipe ends and fitting outlets that have the same outside diameter and are not different in wall thickness by more than one Standard DR, for example, SDR 13.5 to SDR 17, or SDR 11 to SDR 13.5. Transitions between unlike wall thickness greater than one SDR shall be made with a transition nipple (a short length of the heavier wall pipe with one end machined to the lighter wall) or by mechanical means or electrofusion. SDR's for polyethylene pipe are 7.3, 9, 11, 13.5, 17, 21, 26, 32.5 and 41.

5.7.3.1.2 Heat Fusion Training Assistance.

Upon request and at the requestor's expense, training personnel from the Manufacturer or his Representative shall be made available.

5.7.3.2 Joining by Other Means.

Polyethylene pipe and fittings may be joined together or to other materials by means of (a) flanged connections (flange adapters and back-up rings), (b) mechanical couplings designed for joining polyethylene pipe or for joining polyethylene pipe to another material, (c) MJ Adapters or (d) electrofusion. When joining by other means, the installation instructions of the joining device manufacturer shall be observed.

5.7.3.2.1 ID Stiffener and Restraint.

A stiffener shall be installed in the bore of the polyethylene pipe when an OD compression mechanical coupling is used and when connecting plain end PE pipe to a mechanical joint pipe, fitting or appurtenance. External clamp and tie rod restraint shall be installed where PE pipe is connected to the socket of a mechanical joint pipe, fitting or appurtenance except where an MJ Adapter is used.

5.7.3.3 Branch Connections.

Branch connections to the main shall be made with saddle fittings or tees. Polyethylene saddle fittings shall be saddle fused to the main pipe per 3.1.

5.7.4 Installation

be of sufficient capacity for the load, and shall be inspected before use. Worn or damaged equipment shall not be used.

5.7.4.7 Backfilling.

See Section 5.1, PIPELINE TRENCH EXCAVATION AND BACKFILL. During embedment placement and compaction, care shall be taken to ensure that the haunch areas below the pipe springline are completely filled and free of voids.

5.7.4.8 Protection against shear and bending loads.

In accordance with ASTM D 2774, connections shall be protected where an underground polyethylene branch or service pipe is joined to a branch fitting such as a service saddle, branch saddle or tapping tee on a main pipe, and where pipes enter or exit casings or walls. The area surrounding the connection shall be embedded in properly placed, compacted backfill, preferably in combination with a protective sleeve or other mechanical structural support to protect the polyethylene pipe against shear and bending loads.

5.7.4.9 Final Backfilling.

See Section 5.1, PIPELINE TRENCH EXCAVATION AND BACKFILL.

5.7.5 Testing.

5.7.5.1 Fusion Quality.

The Contractor shall ensure the field set-up and operation of the fusion equipment, and the fusion procedure used by the Contractor's fusion operator while on site. Upon request by the Owner, the Contractor shall verify field fusion quality by making and testing a trial fusion. The trial fusion shall be allowed to cool completely; then test straps shall be cut out and bent strap tested in accordance with ASTM D 2657. If the bent strap test of the trial fusion fails at the joint, the field fusions represented by the trial fusion shall be rejected. The Contractor at his expense shall make all necessary corrections to equipment, set-up, operation and fusion procedure, and shall re-make the rejected fusions.

5.7.5.2 Hydrostatic Leak Testing.

This hydrostatic leak test procedure consists of filling, an initial expansion phase, a test phase, and depressurizing. There are two alternatives for the test phase. Leak testing shall be observed by the OWNER or ENGINEER.

5.7.5.2.1 Filling.

Fill the restrained test section completely with water.

WARNING – Ensure that there is no air trapped in the test section. Failure with entrapped air can result in explosive release and result in death or serious bodily injury. Use equipment vents at high points to remove air.

SECTION 5.8 PORTLAND CEMENT CONCRETE

5.8.1 DESCRIPTION:

This section of the specifications defines materials to be used in all portland cement concrete work and requirements for mixing, placing, finishing, and curing.

5.8.2 MATERIALS:

Materials used in portland cement concrete and reinforcing of portland cement concrete shall meet the following requirements:

5.8.2.1 CEMENT:

Portland cement shall be Type II or as approved by the Engineer and shall comply with the Standard Specification for Portland Cement, ASTM C-150. POZZOLANS, FLY ASH AND/OR SILICA FUME SHALL NOT BE USED.

5.8.2.2 AGGREGATES:

Concrete aggregates shall conform to Tentative Specifications for Concrete Aggregates, ASTM C-33.

5.8.2.3 WATER:

Water used in mixing concrete shall be clean and free from oil, acid, salt, injurious amounts of alkali, organic matter or other deleterious substances.

5.8.2.4 ENTRAINING AGENT:

An air-entraining agent shall be used in all concrete exposed to the weather. The agent shall conform to ASTM Designation C-175 and C-260.

5.8.2.5 ADMIXTURES:

No admixtures unless approved by the Engineer. Calcium chloride shall not be used in reinforced concrete.

5.8.2.6 FLY ASH:

No fly ash shall be added without mix design approved by the Engineer.

5.8.2.7 REINFORCED STEEL:

All bar material used for reinforcement of concrete shall be intermediate grade steel free of rust conforming to the requirements of ASTM Designation A-615 GR-60 and shall be deformed in accordance with ASTM Designation A-305.

Class	Minimum Cement Comp. (sacks/c.y.)	Minimum 28-day Strength (psi)	Primary Use
A	6	4000	Reinforced Structural Concrete
B	6	3500	Sidewalks, curbs, and gutters, cross gutters, pavements, and non- reinforced footings and foundations
C	5	2500	Thrust blocks, anchors, mass concrete

Note: Above specifications contain 94 pound sacks of Portland Cement.

All concrete shall also comply with the following requirements.

AGGREGATES: The maximum size of the aggregate shall be not larger than one-fifth of the narrowest dimension between forms within which the concrete is to be cast, nor larger than three-fourths of the minimum clear spacing between reinforcing bars or between reinforcing bars and forms. For non-reinforced concrete slabs, the maximum size of aggregates shall not be larger than one-fourth the slab thickness.

WATER: Sufficient water shall be added to the mix to produce concrete with the minimum practicable slump. The slump of mechanically vibrated concrete shall not exceed four inches. **NO** concrete shall be placed with a slump in excess of five inches. The maximum permissible water-cement ratio (including free moisture on aggregates) shall be 5 and 5-3/4 gallons per bag of cement respectively for Class A and B air entrained concrete.

AIR-ENTRAINING: Air content for air-entrained concrete shall comply with the following:

Course Aggregate Size (in.)	Air Content %
1-1/2 to 2-1/2	5 ± 1
3/4 or 1	6 ± 1
3/8 or 1/2	7 ± 1

The air-entraining agent shall be added as liquid to the mixing water by means of mechanical equipment capable of accurate measurement and control.

5.8.3.1 FORMS:

Forms shall be substantially built and adequately braced so as to withstand the liquid weight of concrete. All linings, studding, walling and bracing shall be such as to prevent bulging, spreading, or loss of true alignment while pouring and displacement of concrete while setting. Metal forms shall be used for sidewalk work unless otherwise specified by the Engineer. All edge forms for sidewalk pavements, curbs, and gutters shall be of sufficient rigidity and

5.8.3.5 CONCRETE MIXING:

All concrete shall be ready-mixed and delivered in accordance with ASTM C-94. The concrete shall be mixed until there is a uniform distribution of the materials. Sufficient water shall be used in mixing concrete to produce a mixture which will flatten and quake when deposited in place, but not enough to cause it to flow. Sufficient water shall be used in concrete in which reinforcement is to be embedded, to produce a mixture which will flow sluggishly when worked and which, at the same time, can be conveyed from the mixer to the forms without segregation of aggregate. In no case shall the quantity of water used be sufficient to cause the collection of a surplus in the forms or exceed the maximum allowable slump as specified in 5.8.3.

5.8.3.6 DEPOSITING:

Concrete shall be deposited as nearly as practical in its final position to avoid segregation due to rehandling or flowing. The concrete placing shall be carried on at such a rate that the concrete is at all times plastic and flows readily into the corners of forms and reinforcing bars. No concrete that has partially hardened or been contaminated by foreign material shall be deposited in the work, nor shall retempered concrete be used. No concrete shall be dropped more than 3 feet. Concrete delivered to the job site having a temperature that exceeds 90 degrees Fahrenheit shall not be placed. Concrete cooling methods during hot weather will be approved by the Engineer.

All concrete in structures shall be vibrator compacted during the operation of placing, and shall be thoroughly worked around reinforcement and embedded fixtures and into the corners of the forms.

CONSTRUCTION JOINTS: All construction joints shall be located and prepared as shown on the drawings or otherwise approved in writing by the Engineer. Unanticipated cold joints may be cause for rejection of the entire poured section in which the cold joint is located, at the sole discretion of the Engineer, in consultation with others. Rejected sections shall be demolished and re-poured by the Contractor as specified at no additional cost to the Owner.

5.8.3.7 PLACING CONCRETE IN COLD WEATHER:

No concrete shall be poured where the air temperature is lower than 40 degrees Fahrenheit, at a location where the concrete cannot be covered or protected from the surrounding air. Where concrete is poured below a temperature of 35 degrees Fahrenheit the ingredients of the concrete shall be heated so that the temperature of the mixture shall not be less than 50 degrees or more than 100 degrees Fahrenheit. Before mixing, the heated aggregates shall not exceed 125 degrees Fahrenheit and the temperature of the heated water shall not exceed 175 degrees Fahrenheit. Cement shall not be added while the temperature of the mixed aggregates and water is greater than 100 degrees Fahrenheit. When there is likelihood of freezing during the curing period, the concrete shall be protected by means of an insulating covering and/or heating the concrete for a period of not less than 7 days after placing. The temperature must be maintained at a minimum of 40 degrees Fahrenheit. Concrete shall not be placed on frozen soil. Equipment for protecting concrete from freezing shall be available at the job site prior to placing concrete. Particular care shall be exercised to protect edges and exposed corners from freezing. In the event heating is employed, care shall be taken to insure that no part of the concrete

5.8.3.8.7 TROWELED FINISH –

Use for interior floors intended as walking surfaces. The surface shall first be float-finished as specified above. Next, power trowel followed by hand troweling. The first troweling after power floating shall produce smooth surface which is free of defects but which may still show some trowel marks. Additional trowelings shall be done by hand after the surface has hardened. Accomplish final troweling when a ringing sound is produced as the trowel is moved over the surface. Thoroughly consolidate surface by the hand troweling until the finished surface is free of trowel marks, uniform in texture and appearance and level within a tolerance of 1/4 inch in 10 feet in all directions. On surfaces intended to support floor coverings, defects which show through the floor covering shall be removed by grinding.

5.8.3.8.8 BROOM OR BELT FINISH –

Use for exterior horizontal walks and slabs. Immediately after the concrete has received a float finish as specified above, provide a coarse transverse scored texture by drawing a broom or burlap belt across the surface.

5.8.3.9 CURING AND PROTECTION:

As soon as the concrete has hardened sufficiently to prevent damage, the finished surface shall be protected for curing one of the following ways:

Application of a curing compound, conforming to "Specifications for Liquid Membrane-Forming Compounds for Curing Concrete" ASTM C-309. The compound shall be light in color and shall be applied in accordance with the manufacturers recommendations immediately after any water sheen, which may develop after finishing has disappeared from the concrete surface.

Ponding of water on the surface or continuous sprinkling. Application of light colored waterproof plastic materials, conforming to "Specifications for Waterproof Sheet Materials for Curing Concrete" ASTM C-171, placed and maintained in contact with the surface of the concrete. The freshly finished surface shall be protected from hot sun and drying winds until it can be sprinkled or covered as above specified. The concrete surface must not be damaged or pitted by rain. The contractor shall provide and use, when necessary, sufficient tarpaulins to completely cover all sections that have been placed within the preceding twelve (12) hours.

The Contractor shall erect and maintain suitable barriers to protect the finished surface. Any section damaged from traffic or other causes occurring prior to its official acceptance, shall be repaired or replaced by the Contractor at his own expense in accordance with these specifications.

Defective concrete conditions or surfaces shall be removed, replaced, or repaired, without further cost to the OWNER, in accordance with these specifications.

5.8.3.10 CONCRETE TESTING:

The Engineer may order the taking of concrete test cylinders to check the required compressive strengths. If taken, samples will be made in accordance with ASTM C172 and tested as follows:

- a. Air Content: Test for air content shall be performed in accordance with ASTM C 173 or ASTM C 231. A minimum of 1 test shall be conducted each time a slump test is made.

SECTION 5.9 EARTHWORK

5.9.1 DESCRIPTION:

Extent of earthwork is indicated on drawings. Preparation of bedding of pipe and trenching is included in Section 5.1 "Trench Excavation and Backfill".

"Excavation" consists of removal of material encountered to subgrade elevations indicated and subsequent relocation of materials removed. Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction. "Embankment" includes compacted backfill in specified lifts and densities.

A copy of the geotechnical report prepared for this project as appended to this specification book for the information of the CONTRACTOR.

5.9.2 MATERIALS:

5.9.2.1 SATISFACTORY MATERIALS:

Materials are defined as those complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW and SP.

5.9.2.2 UNSATISFACTORY SOIL MATERIALS:

Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classifications groups GC, SC, ML, CL, CH, OL, OH and PT.

5.9.2.3 STRUCTURAL FILL:

Structural fill for sub-grade shall be a well-graded material, either natural or crushed, free from vegetable material and lumps or balls of clay. The 3-inch minus structural fill shall consist of well-graded sandy gravels and 5% to 15% fines (materials passing a No. 200 sieve) by weight.

The plasticity index of the fines shall not exceed 15 and the liquid limit shall not exceed 35. Clean gravel ranging from pea gravel to 6 inches with less than 5% fines and sand combined may alternatively be used as structural fill. All fill soils shall be free of topsoil, highly organic material, frozen and other deleterious materials.

5.9.2.4 BACKFILL AND FILL MATERIALS:

Satisfactory soil materials free of clay, rock or gravel larger than 2 inches in any dimension, debris, waste, frozen materials, vegetable and other deleterious matter.

5.9.2.5 COMPACTION TESTING:

Owner may employ at Owners Expense, testing laboratory to perform soil testing and inspection service for quality control testing during earthwork operations.

5.9.2.6 SITE CONDITIONS:

Rock Excavation in Trenches and Pits - Includes removal and disposal of materials and obstructions encountered which cannot be excavated with a 1.0 cubic yard (heaped) capacity, 42 inch wide bucket on track-mounted power excavator equivalent to Caterpillar Model 215, rated at not less than 90 HP flywheel power and 30,000 lb. drawbar pull. Trenches in excess of 10' - 0" in width and pits in excess of 30' - 0" in length or width are classified as open excavation.

Rock Excavation in Open Excavations - Includes removal and disposal of materials and obstructions encountered, which cannot be dislodged and excavated with modern track-mounted heavy-duty excavation equipment without drilling, blasting or ripping.

Typical of materials classified as rock are boulders 1/2 cu. yd. or more in volume, solid rock, rock in ledges, and rock-hard cementitious aggregate deposits.

Intermittent drilling, blasting or ripping performed to increase production and not necessary to permit excavation of material encountered will be classified as earth excavation.

Do not perform rock excavation work until material to be excavated has been cross-sectioned and classified by the Engineer. Such excavation will be paid on basis of contract conditions relative to changes in work.

Rock Payment Lines are limited to the following:

Two feet outside of concrete work for which forms are required, except footings. One foot outside perimeter of footings. In pipe trenches, 6 inches below invert elevation of pipe and 2 feet wider than inside diameter of pipe, but not less than 3 feet minimum trench width. Neat outside dimensions of concrete work where no forms are required. Under slabs on grade, 6 inches below bottom of concrete slab.

Unauthorized Excavation - Consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be at Contractor's expense.

Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Engineer.

Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Engineer.

Additional Excavation: When excavation has reached required subgrade elevations, notify Engineer who will make an inspection of conditions.

If unsuitable bearing materials are encountered at required subgrade elevation, carry excavations deeper and replace excavated material as directed by Engineer. Removal of unsuitable material and its replacement as directed will be paid on basis of contract conditions relative to changes in work.

Structural Fill and Sub-Ballast: Compact top 8 inches of subgrade and each layer of structural fill material or sub-ballast at 95% maximum modified proctor density ASTM D 1557). Maximum compacted thickness of any one lift shall not exceed 6-inches.

Sub-Grade: Compact top 6 inches of subgrade and each layer of backfill or fill material at 90% maximum modified proctor density (ASTM D 1557).

Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material. Apply water in manner to prevent free water appearing on surface during or subsequent to compaction operations.

Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by dicing, harrowing or pulverizing until moisture content is reduced to a satisfactory value.

5.9.3.10 BACKFILL AND FILL:

Place acceptable soil material in layers not exceeding 8 inches (uncompacted depth) and compact each layer prior to placement of next layer to required subgrade elevations, for each area classification listed below.

Sub-ballast, use structural fill material, or satisfactory excavated or borrow material, or combination of both.

Under Ballast, use sub-ballast material.

Backfill excavations as promptly as work permits, but not until completion of the following:

Acceptances of construction below finish grade including, where applicable, damp proofing, waterproofing, and perimeter insulation.

Inspection, testing, approval, and recording locations of underground utilities.

5.9.3.11 GROUND SURFACE PREPARATION:

Remove vegetation, debris,

unsatisfactory materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break-up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.

When existing ground surface has a density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to

or finish to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

5.9.3.15 DISPOSAL OF EXCESS AND WASTE MATERIALS

Removal to Designated Areas on Owner's Property: Transport acceptable excess excavated material to designated soil storage areas on Owner's property. Stockpile soil or spread as directed by Engineer.

Removal from Owner's Property: Remove waste materials, including unacceptable excavated material, trash and debris, and dispose of it off Owner's property, in a legal manner.

End of Section