TECHNICAL SPECIFICATIONS

COLUMBIA / ADAIR UTILITIES DISTRICT
ADAIR COUNTY, KENTUCKY

WATER SYSTEM EXTENSION & IMPROVEMENTS:
FAIRPLAY AREA WATER LINE IMPROVEMENTS

PROJECT NO. 1629

JANUARY 2017

Monarch Engineering, Inc.

STATE OF KENTUCKY
DERON S. BYRNE
23127
LICENSED PROFESSIONAL ENGINEER

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TABLE OF CONTENTS

SECTION 1 - WATER MAINS

1.0 Work Included. Under this item the Contractor shall provide all labor, tools, equipment, and materials to furnish and install the water mains as shown on the drawings and as directed

1.1 Water Pipe Materials. All pipe materials shall conform to the manufacturer's standard lengths and diameters. Testing when required by the Owner shall be done in accordance with the appropriate ASTM specifications for the material selected. The water main type shall be PVC water pipe or ductile iron.

1.1.1 Polyvinyl Chloride Pipe PVC SDR 17 or SDR 21. PVC pipe shall comply with ASTM D-1784 for material and shall be Class 250 (SDR 17) or Class 200 (SDR 21) as shown on the drawings or indicated on the bid form. All PVC pipe shall conform to the latest revisions of the following specifications:

ASTM D2241 (PVC Plastic Pipe SDR-PR and Class T)
National Sanitation Foundations Testing Laboratories (NSF)

The name of the manufacturer of the plastic pipe to be used must be found on the current listing of Plastic Materials for Potable Water Application, published by the NSF (National Sanitation Foundation), and must meet the requirements of the Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe, D1784, 12454-B (PVC 1120) published by ASTM. Rubber gaskets shall conform to ASTM D3139.

Wall thickness shall be in accordance with ASTM D-2241. Pipe ends shall be beveled to accept the coupling with gasket. The bell section shall be designed to be as strong as the pipe wall.

Samples of pipe physical and chemical data sheets shall be submitted to the Engineer for approval prior to the pipe being purchased.

The pipe shall be homogeneous throughout and free from cracks, holes, foreign inclusions, or other defects. The pipe shall be as uniform as commercially practical in color and shall have a ring painted around the spigot ends in such a manner as to allow field checking of setting depth of the pipe in the socket. Pipe must be delivered to the job site by means that will adequately support it and not subject it to undue stresses. In particular, the load shall be so supported such that the bottom rows of pipe are not damaged by crushing. The pipe shall be unloaded carefully and stored as close to the final point of placement as is practical.

Pipe markings shall include the following marked continuously down the length:

Manufacturer's Name

Nominal Size
Class Pressure Rating
PVC 1120
NSF Logo
Identification Code

The lubricant shall be that as recommended and supplied by the pipe manufacturer.

1.1.2 Polyvinyl Chloride Pipe (PVC) Cast Iron Pipe Size. This pipe shall meet the requirements of AWWA C900-75, latest revision, "Standard for Polyvinyl Chloride (PVC) Pressure Pipe, 4 inch through 12 inch for Water" and shall be furnished in cast iron pipe equivalent outside diameters with separate couplings including gaskets.

The pipe shall be made from Class 12454-A or Class 12454-B virgin compounds as defined in ASTM D-1784. The standard code designation shall be PVC 1120. The PVC compounds shall be tested and certified as suitable for potable water products by the NSF approval marking.

Solvent cement couplings or joints shall not be used. PVC joints using elastomeric gaskets shall be tested as assembled joints and shall meet the laboratory performance requirements specified in ASTM D-3139.

Pipe shall be pressure Class 200, DR 14 or Class 150, DR 18 as shown on the drawings or the bid form.

Pipe and Couplings shall be marked as follows:

Nominal Size and OD Base
Material Code Designation (PVC 1120)
Dimension Ratio Number
AWWA Pressure Class
AWWA Designation Number (AWWA C900)
Manufacturers Name or Trade Mark and Production Record Code
Seal of the NSF Laboratory

Each standard and random length of pipe shall be proof tested at four times its rated class pressure for a minimum of 5 seconds. Bells or couplings shall be tested with the pipe.

The pipe shall not split, crack, or break when tested by the parallel plato method, and it shall not flake or disintegrate when tested by the acetone immersion method as specified by ASTM D-2241.

1.1.3 Ductile Iron Pipe. Ductile Iron Pipe shall be designed in accordance with AWWA (ASA A21.50) and for the conditions as stated in these specifications and the pressure rating for the pipe shall be 350 PSI. Ductile iron pipe shall conform to AWWA

C-151 (ASA A21.51). Pipe shall be cement lined in accordance with AWWA C104 (ASA A21.4) and all exposed pipe and fittings shall have a shop prime coat applied that is compatible with subsequent field enamel paint coats.

The specified thickness will be determined for the given internal and external loading requirements in accordance with ASA A21.50 and will be shown on the drawings or the bid form.

The net weight, class or nominal thickness and sampling period shall be marked on each pipe.

Pipe joints shall be mechanical joint, rubber ring slip joint, flanged, or locked mechanical joint equal to AWWA C-111.

1.1.4 Fittings. Ductile Iron mechanical joint fittings with appropriate adapters shall be used with PVC pipe and ductile iron pipe. Fittings shall comply with AWWA C-110 or C-111 and shall be manufactured for the size and pressure class of the line on which they are used. Compact fittings are acceptable and they shall conform to the latest AWWA specifications.

Mechanical joint fittings shall be used with ductile iron pipe for below ground burial and flange fittings shall be used for all interior piping where ductile iron pipe is used.

1.2 Pipe Handling. Pipe delivered to the site shall be stored, handled, distributed, placed, joined together, etc. in accordance with the manufacturer's recommendation unless directed otherwise by the Engineer.

1.3 Water Main Location. The water main shall be installed in the locations as shown on the drawings and as directed by the Engineer. The Contractor and Engineer shall agree as to the exact location of the water line and there shall be no disputes unless it is clear that the proposed location significantly deviates from the drawings. At those locations where the drawings indicate that a fitting must be installed either by declaration on the drawings or by a defined bend as shown on the drawings, the Contractor shall do so and shall avoid over deflection of the pipe.

1.4 Excavation. The Contractor shall make trench excavations to only such width to provide ample room for proper construction. Sheeting and shoring shall be provided as required for proper safety and compliance with OSHA regulations. Rock excavation shall be taken to a depth of 6 inches below the bottom of the pipe. If poor foundation conditions exist due to unstable subsurface conditions, the trench shall be under excavated to the depth required and filled with stone to obtain proper bearing capacity.

Watchmen or barricades, lanterns, and other such signs and signals as is necessary to warn the public of the dangers in connection with open trenches, excavations and other

obstructions shall be provided by and properly maintained at the expense of the Contractor.

Only one half of street crossings and road crossings shall be excavated before placing temporary bridges over the excavation.

1.5 Blasting and Rock Excavation. The Contractor shall make his own investigation as he deems necessary to ascertain the sub surface conditions to be encountered in the work.

All blasting operations shall be conducted in accordance with municipal ordinances, state and federal laws and the applicable blasting codes. Soil particle velocity shall not exceed the limit set by Kentucky law. All explosives shall be stored in conformity with the applicable ordinances, laws and safety regulations. No blasting shall be done within five feet of any water mains, sewer lines, natural or manufactured gas lines, liquid petroleum lines, or other utilities.

The Contractor shall use delay caps or other approved methods to reduce earth vibrations and noise. Mud capping shall not be permitted as a method to breaking boulders. No blasting shall be permitted on Sundays or after dark.

Prior to commencing with the work, the Contractor shall, during a preconstruction conference with the Owner and Engineer, state clearly his approach to performing the excavations on the project. He shall be familiar with the laws and ordinances covering blasting and shall also give consideration to the use of hydraulically operated rock breaking devices in lieu of blasting where considered necessary. If blasting is not handled in an expert manner at all times the Engineer reserves the right to suspend blasting and require the work to proceed without it. Prior to blasting, the Contractor shall make his own detailed preblast survey of adjacent walks, curbs, retaining walls, house foundations, etc. to determine conditions prior to the work. Such a file of information, including photographs, may be certified in such a manner as the Contractor believes necessary. This information if required or performed shall be supplied to the Engineer prior to performing the work.

1.6 Storage of Excavated Material. All excavated material shall be stored in a manner that will not endanger the work and that will avoid obstructing roadways, sidewalks, and driveways. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, fire and police call boxes, or other utility controls shall be left unobstructed and accessible. Gutters shall be kept clear or other satisfactory provisions made for street drainage, and natural watercourses shall not be obstructed.

1.7 Shoring Sheeting and Bracing. The Contractor shall furnish place and maintain such sheeting and bracing as may be required to support the sides of the excavation or to protect other structures from possible damage. All sheeting and bracing shall be removed upon completion of the work unless permitted to be left in place by the Engineer. Any sheeting or bracing left in place shall be cut off at least two feet below the finished

ground surface elevation. The cost of furnishing, placing, maintaining, and removing sheeting and bracing shall be included in the unit price bid for water lines and all work shall conform the OSHA requirements.

1.8 Bedding and Backfill. All water mains shall be bedded with select earth backfill or six inches of #9 or approved equal stone under and on both sides of the pipe where it is installed along the unpaved areas. Where the water line is installed along the paved areas the water line shall be backfilled with #9 or approved equal stone. Trenches shall be backfilled immediately after the water main has been installed. No rock larger than two inches will be permitted within six inches of the pipe. In unpaved or unsurfaced areas the remainder of the fill may be mounded over the top of the trench. Where trenches are in paved or traveled areas, or yard areas, compaction shall be performed during backfill. The Contractor at no time shall open up more than 500 feet of trench.

Any damage to underground structures, pipes wires, drains, etc., shall not be backfilled until they have been satisfactorily repaired or replaced to the original serviceability at the Contractor's expense and as approved by the Engineer. Settlement of backfill may be done with water furnished by the Contractor under the direction of the Engineer where such will not endanger traffic of damage property. When excavated rock is used for backfilling, it shall have sufficient dirt or fine material to fill all voids and shall not be used within twelve inches of the pipe.

To be accepted as final cleanup all excess rock one inch and larger shall be removed from the disturbed site.

1.9 Thrust Blocks and Anchorage. Thrust blocks shall be installed at all tees, bends, crosses, dead ends, valves, hydrants, blowoff assemblies, and as directed by the Engineer. The size of the thrust block shall depend on the soil and type of fitting, and shall conform to the pipe manufacturer's recommendations. At any location where a vertical bend is required the Contractor shall install the anchorage as directed by the Engineer in conjunction with the pipe manufacturer.

Thrust blocks shall be constructed of Class B concrete conforming to KBH Specification 601 and placed between the fitting and the trench wall. At no time will sack-crete or pre bagged concrete mixtures be allowed. All thrust block and anchorage concrete shall be delivered to the job site by means of a ready mix concrete truck and placed immediately upon arrival.

The thrust blocks shall be sized as shown on the detail drawings or as directed by the Engineer.

1.10 Temporary Surfacing. All trenches in paved areas shall, following compacted backfill, receive a top layer of compacted dense grade stone as shown on the detailed drawings. Such temporary surfacing shall be maintained and shall be paved as soon as conditions permit.

1.11 Hydrostatic Testing. The water line and appurtenances, as rapidly as valves are installed, shall be hydrostatically tested in accordance with these specifications. Defective joints of pipe shall be replaced as directed by the Engineer. Cracked or defective pipe, fittings, valves, or hydrants shall be replaced by the Contractor and the test shall be repeated until the test results are satisfied. All meter settings and service tubing as shown on the drawings shall be included in the hydrostatic test.

The test pressure shall not be less than 1.25 times the working pressure at the highest point along the test section and the hydrostatic test shall be of at least a two hour duration. The test pressure shall not vary by more that five psi. for the duration of the test.

1.11.1 Pressurization. After the pipe has been installed all or any valved section shall be subjected to the hydrostatic test. Each valved section of the pipe shall be slowly filled with water and the specified test pressure, corrected to the elevation of the test gauge, shall be applied by means of a pump connected to the pipe in a manner satisfactory to the Engineer. As part of the testing equipment a meter shall be installed to measure all water added to the tested section.

1.11.2 Air Removal. Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and hydrants. If permanent air vents are not located at all high points, the Contractor shall install corporation cocks at such points so that the air can be expelled as the line is filled with water. After all the air has been expelled, the corporation cocks shall be closed and the test pressure applied. At the conclusion of the pressure test, the corporation cocks shall be removed and plugged or left in place at the discretion of the Owner.

1.11.3 Leakage Defined. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within five psi. of the specified test pressure after the pipe has been filled with water and the air has been expelled. Leakage shall not be measured by a drop in pressure in a test section over a period of time.

1.11.4 Allowable Leakage. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{133{,}200}$$

Where:

L = allowable leakage in gallons per hour
S = length of pipe tested in feet
D = nominal diameter of the pipe in inches
P = average test pressure during the leakage test in pounds per square inch

This formula is based on an allowable leakage of 11.65 gpd./mi./in. of nominal diameter at a pressure of 150 psi.

All leaks shall be repaired whenever or wherever the is evidence of a leak. Water used by the Contractor shall be paid for by the Contractor at the rate of $2.00 per 1,000 gallons.

1.12 Sterilization. Upon completion and acceptance of the hydrostatic test of a section of the water main that section shall be thoroughly disinfected before being place in service by the use of chlorine or chlorine compounds in such amounts as to produce a concentration of not less than 50 ppm and a residual of not less than 25 ppm at the end of 24 hours and followed by thorough flushing. Putting small amounts of chlorine in each joint will not be acceptable.

1.13 Other Utilities. Other utilities encountered in the work shall be preserved and protected. Where relocation or repair is required to accommodate the work it shall be made in a manner acceptable to the utility having jurisdiction over the service connection. Accommodation of service connections shall not constitute any basis for extra payment.

Prior to construction, the Contractor shall arrange to meet with representatives of all utilities, and provide them with his anticipated work schedule. The Contractor shall have the utility companies make their best determination of utility locations in the areas in which he is working. Throughout the progress of the work such field markings of utilities shall be kept current.

1.14 Payment for Water. All water used from the Owner shall be metered by meters supplied by the Contractor. The Contractor shall pay for such water at the rate of $2.00 per 1,000 gallons. This shall include any unmetered water lost which shall be computed on the basis of a discharge velocity of seven feet per second, the diameter of the line, and the estimated duration of free uncontrolled discharge or the approved method.

1.15 Cleanup. The Contractor shall provide effective cleanup of the work as it progresses. At the time of final inspection no trenches shall show any undue evidence of the construction. All areas shall be left free of ruts due to construction and shall have a clean and neat appearance without rubble or debris. The areas shall not be mounded and shall be completely restored, and all yards and fields shall be reseeded. Straw and fertilizing shall accompany the seeding and the seed mixture shall match the existing ground cover. If necessary to hasten proper restoration of terraces, principally along ditch lines, the Contractor shall sod such areas at the Engineer's direction.

1.16 Protection of Adjacent Landscape. Reasonable care shall be taken during construction of the process lines to avoid damage to vegetation. Ornamental shrubbery and tree branches shall be temporarily tied back, where appropriate, to minimize damage. Trees which receive damage to branches shall be trimmed of those branches. Tree trunks receiving damage from equipment shall be treated with a tree dressing.

1.17 Underground Detection Wire. At all locations where PVC piping is utilized, a detection wire shall be installed. Wire shall be installed with the pipe at the trench bottom and stubbed up at each house service connection, valve, and flush hydrant. The wire shall be 12 gauge insulated stranded copper wire, commonly called “bell wire”.

1.18 Exposing Existing Water Line. Where the new water line is to be installed parallel to an existing water line the Contractor shall be responsible for exposing the existing water lines at 100 feet intervals.

1.19 Payment. Payment shall be included in the payment for the work to which it is subsidiary in the Bid Schedule.

SECTION 2 - CASING PIPE

2.0 Work Included. Under this item the Contractor shall provide all labor, tools, equipment, and materials to furnish and install casing pipes as shown on the drawings.

2.1 Materials. Bored and jacked casing pipe shall be plain end steel pipe conforming to AWWA Specification C200 with a minimum yield strength of 35,000 psi. The inside diameter of the casing pipe shall be a minimum of four inches greater than the largest outside diameter of the water pipe, joint or coupling.

The minimum wall thickness shall be in accordance with the following table:

Diameter of Casing-Inches	Minimum Wall Thickness-Inches Under Railroads	All Other Uses
12-3/4 and under	0.188	0.188
14	0.250	0.250
16	0.281	0.250
18	0.312	0.250
20 and 22	0.344	0.250

Casing pipe shall have continuously welded joints. Any field welding shall be performed by a certified welder and shall be in accordance with AWWA Specifications C206

2.2 Prior Approvals. Prior to boring and jacking under roadways the Contractor shall submit drawings and other necessary information regarding the proposed construction to the Engineer for approval by the proper authorities if requested.

2.3 Bore and Jack Construction. The Contractor shall investigate the subsurface conditions which will be encountered and shall base his bid on his findings. No distinction shall be made between boring through earth and boring through rock.

The Contractor shall provide a jacking pit, bore through the earth and or rock, and jack the casing pipe into place at the proper line and grade as the bore is being made. “Free boring” will not be allowed unless directed by the Engineer. The carrier pipe shall be pushed through the casing pipe with care being taken to insure that the pipe joints are tight and properly made. Shims attached to the carrier pipe to prevent floating shall be redwood or that as specifically made for the application.

The approach trench shall be large enough to accommodate one section of casing pipe and the jacks and blocking. Two rails or sills shall be laid in the bottom of the trench to keep the casing at the established line and grade.

The installation procedure must be such that the casing pipe is placed concurrently with the removal of the soil. The outside diameter of the lead auger section must not be less than one half inch smaller in diameter than the casing inside diameter.

The ends of the casing pipe shall be plugged and made watertight prior to backfilling. A neoprene gasket that will slip over the cover pipe and allow the carrier pipe to pass through will be considered water tight.

2.4 Traffic Control Devices and Maintenance of Traffic. The proper placement and maintenance of traffic control devices and the maintenance of traffic flows shall comply with the standards set forth under the General Specifications.

The Contractor shall notify the proper City, County, or State officials prior to the commencement of boring and jacking or tunnel operations.

2.5 Open Cut Construction. Where steel casing pipe is to be installed by open cutting rather than by boring or jacking the same casing pipe as described above will be utilized.

2.6 Measurement and Payment. The unit price bid per linear foot for boring and jacking, as measured from end to end of the casing pipe, shall constitute full compensation for the work as specified. Open cut steel casing pipe as measured from end to end of the casing pipe shall constitute full compensation for the work as specified. Carrier pipes shall be furnished under the item as described in other portions of these technical specifications.

SECTION 3 - CREEK CROSSING

3.0 Work Included. Under this item the Contractor shall provide all labor, tools, equipment, and materials to install creek crossings as shown on the drawings and as directed.

3.1 Materials. The creek crossing shall be installed as per the detailed drawings or as described herein and the casing pipe shall be PVC pipe. In the event where a casing pipe is not required the creek crossing shall be installed with ductile iron. All carrier pipe and casing pipe shall be that as described in other sections of these technical specifications or as shown on the plan sheets

3.2 Installation. The creek crossings shall be installed with plastic carrier pipe placed within a plastic casing pipe, or ductile iron carrier pipe without a casing pipe unless specified otherwise. Where a plastic casing pipe is used it shall be of the minimum size to accommodate the carrier pipe The casing pipe or water line pipe without casing pipe shall be placed a minimum of 30 inches below the bed of the stream, creek, or river and a twelve inch minimum layer of crushed stone shall be placed above the pipe where a casing pipe is not required. Class B concrete shall be placed between the crushed stone and the base of the stream, creek, or river, or between the casing pipe and the base of the waterway. Where concrete is placed, all water from the stream shall be diverted away from the area of concrete placement by means of diversion pipes or temporary embankments.

3.3 Payment. The unit bid shall constitute full compensation for furnishing and installing the creek crossings.

SECTION 4 – VALVE AND VALVE BOX

4.0 Work Included. Under this item the Contractor shall provide all labor, tools, equipment, and materials to install gate valve and valve boxes at the locations as shown on the drawings and as directed.

4.1 Materials. All gate valves shall be resilient wedge seat gate valves which fully comply with the latest revision of AWWA C509, and shall also be UL listed and FM approved. The valves shall be tested and certified to ANSI/NSF 61. The valves shall have a 250 psig working pressure. The valve type shall be NRS (non-rising stem) and the valve shall have an arrow cast on the 2" square operating nut which shows the opening direction. The direction of opening shall be shall to the left. The bolt that attaches the operating nut to the stem shall be recessed into the operating nut so as not to interfere with valve wrench operation.

The valves shall have bolts and nuts for the stuffing box and bonnet with one of the following compositions:

a. Steel, ASTM A-307, Grade B zinc plated.
b. Type 304 stainless steel.
c. Type 316 stainless steel.

Valve stems shall be made of bronze ASTM B-132 alloy C67600 bar stock material. The stem shall have at least one "anti-friction" thrust washer above and below the stem collar to reduce operating torque. The design of the valve stem shall be such that if excessive input torque is applied, stem failure shall occur above the stuffing box at such a point as to enable the operation of the valve with a pipe wrench or other readily available tool. The stem material shall provide a minimum 70,000 psi tensile strength with 15% elongation and yield strength of 30,000psi. Valves with cast stems or two piece stem collars are not acceptable.

The valves shall have a stuffing box that is o-ring sealed. Two o-rings shall be placed above and one o-ring below the stem thrust collar. The thrust collar shall be factory lubricated. The thrust collar and its lubrication shall be isolated by the o-rings from the waterway and from outside contamination providing permanent lubrication for long term ease of operation. Valves without a stuffing box are unacceptable. Valves without at least three stem o-rings are also unacceptable. The valve body, bonnet, stuffing box, and disc shall be composed of ASTM A-126 Class B grey iron or ASTM A395 or A536 ductile iron. The body and bonnet shall also adhere to the minimum wall thickness as set forth in Table 2, section 4.3.1 of AWWA C509.

The valve disc and guide lugs must be fully (100%) encapsulated in SBR ASTM D2000 rubber material. The peel strength shall not be less than 75 pounds per inch. Guide caps of an acetal bearing material shall be placed over solid guide lugs to prevent abrasion and to reduce the operating torque.

The valves shall have all internal and external ferrous surfaces coated with a fusion bonded thermosetting powder epoxy coating of 10 mils nominal thickness. The coating shall conform to AWWA C550.

Tapping valves shall have an inlet flange conforming to ANSI B16.1 Class 125 for attachment to a tapping sleeve or cross. In addition, the valve inlet flange shall have a machined projection or raised face complying with MSS SP-60 for accurate alignment to the mating recess in the tapping sleeve flange. The seat opening of the tapping valves shall be at least .30" larger than the nominal pipe size to permit full diameter cuts.

The valves shall be warranted by the manufacturer against defects in materials or workmanship for a period of ten (10) years from the date of manufacture. The manufacturing facility for the valves must have current ISO certification.

Each valve shall have the manufacturer's initials, pressure rating, and the year in which manufactured, cast onto the body. The manufacturer shall be Mueller Co. or approved equal

Valve boxes shall be of cast iron extension type with screw or slide adjustments and flared base. The minimum thickness of metal shall be 3/16". The cover shall have the word "WATER" cast in the metal. Valve boxes shall be installed over each outside gate valve unless otherwise shown on the drawings. The boxes shall be of such length as to provide a depth of cover of not less than 30 inches over the pipe.

Isolation valves shall consist of a gate valve and valve box along with a meter setting and two service taps with polyethylene tubing located on both sides of the valve. The meter setting shall be that as described in that portion of the Specifications with the exception that it shall have a shutoff on both sides of the meter setter.

4.2 Installation. Valve boxes shall be set plumb and straight and with the operating nut directly in the center in thoroughly compacted earth with the top of the box level and projecting one fourth inch above paved streets and one inch above other areas. The valve boxes in unpaved areas shall have a four inch thick concrete slab three feet in diameter around and sloping away from the valve box.

The isolation valve shall be placed in the location as shown on the plans and as directed by the Engineer. The meter setting shall be placed adjacent to the gate valve and the taps to the main line shall be made on both sides of the valve. The service tubing shall connect the meter setting to the main line taps and the setter will be placed with shutoffs in the 'Off' position. There meter shall not be required, nor delivered to the Owner.

4.3 Payment. The unit price bid shall constitute full compensation for furnishing and installing gate valves, isolation valves, valve boxes, and other related appurtenances.

SECTION 5 – FLUSH HYDRANT

5.0 Work Included. Under this item the Contractor shall provide all labor, tools, equipment, and materials to install the hydrants as shown on the drawings and as directed.

5.1 Materials. The hydrant shall conform to all of the applicable requirements of ANSI/AWWA C502 Standard. They shall have a sealed oil reservoir that will provide positive lubrication of the stem threads and bearing surfaces each time the hydrant is opened. The hydrant shoe shall be designed for maximum full flow and the hydrant working pressure shall be 200 PSI. The hydrant shall be two way type with two 2 1/2-inch openings or three way type with two 2 1/2-inch openings and one 4 1/2-inch opening as shown on the drawings and outlined in the Bid Schedule. Flush hydrants shall be manufactured by Mueller Co. or approved equal.

5.2 Installation. The hydrants shall be set in accordance with the detailed drawings complete with gate valve and connecting pipe. The hydrant shall be installed perpendicular to the surrounding ground surface and the hydrant riser shall be completely buried. The depth of bury shall be the same as the adjoining water line. The shoe of the hydrant shall be encased in Class B concrete and the concrete shall extend to undisturbed earth. Gravel shall be placed around the hydrant on top of the concrete thrust restraint and at the weep hole a minimum depth of twelve inches in depth. Select earth backfill shall be compacted to fill the remaining excavated void and the surface shall match the surrounding surface. The hydrant shall be secured to the companion gate valve by means of threaded rods secured to the valve and hydrant or by other approved means. The hydrant shall be coated with a prime coat and two finish coats of paint as suggested by the manufacturer and approved by the Engineer. The shop drawings shall indicate the coating and color proposal.

5.3 Payment. The unit price bid shall constitute full compensation for furnishing and installing the hydrant, gate valve, up to ten feet of water line, and any associated pipe fittings required to install the hydrant to the main water line.

SECTION 6 - CONNECTION

6.0 Work Included. Under this item the Contractor shall provide all labor, tools, equipment, and materials to connect and disconnect water mains as shown on the drawings and as directed.

6.1 Materials. The connections and disconnects shall be performed by the use of ductile iron mechanical joint fittings, approved tapping valves and sleeves, and water main pipe as shown on the drawings described elsewhere in these technical specifications. Concrete for thrust restraint shall be Class B concrete and sack-crete shall not be allowed.

6.2 Installation. The connections shall be made with a tapping sleeve and valve and done so in accordance with the Owners schedule of operation. Once the main line has been tapped the new section of water main shall be valved off from the rest of the system by closing the tapping valve. The tapping valve shall remain closed until the Engineer has been satisfied that the new water main has been installed correctly, met the requirements of the hydrostatic test, been sanitized in accordance with the regulatory requirements, and any water main to be abandoned has been disconnected from the water system. The disconnection of a water main that is to be abandoned shall be accomplished by installing a blind flange at the point of abandonment and secured by means of a concrete thrust block. In the event where the thrust block shall be installed in the area of the abandoned water main a minimum three foot section of the abandoned water main shall be removed and the void replaced with concrete.

6.3 Payment. The unit price bid shall constitute full compensation for furnishing and installing the connections including any abandonment or disconnections of the water mains. This shall include all fittings but water mains and gate valves shall be paid as per the bid schedule for those respective items.

SECTION 7 - AUTOMATIC AIR RELEASE VALVE

7.0 Scope of Work. Under this item the Contractor shall provide all labor, tools, equipment and materials to install automatic air release valves and air vacuum valves as shown on the drawings and as directed.

7.1 Materials. All air release valves shall be of the type which will automatically release air which accumulates in the pipe system. The body and cover shall be cast iron and the float shall be stainless steel. Unless otherwise indicated, the valves shall be suitable for use in lines having an average working pressure of 150 psi. The air relief valves shall be that as manufactured by Cla-Val Series 36, or approved equal. Valve shall be constructed of cast iron with a stainless steel float and linkage, and a Buna-N seat. A ball valve shall be installed below each air relief valve.

7.2 Installation. The air release valve boxes shall be Jumbo Utility Box as manufactured by Pentek Access Boxes by Highline Products, or approved equal. The top shall consist of a 30-inch x 30-inch single leaf hinged aluminum lid with locking latch and continuous hinge centered over air release valve.

The valves shall be connected to the water main with a saddle, corporation stop, and four inch nipple. The nipple shall consist of a 3/8-inch tap with shutoff for connection to a pressure gauge.

7.3 Payment. The unit price shall constitute full compensation for the furnishing and installation of the air release valve assembly including the air release valve, pit, lid and required piping.

SECTION 8 – MASTER METERS

8.0 Work Included. Under this item the Contractor shall provide all labor, tools, equipment, and materials to install the control valves and master meters in vaults and building as shown on the drawings and as described herein.

8.1 Materials. The master meter shall be a direct reading turbine type meter, with strainer, as manufactured by Badger Meter Inc., the type being the Recordall Compound Meter Series, or approved equal. Each meter shall be equipped with a companion plate strainer as shown also manufactured by Badger Meter Inc., or approved equal. Each meter shall be equipped with the Orion telemetry system compatible with the Owners current system. All piping for the station within the vault and buried extending to the point of connection to the main line shall be Ductile Iron CL350 with flanged ends. The ductile iron piping shall extend five feet beyond the vault on each side and connect to the main water line with a mechanical joint reducer. The gate valve shall be hand wheel operated and sized as shown on the Plans. All piping shall be flanged ductile iron 350 psi. The concrete vault shall be made of 4,000 PSI strength concrete and is shall be of the dimensions as shown of the Drawings. All walls of the vault shall be reinforced with No. 4 bars as shown on the Drawings. The vault shall be equipped with a 36-inch x 36-inch aluminum hatch(s), traffic rated, with a recessed padlock as manufactured by USF Foundry Model No. THS 2424 or approved equal.

8.2 Installation. The meter shall be installed within the concrete vault of the dimensions as shown on the drawings. The hatch opening shall be installed above the meter and the piping shall rest on concrete support piers as shown or directed by the engineer. A 4-inch drain shall be installed at the bottom of the vault and extended to daylight as directed by the Engineer.

8.3 Payment. The unit price shall constitute full compensation for the furnishing and installation of the master meter including, but not limited to, the valves, piping, vault, connection to the mainline, etc. as is shown on the bid schedule.

SECTION 9 - METER SETTINGS

9.0 Work Included. Under this item the Contractor shall provide all labor, tools, equipment, and materials to install the meter settings/vaults as shown on the drawings and as directed by the engineer.

9.1 5/8-inch x 3/4-inch Meters

9.1.1 Materials. The meter settings shall consist of a saddle, corporation stop, service tubing, coppersetter, meter, meter box, and appurtenances. The corporation stops shall be as manufactured by Ford F-Series with a pack joint for polyethylene pipe. Saddles shall be equal to the Ford S60 Series with a hinged pin for PVC and 202 Series for ductile iron. The coppersetter shall be equal to the Ford 60 Series Coppersetter V162-6W with a seven inch rise for a 5/8 inch by 3/4 inch meter and complete with an inlet ball valve and outlet single check valve. A tandem coppersetter to accommodate a pressure reducer and meter shall be used where specified. The pressure reducing valve shall be Mueller, Model No. H-9300 No. 3, or approved equal with a bronze strainer. Each regulator is to have an adjustable pressure range of 60-125 psi and to be set at 60 psi.

The meters shall be a displacement type magnetic drive cold water meter complying with ANSI/AWWA Standard C700, latest revision. They shall be manufactured by Badger Meter, Inc. and they shall be the Sealed Register Series type meter. The size of the meter shall be 5/8 inch by 3/4 inch or as shown otherwise on the Plans. The meter shall have a straight reading dial in U. S. gallons and must have a working pressure of 150 psi. Serial numbers shall be stamped on both the lid and meter body. Each meter shall be equipped with the Orion AMR system compatible with the Owners current system.

The meter boxes shall be equal to that as manufactured by Ametek, model 160104 for standard meter settings and they shall be 21 inches deep. The meter box shall be supplied in three pieces with a 3-inch and 6-inch extension to be used on each setting and the lid shall be cast iron. For tandem meter settings the box shall be model 190101 along with two 6-inch extensions.

Service tubing shall be 3/4 inch polyethylene or type K copper tubing with a minimum pressure rating of 200 PSI.

9.1.2 Installation. Meters shall be set as shown on the detail drawings with backfill neatly compacted in place. The top of the meter box shall be set 1/2 inch above grade. The meter shall be at least 18 inches below the ground surface.

Where applicable, the contractor is also responsible under this bid item for the abandonment of the existing meter settings. This includes disconnection at the direction of the engineer, removing all remnants of the meter box and all other related appurtenances to a point two feet below existing ground level. All existing interior

piping, meters, valves, and other appurtenances shall be removed and delivered to the owner prior to demolition and removal of the existing meter box.

Where applicable, the contractor is also responsible under this bid item for making the connection to the existing service line on the user side of the meter

9.2 1-inch and larger Meters

9.2.1 Materials. The meter settings shall consist of a saddle, corporation stop, service tubing or piping, coppersetter, meter, meter vault, and appurtenances. The corporation stops shall be as manufactured by Ford F-Series with a pack joint for polyethylene pipe. Saddles shall be equal to the Ford S60 Series with a hinged pin for PVC and 202 Series for ductile iron. The coppersetter shall be tandem type and equal to the Mueller Co. coppersetter Model No. B2423-2-63 having a maximum rise of twelve inches and being appropriate for the meter and pressure reducing valve specified herein. The coppersetter shall be complete with an inlet ball valve, outlet dual check valve and a bypass equipped with an inline ball valve and dual check valve. The pressure reducing valve shall be Bermad, Model No. 720, or approved equal equipped with an approved strainer. Each pressure regulator is to have an adjustable pressure range of 60-125 psi and to be set at 60 psi.

The meters shall be a displacement type magnetic drive cold water meter complying with ANSI/AWWA Standard C700, latest revision. They shall be manufactured by Badger Meter, Inc. and they shall be the Sealed Register Series type meter. The size of the meter shall be indicated on the Plans. The meter shall have a straight reading dial in U. S. gallons and must have a working pressure of 150 psi. The meter shall have a test plug to facilitate testing of the meter. Serial numbers shall be stamped on both the lid and meter body. Each meter shall be equipped with the Orion AMR system compatible with the Owners current system.

The meter vault shall be as shown on the drawings. It shall of the dimensions shown on the plans and be made up of 1-inch thick HDPE flat stock. The cover & hatch shall be made of aluminum with a load rating of 125 PSF. The hatch shall be 30”x30” with a continuous hinge and a locking latch.

The meter vaults shall be entirely pre-fabricated and the completed assembly shall be delivered to the site ready for installation. Meter vaults shall be supplied by the C.I. Thornburg Company or approved equal.

Service tubing shall be the appropriate size PVC, polyethylene or type K copper tubing with a minimum pressure rating of 250 PSI.

9.2.2 Installation. Meters shall be set as shown on the detail drawings with backfill neatly compacted in place. The top of the meter vault shall be set 1/2 inch above grade and the meter itself shall be at least 18 inches below the ground surface.

Where applicable, the contractor is also responsible under this bid item for the abandonment of the existing meter settings. This includes disconnection at the direction of the engineer, removing all remnants of the meter box/vault and all other related appurtenances to a point two feet below existing ground level. All existing interior piping, meters, valves, and other appurtenances shall be removed and delivered to the owner prior to demolition and removal of the existing meter box/vault.

Where applicable, the contractor is also responsible under this bid item for making the connection to the existing service line on the user side of the meter (i.e. Service Line Reconnection).

9.3 Payment. The unit price bid shall constitute full compensation for furnishing and installing the meter setting/vault with the above described appurtenances and procedures. Service tubing shall be paid by the linear foot. Installation of the service tubing through or beneath paved surfaces shall be considered as an incidental cost for the installation of the service tubing and there shall be no compensation for pavement replacement.

SECTION 10 -DIRECTIONAL DRILLING / BORING

10.0 Scope of Work. It is intent of this specification to define the acceptable methods and materials for installing water lines by the horizontal directional drilling method and the requirements for high density polyethylene (HDPE) pipe installed by horizontal directional drilling, directional boring, guided boring or in open cut trenches.

10.1 Requirements. Contractor shall provide HDPE pipe conforming to all standards and procedures, and meeting all testing and material properties as described in this specification for installation by horizontal directional drilling.

The estimated length of each directional bore is indicated on the plan sheets. This stated length shall be the footage used for the contractors payment calculation regardless of the actual length required for installation.

Contractor shall be responsible for all installation processes and procedures associated with the installation by horizontal directional drilling in accordance with this specification.

10.2 Installation Plan. At least 7 days prior to mobilizing equipment, Contractor shall submit his detailed installation plan to the Engineer.

The plan shall also include a listing of major equipment and supervisory personnel and a description of the methods to be used.

10.3 Variations in Plan or Profile. The Contractor may request changes to the proposed vertical and horizontal alignment of the installation and the location of the entry and exit points. Proposed changes shall be submitted in writing to the Engineer and receive approval of the Engineer prior to construction.

10.4 Alignment. The proposed plan and profile installation locations are based on alignments to accommodate acquired right-of-way, to avoid obstructions, and to properly maintain operation flow velocities.

10.5 Qualifications. Directional drilling and pipe installation shall be done only by an experienced Contractor specializing in directional drilling and whose key personnel have at least five (5) years experience in this work. Furthermore, the Contractor shall have installed directional drilled pipe at least as large as 12 inches in diameter, have performed crossings at least 650 feet in length, and successfully installed at least 2000 feet in length.

10.6 Products. High Density Polyethylene (HDPE) pipe accordance to these specifications shall be used in HDD installations. All piping system components shall be the products of one manufacturer and shall conform to the latest edition of ASTM D2447, ASTM D3350, and ASTM F714 for HDPE.

Pipe shall conform to the dimensionality and general characteristics of the mainline carrier piping to which it will be connected to. The inside diameter of the pipe to be used in HDD applications shall be equal to or greater than that of the mainline carrier piping.

10.7 Piping. Piping shall be extruded from a polyethylene compound and shall conform to the following requirements:

The polyethylene resin shall meet or exceed the requirements of ASTM D3350 for PE 3408 material with a cell classification of 335434C, or better. The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black, well dispersed by precompounding in a concentration of not less than 2 percent.

The maximum allowable hoop stress shall be 800 psi at 73.4 degrees F.

The pipe manufacturer shall be listed with the Plastic Pipe Institute as meeting the recipe and mixing requirements of the resin manufacturer for the resin used to manufacture the pipe in this project.

Joining shall be performed by thermal butt-fusion in accordance with the manufacturer's recommendations.

10.8 Execution. All HDD pipes shall be cut, fabricated, and installed in strict conformance with the pipe manufacturer's recommendations. Joining, laying, and pulling of HDD pipe shall be accomplished by personnel experienced in working with HDD pipe being used. The pipe supplier shall certify in writing that the Contractor is qualified to join, lay, and pull the pipe or representative of the pipe manufacturer shall be on site to oversee the pipe joining. Expense for the representative shall be paid for by the Contractor.

10.9 Transportation and Unloading. All pipe shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Care shall be taken during transportation of the pipe to ensure that it is not cut, kinked, or otherwise damaged. Any pipe damaged in shipment shall be replaced as directed by the owner or engineer.

Each pipe shipment should be inspected prior to unloading to see if the load has shifted or otherwise been damaged. Notify owner or engineer immediately if more than immaterial damage is found. Each pipe shipment should be checked for quantity and proper pipe size, color, and type.

Pipe should be loaded, off-loaded, and otherwise handled in accordance with AWWA M23, and all of the pipe supplier's guidelines shall be followed. Off-loading devices such as chains, wire rope, chokers, or other pipe handling implements that may scratch, nick, cut, or gouge the pipe are strictly prohibited.

During removal and handling, be sure that the pipe does not strike anything. Significant impact could cause damage, particularly during cold weather.

If appropriate unloading equipment is not available, pipe may be unloaded by removing individual pieces. Care should be taken to insure that pipe is not dropped or damaged. Pipe should be carefully lowered, not dropped, from trucks.

10.10 Handling and Storage. Any length of pipe showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work. Damaged areas, or possible areas of damage may be removed by cutting out and removing the suspected incident fracture area. Limits of the acceptable length of pipe shall be determined by the owner or engineer. Any scratch or gouge greater than 10% of the wall thickness will be considered significant and can be rejected unless determined acceptable by the owner or engineer.

Pipe shall be stored and stacked per the pipe supplier's guidelines. Pipe lengths should be stored and placed on level ground. Pipe should be stored at the job site in the unit packaging provided by the manufacturer. Caution should be exercised to avoid compression, damage, or deformation to the ends of the pipe. . If pipe is to be stored for periods of 1 year or longer, the pipe should be shaded or otherwise shielded from direct sunlight. Covering of the pipe which allows for temperature build-up is strictly prohibited. Pipe should be covered with an opaque material while permitting adequate air circulation above and around the pipe as required to prevent excess heat accumulation.

The open ends of all sections of joined and/or installed pipe (not in service) shall be plugged at night to prevent animals or foreign material from entering the pipe line or pipe section. Waterproof nightcaps of approved design may be used but they shall also be so constructed that they will prevent the entrance of any type of natural precipitation into the pipe and will e fastened to the pipe in such a manner that the wind cannot blow them loose. The practice of stuffing cloth or paper in the open ends of the pipe will be considered unacceptable.

Pipe shall be handled and supported with the use of woven fiber pipe slings or approved equal. Care shall be exercised when handling the pipe to not cut, gouge, scratch or otherwise abrade the piping in any way. Where possible, the pipe shall be raised and supported at a suitable distance back from the open end such that the open end will be below the level of the pipe at the point of support.

10.11 Installation.

The Contractor shall install the pipelines by means of horizontal directional drilling. The Contractor shall assemble, support, and pretest the pipeline prior to installation in the directional drill tunnel.

Horizontal directional drilling shall consist of the drilling of a small diameter pilot hole from one end of the alignment to the other, followed by enlarging the hole diameter for the pipeline insertion. The exact method and techniques for completing the directionally drilled installation will be determined by the Contractor, subject to the requirements of these Specifications.

The Contractor shall prepare and submit a plan to the Engineer for approval for insertion of the HDD pipe into the opened bore hole. This plan shall include pullback procedures, ballasting, use of rollers, side booms and side rollers, coating protection, internal cleaning, internal gauging, hydrostatic tests, dewatering, and purging.

The required piping shall be assembled in a manner that does not obstruct adjacent roadways or public activities. The Contractor shall erect temporary fencing around the entry and exit pipe staging areas.

10.12 Joining Pipe Sections. The joining of pipe sections shall be completed by a Fusion Technician who is fully qualified by the pipe supplier to install the HDD pipe of the type(s) and size(s) being used. Qualification shall be current as of the actual date of fusion performance on the project.

HDD pipe will be handled in a safe and non-destructive manner before, during, and after the fusion process and in accordance with this specification and pipe supplier's guidelines. The fusion process shall be performed by qualified fusion technicians, as documented by the pipe supplier. Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine.

Only appropriately sized and outfitted fusion machines that have been approved by the pipe supplier shall be used for the fusion process. Fusion machines must incorporate the following elements:

HEAT PLATE - Heat plates shall be in good condition with no deep gouges or scratches. Plates shall be clean and free of any debris or contamination. Heater controls shall function properly; cord and plug shall be in good condition. The appropriately sized heat plate shall be capable of maintaining a uniform and consistent heat profile and temperature for the size of pipe being fused, per the pipe supplier's guidelines.

CARRIAGE – Carriage shall travel smoothly with no binding at less than 50 psi. Jaws shall be in good condition with proper inserts for the pipe size being fused. Insert pins shall be installed with no interference to carriage travel.

GENERAL MACHINE - Overview of machine body shall yield no obvious defects, missing parts, or potential safety issues during fusion.

DATA LOGGING DEVICE – An approved datalogging device with the current version of the pipe supplier's recommended and compatible software shall be used.

Datalogging device operations and maintenance manual shall be with the unit at all times. If fusing for extended periods of time, an independent 110V power source shall be available to extend battery life.

Other equipment specifically required for the fusion process shall be used as necessary. Pipe rollers shall be used for support of pipe to either side of the machine. A weather protection canopy that allows full machine motion of the heat plate, fusion assembly and carriage shall be provided for fusion in inclement, extreme temperatures, and /or windy weather, per the pipe supplier's recommendations. An infrared (IR) pyrometer for checking pipe and heat plate temperatures. Fusion machine operations and maintenance manual shall be kept with the fusion machine at all times. Facing blades specifically designed for cutting HDPE pipe shall be used.

Each fusion joint shall be recorded and logged by an electronic monitoring device (data logger) connected to the fusion machine. The fusion data logging and joint report shall be generated by software developed specifically for the butt-fusion of HDPE. The software shall register and/or record the parameters required by the pipe supplier and these specifications. Data not logged by the data logger shall be logged manually and be included in the Fusion Technician's joint report.

10.13 Testing. The pipe shall be hydrostatically tested after joining into continuous lengths prior to installation and again after installation. Pressure and temperature shall be monitored with certified instruments during the test. After this test, the water will be removed with pigs. Erosion prevention procedures will be used during removal and discharge of the water. Hydrostatic testing shall be performed in accordance with Section 1 of the Specifications. All costs associated with acquiring water for testing shall be included in the established contract unit bid prices.

10.14 Tolerances. Pipe installed by the directional drilled method must be located in plan as shown on the Drawings, and must be no shallower than shown on the Drawings unless otherwise approved. The Contractor shall plot the actual horizontal and vertical alignment of the pilot bore at intervals not exceeding 30 feet. This "as built" plan and profile shall be updated as the pilot bore is advanced. The Contractor shall at all times provide and maintain instrumentation that will accurately locate the pilot hole and measure drilling fluid flow and pressure. The Contractor shall grant the Engineer access to all data and readout pertaining to the position of the bore head and the fluid pressures and flows.

When requested, the Contractor shall provide explanations of this position monitoring and steering equipment. The Contractor shall employ experienced personnel to operate the directional drilling equipment and, in particular, the position monitoring and steering equipment. No information pertaining to the position or inclination of the pilot bores shall be withheld from the Engineer.

Sags in the pipeline shall not exceed 5 percent of the nominal pipe diameter. Sags will only be allowed where the entering and exiting grades are adequate to provide velocities

through the sag area sufficient for moving solids. No more than (1) sag area shall occur between two (2) manholes. The alignment of each pilot bore must be approved by the Engineer before pipe can be pulled. If the pilot bore fails to conform to the above tolerances, the Engineer may, at his option, require new pilot boring to be made.

After the pipe is in place, cleaning pigs shall be use to remove residual water and debris. After the cleaning operation, the Contractor shall provide and run a sizing pig to check for anomalies in the form of buckles, dents, excessive out-of-roundness, and any other deformations. The sizing pig run shall be considered acceptable if the survey results indicate that there are no shaper anomalies (e.g. dens, buckles, gouges, and internal obstruction) greater than 2 percent of the nominal pipe diameter, or excessive ovality greater than 5 percent of the nominal pipe diameter. For gauging purposes, dent locations are those defined above which occur within a span of five feet or less. Pipe ovality shall be measured as the percent difference between the maximum and minimum pipe diameters. For gauging purposes, ovality locations are those defined above which exceed a span of five feet.

10.15 Ream and Pullback.

Reaming: Reaming operations shall be conducted to enlarge the pilot after acceptance of the pilot bore. The number and size of such reaming operations shall be conducted at the discretion of the Contractor.

Pulling Loads: The maximum allowable pull exerted on the HDD pipelines shall be measured continuously and limited to the maximum allowed by the pipe manufacturer so that the pipe or joints are not over stressed.

Torsion and Stresses: A swivel shall be used to connect the pipeline to the drill pipe to prevent torsional stresses from occurring in the pipe. The lead end of the pipe shall be closed during the pullback operation.

Pipeline Support: The pipelines shall be adequately supported by rollers and side booms and monitored during installation so as to prevent over stressing or buckling during the pullback operation. Such support/rollers shall be spaced at a maximum of 60 feet on centers, and the rollers to be comprised of a nonabrasive material arranged in a manner to provide support to the bottom and bottom quarter points of the pipeline allowing for free movement of the pipeline during pullback. Surface damage shall be repaired by the Contractor before pulling operations resume.

The contractor shall at all times handle the HDD pipe in a manner that does not over stress the pipe. Vertical and horizontal curves shall be limited so that wall stresses do not exceed 50% of yield stress for flexural bending of the pipe. If the pipe is buckled or otherwise damaged, the damaged section shall be removed and replaced by the Contractor at his expense. The Contractor shall take appropriate steps during pullback to ensure that the pipe will be installed without damage.

10.16 Handling Drilling Fluids and Cuttings.

During the drilling, reaming, or pullback operations, the Contractor shall make adequate provisions for handling the drilling fluids, or cuttings at the entry and exit pits. These fluids must not be discharged into the waterway. When the Contractor's provisions for storage of the fluids or cuttings on site are exceeded, these materials shall be hauled away to a suitable legal disposal site. The Contractor shall conduct his directional drilling operation in such a manner that drilling fluids are not forced through the subbottom into the waterway. After completion of the directional drilling work, the entry and exit pit locations shall be restored to original conditions. The Contractor shall comply with all permit provisions.

Pits constructed at the entry or exit point area shall be so constructed to completely contain the drill fluid and prevent its escape to the waterway. The Contractor shall utilize drilling tools and procedures which will minimize the discharge of any drill fluids. The Contractor shall comply with all mitigation measures listed in the required permits and elsewhere in these Specifications.

To the extent practical, the Contractor shall maintain a closed loop drilling fluid system.

The Contractor shall minimize drilling fluid disposal quantities by utilizing a drilling fluid cleaning system which allows the returned fluids to be used.

As part of the installation plan specified herein before, the Contractor shall submit a drilling fluid plan which details types of drilling fluids, cleaning and recycling equipment, estimated flow rates, and procedures for minimizing drilling fluid escape.

10.17 Drilling Operations.

The Contractor shall prepare a plan to be submitted for Engineer approval which describes the noise reduction program, solids control plant, pilot hole drilling procedure, the reaming operation, and the pullback procedure. All drilling operations shall be performed by supervisors and personnel experienced in horizontal directional drilling. All required support, including drilling tool suppliers, survey systems, mud cleaning, mud disposal, and other required support systems used during this operation shall be provided by the Contractor.

Drill pipe shall be API steel drill pipe, Range 2, Premium Class or higher, Grade S-135 in a diameter sufficient for the torque and longitudinal loads and fluid capacities required for the work. Only drill pipe inspected under API's Recommended Practice Specification API RP 7G within 30 days prior to start and certified as double white band or better shall be used.

A smoothly drilled pilot hole shall follow the design centerline of the pipe profile and alignment described on the construction drawings.

Between the entry or exit point the Contractor shall provide and use a separate steering system employing a ground survey grid system, such as "TRU-TRACKER" or equal wherever possible. The exit point shall fall within a rectangle 5 feet wide and 10 feet long centered on the planned exit point.

During the entire operation, waste and leftover drilling fluids from the pits and cuttings shall be dewatered and disposed of in accordance with all permits and regulatory agencies requirements. Remaining water shall be cleaned by Contractor to meet permit requirements.

Technical criteria for bentonite shall be as given in API Spec. 13A, Specification or Oil Well Drilling Fluids Material for fresh water drilling fluids. Any modification to the basic drilling fluid involving additives must describe the type of material to be used and be included in Contractor's drilling plan presented to the Engineer. The Owner retains the right to sample and monitor the waste drilling mud, cuttings and water.

10.18 Environmental Provisions.

The Horizontal Directional Drilling operation is to be operated in a manner to eliminate the discharge of water, drilling mud and cuttings to the adjacent creek or land areas involved during the construction process. The Contractor shall provide equipment and procedures to maximize the recirculation or reuse of drilling mud to minimize waste. All excavated pits used in the drilling operation shall be lined by Contractor with heavy duty plastic sheeting with sealed joints to prevent the immigration of drilling fluids and/or groundwater.

The Contractor shall visit the site and must be aware of all structures and site limitations at the directional drill crossing and provide the Engineer with a drilling plan outlining procedures to revent drilling fluid from adversely affecting the surrounding area.

The general work areas on the entry and exit sides of the crossing shall be enclosed by a berm to contain unplanned spills or discharge.

Waste cuttings and drilling mud shall be processed through a solids control plant comprised as a minimum of sumps, pumps, tanks, desalter/desander, centrifuges, material handlers, and haulers all in a quantity sufficient to perform the cleaning/separating operation without interference with the drilling program. The cutting and excess drilling fluids shall be dewatered and dried by the Contractor to the extent necessary for disposal in offsite landfills. Water from the dewatering process shall be treated by the Contractor to meet permit requirements and disposed of locally. The cuttings and water for disposal of locally. The cuttings and water for disposal are subject to being sampled and tested. The construction site and adjacent areas will be checked frequently for signs of Unplanned leaks or seeps.

Equipment (graders, shovels, etc.) and materials (such as groundsheets, hay bales, booms, and absorbent pads) for cleanup and contingencies shall be provided in sufficient quantities by the Contractor and maintained at all sites for use in the event of inadvertent leaks, seeps or spills.

Waste drilling mud and cuttings shall be dewatered, dried, and stock piled such that it can be loaded by a front end loader, transferred to a truck and hauled offsite to a suitable legal disposal site. The maximum allowed water content of these solids is 50% of weight. Due to a limited storage space at the worksite, dewatering and disposal work shall be concurrent with drilling operations. Treatment of water shall satisfy regulatory agencies before it is discharged.

10.19 Payment. The estimated length of each directional bore is indicated on the plan sheets. This stated length shall be the footage used for the contractors payment calculation regardless of the actual length required for installation.

SECTION 11 - PAVEMENT REPLACEMENT

11.0 Work Included. Under this item the Contractor shall provide all labor, tools, equipment, and materials to install the concrete and bituminous pavement replacement that is disturbed during construction.

11.1 Materials. The Contractor shall use Class A concrete for all concrete pavement that is to be replaced and it shall be reinforced with No. 4 reinforcing bars placed on twelve inch centers both ways unless directed otherwise.

Pavement replacement for bituminous surfaces shall consist of a prime coat of emulsified asphalt, Class 1 Bituminous Binder, and Class 1 Bituminous Concrete as specified by the Kentucky Bureau of Highways latest specifications.

Support gravel shall be No. 4 stone, No. 57 stone, and dense grade aggregate.

11.2 Installation. Immediately upon placement of the water lines and appurtenances the disturbed traveled way shall be backfilled with No. 57 stone or dense grade aggregate extending from the top of the pipe to the traveled way surface. The area of disturbance will be repaved once settlement has subsided or once installation of the water line has been completed as directed by the Engineer.

Where concrete pavement replacement is required the top twelve inches of stone backfill shall be tamped with a mechanical tamping machine and the lifts shall not exceed twelve inches. The use of rubber tire or track driven equipment such as backhoes or dozers shall not satisfy the requirement for final tamping. The reinforcing steel shall be placed within three inches of the surface of the concrete to be replaced and it shall be supported with concrete support pieces. The area to be repaved shall be formed to coincide with the adjoining concrete surfaces and the edges of the repaved area shall be smooth and uniform. The concrete shall be placed on top of the compacted gravel at a depth of six inches minimum and the surface shall be flush with the adjoining surface. The surface finish shall match the adjoining surface finish and the locations where the repaved surface connect to the existing surface shall be smooth and uniform such that ponding shall not occur.

Where bituminous pavement replacement is required the pipe trench shall be backfilled and the surface prepared as describe above for concrete pavement replacement. Upon placement of the bituminous the surface shall be prepared with a prime coat applied at the rate of 0.35 gallons per square yard. A 2-inch thick layer of bituminous binder shall then be placed above the prime coat. The final coat of bituminous concrete shall then be placed at a depth of 1 1/2 inches and rolled to a smooth finish connecting with the existing pavement.

11.3 Final Acceptance. All pavement that is replaced shall be inspected prior to the final warranty period expiration. Any pavement replacement found to be deteriorated or not uniform due to settlement of the disturbed subsurface shall be repaired before the work is recommended for final acceptance. It is anticipated that this inspection shall take place on or about the eleventh month of the one year warranty period. The warranty period for all pavement replacement shall not commence until the final warranty period for the project in its entirety is initiated.

11.4 Payment. Pavement Replacement shall be incidental to the installation of the water line. There shall be no separate pay item for pavement replacement.

SECTION 12 - EXPLORATION

12.0 Work Included. Under this item the Contractor shall provide all labor, tools, equipment, and materials to explore for existing water lines and appurtenances that are not as shown on the Drawings.

12.1 Description of Work. In those locations where the existing water lines and appurtenances are not in the locations as shown on the Drawings the Contractor shall explore for the utility at the direction of the Engineer. The Contractor shall utilize all equipment necessary to search for the water line or appurtenance and any disturbance of other utilities shall be the responsibility of the Contractor. Any other work or disturbance created by the Contractor as a result of the exploration shall be incidental to this item.

In locations where new water lines are to be installed parallel to existing lines, the contractor shall locate existing water lines in 100 foot intervals. This particular requirement shall be considered incidental to the installation of the water lines and it shall not be included in the calculation of this pay item.

12.2 Payment. The unit price bid shall constitute full compensation for the exploration of the water lines and appurtenances. The Resident Engineer shall approve the Contractor to initiate and terminate the exploration and the Resident Engineer shall monitor the amount of time in 15 minute increments.

SECTION 13 – EROSION CONTROL

13.0 Scope of Work. It is intent of this specification to define the acceptable methods and materials for preparing storm water Best Management Plan and Notice of Intent, installing all applicable erosion control measures in accordance with Best Management Practice Plan and as specified and maintain erosion control measures as needed.

13.1 Installation Plan.

13.1.1 Minimize Disturbance and Buffer Strips Only areas necessary for construction shall be disturbed, cleared or graded. Vehicles and construction equipment shall be excluded from these areas so to preserve all natural vegetation. All areas that are disturbed during construction, including slopes, shall be protected during clearing and construction in accordance with the approved erosion and sediment control plan until they are permanently stabilized.

If top soil is needed for the re-establishment of vegetation, it shall be piled until the necessary amount needed to finish grading of all exposed areas. Areas that are to be filled shall be cleared, grubbed to remove trees, vegetation, roots and other objectionable material, and stripped of topsoil.

Areas to receive topsoil shall be scarified to a minimum depth of three inches prior to the placement of topsoil. All fills shall be compacted as required by building standards to reduce erosion, slippage, settlement, subsidence and other related problems. Fill intended to support buildings, structures, conduits, etc., shall be compacted in accordance with local requirements or codes.

13.1.2 Land Grading for Minimizing Erosion. Only areas necessary for construction shall be disturbed, cleared or graded. Vehicles and construction equipment shall be excluded from these areas so to preserve all natural vegetation. All areas that are disturbed during construction, including slopes, shall be protected during clearing and construction in accordance with the approved erosion and sediment control plan until they are permanently stabilized. All sediment control measures shall be constructed and maintained in accordance with the approved erosion and sediment control plan and according to the standards and specifications for the appropriate erosion control practices.

If top soil is needed for the re-establishment of vegetation, it shall be piled until the necessary amount needed to finish grading of all exposed areas. Areas to receive topsoil shall be scarified to a minimum depth of three inches prior to the placement of topsoil.

The outer face of the fill slope should always be allowed to stay loose, not rolled, compacted, or bladed smooth. A bulldozer may run up and down the fill slope so the dozer treads create groves perpendicular to the slope. Use slope breaks, such as diversions, benches, or contour furrows as appropriate, to reduce the length of cut-and-fill slopes to limit sheet and rill erosion and prevent gullying. The finish cut-and-fill slopes,

which are to be vegetated with grass and legumes, should not be steeper than two horizontal to one vertical.

Roughen the surface of all slopes during the construction operation to retain water, increase infiltration, and facilitate vegetation establishment.

Seeps or springs encountered during construction shall be handled in accordance with approved methods.

Stabilize all graded areas with vegetation, crushed stone, rip-rap, or other ground cover as soon as grading is completed or if work is interrupted for 21 working days or more.

Use mulch to stabilize areas temporarily where final grading must be delayed. Stockpiles, borrow areas and spoil areas shall be shown on the plans and shall be stabilized to prevent erosion and sedimentation.

13.1.3 Erosion Control Blankets and Matting.

A. Site Preparation. Proper Site Preparation is essential to ensure complete contact of the protection matting with the soil. Grade and shape area of installation. Remove all rocks, clods, vegetation or other obstructions so that the installed blankets, or mats will have direct contact with the soil. Prepare seedbed by loosening two to three inches of topsoil above final grade. Incorporate amendments, such as lime and fertilizer, into soil according to soil test and the seeding plan.

B. Seeding. Seed area before blanket installation for erosion control and re-vegetation or seed after mat installation for turf reinforcement. When seeding prior to blanket installation, all check slots and other areas disturbed during installation must be re-seeded. Where soil filling is specified, seed the matting and the entire disturbed area after installation and prior to filling the mat with soil.

C. Anchoring. U-shaped wire staples, metal geotextile stake pins or triangular wooden stakes can be used to anchor mats to the ground surface. Wire staples should be a minimum of 11 gauge. Metal stake pins should be 3/16 inch diameter steel with a 1 ½ inch steel washer at the head of the pin. Wire staples and metal stake should be driven flush to the soil surface. Two inches of wood staking should remain above the soil surface. All anchors should be six to eight inches long and have sufficient ground penetration to resist pullout. Longer anchors may be required for loose soils.

D. Installation on Slopes. Begin at the top of the slope and anchor its blanket in a six inches deep by six inches wide trench. Backfill trench and tamp earth firmly. Unroll blanket down slope in the direction of the water flow. Lay blankets loosely and maintain direct contact with the soil. Do not stretch. The edges of adjacent parallel rolls must be overlapped two to three inches and be stapled every three feet. When blankets must be spliced, place blankets end over end (shingle style) with six inches overlap. Staple through overlapped area, approximately twelve inches apart.

Blankets shall be stapled sufficiently to anchor blanket and maintain contact with the soil. Staples shall be placed down the center and staggered with the staples placed along the edges Steep slopes, 1:1 to 2:1, require 2 staples per square yard. Moderate slopes, 2:1 to 3:1, require 1 ½ staples per square yard (1 staple three feet on center). Gentle slopes require 1 staple per square yard.

E. Installation in Channels. Dig initial anchor trench twelve inches deep and six inches wide across the channel at the lower end of the project area. Excavate intermitten check slots, six inches deep and six inches wide across the channel at twenty five to thirty five foot intervals along the channel. Cut longitudinal channel anchor slots four inches deep and four inches wide along each side of the installation to bury edges of matting, whenever possible extend matting two to three inches above the crest of channel side slopes.

Beginning at the downstream end and in the center of the channel, place the initial end of the first roll in the anchor trench and secure with fastening devices at one foot intervals. Note: matting will initially be upside down in anchor trench.

In same manner, position adjacent rolls in anchor trench, overlapping the preceding roll a minimum of three inches. Secure these initial ends of the mats with anchors at one foot intervals, backfill and compact soil. Unroll center strip of matting upstream. Stop at next check slot or terminal anchor trench. Unroll adjacent mats upstream in similar fashion, maintaining three inch overlap.

Fold and secure all rolls of matting snugly into all transverse check slots. Lay mat in the bottom of the slot the fold back against itself. Anchor through both layers of mat at one foot intervals the backfill and compact soil. Continue rolling all mat widths upstream to the next check slot or terminal anchor trench. Alternate method for non-critical installations: place two rows of anchors on six inch centers at twenty five to thirty foot intervals in lieu of excavated check slots.

Shingle-lap spliced ends by a minimum of one foot with upstream mat on top to prevent uplifting by water or begin new rolls in a check slot. Anchor overlapped area by placing two rows of anchors, one foot apart on one foot intervals.

Place edges of outside mats in previously excavated longitudinal slots, anchor using prescribed staple pattern, backfill and compact soil.

Anchor, fill and compact upstream end of map in a twelve inch by six inch terminal trench. Secure mat to ground surface using U-shaped wire staples geotextile pins or wooden stakes. Seed and fill turf reinforcement matting with soil, if specified. After seeding, spread and lightly rake ½ inch to ¾ inch of fine topsoil into the mat apertures to completely fill mat thickness. Use backside of rake or other flat implement.

Spread topsoil using lightweight loader, backhoe, or other power equipment. Avoid sharp turns with equipment. Do not drive tracked or heavy equipment over mat. Avoid any

traffic over matting if loose or wet soil conditions exist. Use shovels, rakes or brooms for fine grading and touch up. Smooth out soil filling just exposing top netting of matrix.

F. Inspection and Maintenance. All blanket and mats should be inspected periodically following installation. Inspect installation after significant rainstorms to check for erosion and undermining. Any failure should be repaired immediately. If washout or breakage occurs, reinstall the material after repairing the damage to the slope or drainage way.

13.1.4 Topsoiling. Determine whether the quality and quantity of available topsoil justifies selective handling. Soils of the textural class of loam, sandy loam, and silt loam are best; sandy clay loam, silty clay loam, clay loam, and loamy sand are fair. Do not use heavy clay and organic soils such as peat or muck as topsoil.

Strip topsoil only from those areas that will be disturbed by excavation, filling, road building, or compaction by equipment. Determine depth of stripping by taking soil cores at several locations within each area to be stripped. Put sediment basins, diversions, and other controls into place before stripping. Select stockpile location to avoid slopes, natural drainage ways, and traffic routes. Use sediment fences or other barriers where necessary to retain sediment.

Protect topsoil stockpiles by temporarily seeding and/or mulching as soon as possible to assure the stored material is not exposed and allowed to erode.

If stockpiles will not be used within twelve months they must be stabilized with permanent vegetation to control erosion and weed growth.

Before spreading topsoil, establish erosion and sedimentation control practices such as diversions, berms, dikes, waterways, and sediment basins.

Where the pH of the existing subsoils 6.0 or less, or the soil is composed of heavy clays, incorporate agricultural limestone in amounts recommended by soil tests or specified for the seeding mixture to be used. Incorporate lime to a depth of at least two inches by disking.

Immediately prior to spreading the topsoil, loosen the subgrade by disking or scarifying to a depth of at least three inches, to ensure bonding of the topsoil and subsoil. If no amendments have been incorporated, loosen the soil to a depth of at least six inches before spreading topsoil.

Uniformly distribute topsoil to a minimum compacted depth of two inches on 3:1 slopes and four inches on flatter slopes.

Do not spread topsoil while it is frozen or muddy or when the subgrade is wet or frozen.

Correct any irregularities in the surface that result from topsoiling or other operations to prevent the formation of depressions or water pockets.

Compact the topsoil enough to ensure good contact with the underlying soil, but avoid excessive compaction, as it increases runoff and inhibits seed germination. Light packing with a roller is recommended where high maintenance turf is to be established.

13.1.5 Temporary Gravel Construction Entrance. The aggregate size for construction of the pad shall be two to three inch stone. Place the gravel to the specific grade and dimensions shown on the plans, and smooth it.

The thickness of the pad shall not be less than six inches. Use geotextile fabrics, if necessary, to improve stability of the foundation in locations subject to seepage or high water table.

The width of the pad shall not be less than the full width of all points of ingress or egress and in any case shall not be less than twelve feet wide.

The length of the pad shall be as required, but not less than fifty feet.

Locate construction entrances and exits to limit sediment leaving the site and to provide for maximum utility by all construction vehicles. Avoid entrances which have steep grades and entrances at curves in public roads.

The entrance shall be maintained in a condition that will prevent tracking or flowing of sediment onto public rights of way. This may require periodic top dressing with additional stone as conditions demand, and repair and/or clean out of any measures used to trap sediment.

All sediment spilled, dropped, washed or tracked onto public rights-of-way shall be removed immediately. Provide drainage to carry water to a sediment trap or other suitable outlet.

When necessary, wheels shall be cleaned to remove sediment prior to entrance onto public rights-of-way. When washing is required, it shall be done on an area stabilized with crushed stone that drains into an approved sediment trap or sediment basin.

All sediment shall be prevented from entering any storm drain, ditch or watercourse through use of sand bags, gravel, straw bales, or other approved methods.

Maintain the gravel pad in a condition to prevent mud or sediment from leaving the construction site. Replace gravel material when surface voids are visible. After each rainfall, inspect any structure used to trap sediment and clean it out as necessary. Immediately remove all objectionable material spilled, washed, or tracked onto public roadways. Remove all sediment deposited on paved roadways within 24 hours.

13.1.6 Rock, Log and Straw Bale Check Dams. The maximum spacing between the dams shall be such that the toe of the upstream dam is at the same elevation as the top of the downstream dam.

Rock dams shall be constructed of two to fifteen inch rock. Keep the center rock (spill way) section at least six inches lower than the outer wall edges. Extend the abutments eighteen inches into the channel bank.

Straw bales shall be placed in a single row, lengthwise, oriented perpendicular to the flow, with the ends of adjacent bales tightly abutting one another. Straw bales shall be extended such that the bottoms of the end bales are higher in elevation than the top of the middle bale spillway to ensure that sediment-laden runoff will flow over the barrier, and not around it.

Each straw bale shall be embedded in the soil a minimum of four inches. Use straw, rocks, or filter fabric to fill any gaps between the bales and tamp the backfill material to prevent erosion under or around the bales. If the straw bales are wire bound, they should be oriented so the bindings are around the sides rather than along the top and bottom. Wire bindings that are placed in contact with the soil soon disintegrate and may allow the bale to fall apart.

Construct an energy dissipater to reduce downstream erosion.

The check dams shall be inspected for damage periodically during the winter and after each significant storm (one inch in 24 hours). Prompt repairs shall be made to ensure that the dam is functioning properly. Any erosion caused by flows around edges of the dam or under the structure shall be corrected immediately.

Remove sediment from behind the dams when they become sixty percent full, or as needed. The removed sediment shall be deposited in an area that will not contribute sediment off site and can be permanently stabilized. Remove check dams and stakes when stabilization is complete.

13.1.7 Straw Bale Dike. The bales shall be placed on the slope contour at the base of the slope or around the perimeter of the construction site. If the dike is constructed at the toe of a slope, place it five to six feet away from the slope if possible.

Do not construct the dike more than one bale high. Bales shall be placed in a row with the ends tightly abutting. Each bale shall be embedded in the soil a minimum of four inches. Use straw, rocks, or filter fabric to fill any gaps between the bales and tamp the backfill material to prevent erosion under or around the bales.

If the bales are wire bound, they should be oriented so the bindings are around the sides rather than along the top and bottom. Wire bindings that are placed in contact with the soil soon disintegrate and may allow the bale to fall apart.

The bales shall be securely anchored in place by two wooden stakes or rebar driven through the bales. The first stake in each bale shall be driven toward the previously laid bale to force the bales tightly together. Drive the stakes at least eighteen inches into the ground.

The straw bale dikes shall be inspected weekly and after each significant storm (one inch in 24 hours). Repairs and/or replacement shall be made promptly. Remove the straw bales when the upslope areas have been permanently stabilized. Remove sediment behind barrier when it reaches a depth of 6 inches.

13.1.8 Silt Fence. The height of a silt fence shall not exceed thirty six inches. Storage height shall never exceed eighteen inches. The fence line shall follow the contour as closely as possible. If possible, the filter fabric shall be cut from a continuous roll to avoid the use of joints. When joints are necessary, filter cloth shall be spliced only at a support post, with a maximum six inch overlap and both ends securely fastened to the post.

Posts shall be spaced a maximum of ten feet apart and driven securely into the ground (minimum of twelve inches). When extra strength fabric is used without the wire support fence, post spacing shall not exceed six feet. Turn the ends of the fence uphill.

A trench shall be excavated approximately four inches wide and six inches deep along the line of posts and upslope from the barrier.

When standard-strength filter fabric is used, a wire mesh support fence shall be fastened securely to the upslope side of the posts using heavy duty wire staples at least one inch long, tie wires or hog rings. The wire shall extend into the trench a minimum of two inches and shall not extend more than thirty six inches above the original ground surface.

The standard-strength filter fabric shall be stapled or wired to the fence, and six inches of the fabric shall extend into the trench. The fabric shall not extend more than thirty six inches above the original ground surface. Filter fabric shall not be stapled to existing trees.

When extra-strength filter fabric and closer post spacing are used, the wire mesh support fence may be eliminated. In such a case, the filter fabric is stapled or wired directly to the posts.

The trench shall be backfilled and the soil compacted over the toe of the filter fabric.

Silt fences placed at the toe of a slope shall be at least six feet from the toe in order to increase ponding volume.

Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized, and any sediment stored behind the silt fence has been removed.

Silt fences and filter barriers shall be inspected weekly and after each significant storm (one inch in 24 hours). Any required repairs shall be made immediately. Sediment shall be removed when it reaches 1/3 height of the fence or nine inches maximum.

9.1.9 Drop Inlet Sediment Barriers.

A. Straw Bale Barrier. Excavate a four inch deep trench around the inlet and make the trench as wide as a straw bale in order to embed the bales properly. Orient the straw bales with the bindings around the sides of the bales so the wire does not come in contact with the soil.

Place bales lengthwise around the inlet and press the ends of adjacent bales together. The bales may be loosely joined if more gravel is utilized.

Drive two two by two inch stakes through each bale to anchor the bale securely in place.

Utilize ¾ inch to two inch gravel to fill the void spaces between the bales if necessary to dewater the ponded area more rapidly.

B. Silt Fence Sediment Barrier. Support posts for a silt fence must be steel fence posts or two inch by four inch wood, length three feet minimum, spacing three feet maximum, with a top frame support recommended. Excavate a trench four inches wide and six inches deep and bury the bottom of the silt fence in the trench. Backfill the trench with gravel or soil. Compact backfill well. The height of the silt fence shall be a maximum of eighteen inches measured from the top of the inlet.

Inspect the barrier after each rain and promptly make repairs as needed. Sediment shall be removed after each significant storm (one inch in 24 hours) to provide adequate storage volume for the next rain. The removed sediment shall be deposited in an area that will not contribute sediment off-site and can be permanently stabilized. For gravel filters, if the gravel becomes clogged with sediment it must be carefully removed from the inlet and either cleaned or replaced.

13.1.10 Curb Inlet Sediment Barriers. Place the barriers on gently sloping streets where water can pond. The barriers must allow for overflow from a severe storm event. Slope runoff shall be allowed to flow over blocks and gravel and not be bypassed over the curb. A spillway shall be constructed with the sandbag structures to allow overflow.

The sandbags should be of woven-type geotextile fabric since burlap bags deteriorate rapidly. Sandbags shall be filled with ¾ inch drain rock or ¼ inch pea gravel.

The sandbag shall be placed in a curved row from the top of the curb at least three feet into the street. The row should be curved at the ends, pointing uphill.

Several layers of bags should be overlapped and packed tightly. Leave a one-sandbag gap in the top row to act as a spillway.

Inspect and clean the barrier after each significant storm (one inch in 24 hours) and remove sediment from behind the structure after every storm. Any sediment and gravel shall be immediately removed from the traveled ways of roads. The removed sediment shall be placed where it cannot enter a storm drain, stream, or be transported off site.