

## **Exhibit B**



# **Kershaw County Utilities Sanitary Sewer Standards**

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### **Sanitary Sewer Standards**

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# Section 1

## Gravity Sanitary Sewer System

### Design Standards

#### A. GENERAL

- 1) The following sanitary sewer system design standards are based on Federal, State and local health requirements and the requirements of Kershaw County Utilities.
- 2) These design standards are applicable to all developments, subdivisions and/or parks requiring sanitary sewer service from Kershaw County.

#### B. GRAVITY SEWER SYSTEM DESIGN CRITERIA

- 1) Minimum main line size: 8 Inch
- 2) Service Lines:
  - a. Single service line may only serve one residential unit.
  - b. A single service line may serve up to two (2) residential units or one commercial building upon written approval from Kershaw County.
  - c. 8 inch service lines shall be installed on a multi-family building consisting of more than four (4) units. 2 Units shall be 6 inch lines.
  - d. 8 inch lines shall connect to a manhole.
- 3) Minimum Pipe Slope Per 100 feet:
  - a. Main lines:
    - 8-inch: 0.34%
    - 10-inch: 0.28%
    - 12-inch: 0.22%
    - 15-inch: 0.15%
    - 18-inch: 0.12%
    - 20-inch or 21 inch: 0.10%
    - 24-inch: 0.08%
  - b. Service lines:

4-inch 2.0%

6-inch 1.0%

8-Inch 0.4%

### C. CAPACITY DESIGN

- 1) Minimum flow for residential or apartment unit: 360 gallons per day per unit.
- 2) All other flows: comply with the unit contributory loading criteria, Appendix A of the South Carolina Department of Health and Environmental Control Standards for Wastewater Facility Construction: Reg. 61-67.

### D. SEWER PIPES

- 1) Straight alignment and uniform slope between manholes.
- 2) Depth adequate to receive wastewater from the lowest service and prevent freezing.
- 3) Slopes greater than 20%, anchor using concrete anchors.
- 4) Where a smaller sewer joins a larger one, match the crowns of each.
- 5) Residential service laterals should be located at the property pin from opposite corner of water service line.
- 6) Locate sewer mains and manholes outside of paved roadway.

### E. COVER

- 1) Provide suitable cover on all lines. Minimal cover depth as follows:
  - a. Less than 8 inch diameter: 30 inches
  - b. 8 inch to 12 inch diameter: 36 inches
  - c. 14 inch diameter and larger: 48 inches
  - d. All piping located within a public right-of- way shall be constructed in accordance with applicable permits and Kershaw County Utilities minimum requirements.
  - e. Special conditions other than those listed above may be approved if requested in writing from Kershaw County Utilities.

### F. DUCTILE IRON PIPE LOCATIONS

- 1) Use ductile iron pipe where sanitary sewer:

- a. Crosses beneath water mains with less than 18 inches separation.
- b. Crosses beneath storm drainage pipe with less than three (3) feet of clearance.
- c. Crosses any water bodies.
- d. Is installed in casing.
- e. Cover is less than the minimum prescribed in Part E above.

## G. MANHOLES

- 1) Manhole diameter:
  - a. Minimum diameter shall be 48 inches.
  - b. For sewers 8 inches up to 12 inches manholes shall be a minimum of four (4) feet in diameter.
  - c. For sewers 14 inches to 18 inches manholes are to be a minimum of five (5) feet.
  - d. For sewers 21 inches and larger manholes are to be six (6) feet diameter.
  - e. A minimum access diameter of 24 inches shall be provided.
- 2) Drop Type: A drop manhole shall be used for a sewer entering a manhole at an elevation of 24 inches or more above the manhole invert.
  - a. All drop manholes must be inside drops with a minimum of a five (5) foot diameter for pipe up to 18" and six (6) foot diameter for pipe larger than 18"
  - b. If manhole invert is less than 24 inches, the invert shall be filleted to prevent solids deposition.
- 3) Manhole Location:
  - a. At the end of each line
  - b. At all changes in grade, size or alignment.
  - c. At all intersections and at distances not greater than 400 feet
- 4) Manhole top elevations:
  - a. Shall be at finished grade elevation
  - b. If located in pavement, shall be set to match finished pavement grade.
  - c. Watertight manhole covers are to be used wherever the manhole tops may be flooded by street runoff, high water or below the 50 year flood elevation

## SECTION 2

### GRAVITY SANITARY SEWER MATERIALS FOR CONSTRUCTION

#### A. PIPE AND FITTINGS

1) Ductile-iron fittings (DIP):

- a. Ductile iron pipe shall be in accordance with ANSI A21.50/AWWA C150 and conform to the requirements of ANSI A21.51/AWWA C151, latest standards. Push-on and restrained joint pipe shall have a minimum rated working pressure of 150 psi. All buried pipe shall be pressure class as follows:

Pipe Size (INCH)	Pressure Class (Psi)
6-12	350
14-20	250
24	200
30-64	150

- b. Ductile Iron Pipe and fittings shall be furnished with push-on joints, push-on restrained joints, and mechanical joints as required. Pipe ends (spigot end, bell, and socket) for all pipes shall be gauged with suitable gauges at sufficiently frequent intervals to ensure compliance to the standard dimensions of ANSI/AWWA C151/A1.5, latest edition.
- c. Push on joints shall conform to ANSI A21.11/AWWA C111 approved Fastite, Tyton, Bell-tite, or equal.
- d. Mechanical joints shall conform to AWWA C111. Bolts shall be high strength low alloy steel per AWWA C111.
- e. Restrained Joint Pipe and Fittings:
- 1) Provide restrained joint pipe and fittings on all piping at each fitting, valves and on the pipe joints.
  - 2) Provide for use with mechanical joint pipe and fittings.
  - 3) Restrained joint pipe will be indicated clearly on plans. The location and length of restrained joint pipe will be clearly marked on the drawings.
  - 4) Acceptable products:
    - a. American Cast Iron Pipe-Fast Grip, Flex-Ring, Field Flex-Ring or Lock-ring
    - b. US Pipe-TR Flex or Filed Lok 350 Gaskets
    - c. Griffin Pipe- Snap-Lok Restrained Joint

- d. EBBA- Megalug Restraint Gland
  - e. Ford-Series 1400 Restraint Gland
  - f. Lining: Pipe and fittings shall have standard thickness cement mortar lining conforming to ANSI A11.4/AWWA C104 and exterior asphaltic coating.
  - g. When transition is required from PVC sewer main to ductile iron pipe sewer main, restrained joints will be used.
- 2) Polyvinyl chloride pipe and fittings (PVC):
- a. PVC gravity sewer piping shall conform to all requirements of ASTM D3034. It shall have a Standard Dimension Ratio (SDR) of 26. All PVC pipe shall be Type 1, Grade 1 PVC suitable for a 150-psi working pressure and designed to withstand without failure an internal hydrostatic pressure of 500 psi for 1000 hours per ASTM 1598. Joints shall be push-on type using synthetic rubber ring gaskets conforming to ASTM D 1869 and non-toxic, water soluble, vegetable origin lubricant.
  - b. Wall thickness shall be SDR26.
  - c. Saddle type fittings shall not be used.
- 3) General Information
- a. All materials used in the construction of sewers shall be new and unused when delivered on-site and shall be suitable for installation and operation under the conditions for which they are to be used.
  - b. Connection between PVC and DIP shall be made with mechanical coupling.
  - c. Service pipe material shall be schedule 40 pvc. Fernco type couplings are not allowed.
  - d. Casing pipes shall be installed at:
    - 1) Railroad crossings, as directed by the railroad;
    - 2) Highway crossings, as directed by SCDOT, or;
    - 3) As directed by Kershaw County Utilities.
  - e. No sewer line of any type shall be allowed to pass through any storm drainage structure.
  - f. Gravity sewers shall be laid at least ten (10) feet horizontally from any existing or proposed potable water main. The distance shall be measured edge to edge of the pipe. Where it is not practical to maintain a ten foot separation, the County may allow deviation on a case-by-case basis, if supported by data from the design engineer.
  - g. All sewers shall be designed to prevent damage from superimposed loads. Proper allowance for loads on the sewer main shall be made because of the width and depth of the trench where necessary to withstand extraordinary

superimposed loading, special bedding, concrete cradle or special construction may be used.

## B. MANHOLES

### 1) Use precast manholes:

- a. Comply with ASTM C478.
- b. Portland cement: ASTM C150, Type II, 4000 psi and absorption shall not exceed 6%.
- c. The minimum wall thickness of the manhole riser sections shall be:

4' Diameter Manhole	5" Minimum Wall Thickness
5' Diameter Manhole	5" Minimum Wall Thickness
6' Diameter Manhole	6" Minimum Wall Thickness

Cone sections must have a minimum wall thickness of 8" at their top.
- d. Monolithic base slab with walls. Bottoms cast with invert and bench are acceptable.

Minimum thickness of bottom:

6"-4' diameter

8"-5' and 6' diameter

Manhole bottoms subjected to high groundwater pressure shall be designed to withstand hydraulic forces. Stamped and signed bottom design calculations by a SC registered engineer shall be provided to Kershaw County.

- e. Flat slab top sections: HS-20 traffic loadings.
- f. Suitable openings for inlet and outlet sewer pipe shall be cast or cored into the base sections and into riser sections for drop connections. These openings shall be circular, accurately made, and located as required for each manhole. Base riser sections shall be set on compacted pipe embedment materials 12" in thickness. See details.
- g. Flexible manhole sleeves or flexible manhole entrance joints shall be installed on all pipe entering and leaving manholes. Flexible manhole sleeves shall be of high quality synthetic rubber terminating in a substantial serrated flange of the same material. The flange shall be secured to the wall of the manhole base to form a tight water-stop. Minimum thickness of the sleeve material shall be 3/8". Sleeve materials shall comply with the requirements of ASTM Specification C923. Sleeves shall be secured to the sewer pipe to make a watertight union with stainless steel strap clamps, draw bolts, and nuts.
- h. The manhole sections shall be joined with "Ram-Nek" joint sealer or equal. "Ram-Nek" shall be set on clean and dry surfaces and placed as recommended



by the manufacturer. After manhole sections are joined, the inside of the bell and spigot joint shall be covered with a smooth tapered coat of premixed non shrink grout to a thickness of 2" at the joint. Outside of the bell and spigot joint shall be wrapped with WrapidSeal Manhole Encapsulation System as manufactured by Canusa, or approved equal.

- i. Manhole inverts shall be constructed of cement grout and shall have the same cross section as the invert of the sewers, which they connect. The manhole invert shall be carefully formed to the required size and grade by gradual and even changes in sections. All channels shall be troweled smooth. Changes in direction to flow through the manhole shall be made to a true curve with as large a radius as the size of the manhole will permit. Concrete brick will be used only to form the invert channel walls. All other annular space shall be filled with non-shrink concrete grout. No fillers such as broken block, gravel, sand, or excavated material, are allowed in the construction of fillets (benches). Inverts shall be "U" design with top of "U" even with the crown of the pipe. Invert piping shall not extend inside manhole any farther than 2". The slope of the invert benches shall provide a minimum of 2" higher than the crown of the pipe. When dissimilar pipe sizes occur, the elevation of the crown of the pipes must be the same.
  - j. Manhole sections shall be free from large honeycomb, cracks, spalls, large chips, exposed reinforcing, and broken bells or spigots. Allowable deviation in form joints shall be 1". Edges of bells and spigots shall be even and straight.
  - k. Size lift holes and inserts for a precision fit with the lift devices.
    - 1) Do not penetrate through the manhole wall.
    - 2) Comply with OSHA Standard 1926.704.
  - l. Provide flat slab tops where manhole depth is less than 4'-0".
- 2) Coatings:
- a. No coatings for standard manholes.
  - b. Coat receiving manholes where a sewer force main enters and manholes within the pump station site with NeoPoxy NPR-5300 series or approved equal.
    - 1) Coating shall be installed at 200 mils nominal thickness. Contractor shall verify thickness during installation by the use of a wet film thickness gauge.
- 3) Frames and covers:
- a. Manufacture: The covers will have no holes or perforations. Two (2) stainless steel pick bars will be included on the cover. Castings shall be of uniform quality, free from sand holes, gas holes, shrinkage, cracks and other surface defects. Castings shall be reasonably smooth and well cleaned by shoot blasting.

Surfaces of the castings shall be free from burned-on sand. Bearing surfaces between manhole rings and covers shall be cast or machined with such precision that uniform bearing shall be provided throughout the perimeter area of contact. As-cast dimensions may vary within accepted foundry tolerances as outlined in the iron Castings handbook published by the American Foundrymen's Society, Inc. Nominally, castings dimensional tolerances shall be +/- 1/16 inch per foot. All published castings weights are an average and approximate values and may vary +/- 5%.

- b. Approved Manufacture is U.S Foundry & MFG. CORP. Frame is USF 755 and NR Cover. Item No. 8015472. Please see Standard Details for manhole ring and cover details.

4) Manhole Frame to cone connection (Exterior)

- a. Wrap outside of frame to cone connection with WrapidSeal Manhole Encapsulation System as manufactured by Canusa, or approved equal.
- b. Products must be installed as per manufacturer's instructions.

5) General

- a. Drop manhole- Pipe and fittings of the proper size and material shall be constructed inside the manhole and supported by 316 stainless steel clamps and bolts. See Detail.
- b. All manholes must be marked using a fiberglass marker with signage saying warning sewer manhole.

**C. PIPE AND MANHOLE FOUNDATION AND BACKFILL MATERIALS**

1) Pipe Bedding Materials

- a. Crushed stone shall be No.57 granite

2) Backfill Materials

- a. Reuse of existing excavated materials will be allowed provided the materials are compactable, dried or dampened to the optimum moisture content, are free from roots and large clods of clay, and are granular and non-cohesive in nature.
- b. Select fill shall be sand-clay, fine sand or sand gravel mixes.

**D. JACK AND BORE**

1) General

- a. Jack and bore shall be performed in accordance with these minimum standards and in accordance with all applicable permits.

1) Casing pipe

- a. Carrier pipe 6" in diameter or less: Casing shall be a minimum of 4" larger than the largest outside diameter, including joints, couplings and bells.
- b. Carrier pipe greater than 6" in diameter: Casing pipe shall be a minimum of 6" larger than the largest outside diameter, including joints, couplings and bells.
- 2) The end of casing pipe shall extend a minimum of six feet from the edge if pavement/back of curb or as required by permitting agency.
- 3) The top of the casing pipe shall be a minimum of four (4) feet below the crown of the finished asphalt roadway, or as required by permitting agency.
- 2) Casing pipe for dry bores
  - a. Steel complying with ASTM A139 for Grade B with minimum yield strength of 35,000 psi.
  - b. Provide ends suitable for field welding. Joints shall be welded continuously.
  - c. Minimum wall thickness as follows:

<u>Diameter casing</u>	<u>Minimum wall thickness</u>
Under 14"	0.251 inches
14" and 16"	0.282 inches
18"	0.313 inches
20"	0.344 inches
22"	0.375 inches
24"	0.407 inches
26"	0.438 inches
28" and 30"	0.469 inches
32"	0.501 inches
34" and 36"	0.532 inches

- 3) Pipeline casing spacers:
  - a. Provide pipeline-casing spacers for piping installed in casing.
  - b. Provide a minimum of one spacer per ten linear feet for ductile iron pipe.
  - c. Provide spacer with a shell of 14 gauge Type 316 stainless steel.
  - d. Provide 5/16" stainless steel connecting bolts and lock nuts, minimum three (3) per flange.
  - e. Provide shell liner of .090" thick PVC, 85-90 durometer
  - f. Runners from 2" wide ultra high molecular weight polymer with a high resistance to abrasion and a coefficient of friction of 0.11-.013 in accordance with ASTM D-1894.
  - g. Support runners on 14 gauge reinforced Type 316 stainless steel risers welded to shell.
  - h. All metal surfaces to be fully passivated.

- i. The diameter as measured over the runners shall exceed the pipeline bell or coupling outside diameter.
- j. Acceptable product: Cascade Manufacturing or approved equal.

# **SECTION 3**

## **GRAVITY SANITARY SEWER SYSTEM**

### **TESTING AND INSPECTION**

#### **A. TESTING AND INSPECTIONS**

##### **1) General**

Kershaw County Utilities will require that all sanitary sewer systems pass the following test prior to acceptance: (Kershaw County Utilities shall be notified 72 hours before inspections).

##### **2) Air Testing**

The contractor shall conduct low-pressure air tests on all completed sections of gravity. The air test results will be used to evaluate materials and construction methods on the sewer line sections.

The contractor must furnish air compressor and all other equipment necessary to conduct air tests.

- a. A predetermined required time for a specified pressure drop shall be used to determine the lines acceptability. Traditionally, a pressure drop of 1.0 psig has been specified, provided that the required holding times are adjusted accordingly. If the specified pressure drop is 0.5 psig rather than the more traditional 1.0 psig, then the required test times for a 1.0 psig pressure must be halved. Specifying a 0.5 psig pressure drop is desirable in that it can reduce the time needed to accomplish the air test without sacrificing test integrity. Therefore, the following subsections contain provisions for the traditional 1.0 psig pressure drop and the more efficient 0.5 psig pressure drop. All requirements for a specified 0.5 psig drop are given in parentheses.

- b. Determination of Line Failure

If the pressure drops 1.0 psig (or 0.5 psig) before the appropriate time shown in Table I (or Table II) have elapsed, the air loss rate shall be considered excessive and the section of pipe has failed the test.

If time shown in Table I (or Table II), for the designated pipe size and length, elapses before the air pressure drops 1.0 psig (or 0.5 psig); the section undergoing test shall have passed and shall be presumed to be free of defects. The test may be discontinued once the prescribed time has elapsed even though the 1.0 psig (or 0.5 psig) drop has not occurred.

c. Line Repair or Replacement

If the section fails to meet these requirements, the contractor shall determine at his own expense the source, or sources of leakage, and he shall repair or replace all defective materials and/ or workmanship to the satisfaction of Kershaw County Utilities. The completed pipe installation shall then be retested and required to meet the requirements of the test.

d. Specified Time Tables

To facilitate the proper use of this recommended practice for air testing, the following tables are provided. Table I contains the specified minimum times required for a 1.0 psig pressure drop from a starting pressure of at least 4.0 psig greater than the average back pressure of any ground water above the pipes invert. Both tables also include easy to use formulas for calculating required test times for various pipe sizes and odd lengths.

e. Manhole Vacuum Test

All manholes shall be tested via vacuum testing per ASTM C1244 except that the minimum test times shall be as defined in the Manhole Vacuum Test Table (test times modified from those in ASTM C-1244). Vacuum testing shall not be performed until the manhole is completely finished, including applying any protective coating where specified. Manholes shall be thoroughly cleaned of all silt, debris and foreign matter of any kind prior to the vacuum testing and then again prior to final inspection as required.

A vacuum of 10 inches of mercury shall be drawn on the manhole, the valve on the vacuum line of the test unit closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop to 9 inches of mercury. The manhole shall pass if the time for the vacuum reading to drop to 9 inches exceeds the time indicated in Table III. The test times in Table III are modified from those in ASTM C-1244. Table III shall be included on the contractors test reports. Refer to ASTM C-1244 for further requirements.

Any leaks found during the vacuum testing shall be repaired by the Contractor in a manner approved by Kershaw County Utilities. At no additional cost to the owner, the manhole shall be vacuum tested again after such repairs are made until the manhole passes the vacuum test.

- 3) Test for Displacement of Buried Sanitary Sewers: After trench has been backfilled and compacted, after cover over pipeline has been brought to finished grade, and

after debris and silt has been removed, pipelines shall be tested as follows: Light will be flashed between manholes, or if manholes have not yet been constructed, between locations of manholes, by means of flashlight or by reflecting sunlight with mirror. Contractor shall correct poor alignment, displaced and other defects as indicated.

4) Test for Deflection of PVC Sanitary Sewers:

1. Measure pipelines for vertical ring deflection within 15 days after completion of backfill and at least four months after installation, but no later than 30 days before substantial completion of the project. Limit maximum ring deflection of pipeline under load to 5 percent of vertical internal pipe diameter. Contractor shall relay or replace pipe exceeding this deflection and retest.
2. Use deflectometer that produces continuous record of pipe deflection or pull mandrel, sphere, or pin-type go/no-go device through the pipeline. Make diameter of the go/no-go device 95 percent of undeflected inside diameter of pipe.

**Table I**

Specification time required for a 1.0 psig pressure drop for size and length of pipe indicated for Q=0.0015

1 Pipe Dia. (in)	2 Minimum Time (min:sec)	3 Length for Minimum Time (ft)	4 Time for Longer Length (sec)									
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	
4	4:00	597	0.380L	4:00	4:00	4:00	4:00	4:00	4:00	4:00	4:00	4:00
6	5:40	398	0.854L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	5:42	6:24
8	7:34	298	1.520L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	10:08	11:24
10	9:26	239	2.374L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	15:49	17:48
12	11:20	199	3.418L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	22:47	25:38
15	14:10	159	5.342L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	35:36	40:04
18	17:00	133	7.692L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	51:16	57:41
21	19:50	114	10.470L	19:50	26:10	34:54	43:37	52:21	61:00	59:48	59:48	78:31
24	22:40	99	13.674L	22:47	34:11	45:34	56:58	68:32	79:46	91:10	91:10	102:33
27	25:30	88	17.306L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	115:22	129:48
30	28:20	80	21.366L	35:37	53:25	71:13	89:02	106:50	124:38	142:26	142:26	160:15
33	31:10	72	25.852L	43:05	64:38	86:10	107:43	129:16	150:43	172:21	172:21	193:53
36	34:00	66	30.768L	51:17	76:55	102:34	128:12	153:50	179:29	205:07	205:07	230:46



**Table II**

Specification time required for a 0.5 psig pressure drop for size and length of pipe indicated for Q=0.0015

1 Pipe Dia. (in)	2 Minimum Time (min:sec)	3 Length for Minimum Time (ft)	4 Time for Longer Length (sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft
4	4:00	597	0.190L	4:00	4:00	4:00	4:00	4:00	4:00	4:00
6	4:00	398	0.427L	4:00	4:00	4:00	4:00	4:00	4:00	4:00
8	4:00	298	0.760L	4:00	4:00	4:00	4:00	4:00	5:04	5:42
10	4:43	239	1.187L	4:43	4:43	4:43	4:57	5:56	6:55	7:54
12	5:40	199	1.709L	5:40	5:40	5:42	7:08	8:33	9:58	11:24
15	7:05	159	2.671L	7:05	7:05	8:54	11:08	13:21	15:35	17:48
18	8:30	133	3.846L	8:30	9:37	12:49	16:01	19:14	22:26	25:38
21	9:55	114	5.235L	9:55	13:05	17:27	21:49	26:11	30:32	34:54
24	11:20	99	6.837L	11:24	17:57	22:48	28:30	34:11	39:53	45:35
27	12:45	88	8.653L	14:25	21:38	28:51	36:04	43:16	50:30	57:43
30	14:10	80	10.683L	17:48	26:43	35:37	44:31	53:25	62:19	71:13
33	15:35	72	12.926L	21:33	32:19	43:56	53:52	64:38	75:24	86:10
36	17:00	66	15.384L	25:39	38:28	51:17	64:06	76:55	89:44	102:34

**Table III****Manhole Vacuum Test Table**

Minimum Vacuum Test Times for various Manhole Diameters								
Manhole Depth (feet)	Manhole Diameter (inches)							
	36	42	48	54	60	66	72	
	Test Time (seconds)							
8	60	60	60	60	60	60	66	
10	60	60	60	60	66	72	82	
12	60	60	60	70	78	86	98	
14	60	60	70	82	92	102	114	
16	60	68	80	92	104	116	134	
18	64	76	90	104	118	130	146	
20	70	84	100	116	130	144	162	
22	78	92	110	128	144	158	178	
24	84	102	118	140	156	174	194	
26	92	110	128	150	170	188	210	
28	98	118	138	162	182	202	226	
30	106	126	148	174	196	216	242	

## 5) CLOSED CIRCUIT TELEVISION (CCTV) INSPECTION OF SEWER LINES

a. Intent-It is the intent of this specification to provide inspection criteria for all sanitary sewer pipelines installed as part of any new development project. This specification requires that the pipelines be inspected utilizing the Pipeline Assessment Certification Program (PACP) inspection standards and closed-circuit television techniques. This procedure has been developed to identify and locate any sewer line defects, determine corrective action and perform/document post correction inspection.

b. Scope of Work

- i. The contractor shall video inspect all mainline sections from manhole to manhole. Video inspection shall be performed after the all pipe has been laid, low-air pressure test completed and passed, and after all utilities have been installed.
- ii. Prior to performing CCTV inspection, the contractor shall thoroughly clean the sewer line(s) and service laterals to be televised. After cleaning, all equipment will be removed from the sewer line(s). Just prior to performing the video inspection procedure, water must be introduced into the nearest downstream manhole. This will insure that any pipe segments with bellies are easily identified during CCTV inspection.

c. CCTV and associated equipment:

- i. Television inspection equipment shall have an accurate footage counter that will display on the monitor and record the camera distance from the centerline of the starting manhole. Line segment inspections shall be made manhole to manhole. Prior to the beginning of each CCTV inspection, manhole identification numbers, as indicated on project drawing or as supplied by the Developer's Engineer, will be displayed in the title and shall become part of the video record. Manhole identification numbers shall correspond to the numbers shown on the project plans.
- ii. The camera shall be of the remotely operated pan and tilt type. The rotating camera and light head configuration shall have the capability of panning 360 degrees with tilt capability of providing a full view of the pipe to ensure complete inspection of the mainline pipe and service laterals.
- iii. The camera, television monitor, and other equipment shall be color. To ensure peak picture quality throughout all conditions encountered, the camera shall be equipped with circuitry to allow for the remote

adjustment of the optical focus iris from the power control unit at the viewing station. A variable intensity control of the camera lights shall be located at the viewing station.

- iv. All fog shall be evacuated from the pipeline and the pipeline kept clear of any fog during the CCTV inspection process.
- v. Lighting and camera quality shall be suitable to allow a clear, in focus picture for the entire inside periphery of pipelines extending at least ten (10) feet in front of the camera. In High Density Polyethylene (HDPE) or ductile iron poly lined pipe, lighting shall be enough to provide a clear view at least two (2) feet in front of the camera.

d) Execution

- i. It is the responsibility of the contractor to provide the CCTV contractor with a set of Kershaw County approved adjusted construction plans reflecting modifications during construction prior to the CCTV inspection activities. Line segment inspections shall be made manhole to manhole.
- ii. Internal inspection of pipelines shall be performed by PACP certified personnel, trained in the identification of pipe deficiencies and condition assessment utilities closed-circuit television inspection equipment. The travel speed of the camera shall be variable but uniform and shall not exceed 30 feet per minute. The television system shall be capable of performing line segment inspection in increments of 400 feet with one set up.
- iii. As directed by Kershaw County Utilities, the Developer's Engineer or his representative, the camera shall be stopped to view and analyze conditions that appear unusual or uncommon.
- iv. Access for CCTV inspection shall be made via existing line segment manholes. Should access to a particular sewer segment be difficult, and where adjacent segments require television inspection, the CCTV Contractor may be allowed to complete the inspection of multiple sewer line segments with one set up. When multiple sewer line segments are inspected utilizing one set up, the CCTV Contractor shall zero the footage counter at each subsequent sewer manhole to establish a uniform starting point for each line segment televised.
- vi. At all defects and service connections, the camera shall be stopped and pan and tilt features shall be used to obtain a clear picture. At each service lateral, the camera shall be panned to view up each lateral or point of connection. Make note of any deficiencies through the use of the Data Collection Software.

- vii. Contractor shall record inspection in a PACP format and the video shall be recorded in an extra-high quality CD/DVD format. The title block shall include the following information:
  - 1) Date
  - 2) Camera's operator's identification (Name, ID number, etc.)
  - 3) Upstream manhole number
  - 4) Downstream manhole number
  - 5) Size of pipe
  - 6) Pipe material
  - 7) Direction of movement of camera and direction of normal flow
  - 8) Location of service connections indicated by clock position and with counter distance in feet from beginning manhole's centerline.
- vii. Should CCTV Contractor's television equipment become lodged in any sewer line, it shall be removed by CCTV Contractor at his expense. This shall include, if necessary, excavation and repair of the sewer main, underground utilities, backfilling and surface restoration. Upon removal of CCTV equipment and repair, CCTV Contractor shall re-televiser the line segment to demonstrate to the Developer's Engineer and Kershaw County Utilities representative that the line segment has been placed back into operational condition with no further deficiencies.

e) Acceptance

- i. CCTV Contractor shall present inspection video and inspection logs on CD/DVD disk. A continuous image in complete conformance with these specifications with a full view of the internal pipe surface is required. CCTV Contractor shall re-televiser any segment for which the video does not present a clear image of at least 100% of the internal pipe surface at all times, and/or is accompanied by an incomplete inspection log.
- ii. Any of the following observations shall be considered defects:
  - 1) Any bellies in a joint of pipe will cause for rejection of the pipe segment.
  - 2) Joint separations
  - 3) Offset joints
  - 4) Chips in pipe ends
  - 5) Cracked or damaged pipe or evidence of the presence of an external object bearing upon the pipe (rocks, roots, etc.)
  - 6) Infiltration
  - 7) Roots
  - 8) Debris or other foreign objects inside of pipe.

- 9) Other obvious deficiencies when compared to Approved Plans, Permits, and or Minimum Standards.
- iii. Kershaw County Utilities will require corrections prior to acceptance of the project.
- iv. The Contractor shall be notified in writing of any deficiencies revealed by the television inspection that will require repair. The Contractor shall excavate and make the necessary repairs. Upon completion of discrepancies, the line segment(s) shall be re-inspected at the Developer's/Contractor's expense. CCTV inspection video shall be submitted to Kershaw County Utilities for review upon completion of discrepancies.

## **SECTION 4**

### **SANITARY SEWER FORCE MAIN DESIGN STANDARDS**

#### **A. GENERAL**

- 1) The following sewer force main design standards are based on Federal, State and local health requirements and the requirements of Kershaw County Utilities.
- 2) These design standards are applicable to all developments including, but not limited to, residential, commercial and industrial developments, subdivisions and/or parks requiring sewer service from Kershaw County Utilities.

#### **B. SEWER FORCE MAIN DESIGN CRITERIA**

- 1) Minimum pipe size: 4 inches.  
NOTE: Under conditions that arise from time to time, where normal installations cannot be implemented, Kershaw County Utilities will review submittals on a grinder station. Minimum pipe size for a grinder pump station: 2 inches.
- 2) Design velocity:  
Minimum: 2 feet per second (2.5 fps for grinder stations)
- 3) Maximum pipe size:  
Provide so as to maintain the minimum 2 feet per second velocity and minimize pump head.
- 4) Hazen and Williams design coefficient:
  - a. PVC, DIP, HDPE: C=120

#### **C. AIR RELEASE VALVES**

- 1) Provide at high points in the force main.
- 2) Design force main to minimize the number of air release valves.
- 3) Provide at a maximum 3000 feet intervals where force main is installed at little or no slope.

#### D. PLUG AND CHECK VALVES

- 1) For force mains greater than 5,000 feet in length, provide a plug valve at the halfway point.
- 2) Where a force main is tying into an existing force main:
  - a. Provide check valve
  - b. Provide two (2) plug valves, one upstream and one downstream of the check valve. (Approved Manufactures are Kennedy and M&H.)

#### E. FORCE MAINS ENTERING MANHOLES

- 1) Force main to enter at the receiving manhole's flow line. See Details.

#### F. COVER

- 1) Provide suitable cover on all sewer force mains. Minimal cover depth as follows:
  - a. 4 " dia. Thru 12" dia.: 36"
  - b. 14" dia. and larger: 48"
- 2) All piping located within public right-of-way shall be constructed in accordance with applicable permits and Kershaw County Utilities minimum requirements.
- 3) Special condition other than those listed above may be approved if requested in writing from Kershaw County Utilities.

#### G. DUCTILE IRON PIPE LOCATIONS

- 1) Use ductile iron pipe where a sewer force main:
  - a. Crosses over or under a water main.
  - b. Crosses beneath storm drainage pipe with less than three (3) feet of clearance.
  - c. Crosses above storm drainage pipe with less than two (2) feet of clearance.
  - d. Crosses any water bodies.
  - e. Installed in casing.
  - f. Attached to bridges or other structures above grade.
  - g. Cover is less than the depth prescribed in Part F above.

**SECTION 5**  
**SANITARY SEWER FORCE MAIN**  
**MATERIALS FOR CONSTRUCTION**

**A. PIPE AND FITTINGS**

1) Ductile-iron pipe and fittings (DIP):

- a. Ductile iron pipe shall be in accordance with ANSI A21.50/AWWA C150 and conform to the requirements of A21.51/AWWA C151, latest standards. Push-on and restrained joint pipe shall have a minimum rated working pressure of 150 psi. All buried pipe shall be pressure class as follows.

Pipe Sizes (inch)	Pressure Class (psi)
4-12	350
14-20	250
24	200
30-64	150

- b. Ductile iron pipe and fittings shall be furnished with push on joints, push-on restrained joints, mechanical joints, and flanged joints as required. Pipe ends (spigot end, bell, and socket) for all pipes shall be gauged with suitable gauges at sufficiently frequent intervals to ensure compliance to the standard dimensions of ANSI/AWWA C151/A1.5, latest edition.
- c. Push-on joints shall conform to ANSI A21.11/AWWA C111. Approved products: Fastite, Tyton, or Bell-tite.
- d. Mechanical joints shall conform to AWWA C111. Bolts shall be high strength low alloy steel per AWWA C111.
- e. Flange joints shall conform to ANSI A21.11/AWWA C115. Bolts and nuts shall conform to ANSI A21.11/AWWA C111. Component flanges shall be ductile iron and manufactured in accordance with ANSI/AWWA C115/A21.15, latest edition. Component flanges shall be rated for a water service of 250-psi or greater working pressure. Component flanges shall be faced and drilled to meet the drilling pattern of ASME/ANSI B161.1, class 125 flanges. Hollow back flanges are not acceptable.
- f. Restrained joints shall be American Fast-Grip, Flex-Ring, Field Flex-Ring, LOK-Ring, US Pipe TR Flex, Field Lock, Griffin Snap-LOK, Ebba Megalug or Sigma One-



LOK. Restrained joints shall be in accordance with DIPRA, "Thrust Restraint Designed for Ductile Iron Pipe".

2) PVC pipe

PVC pipe shall be approved in the sizes from 4-inch through 12-inch nominal diameter in accordance with AWWA C900, ASTM D2241.

- 1) All PVC shall be designed and manufactured in accordance with AWWA C900, latest revision, from virgin polyvinyl chloride resin meeting cell Class 12454-A or 12454-B as defined in ASTM D1784. All compounds shall qualify for a rating of 4000 psi for water at 73.4 degrees Fahrenheit per the requirements of PPI TR3.
- 2) PVC pipe shall be pressure class 200 (DR14) furnished in ductile iron pipe equivalent outside diameters in 20-foot lengths.
- 3) Each length of PVC pipe shall bear markings indicating the following information at the intervals not to exceed five (5) feet: (1) manufacture's name or trade mark, (2) nominal pipe size and OD base, (3) AWWA material code designation, (4) dimension ratio, (5) AWWA pressure class, (6) AWWA C900 designation, and (7) product record code.
- 4) All PVC pipe shall be elastomeric-gasket bell-end pipe. One gasket shall be furnished with each length of PVC pipe.
- 5) Fittings used in the laying of PVC shall be Iron fittings. Fabricated or molded fittings will not be acceptable in any application.

3) General

- a. When transition is required from PVC sewer main to ductile iron pipe sewer main, restrained joints shall be used.
- b. Magnetic tape: All sewer mains which are installed by the open trench method, regardless of piping material, shall also include the installation of an electronically or magnetically detectable tape buried directly over the pipe at a maximum of 24 inches above the pipe. The tape shall be at least two (2) inches wide, being green on top, and be boldly labeled every 18 to 32 inches as follows 'CAUTION SEWER LINE BURIED BELOW'. The tape shall have a tensile strength of not less than 4000 psi; dart impact strength of not less than 120 rams per 1.5 mils, is not less than 0.0055 inch thick, and includes sufficient metal to allow easy detection.
- c. Tracer wire: All sewer force mains installations, regardless of piping material, shall also include the installation of a locator wire. The locator wire shall be polyethylene taped to the top of the pipe during the pipe laying operation. For

sewer mains installed by the open trench or horizontal directional drilling method shall be stranded 12-gauge copper with green insulation rated UF or USE by Underwriters Laboratories. The tracer wire shall be looped into "dummy" cast-iron water valve boxes (with caps labeled "SEWER" and painted white) installed at grade level, one being installed adjacent to the valve vault at the source pump station. Additional valve boxes shall be installed at intervals not greater than every one thousand (1000') feet along the path of the force main. A final valve box shall be installed at the discharge point of the force main, whether at a manhole or at a "tee" into another force main.

## **B. RESTRAINED JOINT PIPE AND FITTINGS FOR DUCTILE IRON**

- 1) Provide restrained joint pipe and fittings on all piping at each fitting and valve. Restrained joints shall be in accordance with DIPRA, "Thrust Restraint Designed for Ductile Iron Pipe". See Details.
- 2) Provide "MEGALUG" as manufactured by EBBA Iron Sales, or Ford Series 1400, on all fittings.

## **C. AIR RELEASE VALVES**

- 1) Provide combination air valve for sewer.
- 2) The combination air valve shall be suitable for use at pressures anticipated in the force main.
- 3) The valve shall have Type 316 stainless steel body, cover and cover bolts with a NPT inlet and outlet connection. Valves shall have a type 316 stainless steel float and a replaceable seat of Buna-N or other suitable material. Venting orifice and internal linkage mechanism shall be Type 316 stainless steel.
- 4) Valve size shall be 1" or 2" size as shown on the plans, both sizes to be supplied with 2" NPT pipeline connection.
- 5) Valve shall be supplied with flushing attachments consisting of 2" stainless steel inlet isolating ball valve, 1" stainless steel blow off ball valve and 1/2" stainless steel flushing ball valve and stainless steel nipples and a 5' rubber hose with quick connects couplings.
- 6) Valve manhole:
  - a. Air release valves shall be enclosed in a 4' diameter precast manhole.
  - b. Manhole wall sections shall be coated with NeoPoxy NPR-5303 at 200 mils nominal thickness or approved equal.
  - c. Provide manhole frame and cover. See Details.

## D. CASING, SPACERS AND END SEALS

### 1) General

- a. Provide bore and jack with casing for pipes larger than 2". See Detail.
- b. Casing pipe
  - 1) Carrier pipe 6' in diameter or less: Casing pipe shall be a minimum of 4" larger than the largest outside diameter, including joints, couplings and bells.
  - 2) Carrier pipe greater than 6" in diameter: Casing shall be a minimum of 6" larger than the largest outside diameter, including joints, couplings and bells.
  - 3) The end of casing pipe to extend a minimum of six (6) feet from the edge of pavement/back of curb, or as required by permitting agency.
  - 4) The top of casing pipe shall be a minimum of four (4) feet below the crown of the finished asphalt roadway, or as required by the permitting agency.
  - 5) The top of casing pipe shall be a minimum of two (2) feet below the design invert of roadside drainage ditches and pipes.
- c. Carrier pipe shall be restrained joint ductile iron pipe.
- d. Continuously weld joints of casing pipe of sufficient size to accommodate the required length of assembled casing necessary to insure that at no time the end of the casing comes to a rest under the pavement during the boring and jacking operation. No welding of casing under pavement.

### 2) Casing pipe for dry bores

- a. Steel complying with ASTM A139 for Grade B with a minimum yield strength of 35,000 psi.
- b. Provide ends suitable for welding.
- c. Minimum wall thickness as follows:

Diameter of Casing (Inches)	Minimum Wall Thickness (Inches)
Under 14	0.251
14 and 16	0.282
18	0.313
20	0.344
22	0.375
24	0.407

26	0.438
28 and 30	0.469
32	0.501
34 and 36	0.532

3) Pipeline casing spacers:

- a. Provide pipeline casing spacers for piping installed in casing.
- b. Provide spacer with shell of 14 gauge Type 316 stainless steel.
- c. Provide a minimum of one spacer per ten liner feet of pipe for ductile iron pipe.
- d. Provide shell liner of 0.90" thick PVC, 85-90 durometer.
- e. Provide 5/16" stainless steel connecting bolts and lock nuts, minimum three (3) per flange.
- f. Runners from 2" wide ultra high molecular weight polymer with a high resistance to abrasion and a coefficient of friction of 0.11-0.13 in accordance with ASTM D-1894.
- g. Support runners on 14 gauge reinforced Type 316 stainless steel risers welded to shell.
- h. All metal surfaces to be fully passivated.
- i. The diameter as measured over the runners shall exceed the pipeline bell or coupling outside diameter.
- j. Acceptable product: Cascade Manufacturing or approved equal.

**SECTION 6**  
**SANITARY SEWER FORCE MAIN**  
**TESTING AND INSPECTION**

A) HYDROSTATIC TESTING

- 1) General
  - a) Clean and flush line of dirt and foreign material.
  - b) Do not perform hydrostatic tests until at least 24 hours after installation of concrete thrust blocking.
  - c) Provide temporary plug and blocking at open ends.
  - d) The Contractor shall provide an approved test pump.
  
- 2) The test pressure in the line shall be pumped up to the test pressure and be of the line or 150 psi, whichever is greater, as measured at the lowest point in the section of line being tested, and no less than 1.25 times the working pressure as measured at the highest point in the section.
  
- 3) The pressure in the line shall be pumped up to the test pressure and constantly maintained for 90 minutes and recorded. Kershaw County must be notified 72 hours in advance prior to testing. Kershaw County must be present during testing for test to be valid.
  
- 4) Leakage is the quantity of water that must be supplied to the newly laid pipe or any closed-valved section to maintain the pressure within the limits stated above.

**SECTION 7**  
**SANITARY SEWER PUMP STATION**  
**DESIGN STANDARDS**

**A. GENERAL**

- 1) The following sanitary sewer pump station design standards are based on Federal, State and local health requirements and the requirements of Kershaw County Utilities.
- 2) These design standards are applicable to all developments including but not limited to residential, commercial and industrial developments, subdivisions and/or parks requiring sanitary sewer service from Kershaw County Utilities.
- 3) Design criteria for other than normal circumstances are to be presented to Kershaw County Utilities for approval prior to preparation of plans and specifications.
- 4) The Engineer should submit the following design calculation:
  - a. Station service area ultimate loading.
  - b. Flotation calculation (weight of station without pumps vs. uplift).
  - c. Cycle time calculation maximum six (6) cycles/hour.
  - d. Provide certification that motor and control circuit will permit twelve (12) cycles/hour.

**B. GENERAL PUMP STATION DESIGN**

- 1) Minimum of two pumps of equal capacity, each capable of handling the design peak flow.
- 2) Capable of passing 3" diameter spherical solids, minimum.
- 3) Suction and discharge piping: 4" diameter, minimum.
- 4) NOTE: Under conditions that arise from time to time, where normal installations cannot be implemented, Kershaw County Utilities will review submittals on a grinder station.
- 5) Peak factor: Minimum, 2.5
- 6) Future capacity: When designing pumps, consideration is to be given to the ultimate capacity of the pump station, in accordance with Kershaw County Utilities Master Plan.
- 7) Wet well level settings:
  - a. Distance between pump OFF and lead pump ON: minimum as specified by the pump manufacture, or as calculated for cycle time; whichever is greater.

- b. Distance between lead pump ON and lag pump ON: 6", minimum.
  - c. Distance between lag pump ON and alarm ON: 6", minimum.
  - d. Distance between alarm elevation and inlet pipe: 1'-0", minimum.
- 8) Provide a check valve and plug valve on each pump discharge line.
  - 9) Pumps shall have an operating point at or near peak efficiency.
  - 10) Pumps shall be non-overloading for all duty points.
  - 11) Provide components of the pump station as shown in Details.
  - 12) Provide by-pass connection sized to handle peak flows.
  - 13) Locate pumps, influent pipe, floats so that they can be easily removed.
  - 14) Provide manhole on influent line (must be coated) within pump station fence for by-pass pumping.
  - 15) Provide ½" tap with 316 stainless steel ball valve and pressure gauge connection prior to the check valve.
  - 16) Provide an On-Site back-up Generator with automatic transfer gear or an On-site Godwin dry-prime diesel by-pass pump. Bypass pump must be sized to handle peak flows. Both Generator and By-Pass pump must have fuel capacity to run at peak flows for a minimum of 24 hours without stopping.
  - 17) Must provide one spare pump for each station if back-up generator is used instead of Godwin dry prime pump.

### C. PUMPS AND MOTORS

- 1) Acceptable pump manufactures for submersible pumps are:
  - a. ABS,
- 2) Pumps shall be equipped as follows:
  - a. Pumps shall be designed to handle peak flow with one pump out of service.
  - b. Motors shall be non-overloading over entire pumping range.
  - c. Motors shall have Class F (155 degree C) insulation and withstand Class B (130 degrees C) temperature rise with a service factor of 1.1 at the efficient point of the curve. Motors shall be suitable for use in Class I, Division I areas.
  - d. Motor rpm shall not exceed 1800 rpm.
  - e. Three (3) phase power shall be required on all motors greater than 5 Hp. No "add-a-phase" systems will be allowed. No phase converters will be allowed. Single-phase power will be allowed on pumps 5 Hp and less. If three (3) phase power is not available changes may be made on a case by case bases with the approval of Kershaw County Utilities.
  - f. Unbalanced voltage on motors under load shall not exceed 1.0% when measured at the motor terminals. Voltage shall be read with an accurate digital

voltmeter and recorded as part of the final inspection; calculation shall be NEMA Standard MG-1972.

- g. Minimum motor power factor shall be 85%.
- h. Transient Voltage Surge Suppressors (TVSS) are required for all services.
- i. Lower seals shall be silicone carbide to silicone carbide.
- j. B-10 bearing life shall be a minimum of 50,000 hours.
- k. Pump and motor shall have adequately sized 316 stainless steel lifting chain; length shall reach top of station plus an additional 6'. Chain shall be 3" welded hot-dipped 316 stainless steel link chain.
- l. Motors shall be equipped with moisture detection probe and have moisture detection indication lamp mounted on control panel. Moisture detection shall cause motor shut down.
- m. Motor shall be wired for lead-lag operation and shall be equipped for alternate cycle operation.
- n. Each motor shall have a separate run time totalizer and an H-O-A switch.

#### D. WETWELL DESIGN CRITERIA

- 1) Size the wetwell based on the following:
  - a. Flow from proposed development and any associated future development. Flows to be determined using the "Unit Contributing Loading Requirements" as otherwise outlined by DHEC's latest revision.
  - b. Capability to receive flows from surrounding areas as determined by Kershaw County's Master Plan.
  - c. Minimum allowable wetwell diameter shall be 8'-0".
  - d. Normal operating volume shall prevent any one pump from starting more than three (6) times per hour.
- 2) Coat wetwell, piping, wall and bottom surface of the top cover with NeoPoxy NPR-5303 epoxy or approved equal.
  - a. NPR-5303 coating or approved equal shall be installed at 200 mils nominal thickness.
- 3) Locate to allow access with vacuum truck and boom truck.
- 4) Minimum slope of one to one on the floor to the hopper bottom.
- 5) Horizontal area of hopper bottom shall be no larger than necessary for proper installation and operation of the pump or pump inlet.
- 6) Provide a vent with screen. See Detail.
- 7) The bottom slab of the wetwell shall be set on a minimum of 12" of gravel.



- 8) Top of slab shall be set to provide positive drainage away from the station and minimize flooding. At a minimum, top of slab shall be 6" inches above final grade.
- 9) Steps shall NOT be used in wetwells.

#### E. ELECTRICAL

- 1) Electrical design of pump station shall conform to the latest editions of NFPA 70 (National Electrical Code) and NFPA 820 (Standard for Fire Protection in Wastewater Treatment and Collection Facilities).
- 2) All areas designated as hazardous as defined by NFPA 820 shall be so delineated on the contract documents.
- 3) Design electrical service to handle the ultimate capacity of the pump station. Coordinate electrical service with local utility (230V or 460V) prior to design of pump station controls. Main disconnect device shall be rated and labeled for use as service entrance equipment.
- 4) Provide transient voltage surge suppresser on load side of transfer switch.
- 5) Provide GFI Duplex receptacles.
- 6) Provide 150 watt High Pressure Sodium (HPS) area floodlight with electric eye with on/off switch mounted on control panel rack for manual operation.
- 7) Pump shall be shipped with non-wicking electrical power cable, and seal failure cable, factory installed and tested.
- 8) Conduit shall be UV-resistant PVC, Schedule 80, for size two (2) inch. Electrical conduit greater than two (2) inch shall be galvanized.
- 9) Wetwell cable hangers shall be 316 stainless steel located at the edge of the hatch.
- 10) Electrical control panel shall be large enough to house all control equipment to include an RTU from Missions communication.
- 11) All electrical work shall be performed by licensed personnel.
- 12) Electrical permit shall be applied for at the applicable permitting agency.

#### F. CONTROL PANEL

- 1) A minimum of the following components shall be installed at a separate hinged inner door:
  - a. Hand-Off-Automatic selector switches.
  - b. Lead 1, Lead 2 Automatic selector switch
  - c. 6 digit, non-reset, elapsed time meters.

- d. Voltmeter with Off-L1-L2-L3 selector switch
  - e. Ammeter with Off-L1-L2-L3 selector switch
  - f. Indicating lights for:
    - 1) Pump running
    - 2) Seal alarm
    - 3) High level alarm
    - 4) Phase failure
  - g. Push-buttons for:
    - 1) Alarm horn silence
    - 2) Test seal alarm
    - 3) Reset seal alarm
  - h. GFI Duplex Receptacle 20A.
  - i. Local-remote (Omni RTU) control switch.
  - j. Mount pump data plate information inside panel. See Detail.
- 2) A minimum of the following components shall be mounted at the mounting back plate:
- a. Fuse less, NEMA rated, soft start starters shall be required on all 20 Hp pumps or larger with instantaneous short-circuit protection, heavy-duty 3-pole industrial contactors, and 3 phase adjustable bimetallic overload protection. Approved soft starts are Square D Altistart 48.
  - b. Control circuit transformer 120V with primary circuit breaker and secondary circuit breakers for:
    - 1) Control
    - 2) Duplex receptacle
  - c. Automatic electrical alternation
  - d. Control relays
  - e. Transient Voltage Surge Suppressor (TVSS)
  - f. Power terminals, control terminals
  - g. Condensation protective space heater with thermostat.
- 3) An alarm horn and red flashing alarm light with a minimum of 60-watt lamp shall be installed. Alarm light shall be approved for vapor tight side installation.
- a. Alarm light shall be on at High level.
- 4) Control sequence shall be designed so that panel will function automatically after a power failure, and a manual reset is not necessary.
- 5) Control wire to be MTW 90 degree C #14 AWG.
- a. All wiring should be neatly grouped in plastic wire troughs except wiring from the back plate to the door shall be done in a separate bundled harness for control, voltmeter and ammeter circuits.

- b. All wiring shall have a wrap around wire identification number as shown in the wiring diagram at both ends.
  - c. All components shall be identified with the same number as shown in the wiring diagram.
  - d. All door mount components shall have engraved nameplates.
- 6) All conduits into the control panel must be sealed with a maximum of 1/4" Cheeco.
  - 7) Electrical supply, control and alarm circuits shall be designed to provide strain relief and allow disconnection from outside the wetwell. Terminals and connectors shall be protected from corrosion by location outside the wetwell or through use of watertight seals.
  - 8) Pump motor power cords shall be designed for flexibility and serviceability under conditions of extra hard usage and shall meet the requirements of the mine Safety and Health Administration for trailing cables.

#### G. PUMP STATION SITE

- 1) Minimum property size: 50' x 50'. Pump station site, including access road to be deeded to Kershaw County requires a signed Deed and Affidavit along with an approved plat for recording at the Register of Deeds located in the Kershaw County Government Center.
- 2) Site shall be serviced by an asphalt road. Road and site drainage shall be included and approved by appropriate agency.
- 3) Access road:
  - a. Minimum 16 foot wide.
  - b. Asphalt. In accordance with SCDOT when tying into a State Road and Kershaw County Standards when tying into a County road.
- 4) Area within pump station site:

Area to be covered with geo-fabric underlayment and minimum of 6" 57 stone as cover.
- 5) Fencing of Pump station site:
  - a. Fence materials:
    - 1) Chain link shall be 6' high, ends twisted and barbed, and commercial grade 9 gauge.
    - 2) End, cover and pull posts shall be 2 1/2" O.D.
    - 3) Top and line posts shall be 2" O.D.
    - 4) Bottom tension wire shall be 7-gauge spring coil wire.
    - 5) Gate posts shall be 3" O.D.

- 6) Fabric: 2 inch diamond mesh interwoven wire, 6 gage thick, top selvage knuckle end closed, bottom selvage twisted tight; with vinyl coating.
  - 7) Posts, rails, and frames : ASTM F 1083 Schedule 40 hot-dipped galvanized steel pipe, welded construction, minimum yield strength of 50 ksi for sizes NPS 5 and larger.
  - 8) Concrete: ASTM C94/C 94M, ready mix; Normal Portland Cement, 2500 psi strength at 28 days, 3 inch slump; 1 inch nominal sized coarse aggregate.
  - 9) Vehicle access gate shall be a pair of 7' long 6' high sections constructed of 2" O.D. pipe. Gate shall be equipped with a prop post center latch and hasp assembly. A ground anchor cast in concrete shall be provided. Gates shall be factory fabricated and equipped with gate hold backs.
- b. Any other fence types will be reviewed on a case by case basis and are subject to the approval of Kershaw County Utilities.
- 6) Design gate to allow entrance of service trucks without blocking the main roadway.
  - 7) Design site layout to allow access of service trucks to the pump station wetwell.
  - 8) Power shall be located underground and shall be located on the rack in such a manner so electric meter can be easily read from outside the fenced area.
  - 9) The station shall have a 3/4" water service with a non freezing yard hydrant.
  - 10) All power lines within the site shall be underground. No overhead power lines will be allowed to cross the site.

#### H. PUMP STATION SPARE PARTS AND COMPLETION

- 1) Prior to commissioning, Contractor shall furnish the following:
  - a. Three (3) complete sets of record drawings.
    - 1) Three (3) paper copies.
    - 2) One (1) electronic in Adobe Acrobat (PDF)
  - b. Four (4) copies of O&M Manual with factory pump curves for installed pumps.
  - c. Pump station inspection log with drawdown test information.
- 2) All electrical schematics and drawdown tests shall be laminated and mounted inside control panel door.
- 3) Provide a factory authorized representative throughout duration of startup and performance testing. Factory Representative shall remain on site until startup and performance testing has been accepted by Kershaw County Utilities.
- 4) Spare Parts:
  - a. Provide the minimum spare parts:
    - 1) One pump
    - 2) One of each seal assemblies.

- 3) One of each type of relay.
  - 4) One pump alternator.
  - 5) One of each type pilot light
  - 6) One box of each type lamp.
  - 7) One set of fuses complete
- b. Package in one container all spare parts and clearly identify on the outside what the unit is for. Seal tightly and properly protect for long term storage.
- 5) Warranty:

The pump manufacturer shall warrant the units being supplied for a period of five (5) years or 10,000 hours under the Municipal Wastewater Permanent Installation Warranty Policy under normal use, operating and service. The warranty shall be in printed form and apply to all similar units.

**SECTION 8**  
**SANITARY SEWER PUMP STATION**  
**TESTING AND INSPECTIONS**

A. Provide the following tests after installation:

- 1) In the presence of the Developer's Engineer and Kershaw County employee.
  - a. Remove pump from structure.
  - b. Replace, demonstrating proper alignment and operation of matting parts.
- 2) Operate pumps utilizing manual and automatic modes.
- 3) Demonstrate proper operational sequences, including alarm conditions.
- 4) Measure amperage, voltage, pumping rate and discharge pressure for:
  - a. Each pump operating separately.
  - b. Both pumps operating simultaneously.
- 5) The design engineer shall conduct testing of pump station pumps and controls to verify operating parameters are met per design criteria. The design engineer shall be responsible for coordinating the pump manufactures, Kershaw County Utilities representative, and the contractor for draw down testing.