5.0 PURPOSE AND DESIGN REQUIREMENTS. The purpose of this chapter is to outline the requirements for proper sanitary sewer pipe sizing, construction, and inspection. Unless the requirement is waived by the Engineer, a complete set of construction plans, project specifications, proposed and anticipated future flows and service area, and design calculations shall be made available to him for review and approval. Design and installation criteria shall conform to the Recommended Standards for Wastewater Facilities - 1990 - or latest edition (Great Lakes-Upper Mississippi River Board of State Public Health and Environmental Managers, commonly referred to as 10 State Standards).

5.0.1 Depth. In general sewers shall be sufficiently deep so as to receive sewage from the first floor of all places served by the sewers and to prevent freezing, but shall not be less than four (4) feet of cover, unless otherwise approved by the Engineer.

5.0.2 Slope. All sewers shall be so designed and constructed to give mean velocities, when flowing full of not less than two (2) feet per second. The following are the minimum slopes, as specified in 10 State Standards: however, slopes greater than these are desirable.

<table>
<thead>
<tr>
<th>Sewer Size</th>
<th>Per 100 Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 inch</td>
<td>0.40</td>
</tr>
<tr>
<td>10 inch</td>
<td>0.28</td>
</tr>
<tr>
<td>12 inch</td>
<td>0.22</td>
</tr>
<tr>
<td>14 inch</td>
<td>0.17</td>
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<tr>
<td>15 inch</td>
<td>0.15</td>
</tr>
<tr>
<td>16 inch</td>
<td>0.14</td>
</tr>
<tr>
<td>18 inch</td>
<td>0.12</td>
</tr>
<tr>
<td>21 inch</td>
<td>0.10</td>
</tr>
<tr>
<td>24 inch</td>
<td>0.08</td>
</tr>
<tr>
<td>27 inch</td>
<td>0.067</td>
</tr>
<tr>
<td>30 inch</td>
<td>0.058</td>
</tr>
<tr>
<td>36 inch</td>
<td>0.046</td>
</tr>
</tbody>
</table>

Sewers shall be laid with uniform slope between manholes. Sewers on 20 percent slope or greater or when specified by the Engineer, shall be anchored securely with concrete anchors spaced no further than 36 feet center to center.

5.0.3 Sizing. New sewer systems shall be designed on the basis of an average daily per capita flow of sewage of not less than 100 gallons per day. This figure is assumed to cover normal infiltration, but an additional allowance should be made where conditions are unfavorable. Generally, the main, trunk and outfall sewers shall be designed to carry, when running full, not less than 250 gallons daily per capita contributions of sewage, exclusive of sewage or other waste flow from industrial plants.

No public sewer shall be less than eight (8) inches in diameter. All laterals shall have a minimum grade of 1/8"/ft, including all of the portion of the tap within the right-of-way.

5.0.4 Combined Sewers. Expansion of combined sewers into areas that presently have separate sanitary and storm facilities is not allowed. Replacement combined sewers shall be designed to have adequate capacity to handle 25 year frequency storm events, unless alternate storm event evaluations and/or designs are required by the Engineer.

5.1 PIPE AND FITTINGS. Sanitary sewers shall be constructed of materials per the requirements of Chapter 2 “Materials.”

5.2 TRENCHES EXCAVATION. Unless specifically directed otherwise by the Engineer, no more than 400 feet of trench in open unpaved areas and 100 feet of trench in existing paved areas shall be opened at any time in advance of the pipe, nor shall more than 100 feet be left unfilled. Watchmen or barricades, safety lighting and other such signs and signals as may be necessary to warn the public of the dangers in connection with open trenches, excavation and other obstructions, shall be provided by and at the expense of the contractor.

When so required or when directed by the Engineer, only one-half of street crossings and road crossings shall be
excavated before placing temporary bridges over the side excavated, for the convenience of the traveling public. All backfilled trenches shall be maintained in such a manner that they will offer no hazard to the passage of traffic. The convenience of the traveling public and properly owners abutting shall be taken into consideration. All public or private drives shall be taken into consideration and shall be promptly backfilled or bridged at the direction of the Engineer. Excavated materials shall be disposed of so as to cause the least interference, and in every case the disposition of materials shall be satisfactory to the Engineer.

Trenches in which pipes are to be laid shall be excavated in open cut to the depths shown on the approved plans, cut sheets or as specified by the Engineer. The minimum allowable trench width shall not be less than the outside diameter of the pipe plus eight (8) inches on each side. Where rock is encountered it shall be removed to a minimum depth of four (4) inches below the top of the pipe. Unless specifically authorized by the Engineer, trenches shall in no case be excavated or permitted to become wider than two (2) feet six (6) inches plus the nominal diameter of the pipe at the level of or below the top of the pipe. If the trench does become wider than two (2) feet six (6) inches at or below the top of the pipe, special precautions may be necessary, such as upgrading the class of pipe installed, as determined by the Engineer. The contractor shall bear the cost of such special precautions as necessary.

All excavated materials shall be placed a minimum of two (2) feet back from the edge of the trench.

Where conditions exist that may be conducive to slides or cave-ins, proper and adequate sheeting, shoring and bracing shall be installed (see Section 5.7) to provide safe working conditions and to prevent damage to work.

5.2.1 Drainage of Excavations. The Contractor shall maintain all excavations free of water. He shall provide all dams, channels, sumps, or other means necessary to keep the excavation entirely clear of water and shall provide and operate pumps or other suitable equipment of adequate capacity for de-watering the excavations. If necessary or so directed by the Engineer, the Contractor shall place crushed stone to maintain a firm, water free excavation bottom and base. Pipe bedding, laying, jointing, and the placing of concrete shall be done in a water-free trench or excavation. Trenches shall be kept free of water during the pipe installation and until the pipeline has been backfilled.

5.3 PIPE BEDDING

5.3.1 Standard Bedding. Except as specified in 5.3.2 through 5.3.4 all sewer pipe, including lateral taps within a public right-of-way or easement, shall, as a standard practice be laid using Standard Bedding. Such bedding (material shall be as specified in Section 2), shall be placed a minimum depth of four (4) inches below the bottom of the pipe barrel and thoroughly tamped along each side of the pipe to a height equal to 0.5 of the pipe diameter. Bell holes shall be provided at each joint. Bedding material shall be brought up to a minimum four (4) inches above the top of the pipe.

5.3.2 Special Subgrade Improvement. When directed by the Engineer, unsuitable materials below the normal trench depth shall be removed to a depth sufficient to provide a layer of crushed limestone (#6, #3, or #57 as specified by Engineer) to support the pipe and prevent settlement. The pipe shall then be laid on Dry Mix Concrete Bedding or Standard Bedding placed over the Special Subgrade Improvement.

5.3.3 Dry Mix Concrete Bedding. In areas where wet mucky soil, unstable soil or "running sand" is encountered or as otherwise directed by the Engineer, sewer pipe shall be laid on Dry Mix Concrete. The concrete shall be minimum 2500 psi 28 day strength Class "B" as per Section 2.1. The cement, sand and stone shall be thoroughly mixed (no water) and placed in the trench, to a minimum depth of four (4) inches below the bottom of the pipe. Dry mix concrete shall be thoroughly tamped along each side of the pipe to a height equal to 0.3 of the pipe diameter. Only enough water shall be added to the concrete, after the pipe is in place, to cause hydration of the cement. After water is added the pipe grade shall be rechecked, adjusted as necessary and the concrete re-tamped along the side. The sewer trench shall be kept water free during pipe laying and until the concrete has set. (See Exhibit 5.1 SD - Section No. 8)

5.3.4 Rock Cut Bedding. If the foundation is in rock the excavation shall be undercut to a depth of four (4) inches below the bottom of the pipe bell. The pipe shall be laid on a bed of granular material to provide continuous support for the lower section of the pipe. Granular bedding shall be #57, #67 or 610’s.

5.4 LAYING PIPE. The laying of sewer pipe in finished trenches shall be commenced at the lowest point so that the spigot ends point in the direction of flow (bell pointed upstream). Prior to making pipe joints, all joint surfaces shall be clean and dry and free from gravel or other
extraneous materials. All necessary lubricants or adhesives shall be used as recommended by the pipe manufacturer. No section of pipe shall be brought into position for jointing until the preceding section has been bedded and secured in place.

### 5.4.1 Line and Grade

Control stakes (vertical and horizontal) shall be set at maximum 100’ intervals and at manholes by a licensed land surveyor. The Contractor/Developer shall use a pipe laser and target for maintaining line and grade. A calibrated survey transit shall be on site to verify line and grade compliance. All adjustments to line and grade must be made by scraping away or filling in under the barrel of the pipe and not by wedging or blocking up any portion of the pipe or striking the pipe in an effort to drive it down.

The Contractor shall be responsible for maintaining grades and elevations as called for on the drawing profiles, and any variances found shall be corrected by the Contractor at his own expense.

All pipe lengths shall be laid with ends abutting and true to line and grade as given by the Engineer. They shall be fitted and matched so that when laid they will form a sewer with a smooth and uniform invert. Supporting of pipe shall be as set out hereinbefore under "Pipe Bedding".

Branches, fittings and specials for sewer lines shall be provided and laid as and where directed by the Engineer or shown on the plans.

Before each piece of pipe is lowered into the trench, it shall be thoroughly inspected to insure it’s being clean. Each piece of pipe shall be lowered separately. No piece of pipe or fitting which is known to be defective shall be laid or placed in the lines. If any defective pipe or fitting shall be discovered after the pipe is laid, they shall be removed and replaced with a satisfactory or fitting without additional charge. In case a length of pipe is cut to fit in a line, it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe and a repair type coupling used as a splicing device.

When laying of pipe is stopped for any reason, the exposed end of such pipe shall be closed with a suitable temporary tight-fitting plug fitted into the pipe bell, so as to exclude earth or other material, and precautions taken to prevent flotation of pipe by runoff into trench. The end of the pipe installed shall be adequately buried to prevent flotation and adequately marked so that it may be hand dug to prevent damage when re-excavated.

### 5.5 BLASTING

When it is necessary to use blasting during pipe excavation, the contractor shall follow the procedure as specified hereinbefore in Chapter 3 “Streets”, Section 3.4.3.

### 5.6 OBSTRUCTIONS

In cases where storm sewers, gas lines, water lines, telephone lines, and other utilities, or other underground structures are encountered, they shall not be displaced or damaged. If relocation is necessary, or damage has occurred, the appropriate utility shall be notified immediately. All such lines or underground structures damaged in the construction shall be replaced at the Contractor’s/ Developer’s expense, unless in the opinion of the Engineer, such damage was caused through no fault of the Contractor.

The Contractor shall notify Kentucky Underground Protection, Inc. (BUD System) and all potentially affected utility companies that are not participating in the BUD System prior to excavation adjacent to their facilities.

The Contractor’s attention is further directed to Chapter 1 “Introduction”, Section 1.11 for additional requirements.

### 5.7 SHORING, SHEETING AND BRACING OF EXCAVATIONS

The Contractor shall furnish, place and maintain adequate sheeting and bracing or trench boxes as is necessary to support the sides of the excavation and prevent any movements of earth which could, in any way, diminish the width of the excavation to less than the amount necessary for proper construction, cause damage to the sewer or structure being constructed or to adjacent structures, utilities, pavements or walks, or cause injury to workmen or others through movement of the adjacent earth banks, or to otherwise damage or delay the work. All work shall conform to the Kentucky Occupational Safety and Health Program and Section 29 CFR 1926, Subpart P, “Trenching and Shoring.”

Sheeting and bracing which is to be removed shall be done in a manner that will not endanger the completed work or other structures. The Contractor shall exercise care to prevent the opening of voids during the extraction process. Any voids created while pulling sheeting shall be immediately filled with flowable fill or fine gravel backfill densified by flushing and jetting of water.
Adequate and proper shoring of all excavations shall be the entire responsibility of the Contractor; however, the Engineer may require the submission of shoring plans (accompanied by supporting computations) for review prior to the Contractor undertaking any portion of the work.

Existing foundations that are adjacent to and above an excavation shall be supported by shoring, bracing or underpinning as long as the excavation remains open, or thereafter if required to insure the stability of the foundation and structure. The Contractor shall be held strictly responsible for any damage to said foundations.

Even though computations shall determine the size of the various components, no timber sheeting less than two inches in thickness and no timber bracing, cross bracing or struts less than six inches by six inches will be acceptable. Solid sheeting will be required for wet or unstable material. It shall consist of continuous vertical sheet piling of timber or steel with suitable whales and braces. Care shall be taken to avoid excessive backfill loads on the completed pipelines. The requirement that the width of the ditch at the level of the crown of the pipe be not more than two feet six inches plus the nominal diameter of the pipe, as set out in Section 5.2, shall be strictly observed.

Trench sheeting shall not be removed until sufficient backfill has been placed to protect the pipe.

All sheeting, planking, timbering, bracing and bridging shall be placed, renewed and maintained as long as is necessary.

5.8 BACKFILLING PIPELINE TRENCHES. All backfilling shall be accomplished in accordance with the details shown on Std. Drawing Exhibit 5.1SD.

When directed by the Engineer, or as otherwise needed, the Contractor shall add water to the backfill material or dry out the material, to attain a condition near optimum moisture content (generally between plus 2% and minus 4% of optimal moisture content) to reach maximum density of the material when it is tamped. The Contractor shall obtain compaction of the backfill of at least 95 percent of Standard Proctor (ASTM D 698) density where mechanical tamping of backfill is required.

Before final acceptance, the Contractor will be required to level off all trenches or to bring the trench up to the level of the surrounding terrain. The Contractor shall also remove from roadways, rights-of-way and/or private property all excess earth or other materials resulting from construction.

In the event that pavement is not placed immediately following trench backfilling in streets and highways, the Contractor shall be responsible for maintaining the trench surface in a level condition at proper pavement grade at all times.

In all cases walking or working on the completed pipelines except as may be necessary in tamping or backfilling will not be permitted until the trench has been backfilled to a point one foot above the top of the pipe. The filling of the trench and the tamping of the backfill shall be carried on simultaneously on both sides of the pipe in such a manner that the completed pipeline will not be disturbed and injurious side pressures do not occur.

5.8.1 Method "A" - Backfilling in Open Terrain. Backfilling of pipeline trenches in open terrain shall be accomplished in the following manner:

The lower portion of the trench, from the pipe bedding to a point 12 inches above the pipe shall be backfilled with material free from rock and as acceptable to the Engineer. This material shall be placed in six (6) inch layers along each side of the pipe taking care to keep the level of fill on each side of the pipe equal.

Compaction shall be accomplished by hand-tamping or by approved mechanical methods. Upon approval of the Engineer, crushed stone, or fine gravel may be used as backfill in lieu of compacted earth.

The upper portion of the trench above the compacted portion shall be backfilled with material that is free from large rock. Incorporation of rock having a volume exceeding one-half cubic foot is prohibited. Backfilling this portion of the trench may be accomplished by any means approved by the Engineer. The trench backfill shall be heaped over or leveled.

5.8.2 Method "B" - Backfilling Under Sidewalks and Unpaved Driveways. Backfilling of pipeline trenches under sidewalks and unpaved driveways shall be accomplished in the following manner:

The lower portion of the trench from the pipe bedding to a point 12 inches above the top of the pipe shall be backfilled with material free from rock and/or acceptable to the Engineer. This material shall be placed in six (6)
inch layers along each side of the pipe taking care to keep the level of fill in each side of the pipe equal.

Compaction shall be accomplished by hand-tamping or by approved mechanical methods. Upon approval of the Engineer, crushed stone, or fine gravel may be used as backfill in lieu of compacted earth. Flowable fill is also an acceptable backfill material.

The middle portion of the trench, from a point 12 inches above the top of the pipe to a point six (6) inches below the grade line, shall be backfilled with material free from rock and/or acceptable to the Engineer. This material shall be placed and compacted in layers of approximately six (6) inches.

Upon approval of the Engineer, the Contractor may backfill the middle portion of the trench with crushed stone or fine gravel in lieu of materials that require compaction.

The upper portion of the trench shall be temporarily backfilled and maintained with crushed stone or gravel until such time as the sidewalk is constructed or the driveway surface is restored.

5.8.3 Method "C" - Backfilling Under Streets, Roads and Paved Driveways. Backfilling of pipeline trenches under streets, roads and paved driveways shall be accomplished in the following manner:

The lower portion of the trench, from the pipe bedding to a point eight (8) inches (10 inches for streets classified above local street) below the bottom of the pavement or concrete sub-slab, shall be backfilled with crushed stone, fine gravel or DGA. Flowable fill is also an acceptable backfill material.

The upper portion of the trench, from a point eight (8) inches (10 inches for streets classified above local streets) below the bottom of the pavement or concrete sub-slab up to grade, shall be backfilled with a base course of dense graded aggregate or crushed stone, suitable to the Engineer. At such time that pavement placement is accomplished the excess base course shall be removed as required.

Backfilling with compacted soil or jetted soil backfill may be allowed for development of new streets or roadways, if specifically approved by the Engineer. Acceptable soil for backfill and adequate time for settling and drying of backfill will be required.

5.9 TESTING OF LINES. The testing of sewage force mains and gravity sewers shall be accomplished in accordance with the procedure listed hereinafter.

5.9.1 Sewage Force Mains. On all projects involving the installation of sewage force mains, the finished work shall comply with the provisions listed below, or similar requirements that will insure equal or better results:

a. Hydrostatic testing Force mains shall be tested by performing a hydrostatic test. The force main shall be completely filled with water and subjected to an internal pressure of 100 psi or twice the surge plus operating pressure, whichever is greater, not to exceed 125 percent of the maximum pressure rating for the pipe, measured at the downstream end. The pressure shall be held for a period of two (2) hours. During the test, leakage from the force main shall be measured. The maximum allowable leakage shall be ½ gallon per inch diameter per 1,000 feet of pipe per hour.

b. Where practicable, pipelines shall be tested between line valves or plugs in lengths of not more than 1500 feet.

c. Pipelines shall be tested before backfilling at joints except where otherwise required by necessity, local ordinance, or public convenience.

d. Duration of test shall be not less than two hours where joints are exposed and not less than 24 hours where joints are covered.

e. Where leaks are visible at exposed joints and/or evident on the surface where joints are covered, the joints shall be re-caulked, re-poured, bolts re-tightened or re-laid, and leakage minimized, regardless of total leakage as shown by test.

f. All pipe, fittings and other materials found to be defective under test shall be removed and replaced at the Contractor's expense.

g. Lines that fail to meet tests shall be repaired and re-tested as necessary until test requirements are complied with.

h. Where nonmetallic joint compounds are used, pipelines should be held under normal operating pressure for at least three (3) days before testing.
5.9.2 Gravity Sanitary Sewer Lines. On all projects involving installation of sanitary sewer lines, the finished work shall comply with the provisions listed below or similar requirements that will insure equal or better results.

After the new sewer system has been installed, and prior to final inspection, the Contractor shall clean out the entire system by pushing through each individual line in the system, from manhole to manhole, appropriate tools for the removal of any and all dirt, debris and trash from the lines.

During or subsequent to the final inspection, the Engineer will inspect each individual line, from manhole to manhole, either by use of televisions, lights or other means at his disposal to determine whether the completed lines are true to line and grade as shown on the plans.

All lines or sections of lines that are found to be laid improperly, contain broken or leaking sections of pipe, not properly jointed, or are obstructed in such a manner that they cannot be satisfactorily corrected otherwise, shall be removed and replaced at the Contractor's expense.

The Contractor shall lay sewer lines so as to generally be water tight, including house connections. In no case shall the rate of leakage exfiltration or infiltration average more than 200 gallons per inch pipe diameter per 24 hours per mile of sewer. Any locations of visible leakage shall be replaced or repaired as otherwise approved by the Engineer. The length of the main sewers shall be used in making the foregoing computation even though the house connections (from the main sewer to the property line) should be in place and included as a part of the system when infiltration is measured.

On all projects involving the installation of gravity sewers, the finished work shall comply with the provisions listed below, or similar requirements that will insure equal or better results:

a. Deflection test. Deflection tests shall be performed on all flexible pipe. The test shall be conducted after the final backfill has been in place at least 30 days to permit stabilization of the soil-pipe system. All jetting activity shall be completed prior to deflection testing. No pipe shall exceed a deflection of five (5) percent. A properly sized, manufactured mandrel shall be used for deflection test. It shall have a diameter not less than 95% of the nominal inside diameter of the pipe, depending on which is specified in the ASTM Specifications. The pipe shall measure in compliance with ASTM D 2122. The test shall be performed without any mechanical pulling devices.

b. Air test. Low Pressure Air test shall be performed for all gravity sewer lines. The internal pressure applied shall be at least four (4) psi greater than the maximum pressure that may be exerted by groundwater above the invert of the pipe at the time of the test. However, the internal air pressure in the line shall not be allowed to exceed eight (8) psi. When groundwater pressure is believed to possibly exceed four (4) psi, in the opinion of the Engineer, the Contractor shall also conduct infiltration tests. The air tests shall be performed in accordance with the current Unibell Standard as shown in Exhibit 5-17.

c. Infiltration test. If, in the opinion of the Engineer, the air test may not be conclusive due to groundwater pressure, the Engineer may require infiltration tests to be performed by the Contractor in addition to the air test.

d. Vacuum test. Vacuum testing of manholes may be required by the Engineer, when concerns exist about possible infiltration due to high groundwater and/or deep manholes, manhole construction or manhole installation. Vacuum testing shall be done in accordance with ASTM C1244-93 (current edition). Where practical, testing shall be performed prior to backfilling around the structure. If testing is performed following backfilling, proper determination of groundwater elevation shall be completed and appropriate adjustment made for vacuum testing pressure.

e. Leakage. Regardless of test results, all visible leaks shall be corrected.

5.10 STEEL CASING PIPE. Steel casing pipe for highway or railroad crossings shall be bored and/or jacked in place. All joints between lengths shall be solidly welded with a smooth non-obstructing joint inside.

After the pipe has been installed in the casing pipe, inspected and tested, both ends of the cover pipe shall be sealed completely with concrete or and EPDM elastomeric membrane, in a manner acceptable to the Engineer.
5.10.1 JACK AND BORE CONSTRUCTION. All encasement pipes shall be installed at locations and to the line and grade as shown on the Plans. Encasement pipes shall be steel seamless pipe and shall be new material, with a minimum yield of 35,000 psi. All steel pipe shall conform to requirements of ASTM A53-B and A139. Pipe thickness shall be as follows:

<table>
<thead>
<tr>
<th>Casing pipe size</th>
<th>min. thickness (under hwy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14” &amp; under</td>
<td>0.250”</td>
</tr>
<tr>
<td>16” to 22”</td>
<td>0.375”</td>
</tr>
<tr>
<td>24” to 36”</td>
<td>0.500”</td>
</tr>
</tbody>
</table>

All joints in the encasement pipe shall be welded. Weldings of the steel casing pipe shall be solidly butt-welded with a smooth non-obstructing joint inside and conform to all specifications as required by American Welding Society (AWS). The casing pipe shall be installed without bends. All welders shall be qualified as prescribed by AWS requirements.

Carrier pipes installed inside casing pipes shall be centered throughout the length of the casing pipe. This shall be accomplished by the installation of polyethylene pipeline spacers attached to the carrier pipe in such a manner as to prevent the dislodging of the spacers as the carrier pipe is pulled or pushed through the casing pipe. Spacers shall be of such dimensions to provide: full supportive load capacity of the pipe and contents; such thickness to allow installation and/or removal of the pipe; allowance of no greater than ½ inch movement of the carrier pipe within the casing pipe after the pipes are installed. All pipe spacers shall be fastened and installed per manufacturer’s specifications. They shall be located immediately behind each bell and at a maximum spacing dimension as follows:

<table>
<thead>
<tr>
<th>Carrier Pipe Size</th>
<th>Maximum spacing</th>
</tr>
</thead>
<tbody>
<tr>
<td>10” &amp; under</td>
<td>8’</td>
</tr>
<tr>
<td>12” to 26”</td>
<td>12.4’</td>
</tr>
</tbody>
</table>

The void between the carrier pipe and the steel casing pipe shall be grout filled if so directed by the Engineer.

5.11 MARKING TAPE. Marking tape shall be a composite plastic metallic tape, at least five (5) mils in thickness with impervious plastic film on both sides and aluminum foil in center. The minimum tensile strength shall be 185 lbs. The tape shall be at least three (3) inches in width, colored green, and shall be permanently printed “Caution Buried Sewer Below”.

5.12 LOCATOR WIRE AND MARKERS. The Contractor/Developer shall install a trace wire along the entire force main system. The tracer shall be continuous along the main with no gaps, breaks or open circuits. The insulated copper wire shall be installed along the top elevation of the pipe, secured with tape and shall be connected to the exterior of each valve box for future electronic signal tracing. The wire shall be brought to the surface inside a two (2) inch PVC conduit. Where the main is laid off the road, the wire is to be brought to the surface approximately every 1000 feet. Markers will be provided by the RWRA; valve boxes to be furnished by Contractor/Developer.

Splices in the tracer wire shall provide a positive, secure connection and shall be protected by wrapping with electrical tape, approved electrical connector or electrical sealing compound. The wire shall be loosely strung and shall not be pulled taut. All tracer wire shall be tested by the Contractor/Developer and shall satisfactorily convey electrical signal.

Insulated copper wire shall be AWG #12, Type 1, THHN or THWN 600 V; insulation shall be gasoline and oil resistant.

5.13 MANHOLES. Manholes shall be installed at the end of each line; at all changes in grade, size or alignment; at all intersections; and at distances not greater than 400 feet. Sanitary manholes shall be constructed of precast concrete (see Std. Drawing Exhibit 5.2SD) and shall be of the form and dimensions as shown on the approved plans. They shall be constructed of 4000 psi concrete. Cast in place manhole bases shall be a minimum 3500 psi concrete. All precast manhole adjustment rings, cones, flat slabtops, barrel sections and bases shall conform to the requirements of ASTM C 478. All structure shall be designed to handle HS-20 loading. All cone and transition sections shall be eccentric in shape. Base and riser sections shall be custom-made with openings to meet indicated pipe alignment conditions. The maximum size pipe allowed in a given
sized manhole shall be as follows. 24” pipe in four (4) foot diameter structure, 36” pipe in five (5) foot diameter, 48” in six (6) foot diameter. Outside diameter may be considered on a case-by-case basis for other pipe materials. The minimum distance allowed between precast holes for the pipes shall be 12 inches, or ½ the outside diameter, whichever is larger.

Openings in precast structures for pipes shall be the outside diameter of the pipe plus a maximum of six (6) inches. In order to use non-shrink grout, the opening shall be the outside diameter of the pipe plus three (3) inches. (Outside diameter of pipe plus 4 ½ inches is permissible when tapered hole forms are utilized).

Openings around the pipe in precast structures shall either be filled with non-shrink grout for the wall thickness of the structure or the pipe shall be encased with minimum six (6) inch collar of concrete from the inside face of the wall to 1’0” outside the outer face of the wall. The pipe shall be adequately supported to prevent settling while the grout or the concrete encasement is setting up. The inside faces of the structure walls shall be finished with a trowel and wet brush finish.

5.13.1 Standard Manholes. The standard manhole shall be six feet or less in depth, measured from the base of the cover frame to the manhole downstream invert and shall be of cone type, top construction as shown on Std. Drawing Exhibit 5.2SD.

5.13.2 Shallow Manholes. The shallow manholes shall be five feet or less in depth, measured from the base of the cover frame to the manhole downstream invert and shall be of flat top construction as shown on Std. Drawing Exhibit 5.2SD.

5.13.3 Manhole Inverts over existing sewers. Manhole inverts shall be formed from 3500 psi concrete as shown on Exhibit 5.2SD. Inverts for a "straight-through" manhole shall be formed by laying the pipe straight through the manhole, pouring the concrete invert, and then cutting out the top half of the pipe. Curved invert shall be constructed of concrete, as shown, and shall form a smooth, even half-pipe section as shown. The inverts shall be constructed when the manhole is being built using prefabricated forms. The excavation shall be kept free of water while the manhole is being constructed and the manhole shall not be backfilled until inspected by the Engineer.

5.13.4 Manhole Frames and Lids. Manhole castings shall consist of cast iron frames and 22-3/4 inch diameter covers, weighing not less than 300 pounds per frame and cover, rated for traffic, dimensioned as shown on the plans. Manhole lids must sit neatly in the rings, with contact edges machined for even bearing and tops flush with ring edge. They shall have sufficient corrugations to prevent slipperiness. Lids on sanitary sewer manholes must not be perforated. Lids shall be bolt-down or supplied with an approved diaphragm as may be warranted when surface flooding is a potential. Castings shall meet the requirements for ASTM A 48.

5.13.5 Watertight Sewer Pipe Connections. Watertight sewer pipe connections shall be elastomeric gaskets or couplings, manufactured in accordance with ASTM C 923, Standard Specification for resilient connectors between reinforced concrete manhole structures and pipes, and shall be on RWRA’s list of approved materials.

5.13.6 Joint Sealants. Joint seals shall be either Type A Rubber Gaskets or Forsheda Rubber gaskets. They shall meet the requirements of AASHTO M 198. Bituminous mastic joint sealing material is allowed only if it is a one (1) inch molded mastic compound.

5.13.7 Manhole Concrete Sealants. When required by the engineer, manhole sealants shall be used in accordance with the manufacturer's recommendations and by one of the two following methods.

Method #1: The manhole manufacturer shall give written conformation that all reinforced precast concrete manhole sections contain the inorganic copolymer waterproofing admixture IPANEX, manufactured by IPA Systems, Inc., in compliance with manufacturer's dosage and mixing instructions. Alternatively, XYPEX Chemical Company concrete batch admixture may be used, if in compliance with manufacturer's dosage and mixing instructions.

Method #2: Before assembly, the entire outer surface of the manhole, including the underside of the manhole base, shall receive a minimum of two coats of FARBERTITE (IPA Systems, Inc.) in accordance with manufacturer’s application instructions. After assembly (sealing all joints between manhole sections and plugging all lift holes as indicated above), Contractor shall apply a minimum of two coats of DRYCON (IPA Systems, Inc.) to the entire manhole interior in
accordance with manufacturer’s mixing and application instructions.

5.13.8 Drops into Standard Manholes. Internal or external drop assemblies are required for any vertical drop of 24 inch or greater. Manholes with external drops shall have an extended base to tie the drop assembly into. The stack pipe shall be laid vertically as shown on the plans and encased with structural flowable fill. Internal drops may be constructed when the size of the pipe to be dropped is less than or equal to 12” diameter. Internal drops shall have supports at a maximum of four (4) foot spacing, with a minimum of two (2) per drop. All support hardware, including bolts, shall be stainless steel. See standard drawings.

5.14 BUILDING CONNECTIONS. In both separate and combined sewer systems, building sanitary laterals shall be run to the right-of-way or easement free of any intrusion of storm water flows (i.e. roof drains, foundation drains, yard drains, groundwater, and geothermal systems). The effort shall be made to daylight all storm flows and to allow for surface storage and/or ground absorption of all storm flows whenever possible. In combined sewer systems the effort shall also be made to keep the sanitary and storm systems separate where possible to facilitate the future separation of the systems.

Tee-wye's shall be installed (with the flow) on the collector sewers for all house or building connections at locations established by the developer's Engineer. At least one connection shall be provided for each platted lot. The Contractor shall lay the connection lines from this point to the property line, or easement line.

Each separate dwelling structure, commercial building or industrial building shall be provided with a separate sewer connection. Such connections shall be PVC plastic pipe or Ductile Iron pipe. All connections that service single-family dwellings shall be not less than four (4) inch diameter pipe. All connections that serve multi-family dwellings, commercial buildings and industrial buildings shall be not less than six (6) inches diameter pipe. Trenching, pipe laying, joints and backfilling shall conform to the requirements set out herein. All open ends shall be sealed with PVC or compression joints compatible with the pipe bell.

For shallow sewers in rock or earth trench, the tee-wyes shall be encased entirely with crushed stone and fully compacted. The pipe shall be laid on a uniform slope from the tee without the use of bends.

For deep sewers in earth, the tee-wyes shall be encased entirely with crushed stone as above. House connection pipe in this case shall be appropriate extra strength sewer pipe from the tee branch to the property line. The pipe shall be laid on a uniform grade from the tee branch to the right-of-way to meet the probable building sewer grade.

For deep sewers in rock, the tees shall be encased entirely with Class "B" concrete. House connection pipe in this case shall be appropriate extra strength sewer pipe, as shown on the drawings extending from the tee to the property line. The pipe shall be laid on a uniform grade from the tee branch to the right-of-way to meet the probable building sewer grade.

Under normal conditions, where elevations are not critical, house connection pipes shall be laid on a slope of not less than one foot per 100 feet (approximately 1/8-inch per foot).

The tapping of house connections into manholes on the newly constructed sewers will not be permitted, except at the end of the collector lines where necessary or required by the Engineer. Where it is necessary to do so, the invert of the house connection shall not be higher than a point three inches below the top of the bench in the manhole and suitable trough shall be provided in the bench to prevent the accumulation of solids on the bench. If necessary, a standard drop connection shall be provided for a house service that is tapped into a manhole.

The installation of house connections shall follow immediately or be concurrent with the construction of the main sewer. This method of construction will permit more advantageous handling of backfilling and will also avoid possible damage to the main sewer by subsequent exposure for connection of the service lines.

5.15 CONNECTIONS TO EXISTING LINES. Connection to existing gravity sewer lines shall be made where indicated on the plans. The connection shall be made to the main by installing a proper saddle and tee/wye, or constructing a new manhole at the connection. The proper saddle shall include a gasket and stainless steel clamps. If constructing a new manhole, the invert channel shall be formed around the existing sewer line and the top half of the existing sewer line shall be cut away to form the invert channel of the existing line and to accept the invert channel of the new line.
5.16 REMOVAL AND REPLACEMENT OF EXISTING FACILITIES

5.16.1 Sidewalks. See section 9.1.
5.16.2 Pavement. See section 9.2.
5.16.3 Curb and Gutter. See section 9.3.

5.17 CONCRETE CRADLE, ANCHORS, CAPS OR ENCASEMENT. Concrete cradle, anchors, cap or encasement of sewer lines and/or fittings shall be placed where shown on the Plans, required by the specifications, or as directed by the Engineer. Concrete shall be Class "B" and shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed. In tamping concrete, care shall be taken not to disturb the grade or line of the pipe or injure the joints. Measures shall be taken to avoid flotation of PVC pipe.

See Std. Drawing Exhibit 5.1 SD.

5.17.1 CONCRETE CAP. Where shown on the Plans or where a sanitary sewer pipe will have less than two (2) feet of vertical clearance below an existing or proposed storm drain, or utility conduit, a concrete cap shall be installed unless the pipe itself is proven to RWRA to have adequate strength. The length of the concrete cap shall be as shown on the Plans or two (2) feet beyond the outside edge of the storm drain or utility conduit, or two (2) feet beyond the point where the sewer pipe attains 30 inches of cover in an easement or four (4) feet of cover in a right-of-way, or surfaces subject to vehicular traffic, or as directed by RWRA. The sewer pipe shall be laid and supported on uniform crushed stone bedding to the top of the pipe, and concrete shall be placed over the pipe to a thickness of at least six (6) inches for the full trench width.

5.17.2 CONCRETE ENCASEMENT. Where shown on the Plans or where conditions exist requiring additional pipe protection (stream crossings, ditch crossings, shallow trench or poor soil conditions), pipes shall be encased in concrete, as determined by RWRA. The length of the concrete encasement shall be at least two (2) feet beyond the point where additional pipe protection is required, as shown on the Plans, or as directed by RWRA. The sanitary sewer or storm drainage pipe shall be laid and supported as required for a concrete for a concrete cradle, and concrete shall be placed around the pipe six (6) inches either side of it and up to at least six (6) inches over the top of the pipe. Proper bracing of the pipe shall be provided to prevent movement or flotation of the sewer pipe during placing of concrete. In rock-bottom streams, the encasement shall extend from 6 inches below the pipe up to the original rock level, unless otherwise shown on the Plans. Encasement shall be required when crossing a blue line stream and shall extend to five (5) feet beyond the top of bank on each side of said stream. Concrete encasement is required for plastic pipe with less than 30 inches of cover in easements and less than four (4) feet of cover in street rights-of-way.

5.18 SAFELOADING. Safeloading shall consist of completely filling the designated areas with grout in such a manner to make them safe from collapse or at the Contractor’s option, safeloading may be done by filling the designated area with free-flowing low strength mortar. Appreciable deposits of debris shall be removed from other structures prior to safeloading. The ends of existing culverts shall be plugged by use of bulkheads containing small openings at the tops through which the grout may be pumped at a minimum pressure of 15 pounds per square inch. All structures to be safeloaded shall be completely filled with grout or low strength mortar.

5.19 FLOWABLE FILL. Flowable fill is a low strength mixture consisting of Portland cement, sand, class F fly ash, water and other materials as approved by the Engineer. Flowable fill has a density between 115 .b/cf and 130lb/cf and is of a consistency that will flow under and around pipe. Flowable fill does not require compaction, finishing, or curing and will not settle after hardening occurs. It is ideal for use in restricted areas where placing and compacting fill material is difficult and where traffic cannot be delayed for a long period. When used to backfill aluminum pipe, and approved means of separation shall be provided, such as bituminous coating.

To expedite settlement and hardening of the flowable fill, bleed water shall appear on the surface within five (5) to 10 minutes after placement. The release of water by bleeding caused the solid particles to realign into intimate contact and the mixture becomes firm. A delay in bleeding indicates there are too many fines in the mixture or insufficient water. If the maximum water was added, the fly ash quantity shall be reduced in increments of 50 lbs. until the mixture is bleeding freely. Approximately 60 lbs. of sand shall be added to replace each 50 lbs. increment of fly ash to maintain the original yield. If two increment reductions, 100 lbs., do not promote free bleeding of the mixture, other possible remedies shall be evaluated. The flowable fill is too dry when cracks develop as it flows into place.

A set of test cylinders shall be cast for each 300 cubic yards of flowable fill. Cylinders shall not be rodded, but the sides of the mold shall be tapped lightly. The test
cylinders shall be allowed to bleed for about 30 minutes, refilled, and then covered with a sheet of tough durable impervious plastic or cylinder lid. Plastic shall be secured in place around the mold, within one inch of the top, with a rubber band or string prior to covering the lid with wet burlap. The burlap shall be removed after 34 hours and the cylinder cured at 60 degrees Fahrenheit to 90 degrees Fahrenheit, in the shade, until 28 days old. The plastic covering and mold shall then be removed and the compressive strength test shall be performed. The average of the 28 days compressive strength tests shall be 50 psi to 100 psi. This strength range will provide the optimum balance of adequate cohesion while allowing ease of subsequent removal, if necessary.

5.20 LOCATING NEAR WATER MAINS

5.18.1 Horizontal Separation. Whenever possible, sewers should be laid at least 10 feet, horizontally, from any existing or proposed water main (edge to edge). Should local conditions not allow a lateral separation of 10 feet, a sewer may be laid closer than 10 feet to the water main if:

a. It is laid in a separate trench or the same trench with the water mains located at one side on a bench of undisturbed earth.

b. The elevation of the crown of the sewer is at least 18 inches below the invert of the water main.

5.20.2 Crossings. Sewers crossing water mains shall be laid to provide a minimum vertical distance of 18 inches between the outside of the water main and the outside of the sewer. The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible form the water main joints. Where a water main crosses under a sewer, adequate structural support shall be provided for the sewer to maintain line and grade.

When it is not possible to obtain proper horizontal and vertical separation as stipulated above, the sewer shall be designed and constructed equal to water pipe and pressure tested at 150 psi to assure water tightness prior to backfilling. The pressure pipe shall extend a minimum of 10 feet in each direction from the crossing and be properly connected with an approved manufactured fitting or mechanical joint. The sanitary sewer line or the lower of the two utilities shall be encased in concrete or capped as determined appropriate by the Engineer. The encasement or capping shall extend for 10 feet on both sides of the crossing, measured perpendicular to the water main.

5.21 BASEMENTS. Unless specifically exempted by the Engineer in writing, buildings with basement floor drains and/or other basement plumbing shall have a sump facility (with check valve) that pumps all sewerage to an elevation just below the first floor elevation prior to discharging, dropping into the sanitary lateral for the building. Storm water flows (i.e. roof drains, foundation drains, yard drains, and geothermal systems) shall not be connected to laterals going to sanitary or combined sewers. Sanitary laterals shall not be run at excessive depths that would allow for basement plumbing to gravity to the main.

5.22 BUILDING DEMOLITION. During the demolition of any building that has sewer service, the Contractor shall be responsible for locating the tap at the right-of-way or easement line and installing a proper cap on the end of the tap to the public line. Contractor shall comply with permitting and inspection requirements of the Engineer. Expenses incurred by the sanitary sewer service provider shall be assessed to the demolition contractor for failure to properly notify agency for cap inspection.

5.23 GREASE TRAPS / OIL SEPARATORS / MONITORING MANHOLES. Requirements for these facilities shall be as required in the Sewer Use Ordinance, Kentucky Plumbing code and policies of the Regional Water Resource Agency.

5.24 FUTURE SEWER CONNECTIONS. When areas adjacent to a proposed development can best be served by sewers through the proposed development, the engineer may require that the developer extend sewer service to the far property line of a development or may require easement be established that would serve the adjacent area.

5.25 REPLACEMENT OF EXISTING MAILBOXES, CULVERTS AND OTHER SUCH FACILITIES. Existing mail boxes, drainage culverts and the like shall not be disturbed unless necessary, in which case, they shall be replaced in as good condition as found as quickly as possible. Existing materials shall be re-used in replacing such facilities when materials have not been damaged by the Contractor's operations. Existing facilities damaged by the Contractor's operation shall be replaced with new materials of the same type at the Contractor's expense.

5.26 CLEAN-UP. Upon completion of the installation of the sewer pipes and appurtenances, the Contractor shall remove all debris and surplus construction materials
resulting from the work. The Contractor shall grade the ground along each side of the pipe trench in a uniform and neat manner leaving the construction area in a shape as near as possible to the original ground line.

5.27 SEEDING AND SODDING. Requirements shall be accomplished in accordance with the specifications as outlined in Chapter 10 hereinafter.
TOP SLAB REQD. WHEN MANHOLE IS LESS THAN 4-1/2" TOTAL HEIGHT (SEE KYP-120)

NOTES:
CONCRETE TO CONFORM TO ASTM C-478 STANDARDS
2" MIN. CONCRETE COVER
RESILIENT CONNECTORS MEET ASTM C-923
MEETS OR EXCEEDS ASTM C-478
#5 REBAR @ 12" C.C EA. WAY IN BASE SLAB
WEIGHT: BASE - 4,350lbs. (30" HT)
RISER - 850lbs./vert. ft.
CONICAL - VARIES
BOOT KORN SEAL OR EQUAL REQ'D
IN THE EVENT OF UNSTABLE, WET OR PUMPING
SUBGRADE USE DRY MIX CONCRETE BEDDING
OR AS OTHERWISE DIRECTED BY THE ENGINEER
LEVEL AND TAMP BEDDING MATERIAL PRIOR
TO PLACING MANHOLE BASE SECTION
PROVIDE ELASTOMERIC MANHOLE BOOT/WATERSTOP
AT EACH MANHOLE OPENING. APPROVED WATERSTOPS INCLUDE:
A: FSX, A-LOCK GASKET OR DURA-SEAL CAST IN PLACE
B: KORN-N-SEAL AND FLEX BOOT COMPRESSION GASKET

SECTION VIEW

CONICAL SECTIONS
24" , 30" , 32" , 36"

BASE SECTIONS
48" MAX HT.
(AS REQD.)

PROVIDE 6" MIN. DGA OR 57's TO VIRGIN DIRT.
TOP SLAB REQD. WHEN MANHOLE IS LESS THAN 4-1/2" TOTAL HEIGHT (SEE KYP-120)

PIPE OPENING SIZE AS REQ'D. MIN. 2" CLEARANCE ABOVE & SIDE PIPE.

SECTION VIEW

NOTES:
CONCRETE TO CONFORM TO ASTM C-478 STANDARDS
2" MIN. CONCRETE COVER
MEETS OR EXCEEDS ASTM C-478
WEIGHT: BASE - 850lbs./vert.ft.
RISER - 850lbs./vert.ft.
CONICAL - VARIES
FERNCO WATERSTOP OR EQUAL REQ'D

CONICAL SECTIONS
24”, 30”, 32”, 36”

BARREL SECTIONS
12” - 72”

BASE SECTIONS
48” MAX HT.
(AS REQ'D)

6” MIN. FLOOR

6” MIN. DGA OR 57’s TO VIRGIN DIRT.

SECTION VIEW

OWENSBORO METROPOLITAN
PUBLIC IMPROVEMENT SPECIFICATIONS
CHAPTER 5
SANITARY SEWERS

4”-0” DIA. OPEN BOTTOM MANHOLE
DETAIL SHEET
EXHIBIT NO. 5-2
NOT TO SCALE
TOP SLAB REQD. WHEN MANHOLE IS LESS THAN 4'-1/2" TOTAL HEIGHT (SEE KYP-120)

STEPS TO BE ALIGNED OVER D.S. INVERT

CONICAL SECTIONS 24", 30", 32", 36"

BARREL SECTIONS 12"-72"

4'-1/2"

BASE SECTIONS 48" MAX. HT. (AS REQ'D.)

1/3 PIPE DIA.

6"

5"

4'-0" DIA.

5'-10" DIA.

5"  12" CENTERS

1" MIN. FALL TO CHANNEL

NOTES:
CONCRETE TO CONFORM TO ASTM C-478 STANDARDS
2" MIN. CONCRETE COVER
RESILIENT CONNECTORS MEET ASTM C-923
#5 REBAR @ 12" C.C. EA. WAY IN BASE SLAB
WEIGHT: BASE - 5,530 lbs./max.
RISER - 850 lbs./vert. ft.
CONICAL - VARIES

FLANGED BASE MANHOLE TO BE USED ON SEWERS
12' DEEP OR MORE OR AS DIRECTED BY ENGINEER
NOTES:
CONCRETE TO CONFORM TO ASTM C-476 STANDARDS
2" MIN. CONCRETE COVER
RESILIENT CONNECTORS MEET ASTM C-923
MEETS OR EXCEEDS ASTM C-478
#5 REBAR @ 12" C.C. EA WAY IN BASE SLAB

SECTION VIEW

<table>
<thead>
<tr>
<th>DIMENSIONS</th>
<th>WEIGHTS</th>
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<tbody>
<tr>
<td>DIA</td>
<td>BASE</td>
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<tr>
<td>4'-0&quot;</td>
<td>8.860lbs</td>
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<tr>
<td>5'-0&quot;</td>
<td>15,001lbs</td>
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<tr>
<td>6'-0&quot;</td>
<td>30,000lbs</td>
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<tr>
<td>10'-0&quot;</td>
<td>56,508lbs</td>
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2'-0" DIA MANHOLES W/ INVERTS
DETAILED SHEET

EXHIBIT NO. 5-4
NOT TO SCALE
NOTES:
CONCRETE TO CONFORM TO ASTM C-478 STANDARDS
2" MIN. CONCRETE COVER
RESILIENT CONNECTORS MEET ASTM C-923
MEETS OR EXCEEDS ASTM C-478
#5 REBAR @ 12" C.C. EA WAY IN BASE SLAB
NOTES:
STEPS TO BE INSTALLED IN TAPERED HOLE FORMED OR DRILLED IN CONCRETE
STEP IS MANUFACTURED BY M.A. INDUSTRIES, INC.

SECTION A-A

OWENSBORO METROPOLITAN PUBLIC IMPROVEMENT SPECIFICATIONS

CHAPTER 5 SANITARY SEWERS

PLASTIC MANHOLE STEPS DETAIL SHEET EXHIBIT NO. 5-6

NOT TO SCALE
CONICAL SECTIONS
24", 30", 32", 36"

2" HOLES FOR DOWEL RODS

SIDE VIEW SECTION

WEIGHT:
24" - 1,325 lbs.
30" - 1,860 lbs.
32" - 1,985 lbs.
36" - 2,440 lbs.

NOTES:
CONCRETE TO CONFORM TO ASTM C-478 STANDARDS
LIFT LOOPS IN 6'8"12'

2" DIA HOLES FOR DOWEL RODS

TOP VIEW

NOTES:
CONCRETE TO CONFORM TO ASTM C-478 STANDARDS
MEETS OR EXCEEDS ASTM-C478
STEP NOT REQD. FOR 3'6" GRADE RINGS
WEIGHT: 3'6"-210lbs
6'0"-420lbs
12'0"-840lbs.
NOT TO SCALE

Exhibit No. 5-10

Manhole Detail

Internal Drop

Sanitary Sewers

Chapter 5

Public Improvement Specifications

OWENSBORO METROPOLITAN

NOTES:

1. Sewer pipe connection to precast manhole with positive seal gasketing system (A.S.T.M. C-923).

2. The minimum diameter will be 4”-0” for 6-inch sewers. For pipe sizes greater than 6-inches, the

3. Manhole diameter shall be approved by RWMA.

4. See Note 1 for threaded internal Steel 1/2 x 1/8 Thick Stainless Steel (g required)

5. Stainless Steel 1/2” Strips

6. Work Specialties

7. See Note 4 for MH 5’ x 5’ x 5’

8. SD-26 Pipe

9. Varies

10. Top of Gasket

11. Glued in Gasket

12. SOC x FTP x SOC

13. See Note 2
SPECIFICATIONS
CONCRETE TO CONFORM TO ASTM C-478 STANDARDS
REINFORCEMENT — ASTM A-615 & ASTM A-615W (LATEST REVISION), GRADE 60
DESIGN LOAD — AASHO HS25 & AASHO HS25W (LATEST REVISION)
APPROX. WEIGHT — BASE 11,200#; LID 10,100#
HOLE SIZE — LENGTH 10'-10", WIDTH 8'-10", DEPTH 6'-0"
Pipe Connect, Opt. — Grout Holes, Other Caskets
Other Options — Risers to Grade, Cast Iron, Petroleum Resistant Mastic

OWENSBORO METROPOLITAN
PUBLIC IMPROVEMENT SPECIFICATIONS

CHAPTER 5
SANITARY SEWERS
GREASE INTERCEPTOR/
OIL SEPARATOR
DETAIL

EXHIBIT NO. 5-12
NOT TO SCALE
4. PROVIDE FLASHING RED LIGHT FOR UNAUTHORIZED ENTRY ALARM
NOTES:

1. L.S. AREA TO BE ENCLOSED BY FENCE. (SIZE, TYPE, HEIGHT SPEC BY RWRA)

2. ALL PRECAST LIFT STATIONS TO HAVE INDRANIC COPOLYMER WATERPROOFING ADMIXTURE "IFANEX" OR "XYPEX" AS PER OWENSBORO PUBLIC IMPROVEMENT SPECS SECTION 5:13:7 METHOD #1

3. ALL LIFTSTATION HARDWARE TO BE 304 STAINLESS STEEL (UNLESS NOTED OTHERWISE)

4. RAIL SYSTEM TO BE FIBERGLASS OR STAINLESS STEEL, SIZED ACCORDING TO PUMP SIZE 6" OR LESS) ANY VARIANCE TO BE APPROVED BY RWRA.

5. CONTRACTOR SHALL PROVIDE ONE (1) SIX (6) OF AVAILABLE) TELEPHONE SERVICE LINE INTO VOICE TELEMETRY CONTROL PANEL.

6. CONTRACTOR TO PROVIDE SYNTHESIZED VOICE TELEPHONE TELEMETRY ALARM SYSTEM (SENSAPHONE 1400 OR EQUIVALENT). ALARM ENCLOSURE TO BE IN A SEPARATE LOCKABLE, WEATHERPROOF STAINLESS STEEL ENCLOSURE.

7. DEVELOPER/ENGINEER MUST CONTACT RWRA, TO RECEIVE "CAD" DRAWINGS
SERVICE SWITCH RACK NOTES:
1. Maintain code required spacing (minimum or greater) for all rack mounted components.
2. Grind smooth the cut edges of all aluminum structural members.
3. All mounting hardware shall be stainless steel.
4. All equipment to be bolted to rack with 1/4" dia. stainless steel bolts with stainless steel lock washers. Damage all threads so nuts cannot be removed.

SERVICE SWITCH RACK ARRANGEMENT
ALL MAIN POWER SUPPLY SHALL BE UNDERGROUND WITHIN PROPOSED LIFT STATION FENCE AREA

CONTROL PANEL TO INCLUDE:
- NEMA TYPE 4X STAINLESS STEEL ENCLOSURE
- BACK PANEL AND INNER DOOR
- INCOMING POWER BLOCK
- MOTOR AND CONTROL CIRCUIT BREAKERS
- NEMA RATED MOTOR STARTERS W/OVERLOAD HEATERS
- PRIMARY VOLTAGE FUSES AND ON/OFF SWITCH (C3)
- CONTROL VOLTAGE TRANSFORMER
- CONTROL CIRCUIT FUSE
- DUPLEX ALTERNATING RELAY W/LEAD SELECT SWITCH
- LAG/OVERLOAD PUMP CIRCUITRY
- HAND-OFF-AUTO SWITCHES
- PUMP RUN LIGHTS
- SEAL FAIL LIGHTS
- CONTROL AND FAULT RELAYS AS REQUIRED
- UL 508 LISTED
- TERMINAL BLOCKS AND GROUND LUGS AS REQUIRED
- AUX. DRY HUMID LEVEL AND SEAL FAIL TELEMETRY CONTACTS
- ALL CONTROLS MUST HAVE ABILITY TO BE OPERATED FROM INNER DOOR

GENERAL NOTES:
1. Primary electric service is to be 230/460 VAC, 3Phase 60 cycle. Primary to be provided by developer, unless approved by R.W.M.A.
(110/230 phase converter maybe allowed for pumps ≤ 10 HP)

2. Mount pump station control panel and electrical equipment on two pressure treated 4' x 4' wooden posts with stainless steel unistrut.

3. Contractor shall provide one ESXiX (if available) telephone service line into voice telemetry box.

4. Contractor to install generator transfer switch (Ronix 7800-6 or equal) between main disconnect and control box.

5. Contractor to install generator receptacle (Hubbell or PS 4100-RW-RECEPTACLE W/ BACK BOX BB-001 (OR EQUAL) FOR 208 OR 240 VOLT INSTALLATIONS. (R4-100-RW FOR 480 VOLT)

6. Contractor to provide synthesized voice telephone telemetry alarm system (Sensaphone 1400 or equal). Alarm enclosure to be in a separate lockable, stainless steel enclosure.

7. All control panels to face outward, and have 3' clearance to any obstruction, including fencing. All control panels shall be lockable, weatherproof, stainless steel enclosures. (Padlock provided by R.W.M.A.)

8. Elec. junction box elevated on deep (1-3/8") SS strut to allow for air passage. Cords enter 5-box from wet well via appropriately sized corrosion resistant sealed cord connectors. Cord connectors to be installed w/ locknut facing down.

OWNESBORO METROPOLITAN PUBLIC IMPROVEMENT SPECIFICATIONS
CHAPTER 5
SANITARY SEWERS
PUMP STATION
DETIAL SHEET 1
EXHIBIT NO. 5-13-b
NOT TO SCALE
"ARI VALVE" AIR RELEASE & VACUUM VALVE OR EQUAL WITHOUT ATTACHMENT

2' X 2' ALUMINUM HATCH WITH HINGED TOP W/ SAFETY WEB NETTING (TRAFFIC RATED IF NECESSARY)

CONCRETE TOP

EXISTING GROUND

48" I.D. MIN. 12" MIN

TREATED 4x4 WITH U BOLT

S.S. VALVE AND NIPPLE

2" DIA. - 4" NIPPLE WITH 4 BOLT F.E. (STAINLESS STEEL NIPPLE)

DIA. X 2" STAINLESS STEEL TAPPED REPAIR CLAMP POWER SEAL MODEL 3131AS OR EQUAL

CLASS 200 PVC FORCE MAIN SIZED BY DESIGN ENGINEER

AIR RELEASE PIT DETAIL

NOTE:
ALL FITTINGS AND HARDWARE TO BE 304 STAINLESS STEEL (S.S.)

OWENSBORO METROPOLITAN
PUBLIC IMPROVEMENT SPECIFICATIONS

CHAPTER 5
SANITARY SEWERS

AIR RELEASE
PIT DETAIL

EXHIBIT NO. 5-15
NOT TO SCALE
### Exhibit 5-17  Gravity sewer air test standard

**TIME REQUIRED FOR A 0.5 PSIG PRESSURE DROP FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015***

<table>
<thead>
<tr>
<th>Pipe Diameter (in)</th>
<th>Minimum Time (min:sec)</th>
<th>Minimum Length (ft)</th>
<th>Specified Minimum for Length (L) Shown (min:sec)</th>
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<tr>
<td></td>
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<td>150 ft</td>
<td>200 ft</td>
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<tr>
<td>6</td>
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<td>36</td>
<td>17:00</td>
<td>17:00</td>
<td>25:39</td>
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*Q is the allowable leakage rate in cu.ft/min/ft sq of inside surface area of pipe.

Table is generated from Uni-Bell PVC Pipe Association Handbook of PVC PIPE.