Wentzville
Missouri · USA
The Crossroads Of The Nation ®

City of Wentzville

Engineering Design Criteria

Chapter 3. Design Requirements for Sanitary Sewers
Chapter 4. Design Requirements for Sewage Pumping Stations

Standard Specifications and Standard Construction Details

Division 300 Sanitary Sewers
Division 400 Sanitary Sewage Pump Stations

January 26, 2016

STATE OF MISSOURI
WILLIAM P. CUNNINGHAM
NUMBER E-22065
REGISTERED PROFESSIONAL ENGINEER
1-26-2016

Table of Contents

Wentzville Engineering Design Criteria

Construction Specifications

Standard Construction Details

3. Design Requirements for Sanitary Sewers

3.01 General

This section gives the minimum technical design requirements of the City for sanitary sewerage piping, pumping and treatment facilities. Adherence to these will expedite review and approval of plans. In general, the formulae presented herein for hydraulic design represent acceptable procedures not necessarily to the exclusion of other sound and technically supportive formulae. Any departure from these design requirements should be brought to the attention of the City and discussed before submission of plans for approval, and should be justified. All construction details pertaining to sanitary sewer improvements shall be prepared in accordance with the City of Wentzville Standard Specifications and Construction Details unless otherwise noted.

3.02 Regulations Governing the Use of Public and Private Sewerage Facilities

The following sections are summarized from the City of Wentzville Sewer Use Ordinance. The current Sewer Use Ordinance in effect shall be considered the governing document and should be consulted for elaboration. Requests for variances or clarification of these regulations should be addressed to the attention of the Director with information supporting the request.

3.02.01 Unlawful Discharges and Sewage Disposal

1. Discharges and deposits of any sewage, industrial wastes, garbage, polluted water or any other substance that constitutes a nuisance or hazard to the public health or welfare into any natural outlet, drainage channel, or watercourse, are prohibited.

2. No cesspool, septic tank or other facility intended or used for the disposal of sewage shall be installed except as hereinafter provided.

3.02.02 Public Sewer Availability

A public sanitary sewer shall be considered to be available if it is within two hundred (200) feet of any part of the property to be connected to the sewer. Under such conditions a direct connection must be made to the public sewer.

3.02.03 Prohibited Discharges and Waste Disposal Into Sanitary Sewers

1. Surface water, stormwater, groundwater, roof runoff, subsurface drainage, uncontaminated cooling water, unpolluted industrial process waters, shall not be discharged to a sanitary sewer.

2. No person shall deposit or throw into any sewer, or into any private drain connecting with a public sewer any waste, product or material of manufacture, rags or garbage which has not been properly shredded, or any substance which may constrict, cause a nuisance, dam or otherwise obstruct any sewer.

3. No gasoline service station, garage, car wash facility, refining plant, chemical plant, packing house, slaughter house, lard rendering establishment, dairy, steam plant, or any other establishment from which any substance would be discharged into the sewers which could tend to obstruct or damage the sewers, or cause a nuisance, or endanger the public health or safety, or endanger persons who might be in such sewers, shall be connected with any public sewer, or to any private sewer which discharges directly or indirectly into any public sewer. EXCEPTION would be through one or more City approved interceptors or traps. Any approved trap shall be maintained and operated in a manner satisfactory to the City, and the substance removed from such traps shall not be deposited in a way or place not previously approved by The City of Wentzville.

   Where grease, oil and grit interceptors, and other, preliminary treatment facilities are provided, they shall be maintained continuously in satisfactory and efficient operation by the owner at his expense. Such facilities shall be subject to inspection by the City at all times. Sampling "T-s or control manholes may be required that would be easily accessible by the City.

   If the substance discharged by any establishment is deemed harmful to the sewer, detrimental to the public health or safety, and dangerous to persons who may enter such sewers, the discharge from such establishment shall be entirely excluded from the sewer.

3.02.04 Wastes Having Excessive Biochemical Oxygen Demand (BOD_5), Suspended Solids, or Toxic Elements

If excessive BOD_5, suspended solids or toxic elements could occur and constitute a nuisance or adversely affect the operation of any existing or proposed sewage treatment plant or overload any sewage treatment plant owned or operated by the City, the owner shall provide, at his expense, such preliminary treatment as may be necessary to:

1. Control objectionable characteristics or constituents in such a manner as to not obstruct or interfere with the maintenance or operation of any public sewerage facility.

2. Control the quantities and rates of discharge of such waters or wastes. Plans, specifications, and other pertinent information relating to proposed preliminary treatment facilities shall be submitted for the approval of the City, and construction of such facilities shall not commence until such approval is granted in writing.

3.02.05 Measurements, Tests, and Analysis

The City shall be provided means to monitor the discharge into the public sewers of any waters or wastes discharging into sewer or any treatment facility maintained and operated by the City that contain any quantity of

substances having the characteristics described in Sections 3.02.03 or 3.02.04, or have an average daily flow greater than two percent (2%) of the average daily sewage capacity of the treatment facility. All discharges shall be subject to the analytical inspection and approval of the City.

Measurements, tests, and analyses of the characteristics of the water and wastes referred to in Sections 3.02.03 and 3.02.04 shall be determined in accordance with the current edition of "Standard Methods for Examination of Water and Wastewater" published jointly by the American, Public Health Association, the American Water Works Association and the Water Environment Federation. Other approved testing methods as specified by the Environmental Protection Agency in 40 CFE PART 136 may also be used. Additional methods of making measurements, tests or analyses of the characteristics of water or wastes may be required by the Director of Public Works, when, in the opinion of the Director, they are necessary.

All measurements, tests or analyses shall be upon suitable samples taken at the sampling "T" or control manhole. In the event no special manhole has been required, the control manhole shall be considered to be the downstream manhole in the public sewer nearest to the point at which the building or industrial connection is made. All non-residential facilities shall have a six (6) inch (minimum) diameter, straight "T" vent for taking samples. This "T" vent shall be located on the lateral line outside the building. The "T" placement shall be before the lateral connects to the public sewer and downstream from any grease traps, interceptors, or any other private wastewater treatment system.

3.02.06 Furnishing Records

It shall be the duty of every person, public utility, or institution holding a permit to operate a sewerage system or sewage treatment plant to furnish records as may be required by the City to ascertain compliance with the rules and regulations and ordinances of the City.

3.03 General Requirements of Sanitary Sewer Construction

All sanitary sewers shall meet the following general requirements:

3.03.01 Size and Shape

The minimum diameters of pipe for sanitary sewers shall be eight (8) inches. Sewers shall not decrease in size in the direction of the flow. Circular pipe sewers shall be used for all sizes of sanitary sewers. The minimum diameters of pipe for sanitary sewer laterals shall be six (6) inches.

3.03.02 Materials

All materials shall conform to The City of Wentzville Standard Specifications and Construction Details.

3.03.03 Bedding

The project Plans and Project Specifications shall indicate the specific type or types of bedding, cradling, or encasement required in the various parts of the sanitary sewer construction if different than the current City of Wentzville Standard Specifications and Construction Details.

Special provisions shall be made for pipes laid under or over fills or embankments in shallow or partial trenches either by specifying extra strength pipe for the additional loads due to differential settlement, or by special construction methods, including ninety (90) percent modified proctor compaction of fill, to prevent or to minimize such additional loads.

Compacted granular backfill shall be required in all trench excavation within public (or private) rights-of-way or areas where street rights-of-way are anticipated to be dedicated for public use. Under areas to be paved, the compacted granular backfill shall be placed to the sub-grade of the pavement. Under unpaved areas, the compacted granular backfill shall be placed to within two (2) feet of the finished surface.

Pipes having a cover of less than three (3) feet shall be encased in concrete, unless otherwise directed by the City.

If the storm and sanitary sewers are parallel and in the same trench, the upper pipe shall be placed on a shelf and the lower pipe shall be bedded in compacted granular fill to the flow line of the upper pipe.

3.03.04 Pipe or Conduit Under Streets and Pavements

Any pipe or conduit material beneath a highway, road, street, or pavement, or with reasonable probability of being so located, shall have ample strength for all vertical loads, including the live load required by the highway authority having jurisdiction, and in no case shall provide for less than an AASHTO HS-20 loading. For other locations, the minimum live load shall be the HS-10 loading. Special considerations may be required for adverse conditions. Granular backfill, consisting of 1" clean stone, shall be utilized in utility trenches for fill, up to the base of the pavement.

3.03.05 Joints

The joint type required for the type of pipe used and the application shall conform to the latest standards set forth in the City of Wentzville Standard Specifications and Construction Details or as approved by the City Engineer.

3.03.06 Monolithic Structures

Monolithic reinforced concrete structures shall be designed structurally as continuous rigid units.

3.03.07 Alignment

Sanitary sewer alignments are normally limited by the available easements which in turn should reflect proper alignment requirements.

Sanitary sewers shall be aligned:

1. To be in straight line between structures for all pipe sewers thirty (30) inches in diameter and smaller.

2. To be parallel with or perpendicular to the centerline of straight streets unless otherwise unavoidable. Deviations may be made only with approval of the City.

3. To avoid meandering, off-setting and unnecessary angular changes.

4. To make angular changes in alignment shall be in a manhole located at an angle point.

5. For sewers thirty-three (30) inches in diameter or larger, consideration may be given to the use of a curvilinear alignment, on a case by case basis. The design must be consistent with all the requirements contained within 10 CSR20-8.120(5)(E)2.

6. To avoid angular changes in direction greater than necessary and any exceeding ninety (90) degrees.

3.03.08 Location

Sanitary sewer locations are determined primarily by the requirements of service and purpose. It is also necessary to consider accessibility for construction and maintenance, site availability and competing uses, and effects of easements on private property.

Sanitary Sewers shall be located:

1. To serve all property conveniently and to best advantage.

2. In public streets, roads, alleys, rights-of-way, or in sewer easements dedicated to the City.

3. In easements on private property only when unavoidable.

4. On private property along property lines or immediately adjacent to public streets, avoiding crossing through the property.

5. At a sufficient distance from existing and/or proposed buildings (including footings) and underground utilities or other sewers to avoid encroachment and reduce construction hazards.

6. To avoid interference between house connections to foul water or sanitary sewers and stormwater sewers.

7. In unpaved or unimproved areas whenever possible.

8. To avoid, whenever possible, any locations known to be or probably to be beneath curbs, paving or other improvements particularly when laid parallel to centerlines.

9. To avoid sinkholes and creeks.

3.03.09 Flowline

The flowline of sanitary sewers shall meet the following requirements:

1. The flowline shall be straight or without gradient change between the inner walls of connected structures.

2. Gradient changes in successive reaches normally shall be consistent and regular, with small or insignificant differences in successive reaches. Gradient designations of less than the nearest 0.001 foot per foot, except under special circumstances and for larger sewers, shall be avoided.

3. Sewer depths shall be determined primarily by the requirements of pipe or conduit size, utility obstructions, required connection, future extensions, and adequate cover.

4. For sanitary, the hydraulic grade line shall not rise above the intrados of the pipe.

5. When the grade of a sewer is twenty (20) percent or greater, a concrete cradle or collars are required. For grades exceeding fifty (50) percent a special design and Project Specifications are required.

6. A 0.2' drop shall be provided from the incoming to outgoing flowline of manholes.

3.03.10 Manholes

Manholes provide access to sewers for purposes of inspection, maintenance and repair. They also serve as junction structures for connecting lines. Requirements of sewer maintenance determine the main characteristics of manholes.

1. Manholes shall be located at changes in direction, changes of pipe size, flowline gradient, and at junction points with connecting sewers.

For sewers thirty-three (33) inches in diameter and larger, manholes shall be located on special structures, at junction points with other sewers, and at changes of size or gradient.

2. Spacing of manholes shall not exceed four hundred (400) feet for pipe sewers thirty-six (36) inches in diameter and smaller and five hundred (500) feet for pipe sewers forty-two (42) inches in diameter and larger, except under special approved conditions. Spacing shall be approximately equal, whenever possible.

3. At stream and channel crossings, manholes shall be located on both sides of the crossing at changes in pipe material. The manhole shall be located a minimum of twenty (20) feet from the top of the bank on both sides of the crossing.

4. All manholes on sanitary sewers that are built within the 100-year flood limits, in the Stormwater overflow path, or in areas determined to be subject to flooding shall be provided with lock-type watertight manhole covers.

5. Manholes located on 8" sanitary sewers shall be 42" diameter, minimum size. Manholes located on 10" sanitary sewers and larger shall be 48" diameter, minimum size. Manholes having one (1) inside drop shall be 48" diameter, minimum size. Manholes having two (2) inside drops shall be 60" diameter, minimum size. Terminal manholes that could facilitate a future extension of the sanitary system shall be 48" diameter manholes, minimum.

3.03.11 Sewage Treatment Facilities

New treatment plants will not be allowed.

3.04 Design Requirements

3.04.01 General

All Sanitary Sewers shall be so designed and constructed as to conform to these design requirements. Hydraulic Calculations shall be submitted when requested by the City. Calculations must include existing and ultimate upstream development conditions.

3.04.02 Gradients

The following minimum slopes of sanitary pipe sewers are those giving at least 3 feet per second velocities flowing full, based on Manning's formula using an "n" value of 0.013 unless otherwise directed by the City. Slopes greater than these minimums shall be used wherever possible.

Pipe Size	Minimum Slope in Ft. per 100 Ft. (% Grade)
8	1.0
10	0.6
12	0.6
15	0.4
18	0.3
21	0.3
24	0.2
27	0.2
30	0.2
36	0.1

Pipes larger than thirty (36) inches in diameter shall maintain a cleansing velocity of three (3) feet per second.

Sanitary Sewer laterals, which shall be a minimum size of 6", shall have a minimum slope of 2%. (2 feet per 100 feet)

3.04.03 Depth and Minimum Cover

The minimum depth of collecting and lateral sewers should be nine (9) feet below the finish street grade to flowline except where the topography indicates this depth is not necessary. Where the nine (9) feet depth is not required, the minimum vertical distance from the low point of a basement or low floor to the flowline of a sanitary sewer at the corresponding house connection shall be not less than the diameter of the sewer plus a vertical distance of two and one-half (2 l/2) feet. This minimum vertical distance shall be increased, if the length of the lateral requires, obtaining a minimum slope of two (2) percent for six (6) inch house laterals. These minimum depths will not apply to interceptor sewers in low areas whose only function is to carry off the accumulated flow to existing or proposed trunk sewers.

All collecting and outfall, sub-trunk and trunk line sewers in low areas in close proximity to natural watercourses shall be constructed at depths low enough to permit all proposed and existing connecting lateral sewers to make the channel crossing so as to have at least two (2) feet of cover over the top of the lateral pipe. All sanitary sewers shall have a minimum of two (2) feet of cover where crossing streams or channels. All sanitary sewers shall be laid deep enough to allow for future extension of the system to fully serve the watershed. The foregoing depth requirements may be modified in special cases when such modifications are feasible and will not jeopardize the design when considered as an integral part of an overall system. The City shall approve all modifications.

All sewer mains twenty (20) feet in depth or greater shall be C900 PVC, said pipe extending from Manhole to Manhole. All sewer laterals connected to C900 PVC main, shall also be of C900 PVC, extending up to the building line of the property being served

3.04.04 Flow Design

All lateral and sub-main or collecting sewers shall be designed on the basis of an average per capita use In the case of industrial flow, when the rate and volume can be predetermined with a reasonable degree of accuracy, no dilutions or diminishing factor shall be applied against this flow in the outfall, sub-trunk or trunk sewers.

3.04.05 Sanitary Flow Table

	Flow (Gallons per day per capita)	Persons per unit
Single Family Homes	100	3.7
Apartment or Condominium		
(1 Bedroom)	100	2.0
(2 Bedroom)	100	3.0
(3 Bedroom)	100	3.7

The Population Equivalent (PE) shall be equal to 100 gallons per day per person. When flows are calculated from commercial or non-residential developments, the PE shall be calculated, along with the basis for same. Calculations shall be provided to the Engineering Department for review for all other types of establishments and uses. Flow quantities must be referenced from an acceptable industry standard or studies. All sewers, lift stations and force mains shall be designed for the peak flow rate using the peaking factor as calculated from the following formula:

$$\text{Peaking Factor} = \left(18 + \sqrt{\frac{PE}{1000}}\right) \div \left(4 + \sqrt{\frac{PE}{1000}}\right)$$

3.04.06 Infiltration

An additional amount of flow due to infiltration shall be evaluated. All sanitary sewers shall be limited to a maximum of 200 gallons per inch of diameter per day per mile of line, as required by MDNR Specifications, when tested by actual infiltration conditions. In addition, there shall be no visible leaks. All manholes on sanitary sewers that are built within the 100 year flood limits or in other areas determined to be subject to flooding shall be provided with lock type watertight manhole covers.

3.04.07 Special Situations and Design Requirements

1. Connections to Manholes

   a. Foulwater drops are required only for sewers containing sanitary flow and then only when it is necessary that sanitary flow enter a manhole at a height of two (2) feet or greater above its flowline. If an inside drop is to be used, a forty-eight (48) inch diameter manhole is required. If two inside drops are to be used, a sixty (60) inch diameter manhole is required.

Sewer-lines shall not enter the manhole in the transition conical section, or through a joint. The slope on incoming pipes should be limited to a maximum one percent for inside drops. Manhole inverts should be shaped to assure proper flow through drop structures. All drop sewer lines are to be ductile iron for the first 20 feet upstream from the manhole.

b. If it is necessary to enter a manhole with a force main this should be done within twelve (12) inches of the flowline of the manhole, and the manhole invert should be shaped to insure proper flow through the structure.

Consideration shall be given to the detention time of the sewage in the force main, and the potential detrimental effects of the release of hydrogen sulfide from the force main on the concrete structure of the manhole. The receiving manhole and the next 2 downstream concrete manholes, at a minimum must be protected by the application of an epoxy coating.

c. The number of lines coming into one manhole should be kept to a minimum. A special detail may be required to assure the proper constructability and maintenance of the structure.

d. Pipes entering and exiting manholes at the flowline should project through the center of the structure and the manhole invert should be shaped to assure proper flow through the structure.

e. Private house lateral connections should be made to the main sewer, not to the manholes.

f. All connections to sanitary manholes are subject to City of Wentzville review and approval and will be made at the City's discretion.

g. Connections to existing structures may require rehabilitation or reconstruction of the structure being utilized. This work will be considered part of the project being proposed.

2. Adjusting Manholes to Grade

When a project requires a manhole to be adjusted to grade, a maximum of twelve (12) inches of rise is allowed if not previously adjusted. Adjustments greater than twelve (12) inches, or lowering, will generally require rebuilding all or part of the manhole.

3. Swimming Pools

Swimming pool backwash connections to the sanitary sewer must not exceed fifty gallons per minute (50 gpm).

4. Channel Crossings

If a sanitary sewer must cross under a channel with less than two (2) feet of cover, ductile iron pipe with restrained joints must be used unless otherwise directed by the City. A manhole shall be provided on both sides of the crossing at changes of pipe materials at a minimum distance of twenty (20) feet from top of bank of both sides of the crossing.

5. Private Force Main Connections

When site topography does not allow for gravity lateral service to the sanitary sewer, a private force main connection may be made. The City requires that a grinder pump or sewage ejector be used in these cases. As indicated above, in Section 3.04.07 1.b., the connection shall be made into a manhole, in accordance with the requirements set forth therein.

6. Storm Sewers Crossing Over Sanitary Sewers

When a storm pipe crosses over a sanitary sewer and the vertical clearance is less than two (2) feet, the sanitary sewer must be encased in concrete through the crossing and for ten (10) lineal feet each side of the crossing.

7. Location in Conjunction with Water Service

Sanitary sewers shall be at least ten (10) feet horizontally from any existing or proposed water main. On crossings, a minimum vertical clearance of eighteen (18) inches shall be provided between the outside of the water main and outside of the sanitary sewer. If these minimum clearances cannot be met, then the requirements set forth in the Standard Specifications shall be followed.

8. Abandonment of Sanitary Sewer Services

Sanitary sewer laterals, from buildings to be demolished, shall be plugged with concrete for their entire length, or removed. Portions of a lateral may be left in service if those portions of the lateral are to be continued in service to replacement buildings, and existing buildings which remain on the lateral. All laterals permanently abandoned shall be cut off and capped at the sewer main as directed by the City.

Sewer mains that are to be abandoned shall either be plugged with concrete for their entire length or removed. Manholes that are to be abandoned shall be plugged with either concrete or the bottoms broken out, with the inlet and outlet piping being plugged. The top section of the manhole, consisting of the cone section lid and cover are to be removed, and the void filled with 1" clean stone.

9. Oil/Gas Separators and Sand Filters

If required by the City, grease, oil and sand interceptors or traps shall be provided when such devices are necessary for the proper handling of liquid wastes containing grease or oil in excessive amounts or any flammable wastes, sand, or other harmful materials which can be trapped. Such interceptors or traps shall not be required for private dwelling units. Prior to the installation of any interceptor or trap, drawings and specifications shall be submitted to the City for approval. All interceptors and traps shall be located so as to be readily accessible for cleaning and inspection.

Grease and oil interceptors or traps shall be constructed of impervious materials capable of withstanding sudden and extreme changes in temperature. All such devices shall be of substantial construction, water-tight, and equipped with easily removable covers which, when bolted in place, shall be gas tight and watertight, unless otherwise approved by the City.

All grease, oil and sand interceptors or traps shall be maintained in effective operation at all times by and at the expense of the user.

3.05 Sanitary Detention Requirements

3.05.01 Surcharged Sanitary Sewers

When it has been determined that the outfall sewer or the downstream system serving a proposed development is overcharged, the City may require the developer to provide special facilities that the City deems necessary. As an example, the downstream system may need to be upgraded in order to provide additional capacity, by the replacement of an inadequately sized pipe, by a pipe sized for the additional flows, or the construction of a pipe, located parallel to the pipe that is undersized.

In the design of such facilities, consideration should be given for the protection of structures and equipment against corrosive and/or explosive gasses that may result from the detention of sewage.

4. Design Requirements for Sewage Pumping Stations

4.01 General

This section gives the minimum technical design requirements for the City of Wentzville for sewage pumping stations.

To provide the most efficient, cost effective, reliable service to the customers of the City, sanitary sewage pump stations will only be considered where a thorough study of all alternatives clearly indicate a gravity collection and disposal system is not practical or feasible.

The following are the standard specifications for pump stations to be installed within the jurisdiction of the City of Wentzville. These specifications not only adhere to the guidelines and set out by the Missouri Department of Natural Resources but also incorporate the most cost effective and reliable design for maintenance and operation.

Failure of any particular equipment or installation design may, from time to time, dictate changes in the design specifications. It is the responsibility of the designing engineer to check with the Engineering Department before starting design work to insure that the designer has the latest revisions.

4.02 Plan Review Procedure

The following material must be submitted to the Engineering Department for review of any proposed pump stations. See section 1.03.02 (2) for the required number of submittal documents.

4.02.01 Engineering report

All pump station plans shall be accompanied by an engineering report typed and bound in an 8 ½" x 11" booklet. The following information shall be included in the report:

1. Title Page
    a. Date
    b. The Developer/Owner
    c. Engineering firm preparing plans.
    d. Engineer's Seal
    e. City of Wentzville Project Number
2. Sewer System Information
    a. Introduction
        1) Type, location and size of development
        2) Number of and range in size of lots or buildings to be serviced.

b. Existing Sewer System

Location and type of gravity system the force main will discharge into.

c. Future of Sanitary Sewer Service

1) State whether the entire development will be serviced by the proposed phase or if several phases will be involved.

2) State the number of lots this phase will encompass initially and finally if future phases are to be constructed.

3) State whether other areas outside of the development may be tributary to the pump station.

3. Pump Station and Force Main Calculation

a. Population Equivalent

Nb = Number of specified types of buildings
Np = number of persons per unit = 3.7
PE = Population Equivalent – Nb x Np = 3.7 x Nb

b. Average Daily Flow (ADF)

F = Flow (See section 3.04.04 and 3.04.05)
I = Infiltration Flow from:

1) gravity system
2) 8 hour retention chambers
3) 12" piping from retention chambers to wet well

I = Piping diameter (in.) x piping length (miles x 200 gal./in.dia./mi,/day)

ADF (GPD) = F + I
ADF (GPM) = ADF (GPD) / 1440 (min./day)

c. Peak Daily Flow (PDF)

PDF (GPD) = Peaking Factor x ADF (GPD)
PDF (GPM) = Peaking Factor x ADF (GPD)

Peaking Factor – See section 3.04.05

d. Total Dynamic Head

1) Static Head (H_S)
E_h = Maximum force main elevation
E_1 = Wet well low water elevation (Pump Off)
H_S (feet) = E_h - E_1

2) Loss (L_f) due to friction in force main
Length = Total equivalent length of force main (feet)
L_f (feet) = Length x Friction Factor

3) Loss (L_s) from friction in the station piping
Length = Equivalent length of station piping (feet)
L_s (feet) = Length x Friction Factor

4) To Calculate the Friction Factors, use the Hazen and Williams formula with the following c-Factors:

For the design pump operating point:

Unlined iron or steel pipe:	C=100
All other pipe (including Plastic and lined DIP)	C=120

To insure pump motor does not overload after initial installation:

Plastic Pipe and lined DIP	C=150
All other pipe	C=140

The operating point on submersible pump stations will be evaluated at low water cutoff.

Friction head loss per 100' pipe:

$$= 0.2083 \times (100/C)^{1.85} \times Q^{1.85} / d^{4.8655}$$

5) TDH (feet) = $H_s + L_f + L_s$

Plot a worst case TDH curve, using the lower C values above, and a best case TDH curve, using the higher C values above, on a manufacturer's pump performance curve sheet.

The Constant Speed Rating (CSR) or the pump's operating point is the point where the worst case TDH and the pump manufacturer's pump performance curve intersect.

Find where the best case TDH and the pump manufacturer's pump performance curves intersect and check the pump is not in an overload condition.

A minimum of four flow rates shall be used to plot each curve.

e. Eight Hour Storage Requirements
Volume of Retention Chambers (V_s) in gallons

V_s = ADF (GPD) ÷ 3 = Cylindrical volume of retention chamber pipe used

Note: Volume of inlet gravity lines or wet well shall not be included to size the eight-hour storage. Only volume of retention chambers shall be used.

f. Buoyancy Calculations

1) W_w = Weight of concrete wet well
W_f =Weight of concrete bottom slab
W_e = Weight of earth backfill on footing
$W_t = W_w + W_f + W_e$

2) W_s = Weight of displaced sewage

3) W_t = should be greater than W_s

4. Cycle Times

a. Volume (V_r) of water required to raise the level in the wet well for the primary pump to turn on:

1) Elevation difference (E5) between primary pump on elevation (E3) and pump off elevation (E4)

E5 (feet) E3 - E4

2) Volume (V_{pf}) of water per vertical foot in the wet well:

V_{pf} (gal./ft.) = A x 7.481 (gal./cu. Ft.)

A = the inside area of the wet well

3) V_r (gal.) = E5 x V_{pf}

b. Cycle time for ADF

1) Time (T_f) required for volume in wet well to reach Vr (Pump Off)

T_f (min.) = V_r / ADF (GPM)

2) Time (T_p) required for pump to return water level to the pump off elevation (Pump On)

T_p (min.) = V_r / (CSR - ADF)

3) Time (T_c) required for one complete cycle of a duplex pump station. (Should the pump station consist of 3 or more pumps, the multiplier shall be equal to the number of pumps included in the station.)

T_c (min.) = 2 x (T_f + T_p)

c. Cycle time for PDF

1) T_f (min.) = V_r / PDF (GPM)
2) T_p (min.) = V_r / (CRS - PDF)
3) T_c (min.) = 2 x (T_f + T_p)

5. Listing of results from the design calculations to be presented in the following order:

a. Number of lots or building
b. Population Equivalent
c. Average Daily Flow in GPM
d. Peak Daily Flow in GPM
e. The volume of the 8 hour retention chamber
f. Static Head
g. Total Dynamic Head
h. The pump selected (including type, size, Hp, RPM, phase and GPM)
i. Total cycle time for ADF
Number of Minutes ON (Pumping Time)
Number of Minutes OFF (Fill Time)
j. Total cycle time for PDF
Number of Minutes ON (Pumping Time)
Number of Minutes OFF (Fill Time)
k. Size and length of force main. (Actual inside diameter shall be used in calculations and not the nominal diameter of pipe.)
l. Velocity maintained in force main
m. Force Main Test Pressure
This figure is taken from the selected pump manufacturers' performance curve and is considered to be the maximum pump shut off head in PSI, plus 50 lbs. This figure shall also be clearly indicated on the force main profile sheet as:
"FORCE MAIN TEST PRESSURE".

6. The manufacturer's specifications for the pumps shall be included in the back of the report booklet. Selected items on the manufacturer's cut sheets shall be marked for ease of identification.

7. Pump performance curves shall be included with the proposed pump information. The C.S.R. rating for both pumps shall be plotted on the manufacturer's curve using a system head-capacity curve. A minimum of four random flow rates shall be used to plot each curve. Figures used to determine each point shall be listed.

8. Construction, Operation and Maintenance

   It is the responsibility of the Developer/Owner to construct the pump station according to the approved construction drawings and specifications included in this report. The Developer/Owner will furnish a 24-hour emergency telephone number in the event the station needs attention/repair before City acceptance.

4.02.02 Individual 24" x 36" design plan sheets of:

1. Pump station structure (1/2" = 1' scale)

2. Pump and valve chamber interior layout (1/2" = 1' scale)

3. Site plan (1/4" = 1' scale)

4. Force main plan and profile, with thrust block locations indicated on each sheet.

5. Gravity system plan and profile, with elevations for both the building lateral and the lowest finished floor connections being indicated on the profile sheet.

6. Detailed items such as: service panels, thrust blocks, alarm towers, etc.

4.02.03 Detail Drawings

A detailed plan and profile drawing of the pump station concrete structure shall be included in the submitted plans detailing:

1. The size and location of all gravity lines, discharge pipes, drain piping and electric passage openings.

2. Reinforcing bar

3. Floor, top and wall dimensions

4. Detail of the wet pit and valve pit hatch casting with the exact location of the hatches (for wet well hatch placement contact pump manufacturer).

5. All elevations of station piping passages

6. Structure elevations at the:

   a. Footing bottom
   b. Wet well flow line
   c. Valve chamber floor
   d. Structure top

7. On pre-cast stations, gravity lines must have their angles of entry included on the structure plans at their point of entry to the structure.

8. All pipes must enter the structure walls with a one foot minimum distance from the center line of the pipe to the face of the adjoining wall to allow for proper pipe gasket placement.

9. One detailed section joint shall be included on the structural sheet. Actual joint elevations shall be determined by the precast manufacturer.

10. A sectional view of the chamber tie walls detailing each wall as you are facing it from the pump chamber and valve chamber side.

11. To prevent the possibility of the valve chamber pulling the top section of the wet well off of the joint, a poured counter weight is required to offset the mechanical lever arm tipping force. The counter weight shall be monolithically poured at the bottom of the upper most wet well section opposite of the valve chamber tie wall. Size and weight of the counter weight shall be shown on the plans.

4.02.04 Structure Sheet

The purpose of this sheet is to provide an accurate, complete, non-cluttered structure sheet for the pre-cast company. All measurements and information needed to cast this structure should be included on this sheet. The pump, pipe, and electrical details shall not be displayed on this sheet. Information not pertinent to the structure should not be included. Structure plans shall be drawn to a ½" equals 1' scale on its own individual plan sheet.

4.02.05 Electrical Plans

1. Electrical Plans shall be submitted detailing all:

   a. Field and factory schematics and wiring diagrams
   b. Conduit and wire sizes
   c. Conduit layouts from:
      i. The electric service entrance to the control panel
      ii. Control panel to the valve vault

2. The following information shall be included on the plans:

   a. Date
   b. Project name
   c. Control panel job number
   d. All nameplate information of the installed pumps
   e. Complete bill of materials for all installed components

3. Plans shall also include all external devices interfaced into the control panel such as:

   a. Valve chamber pressure switches
   b. Floats
   c. SCADA telemetry
   d. Phase converters (when applicable)

4.02.06 Site Plans

A detailed pump station site plan, using a ¼" = 1' scale, shall be submitted along with the completed design plans. The site plan shall include the following:

1. All access roads, fencing and pavement surrounding the pump station.

2. Location of all sewer, water, storm and electric lines running to or through the pump station easement.

3. Location of all pump station appurtenances, such as, control panels, antenna poles, yard hydrants, boxes, phase converters (if applicable), etc. (Yard hydrants are to be located a minimum of 25 feet from the lift station wet well structure.)

4. Details on any proposed landscaping affecting the immediate area surrounding the pump station site.

5. Property information shall be shown on the site plan indicating:

   a. City/Pump Station ingress, egress and sewer easements.
   b. Adjacent private or common ground property lines.
   c. Utility Easements and Drainage Easements.

Plans submitted to the City that do not have required sheets and/or engineering booklet shall be returned to the designing engineer with a "request for missing material". No attempt will be made to review incomplete submittals.

Upon completion of the review by the appropriate City personnel, all comments will be forwarded to the designing engineer by the Engineering Department.

No construction approval of a portion of a sanitary sewer system, which requires a pump station, shall be given until construction approval of the pump station and force main has been made.

4.03 Acceptance Procedure

Before final approval of or acceptance of any pumping station facility by the City, there shall be a field inspection made by the City. The field inspection shall show that such works have been installed and constructed in accordance with the plans, designs and specifications approved by the City before the start of the construction. The Developer and Contractor are responsible for verifying the pump station is ready for each stage of inspection.

However, operation and maintenance of any private, semi-public or industrial pumping station shall be subject to inspection by the City.

Inspection of the pump station structure, gravity system and force main shall be coordinated through the Engineering Division's construction personnel.

Inspection of the internal piping, pumps, electrical and all pump station related appurtenances, i.e. clean outs, air relief valves, shall be coordinated through the Engineering Division.

Representatives from the pumping equipment manufacturer and the installing electrical contractor shall be present at the pump station site for final inspection and start up with the Engineering Division.

Upon completion and prior to acceptance of the installation, the Contractor shall subject the pumping equipment to such operating tests as may be required by the City to demonstrate satisfactory performance of the equipment to meet these specifications. If tests do no demonstrate satisfactory performance of the equipment, deficiencies shall be corrected.

Since sufficient wastewater to test the pump will probably not be available when the test is scheduled, the Contractor shall arrange to obtain water from the public water supply for the test. The minimum quantity of water to be pumped for the test is equivalent to 1.5 minutes of continuous pumping at rated pump capacity for each pump operating alone. Each pump shall be tested a minimum of two times.

Final inspection shall be arranged through the Engineering Division. Pump stations shall only be considered as acceptable by the City upon written confirmation by the Engineering Division's construction personnel. The City will assume operation and maintenance only after 100% acceptance.

The pump shall be tested at start-up with the voltage, current and other significant parameters being recorded. The manufacturer shall provide a formal test procedure and forms for recording data. The recorded data shall be submitted to Engineering Division in conjunction with the as-built electrical schematics before the pump station inspection is called for.

The radio shall be activated by a reputable Systems Integrator familiar with the

MOSCAD System. After activation, a full service report shall be provided that is signed off by the Systems Integrator.

The City shall be notified a minimum of three days before activation to incorporate it into the system. The radio system will not be accepted unless activated and demonstrated completely with City personnel present.

4.04 Pump Station Design Criteria

4.04.01 Structure Requirements

The following table shall be used for the pump station structure design in addition to those items listed below:

Structure Requirement	Standard Specification
Design of Concrete Structures	Sec. 401.2
Joining Chambers	Sec. 401.3
Access Hatches	Sec. 401.4
Access Openings	Sec. 401.5
Gravity Pipes	Sec. 401.6
Valve Chamber Floor	Sec. 401.7
Valve Supports	Sec. 401.8
Entrance Steps	Sec. 401.9
Sealing of Wet Well & Valve Chamber	Sec. 401.10

1. Retention Chamber

Eight-hour retention chambers are required method to allow gravity flows to continue without –

a. Bypass of sewage to the environment
b. Property damage/loss to the City customer
c. Creation of public health hazard

Retention chambers shall be sized based on the 8 hour ADF quantity. Eight-hour retention chambers allow for power outages, lightning strikes to mechanical and/or electrical equipment, mechanical breakdowns, vandalism, force main breaks, and the subsequent repairs necessary to put the station back into operation.

Lift Stations with flows exceeding 250,000 GPD will require eight-hour retention, or will be required to supply a secondary power source (generator or alternate power source) and four hour retention.

Both the pump chamber and the incoming gravity system are not to be considered for the retention calculations. Retention shall be installed below ground with an access manhole located at the upstream end. The connection between the retention chamber and the wet well wall shall be made with a 12" ductile iron pipe. The retention tank must be a dedicated system; it may not be used as part

of the gravity system. The retention tank and connecting line shall be laid with a minimum 1% slope. Note: the lowest development elevation must be above the elevation of the highest point of the retention chamber.

No more than 2 chambers 180' long, minimum of 6' diameter, maximum of 10' diameter, then two power sources or backup generator. As a minimum each retention chamber shall have a manhole, for entrance into the chamber and located on the end furthest from the lift station, as well as a 6" vent, located on the low end of the chamber. Retention chambers of 100' in length or greater requires two manholes.

2. Wet Well Chamber Sizing

The pump station wet well and valve chambers shall each be sized as noted for the following type of pump installations; access hatches will be correspondingly size to the chosen structure size.

a. Two (2) grinder pumps
Valve chamber - 4' x 4' id. Access hatch 48" x 48"
Wet pit – 4' x 4' id. Access hatch 30" x 48"

b. Two 4" or (two) 6" pumps
Valve chamber - 6' x 6' id. Access hatch 72" x 72"
Wet pit – 6' x 6' id. Access hatch 48" x 72"

c. Two 8" pumps
Valve chamber - 7' x 7' id. Access hatch 84" x 84"
Wet pit – 7' x 7' id. Access hatch 60" x 84"

Any other configuration of number or size of pumps shall be reviewed by the Engineering Division on a case by case basis. In addition to the sizes listed above, a minimum clearance from the interior walls to the flanges of the piping shall be 6 inches. Consideration for additional spacing shall be given if a flow meter is required.

3. Incoming Manhole Placement

A manhole shall be placed on the gravity line a minimum of 20' and a maximum of 26' from the pump station structure.

4. Retention Chamber Placement

The 12" pipe joining the 8 hour retention chamber and the pump station shall be no less than 20' in length.

4.04.02 Piping and Valves

The following table shall be used for the pump station piping and valve design in addition to those items listed below:

Piping and Valves Requirement	Standard Specification
Discharge Riser Piping Material	Sec. 402.2
Force Main Material	Div. 300
Transition Piping	Sec. 402.4
Gate and Check Valves	Sec. 402.6
Valve Chamber Drain Valve	Sec. 402.7
Gravity Lines Entering the Station	Sec. 402.8
Retention Pipe	Sec. 402.9
Sealing of Wet Well & Valve Chamber	Sec. 402.10

1. Force Main Design Requirements

Force mains shall meet the following criteria:

a. Velocity – At design average daily flow, a cleansing velocity of at least two feet per second and at maximum eight feet per second shall be maintained.

b. Air Relief / Vacuum Valve – An automatic combination vacuum air relief valve shall be placed at high points in the force main to prevent air locking.

1) The valve shall be equipped with all backwash accessories.

2) The body of the ARV shall be supported to the wall of the structure by a 1-1/4" x 1-1/4" x 1/8" stainless steel angle bracket.

3) Conform with Section 301.3 of the City of Wentzville Standard Specifications and Construction Details.

c. Termination – Force mains shall discharge to the gravity sewer system at a point not more than one foot above the flow line of the receiving manhole. Inside drops will not be permitted. The force main discharge manhole shall be gasketed and sealed down with a locked down cover. The manhole in which the force main connects to, as well as the next two downstream manholes shall be epoxy coated.

d. Thrust Blocks – The force main shall be fitted at all bends with permanent thrust blocks, constructed to withstand the thrust

developed under test pressure plus 50 psi. Thrust block locations shall be given on both plan and profile drawings. A standard thrust block detail shall be drawn on the pump station detail sheet.

e. Clean-Outs – The need for clean out on the force main shall be determined during plan review by the City. As a general guideline, clean-outs will not be required on force mains under 1800 feet in length.

2. Piping Design

The standard pump station piping arrangements called out in this design book have proven themselves to be of sound design in typical pump station installations. Special bracing or water hammer protection devices have not been included or called for. However, when the surrounding terrain or station site is such that extreme hydraulic conditions may be created, it is the responsibility of the designing engineer to anticipate such condition and design for the probability of excessive pressure, stress and/or movement in the piping system. The engineer shall be responsible for including whatever restraints, relief valves, or surge protection, deemed necessary for the protection of the valve and piping system.

4.04.03 Submersible Wastewater Pumps

Sewage pumps installed in the pumping station shall meet the following requirements;

1. General

Pump selection shall be based on the following minimum standards:

a. Single phase pumps are not acceptable.

b. Pumps less than 3 hp are not acceptable.

c. Non-clog pumps are the preferred type pump. Grinder pumps will only be considered when site conditions prove that non-clog type pumps will not perform adequately.

d. All pumps shall be designed to maintain a minimum force main velocity of 2 f.p.s. and a maximum main velocity of 8 f.p.s. for scouring purposes.

e. All pumps except where grinder pumps are used shall be capable of passing spheres of at least three inches (7.6 cm) in diameter, pump suction and discharge piping shall be at least four inches (10.2 cm) in diameter.

f. Grinder Pump Application

1) The pump discharge pipe diameter shall be determined as follows:

Individual Pump Output	Pipe Diameter
50 GPM and Below	2"
51 to 80 GPM	3"
81 GPM and Above	4"

g. For stations with two pumps, the header and force main pipe diameter shall remain the same as the individual pump discharge pipe diameter.

h. For stations with three or more pumps, the header and force main shall be sized to produce a minimum flow of 2 fps and a maximum flow of 8 fps from the combined output of two pumps.

i. Pumps shall be as required by the City's Standard Construction Specifications Section 403.

2. Pump Design

The pump(s) shall be capable of handling raw, unscreened sewage. The discharge connection elbow shall be permanently installed in the wet well along with the discharge piping. The pump(s) shall be automatically connected to the discharge connection elbow when lowered into place, and shall be easily removed for inspection or service. There shall be no need for personnel to enter the pump well. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by a simple linear downward motion of the pump. A sliding guide bracket shall be an integral part of the pump unit. No portion of the pump shall bear directly on the floor of the sump. The pump, with its appurtenances and cable, shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.

4.04.04 Interior

The following table shall be used for the pump station interior design:

Interior Requirement	Standard Specification
Slide Rails	Sec. 404.2
Lifting Chain	Sec. 404.3
Bolts	Sec. 404.4
Fasteners	Sec. 404.5
Floats and Settings	Sec. 404.6
Access Hatches	Sec. 404.7
Locking Hardware	Sec. 404.8
Pressure Sensor Units	Sec. 404.9
Intrinsic Barriers	Sec. 404.10
Pump Chamber Inspection	Sec. 404.11

4.04.05 Electrical

All electrical devices and installation of same shall comply with the specifications set forth in Division 400 Sanitary Sewage Pump Stations of the City of Wentzville Construction Specifications and City of Wentzville Standard Construction Specifications and Details.

1. Pump Control Panel

   The selected pump supplier shall be directly responsible for all panel fabrication and component installation. The pump control panel shall meet the specifications set forth in Division 400 Sanitary Sewage Pump Stations of the City of Wentzville Standard Construction Specifications and Details.

2. Three Phase Motors

   a. All pumps will operate using 480 VAC three phase power.

   b. Any site requiring a total three phase station load in excess of 50 HP will require Ameren-UE/Cuivre River supplied three-phase power.

   c. Any site requiring a total three-phase load less than 50 HP may use a phase converter design upon acceptance from the City. Allowance of such a System will depend on the cost analysis presented by the designer/owner. Allowance will be determined on a case-by-case basis. The Ameren-UE/Cuivre River Electric three-phase power is the preferred source.

3. Electrical Options

There are two possible avenues for the electrical distribution at the pump station. First, is the Ameren-UE/Cuivre River Electric supplied 3 phase source which is preferred and the other is the Ameren-UE/Cuivre River Electric supplied single-phase source. The following is a list of the basic electrical requirement for each.

a. THREE PHASE SOURCE OPTION

1) City will provide generic electrical drawings for three-phase source.

2) City will provide a control program for starter/soft starter operation.

b. SINGLE PHASE (INVERTOR) SOURCE OPTION

1) City will provide generic electrical drawings for single-phase source.

2) Contractor will be required to provide a single phase shielded step up transformer (240/480). It should be capable of supplying 1.5 times the total pump load requirement.

4. Ameren-UE/Cuivre River Electric 3 Phase Supply Control Option

Magnetic across the line horsepower rated motor starters shall be provided per Division 400 of the Standard Construction Specifications and Details. Pumps 20 HP and larger shall be supplied with soft starters and or VFD's with bypass contactors.

5. Phase Converter Option

Because of the higher probability of electrical failure from using a phase converter, this type of system shall only be considered after investigating the feasibility of having three-phase power brought onto the job site. Ameren-UE/Cuivre River Electric supplied three phase power shall be used unless installation cost justified the installation cost of a converter. If a converter is to be used, submitted plans shall detail the converter installation. All phase converter installations shall meet the following requirements:

a. Singe phase 480 VAC shall be run to the station if available. Single phase 240 VAC shall be accepted. It shall be stepped up to single phase 480 VAC through a shielded, isolated, power transformer sized to handle 1.5 times the total pump load requirement.

b. The converter shall be a variable frequency drive unit set up to run at 100% speed. The converter shall be derated to account for the single-phase power supplied to the unit. Converter shall have EMI/RFI filtering built in to the front end to inhibit harmonic interference. It shall be programmed and controlled from a keypad/display unit. The following functions will be available:

1) Local/Manual/Remote with Start/Stop keypad pushbuttons.
2) Keypad and hardwired reset functions.
3) Hardwired input for external failure points.
4) Hardwired remote start/stop through a single contact.
5) Ramp up, ramp down settable 0-30 seconds.
6) Status display.
7) Under voltage protection.
8) Over current protection.
9) Ground fault protection.
10) Failure log.
11) Hardwired run and failure output contacts.

See Section 405.5 of the City of Wentzville Standard Specifications

6. Station Interior Wiring, See Section 405.5 of the City of Wentzville Standard Specifications.

7. Check Valve Pressure Switch Wiring, See Section 405.6 of the City of Wentzville Standard Specifications.

8. Field Wiring Specifications, See Section 405.7 of the City of Wentzville Standard Specifications.

9. Conduit Specifications, See Section 405.8 of the City of Wentzville Standard Specifications.

10. Control Panel Mounting, See Section 405.9 of the City of Wentzville Standard Specifications.

4.04.06 Alarm System

The following specifications shall be used for installation of the pump station alarm system:

1. SYSTEM REQUIREMENTS

a. Each pump station shall have a Motorola MOSCAD-ACE RTU conforming to the City's existing system as specified in

Division 400 of the Standard Construction Specifications and Details.

b. The City's system utilizes a Motorola MOSCAD Central Station Transceiver for interrogation and acknowledgement of alarms.

c. All hardware components and software/integration into the existing SCADA system by the City's Systems Integrator for the RTU shall be provided by the Developer for Contractor installation. Contractor will install and terminate the RTU per the contract drawings. The RTU shall not be energized by the Contractor. RTU CONFIGURATION, programming and startup shall be by the City's Systems Integrator.

Acceptable Manufacturer: Motorola

d. Smaller stations require the MOSCAD SCADA Unit to perform alarming functions for the float-only control system. Larger stations require the MOSCAD to perform all local control and alarming functions and will backup to a hardwired float system and require coordination with the City and City's Systems Integrator before station is approved for design or implementation. Both require integration with the City's existing SCADA system with the City's Systems Integrator.

4.04.07 Paving, Fencing, and Other Requirements

The following table shall be used for the pump station site design:

Site Requirement	Standard Specification
Paving	Sec. 406.2
Fencing	Sec. 406.3
Entrance Road Barrier	Sec. 406.4
Yard Hydrants	Sec. 406.5

4.04.08 Site Details

1. Temporary Erosion Control

Surface water drainage must be diverted away from the pump station site to prevent mud and debris from washing over the paved station area until such time as the surrounding vegetation has sufficiently established itself to prevent erosion.

2. Final Grading and Seeding

All ground surrounding the lift station must be graded, seeded and retained in such a manner so as to prevent ground erosion over the station site or entrance road. Final acceptance of the lift station will not be given until an effective erosion control has been demonstrated.

3. Landscaping

Where applicable, all ground surrounding the lift station shall include the planting of trees and shrubs in sufficient density to screen the presence of the lift station. Shrubs and plantings shall be in accordance with Section 807 of the Standard Specifications and Construction Details.

3. Water Service

A one-inch tap/water yard hydrant/meter setup shall be provided, with yard hydrant located a minimum of 25 feet from the wet well.

4.05 Final Acceptance

Within thirty (30) days after the final inspection and acceptance of the pump station by the City, the following documentation must be submitted to the City of Wentzville.

1. Four sets of as-built schematics
2. A copy of all utility account numbers, and street address of property.
3. Stamped as-built survey of the pump station site and any station access areas, providing certification that all structures, grounds and roads have been located within the bounds of the recorded easement.
4. Letter of completion from the installing paving contractor, guaranteeing all pavement and pavement sub-surfaces to be installed per approved plan specifications.
5. A complete set of as-built drawings in AutoCAD format.(.dwg) shall be supplied on 3.5 inch and CD media.

Four sets of as-built plans shall be forwarded to the Pump Station Division. One set of 11"x17" control panel schematics shall remain on site laminated to the inside of the control panel exterior door.

Pump stations will not be considered for inspection until the as-builds have been received by the City of Wentzville.

4.06 Standard Construction Details

Standard details for construction of sewage pumping stations can be found in The City of Wentzville Standard Specifications and Construction Details.

SECTION 217

Excavation and Trenching for Utilities

217.1 Description. This section covers excavation and trenching work and shall include the necessary clearing, grubbing, and preparation of the site; removal and disposal of all debris; excavation and trenching as required; the handling, storage, transportation, and disposal of all excavated material; all necessary sheeting, shoring, and protection work; preparation of subgrades; pumping and dewatering as necessary or required; protection of adjacent property; backfilling; pipe embedment; surfacing and grading; site restoration; and other appurtenant work.

217.2 General Requirements. Excavation shall provide adequate working space and clearance for the work to be performed therein. In no case shall excavation faces be undercut.

Subgrade surfaces shall be clean and free of loose material of any kind when concrete is placed undercut.

Backfilling and construction of fills and embankments during freezing weather shall not be done except by permission of the City Engineer. No backfill, fill, or embankment materials shall be installed on frozen surfaces, nor shall frozen materials, snow, or ice be placed in any backfill, fill, or embankment. All rock which cannot be handled and compacted as earth shall be kept separate from other excavated materials and shall not be mixed with backfill or embankment materials except as specified or directed by the City Engineer.

217.3 Classification of Excavated Materials. No classification of excavated materials will be made for payment purposes except for rock excavation as specifically noted in the project proposal. Excavation and trenching work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the work, regardless of the type, character, composition or condition thereof except for rock excavation. Payment for rock excavation shall be based on a trench width equal to twice the nominal pipe diameter for pipe having a nominal pipe diameter of greater than 10 inches. For pipe with a 10-inch diameter or less the payment for rock excavation shall be based on a trench width of 2 feet. Payment for rock excavation at manholes or other structures shall be based on the outside diameter or dimensions plus 4 feet to allow a working space of 2 feet beyond each exterior wall.

217.4 Site Preparation. All sites to be occupied by permanent construction or embankments shall be cleared of all logs, trees, roots, brush, tree trimmings, and other objectionable materials and debris. All stumps shall be grubbed. In addition, subgrades for fills and embankments shall be cleaned and stripped of all surface vegetation, sod, and organic topsoil. All waste materials shall be removed from the site and disposed of by and at the expense of the contractor. Topsoil shall be stripped and stockpiled for reuse as specified herein.

217.5 Clearing. The contractor shall do all clearing necessary for access, stringing of pipeline materials, and construction of the pipelines and appurtenant structure. Clearing along creek banks, ditches, swales, etc. shall be kept to a minimum as necessary for sewer or force main installation, to minimize bank erosion prior to riprap installation.

217.6 Use of Explosives. The contractor shall comply with all laws, ordinances, applicable safety code requirements, and regulations relative to the handling, storage, and use

of explosives and the protection of life and property. The contractor shall be responsible for all damage caused by his blasting operations. Suitable methods shall be employed to confine all materials lifted by blasting within the limits of the excavation or trench.

All rock which cannot be handled and compacted as earth shall be kept separate from other excavated materials and shall not be mixed with backfill or embankment materials expect as specified or directed.

Use of explosive shall be prohibited without a blasting permit from the appropriate governing agency.

217.7 Unauthorized Excavation. Except where otherwise authorized, shown, or specified, all materials excavated below the bottom of concrete walls, footings, slabs on grade, and foundations shall be replaced, by and at the expense of the contractor, with concrete placed at the same time and monolithic with the concrete above.

217.8 Dewatering. The contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed herein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

All excavations for concrete structures or trenches which extend down to or below ground water shall be dewatered by lowering and keeping the ground water level beneath such excavations 12 inches or more below the bottom of the excavation.

Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property.

The contractor will be held responsible for the condition of any pipe or conduit which he may use for drainage purposes, and all such pipes or conduits shall be left clean and free of sediment.

217.9 Shielding and Shoring. Except where banks are cut back on a stable slope, excavation for structures and trenches shall be sheeted, braced, and shored, as necessary, to prevent caving or sliding.

All trench slopes, shielding and shoring shall follow the current O.S.H.A. requirements and guidelines at a minimum.

217.10 Stabilization. Subgrades for concrete structures and trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud and muck; and shall be sufficiently stable to remain firm and intact under the feet of the workmen.

Subgrades for concrete structures or trench bottoms, which are otherwise solid, but which become mucky on top due to construction operations, shall be reinforced with one or more layers of crushed rock or gravel. The stabilizing material shall be spread and compacted to a depth of not more than 4 inches, which shall be furnished and installed as specified for granular fills. Not more than 1/2-inch depth of mud or muck shall be allowed to remain on stabilized

trench bottoms when the pipe bedding material is placed thereon. The finished elevation of stabilized subgrades for concrete structures shall not be above subgrade elevations indicated on the drawings.

All stabilization work shall be performed by and at the expense of the contractor.

217.11 Trench Excavation. The contractor shall not open more trench in advance of pipe laying than is necessary to expedite the work. The maximum length of open trench on any line under construction shall be 400 feet.

Except where tunneling is indicated on the drawings, or is permitted by the City Engineer, all trench excavation shall be open cut from the surface.

a. Alignment and Minimum Cover: The alignment of each pipeline shall be fixed and determined from offset stakes. Vertical and horizontal alignment of pipes, and the maximum joint deflection used in connection therewith, shall be in conformity with requirements of the section covering installation of pipe.

b. Limiting Trench Widths: Trenches shall be excavated to a width which will provide adjacent working space and sidewall clearances for proper pipe installation, jointing, and embedment.

1. Minimum Sidewall Clearance. Minimum permissible sidewall clearance between installed pipe and each trench wall, expressed in inches, shall be as follows:

Nominal Pipe Size (inches)	Minimum Side Wall Clearance (inches)
8	5
10	5
12-36	6

The stipulated minimum sidewall clearances are not minimum average clearance, but are minimum clear distances which are required.

2. Maximum Trench Widths. The maximum trench width for sanitary sewer pipe shall be the nominal pipe diameter plus 24 inches.

Where necessary to reduce earth load on trench banks to prevent sliding and caving, banks may be cut back on slopes which shall not extend lower than one foot above the top of the pipe.

c. Unauthorized Trench Widths: Where, for any reason, the width of the lower portion of the trench as excavated at any point exceeds the maximum permitted in the foregoing tables: either; pipe of adequate strength, special pipe embedment, or arch concrete encasement, as required by the loading conditions and with the concurrence of the City Engineer, shall be furnished and installed by and at the expense of the contractor.

d. Mechanical Excavation: The use of mechanical equipment will not be permitted in locations where its operation would cause damage to trees, buildings, culverts, or other existing property, utilities, or structures above or below the ground. In all such locations, hand excavation methods shall be used.

Mechanical equipment used for trench excavation shall be of a type, design, and construction, and shall be so operated, that the rough trench excavation bottom elevation can be controlled, that uniform trench widths and vertical sidewalls are obtained at least from an elevation of one foot above the top of the installed pipe to the bottom of the trench, and that trench alignment is such that pipe when accurately laid to specified alignment will be centered in the trench with adequate clearance between the pipe and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.

e. Excavation Below Pipe Subgrade: Except where otherwise required, pipe trenches shall be excavated below the underside of the pipe, as shown on the Embedment of Pipe Detail, to provide for the installation of granular embedment pipe foundation material.

f. Artificial Foundations in Trenches: Whenever so ordered by the City Engineer, the contractor shall excavate to such depth below grade as the City Engineer may direct and the trench bottom shall be brought to grade with crushed stone foundation material, or such material as the City Engineer may order installed. All timber, concrete, or other foundations made necessary by unstable soil shall be installed as directed by the City Engineer.

Where crushed stone artificial foundations in trenches are required, the material shall be placed on suitably prepared subgrades and compacted by vibration, and shall be crushed rock or gravel free from dust, clay, or trash, graded 1-1/2 inches to No. 4 as defined in ASTM C33.

g. Bell Holes: Bell holes shall provide adequate clearance for tools and methods used in installing pipe. No part of any bell or coupling shall be in contact with the trench bottom, trench walls, or granular embedment when the pipe is jointed.

217.12 Trench Backfill. After the pipe or conduit has been properly bedded, jointed and inspected, and all measurements to record locations of Y-junctions, tess, valves, etc. have been made by the City, and sufficient has elapsed for the joint materials or for any concrete or mortar to set and harden, upon permission of the Inspector, and backfill may be placed.

a. Trenches backfilled and water jetted: Backfill in trenches which are not within or immediately adjacent to pavements, but are located where prevention of backfill settlement is essential, and where mechanical compaction is not required on the Project Plans or by the City Engineer, and where granular fill is not desired, shall be water jetted. Non-granular job-excavated material shall be free from debris, organic matter, perishable compressible materials, and shall contain no stones or lumps of rock fragments larger than six (6) inches in dimension, nor be in such amount that will interfere with the consolidating properties of the fill material. Care shall be taken that stones or lumps are kept separated and well distributed,

and that all voids are completely filled with fine materials. The upper three feet of backfill in sodded or planted areas shall be free of such rocks or lumps larger than one (1) inch in diameter with the upper six (6) inches being free of all objectionable material.

All jetting shall be performed with a probe route on not greater than 7.5-foot centers with the jetting probe centered over and parallel with the direction of the pipe. Trench widths greater than 10 feet will require multiple probes every 7.5-foot centers. Trench backfill depths less than 8 feet in depth shall be probed to a depth extending to half of the trench backfill, but not less than 3 feet. Trench backfill greater than 8 feet in depth shall be probed to half the depth of the trench backfill but not greater than 8 feet. Jetting shall be performed from the low surface topographic point and proceed toward the high point, and from the bottom of the trench backfill towards the surface. The flooding of each jetting probe shall be started slowly allowing slow saturation of the soil. Water is not to be allowed to flow away from the ditch without first saturating the trench. Contractor shall identify the locations of surface bridging (the tendency for the upper backfill crust to arch over the trench rather than collapse and consolidate during the jetting process). The contractor shall break down the bridged areas using an appropriate method such as the wheels or bucket of a backhoe. When the surface crust is collapsed; the void shall be backfilled with the same material within the sunken/jetted area shall be compacted such that no further surface subsidence occurs.

b. Trenches backfilled and mechanically compacted: Backfill in trenches which are not within or immediately adjacent to pavements, but are located where prevention of backfill settlement is essential, and where required on the Project Plans or by the City Engineer, and where granular fill is not desired, shall consist of selected job-excavated earth thoroughly compacted with suitable mechanical tampers to the density of the adjacent undisturbed earth. Non-granular job-excavated material shall be free from debris, organic matter, perishable compressible materials, and shall contain no stones or lumps of rock fragments larger than six (6) inches in dimension, nor be in such amount that will interfere with the consolidating properties of the fill material. Care shall be taken that stones or lumps are kept separated and well distributed, and that all voids are completely filled with fine materials. The upper three feet of backfill in sodded or planted areas shall be free of such rocks or lumps larger than one (1) inch in diameter with the upper six (6) inches being free of all objectionable material. The approved backfill materials shall be placed in layers not exceeding one (1) foot before compaction.

c. Trenches backfilled with granular material: Backfill in trenches through pavements or wherever prevention of backfill settlement is considered essential, and where the Project Plans require, or the City Engineer orders, shall be made with water jetted granular fill from the level six (6) inches above the top of pipe to the subgrade elevation of the pavement. Granular backfill shall consist of ¾" minus crusher-run limestone. Granular material shall be free from wood, paper, cans, ashes, and other weak, unstable, perishable, or compressible materials, and from such quantities of any material, clay or loam, either finely divided or in lumps, as will interfere with the free-flowing and compacting properties of the

composite fill. "Pea gravel" or similar granular materials approximately uniform in size and without bonding properties shall not be used.

END OF SECTION

DIVISION 300
SANITARY SEWERS

SECTION 300

General Requirements

300.1 Location. Sanitary sewer mains, force mains, manholes and lateral connections shall be placed in accordance with the approved plans. Standard Construction Detail (SCD) 500.01 provides a detail of standard utility locations. Gas, water, and other underground utilities shall not conflict with the depth or horizontal location of existing and proposed sanitary and storm sewers including laterals.

300.2 Sanitary Sewer Easements. All sanitary sewers shall be constructed in Public Right of Way, or in easements granted to the City of Wentzville, and as shown on the approved set of improvement plans. Sewers installed as a part of a development may record the easements on the record plat. All other sanitary sewer easements will require easement documents.

300.3 Pre-construction Meeting and Construction Permit. No construction of extensions or modifications shall begin before plans are approved for construction and a Construction Permit is granted by the Engineering Division through a Pre-Construction Meeting coordinated by the City Engineer. Any construction done prior to this Notice may be summarily rejected or refused without further investigation.

300.4 Inspections. All construction work, involving sanitary sewer extensions and/or modifications shall be inspected by the City of Wentzville, in accordance with the requirements contained in Section 102.9. Any work performed without inspection will not be accepted by the City of Wentzville. The City of Wentzville shall be notified a minimum of 48 hours in advance of any construction for coordination and inspections

300.5 As-built Drawings. As-built drawings shall be required for all new construction. See Division 1100 for as-built drawing requirements.

300.6 Field Changes. Small field changes may be accepted by the City Inspector. Larger changes shall require a submittal to the City Engineer for approval.

END OF SECTION

SECTION 301

Sanitary Sewer Mains

301.1 Description. This section covers sanitary sewer pipe and fittings to be furnished complete with all jointing materials and appurtenances. Pipe shall be installed and tested in accordance with Section 303.

301.2 Materials for Public Sewer Lines. Pipe and fittings, jointing materials, and appurtenant materials shall be shown on the drawings and as specified herein.

a. Polyvinyl Chloride (PVC) Pipe: For gravity sewer mains and laterals having less than 20 feet of cover to finish grade, the minimum gravity sewer pipe shall be SDR35. Pipe up to 15 inches in diameter shall conform to ASTM D-3034 (latest revision) Standard Specifications for the PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings, SDR35. Pipe with a diameter of 18 inches or larger shall conform to ASTM F679 (latest revision), Polyvinyl Chloride (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings.

For gravity sewer mains and laterals having greater than 20 feet of cover to finish grade or if the sewer pipe does not have proper horizontal and vertical separation as described in Section 303.14 of these Specifications. the minimum gravity sewer pipe shall be AWWA, C900 PVC. Pipe 6 to 12 inches in diameter shall conform to PC 150(latest revision). Pipe larger than 12", shall conform to AWWA, C905 PVC, PC 165(Latest revision). Where only a portion of a reach has greater than 20 feet of cover, the entire reach extending between manholes shall be installed with C900/C905 PVC pipe.

Joints shall be elastomeric gasket joints providing a water tight seal. Joints shall conform to ASTM D3212 (latest revision) Standard Specification for Joints for Drain and Sewer Plastic Pipes and Fittings Using Flexible Elastomeric Seals. No glued joints on main line sewer will be allowed.

Care shall be taken to assure that no PVC pipe be installed or stored such that it will remain exposed to sunlight or any other conditions that may allow it to deteriorate. UV damaged pipe is not acceptable, and will be rejected.

b. Ductile Iron Pipe (DIP): DIP shall conform to ANSI/AWWA C151/A21.51 (latest revision) American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water, with the thickness class given by the Project Plans and Specifications.

Approved ring gasketed slip-type joints shall be used on the ductile iron pipe unless otherwise noted in the project specifications.

Fittings shall conform to ANSI/AWWA C110/A21.10 (latest revision) American National Standard for Ductile-Iron and Gray-Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids.

c. Polyethylene Pipe: All force mains shall conform to AWWA C906 (latest revision), and shall be DR13.5 with green striping on the exterior.

d. Tracer Wire: A coated number 12 AWG copper tracer wire shall be installed the entire length of the force main as per SCD 304.01. The tracer wire shall be accessible from the surface at intervals not to exceed 500 feet by the use of test stations as indicated on SCD 302.17. The tracer wire shall be extended through all valve vaults (pump station valve vault, air release vault, etc.), leaving a minimum of 5 feet of coiled wire, for access/connection through the manhole opening at ground surface. Any project with over 1500 feet of pipe shall use a 2500' roll of tracer wire.

e. Butt Fusion Fittings: Fittings shall be PE3408 HDPE, Cell Classification of 345464C as determined by ASTM D3350 (latest revision). Butt Fusion Fittings shall have a manufacturing standard of ASTM D3261. Molded & fabricated fittings shall have the same or greater pressure rating as the pipe being fused or as otherwise specified on the plans. Fabricated fittings are to be manufactured using a Data Logger. Temperature, fusion pressure and a graphic representation of the fusion cycle shall be part of the quality control records. Electrofusion fittings may only be used as approved by the City Engineer.

301.3 Valves.

a. Air release valves: When required, all air release valves shall conform to AWWA C512 (latest revision) Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service and shall be the short-body style and specifically manufactured for wastewater applications. The body and cover of the valve shall be constructed of reinforced nylon that has a pressure rating greater than or equal to the force main pipe material. Bolts, pipe, nipples and plugs shall be stainless steel.

Acceptable manufacturer and model: A.R.I. Model D-025 Combination Valve, 2" NPT or approved equal.

All air valves shall be installed in a vertical position and plumbed with an HDPE fusion saddle with brass 2"NPT adapter, a corporation stop-2" NPT, and a brass cam and groove quick coupler-2" NPT. All air valves shall be enclosed in a concrete vault having a minimum diameter 48" and a cast iron access cover as indicated in SCD 302.08. The exposed main shall be bedded with 1" clean rock.

b. Check valves: When required, check valves shall be full body flanged type, with a domed access cover and only one moving part, the flexible disc, conforming to AWWA C508 (latest revision), Swing-Check Valves for Waterworks Service, 2 In. (50 mm) Through 24 In. (600 mm) NPS.

The valve body shall have full flow equal to nominal pipe diameter at all points through the valve. The seating surface shall be on a 45-degree angle to minimize disc travel. A threaded port with pipe plug shall be provided on the bottom of the valve to allow for field installation of a backflow actuator without special tools or removing the valve from the line.

The top access port shall be full size, allowing removal of the disc without removing the valve from the line. The access cover shall be domed in shape to provide flushing action over the disc for operation in lines containing high solids content. The disc shall be of one-piece construction, precision molded with an integral o-ring type-sealing surface, and contain steel and nylon reinforcement in the hinge. The flex portion of the disc shall be warranted for twenty-five years. Non-Slam closing characteristics shall be provided through a short 35-degree disc stroke and a memory disc return action. The valve shall be cycle tested 1,000,000 times with no signs of wear or distortion to the valve disc or seat and shall remain drop tight at both high and low pressures. The test results shall be independently certified.

The valve body shall be construction of ASTM A126 Class B cast iron. Optional body material includes ASTM A536 Grade 65-45-12 ductile iron. The disc shall be precision molded Buna-N (NBR), ASTM D2000-BG.

Valves shall be provided with flanges in accordance with ANSI B16.1, Class 125.

The exterior of the valve shall be coated with a universal alkyd primer. The valve interior shall be coated with an epoxy coating approved for potable water.

Acceptable manufacturer and models: Val-Matic, Swing-Flex® Check Valves Series #500.

c. Gate Valves: When required, gate valves shall be cast iron body resilient seated gate valves conform to AWWA C509 (latest revision), Resilient-Seated Gate Valves for Water Supply Service. The gate valve shall be of the non-rising stem, open left (counterclockwise), bronze stem type. All valves shall have an epoxy coating, minimum 5 mils, on the interior and exterior surfaces. Gate valves, for direct bury, shall be installed vertically, and fitted with a valve box and cover. Valve operators shall be supplied with stainless steel stem extensions, stem guides and 2" square wrench nut or hand wheel as shown on drawings.

Acceptable manufacturer and models: Mueller Co., series 2360; U.S. Pipe Metroseal 250; American Flow Control Series 2500; Kennedy model KS-FW or approved equal.

END OF SECTION

SECTION 302

Sanitary Sewer Manholes

302.1 Description. This section covers standard and drop manholes. Manholes shall be constructed complete with covers, steps, vents, fittings, and other appurtenances, in accordance with the Standard Construction Details and approved improvement plans. All manholes shall be constructed so that they are watertight. Any lifting holes, grade adjustment rings, precast section joints, and any other area which may be subject to infiltration shall be sealed watertight.

All standard and drop manholes shall be constructed of precast concrete sections. Only concentric precast concrete cones will be acceptable. Brick shall not be allowed in the construction of sanitary sewer manholes. All sanitary sewer manholes without top elevations provided by the approved improvement plans will be the responsibility of the contractor, to install to the finished grade of the project.

302.2 Materials.

Concrete	Materials, handling, forms, finishing, curing, and other work as specified in concrete section, except that only calcareous materials shall be used. Granitic materials shall not be used.
Precast Section	Circular precast concrete; ASTM C478, except as modified. See SCD 302.01
Minimum Barrel Diameter	42" for pipe 8" in diameter 48" for pipe 10" to 21" in diameter, single inside drop and terminal manholes 60" for pipe 24" to 36" in diameter and double inside drop
Minimum Wall Thickness	5" minimum
Reinforcement	As indicated on the standards. See SCD 302.01.
Portland Cement	ASTM C150
Hydrated Lime	ASTM C270, Type S
Sand	Concrete sand (fine aggregate) sieved through 8 mesh screen
Shrinkage-Correcting Aggregate	Master Builders "Embeco", Sika "Kemox", Sonneborn "Ferrolith G-DS", or equal
Mortar	One part portland cement, ½ part hydrated lime, 3 parts sand
Non-shrinking Mortar	Premixed or job mixed; job mixed shall be one part shrinkage-correcting aggregate, one part portland cement,

one part sand

Gaskets	
Mastic	Fed Spec SS-S-210; K.T. Snyder "Ram-Nek", Hamilton-Kent "Kent-Seal No. 2", Bidco "C-56", Conseal "CS-102" or equal
Rubber	Neoprene or other synthetic, 40 (plus or minus 5) hardness when measured by ASTM D2240, Type A durometer
Grey Iron Castings	Manhole castings shall conform to the requirements of the Specifications for Gray Iron Castings ASTM A48 (latest revision) Castings shall be fabricated of Class 30B cast iron. Bearing surfaces shall be such that the cover or grating shall seat in any position onto the frame without rocking. Bearing surfaces for manhole frames and covers shall be machined.
Manhole Steps	Manholes steps shall be cast into the full depth of the wall section or installed by an approved alternate method. See SCD 302.12.

302.3 Precast Concrete Sections. Precast sections shall conform in all respects to applicable requirements of SCD 302.12, and shall contain reinforcing steel to prevent cracking during handling.

a. Handling: Precast concrete sections shall be handled carefully and shall not be bumped or dropped. Hooks shall not be permitted to come in contact with joint surfaces. Use of lifting holes will not be permitted. Lift notches that are not deeper than one half of the wall thickness will be allowed. Lifting notches shall be repaired by cementing a properly shaped concrete plug in place with epoxy cement, or by other methods acceptable to the City Engineer.

b. Inspection: Precast concrete sections shall be inspected when delivered and all cracked or otherwise visibly defective units rejected.

302.4 Precast Concrete Base. The requirements of precast concrete sections shall apply to precast concrete bases. Precast bases shall be furnished with "A-Lok" or Z-Lok" water stops, conforming to ASTM C923 (latest revision) Resilient Connector Between Reinforced Concrete Manhole Structures and Pipes. The concrete invert may be furnished with the precast unit; or alternatively the concrete invert fill may be installed in the field and shall conform exactly to the invert elevations of the connecting piping after installations.

The connecting pipe shall be plain end, square cut spigots and shall not protrude more than one inch inside the manhole wall. A clear distance of at least one inch from the end of each connecting pipe and around the pipe shall be provided when the concrete invert fill is installed. This shall be provided under the pipe by a boxout with sides which are at right angles with each other. After completion of the manhole, the boxout shall be filled with suitable non-shrink grout, completely filling the space beneath the pipe and completely filling the space around the pipe. The non-shrink grout material shall provide a smooth, uniform surface between the inside diameter of the pipe and the manhole invert.

302.5 Cast-in-Place Concrete Bases. Cast-in-place concrete manhole bases shall be allowed when it is required to construct a new manhole over an existing sanitary sewer line. When a cast-in-place concrete base is utilized the remainder of the manhole shall consist of precast manhole sections. When precast manhole sections with horseshoe-shaped boxouts are used, a water stop, as recommended or supplied by the pipe manufacturer shall be installed at the center of the manhole walls and grouted in place as specified in this section.

302.6 Construction. All pipes shall have positive drainage through manholes. No flat base structures will be allowed. All terminal manholes shall have positive drainage. All mortar shall be used within 40 minutes after mixing. Mortar which has begun to take initial set shall be discarded and shall not be mixed with additional cement or new mortar. In no case shall the invert section through a manhole be greater than that of the outgoing pipe. The shape of the invert shall conform exactly to the lower half of the pipe it connects. A bench shall be provided on each side of the invert when pipe diameter(s) are less than the manhole diameter. The bench should be sloped no less than one half inch per foot (0.5 in/ft). Side branches shall be connected with as large radius of curve as practicable. All inverts shall be troweled to a smooth clean surface. Circular precast sections shall be provided with a rubber or mastic gasket to seal joints between sections. Where mastic gaskets are furnished, the written installation recommendations of the manufacturer shall be available at the site of the work, and shall be strictly followed. For manhole risers, mastic gaskets with a nominal cross section as shown in the following table shall be furnished unless a different cross section is recommended in writing by the manufacturer.

Minimum Manholes Diameter (inches)	Nominal Cross Section (inches)
48	1 X 3
60	1 X 3
72	1 X 3-1/2

302.7 Waterproofing & Corrosion Protection. The outside surfaces of each manhole shall be waterproofed. An acceptable product is: SS1H, Slow Setting Emulsion, as manufactured by Missouri Petroleum, Bi-State Emulsions, Inc., or approved equal.

Corrosion protection shall be provided on the inside of every Manhole or structure where there is anticipated to be a septic condition or other possible forms of corrosion. The entire surface shall be coated with a two part epoxy coating, with a dry film thickness of at least 6 mil. Manholes which receive the discharge from a sewer force main and the next two downstream manholes shall be so coated, and as noted on SCD 304.01. Other manholes and/or structures which may be subject to corrosion shall also be likewise coated/protected.

302.8 Grade Adjustment Rings. Grade adjustment rings shall be used in lieu of brick construction. Grade adjustment rings shall have minimum dimensions of 26.5 inches opening, 3 inch height and 8 inch width. No more than one grade ring shall be used per adjustment unless the total height of adjustment is 6 inches or greater. A maximum of two grade adjustment rings shall be allowed, and a maximum of 12", total, of grade adjustment rings shall be allowed. Only Concrete adjustment rings shall be allowed on Sanitary Sewer Manholes.

302.9 Drop Manhole Structures. All sanitary sewer drop manholes shall be inside drop type structures.

Structures with an elevation difference between the inflow and outflow pipe less than 2 feet shall be a continuous sweep fall type inside drop structures as shown in SCD 302.03.

Drop structures with an elevation difference between the inflow and outflow pipe of 2 feet or more shall conform to SCD 302.02. The first twenty (20) feet of the incoming drop sewer pipe shall be ductile iron pipe. Manholes with one inside drop shall be 48 inches in diameter and sanitary manholes with two inside drops shall be 60 inches in diameter. No more than two inside drops per manhole unless otherwise approved by the City Engineer.

END OF SECTION

SECTION 303

Sewer Pipe Installation and Testing

303.1 Description. This section covers installation and testing of all sewer pipe. Except where modified by specific requirement in this section, the written installation recommendations of the sewer pipe manufacturer shall be strictly followed. Sewer pipe materials are specified in other sections.

Trenching, excavation and backfilling operations shall be conducted in accordance with Section 217.

303.2 Handling. Equipment used to handle, lay and joint pipe shall be so equipped and used as to prevent damage to the pipe and its jointing materials. All pipe and fittings shall be carefully handled and lowered into the trench. Plastic pipe shall be shaded if necessary to prevent curvature due to thermal expansion. Damaged pipe shall be removed from the site.

303.3 Cleaning. The interior of all pipe and fittings shall be thoroughly cleaned before installation and shall be kept clean until the work has been accepted. All joint surfaces shall be kept clean until the joint is completed. Every precaution shall be taken to prevent foreign material from entering the pipe during installation. No debris, tools, clothing, or other materials shall be placed in the pipe.

303.4 Excavation, Trenching and Backfilling. All sanitary sewer trench excavation and backfilling shall conform to the requirements of Section 217.

303.5 Laying Pipe. Pipes shall be laid true to the lines and grades given on the plans. The bell or groove end shall be laid upstream with the ends abutting to form a concentric joint without shoulders or unevenness of any kind along the invert of the pipe. Bell holes shall be dug to relieve the bell of all load and to be no larger than necessary. Straight alignment shall be checked by either using a laser beam or lamping. Curvilnear alignment of larger diameter sanitary sewers will generally not be allowed. Should a situation arise where curvilinear alignment may warrant consideration, the design must be consistent with all the requirements contained within10 CSR20-8.120(5)(E)2.

Where a sewer main or lateral crosses over or under another pipe, and a vertical clearance of eighteen (18) inches for waterlines and twelve (12) inches for others, cannot be maintained between them, the following concrete encasement shall be required: When the sanitary sewer is the lower pipe, it shall be encased for its entire periphery with Class A concrete for a distance of ten (10) feet on each side of the higher pipe. When the sanitary sewer is the higher pipe, it shall likewise be encased for its entire periphery with Class A concrete for a distance of ten (10) feet on each side of the lower pipe, in addition the lower pipe shall be encased from the springline of the pipe, for the width of the trench, up to the encasement of the upper pipe.

Suitable means shall be used to force the spigot end of the pipe into the bell end without damage to the pipe and its jointing materials, and without disturbing the previously laid pipes and joints.

303.6 Jointing. All joint preparation and jointing operations shall comply with the instructions and recommendations of the pipe manufacturer. Immediately before joints are

pushed together, all joint surfaces shall be coated with the lubricant furnished with the pipe. The position and condition of each rubber gasket (unbonded gaskets) shall be checked with a feeler after the joint is completed.

303.7 Bedding, Cradling, or Encasement. Special care shall be taken to insure that the pipes are solidly and uniformly bedded, cradled, or encased in accordance with the type of bedding, cradle or encasement required by the project plans and specifications and as shown in the SCD 300.01, 300.02 and 300.05. No pipes shall be brought into position until the preceding length has been bedded and secured in place.

Where concrete encasement is required, the pipe shall be supported at not more than two places with masonry supports or selected cut hardwood as approved by the City Engineer of minimum size sufficient to provide the required clearance and to prevent displacement during placing of concrete.

Bedding for sanitary sewer gravity pipe construction shall be Class C. Bedding shall be all stone or crushed limestone and shall be sound, durable and free from cracks and other structural defects that would cause it to deteriorate. It shall not contain any soapstone, shale, or other material easily disintegrated. The bedding shall be placed as shown in the Standard Construction Details, and conform to the following gradations:

For 27 inch diameter and smaller (% by Weight Passing)

Sieve	Maximum	Minimum
1 inch	100	100
¾ inch	100	90
½ inch	60	35
# 100	10	0

For 30 inch diameter and larger (% by Weight Passing)

Sieve	Maximum	Minimum
1½ inch	100	100
1 inch	70	60
¾ inch	50	40
½ inch	35	25
# 100	10	0

Sanitary sewer force mains of C906 polyethylene shall be bedded in native soils without roots, limbs, large rocks, boulders, clumps, or frozen clods or any object that could damage the pipe. Unstable soil or muck shall be removed from the trench bottom. Water shall be removed from the trench before bringing the bedding material and pipe to grade and backfilling. When a trench is cut through rock, it shall be excavated to 6" below the pipe bottom grade, and bedded with non-angular bedding material. All slabs of rock, boulders and large rocks shall be removed.

308.8 Steep Slopes & High Velocities. Wherever sanitary sewers are installed at slopes greater than 20 percent concrete collars/anchors are to be installed as shown in SCD 300.04. Additionally these collars will need to be installed where the calculated velocity

will exceed 15 fps. Velocities shall be calculated for pipes 12" and smaller in size where the slopes exceed 10%, and for larger pipes when the slopes exceed 5%. On those sections of pipe which collars/anchors are installed, the first downstream manhole shall be blocked with a minimum of 4 cubic yards of concrete on the side opposite the steep slope sewer main.

303.9 Protection of Pipe. Whenever pipe laying is stopped for any significant length of time, such as at the end of the workday, the unfinished end shall be protected from displacement, flotation, cave-in, in-wash of soil or debris, or other injuries. A suitable temporary tight-fitting plug, stopper, or bulkhead shall be placed in the exposed bell, groove or socket end. Whenever sanitary force main is left unattended for more than 4 hours, the ends shall be capped with duct tape and shall be visible. Care shall be taken to protect C906 Polyethylene pipe from damage

303.10 Water in Excavation. Water shall not be allowed to rise in the excavation until the joint materials and any concrete cradle or encasement is hardened and cannot be damaged by the water. Particular care shall be used to prevent disturbance or damage of pipe and the joints during backfilling or at any other time.

303.11 Future Connections. Wye and Tee-branches, slants, stubs or other fittings installed in the pipe for future connections shall be closed at the outer end. Care in backfilling shall be used so that such closure and its seal will not be disturbed.

303.12 Pipe slope less than 1%. For sewer pipe with a design grade less than one percent (1%), verification of the pipe grade will be required for each installation reach of sewer, prior to any surface restoration or installation of any surface improvements. The contractor's field supervisor will be required to provide daily documentation verifying that the as-built pipe grade meets the design grade through the submittal of signed cut sheets to the City Engineer upon request. The contractor will be required to remove and replace any sewer reach having an as-built grade which is flatter than the design grade by more than 0.1%. Sewers with grades greater than the design slope may be left in place, provided no other sewer grade is reduced by this variance in the as-built grade. The City Engineer also reserves the right to require the contractor to remove and replace any sewer (at any time prior to construction approval) for which the as-built grade does not comply with the grade tolerance herein stated. Field surveyed verification must be made under direction of the licensed land surveyor or registered professional engineer. The sewer contractor shall be responsible for any cost associated with the field verification of the sewer grade, or removal and replacement of the sewer pipe or associated appurtenances.

303.13 Creek Crossings. Sanitary sewers which cross creeks below the flowline of the watercourse shall conform to SCD 304.02. The sewer outfalls, headwalls, manholes, gateboxes, or other structures shall be located so they do not interfere with the free discharge of flood flows of the stream.
Construction methods will be utilized which will minimize siltation and erosion during construction. Trench backfill material shall be stone, with 1inch fine crushed stone for backfilling/bedding the pipe, in accordance with these specifications. Contractor shall be responsible to insure that silt is not allowed to enter the stream at any point, by the use of silt fencing or other approved BMP, and any silt encountered shall be removed from the site, with disposal/use out of the material outside the area of construction near the channel. No unnecessary excavation or disturbance to trees or vegetation will be allowed. No dumping of any excavated material, to include soil, debris, silt-laden water into the stream will be allowed.

The area of construction at or near the channel shall be maintained in a clean state at all times, with restoration of these areas to begin immediately upon completion of the work. All areas disturbed, with the exception of areas which are Rip-Rapped, shall be seeded/vegetated immediately with no areas left unprotected for more than seven (7) days.

303.14 Aerial Crossings. All sanitary sewer aerial crossings shall conform to SCD 304.03 – 304.07.

303.15 Protection of Water Supplies. All sanitary sewer mains shall be installed in the following manner, so as to protect public water supplies.

Sewer mains shall be laid at least ten feet (10') horizontally from any existing or proposed water main. The distances shall be measured edge-to-edge. In cases where it is not practical to maintain a ten-foot (10') separation, consideration may be given to allow a deviation on a case-by-case basis. If less than 10 feet will separate the water and sanitary sewer, then the water main will need to be installed in a separate trench, or on an undisturbed earth shelf located on one side of the sewer. In both cases the bottom of the water main will need to be at least eighteen inches (18") above the top of the sewer. If it is not possible to obtain the proper horizontal and vertical separation as described above, the sewer must be constructed with AWWA, C900 PVC pipe, for a distance of at least 10 feet beyond the point of the conflict. The sewer must also be concrete encased for the entire length of the sewer so installed. PVC Transition Fittings must be used between the C900 pipe and the SDR 35 pipe. This pipe must then be pressure tested to a minimum of 150 psi, for a period of at least 1 hour without leakage.

Manholes will need to be located a minimum of 10 feet from any water main. If this is not possible, then the water main will need to be relocated to insure this separation is maintained.

303.16 Casing. All bores shall have a steel casing pipe conforming to AWWA C200 (latest revision) and AWWA M11 (latest revision), and if fabricated shall be constructed of A36 steel with a minimum yield point of 36 ksi; or if manufactured shall conform to Grade B with a minimum yield point of 35 ksi. It may be shipped in random lengths between 18 and 22 feet and shall have one end cut square and one end beveled. All casing pipe to be joined with 360 degree welds. It shall be mill primed and coated with cole tar epoxy coating before installation. Where coating is damaged during installation, it shall be repaired and replaced by thorough brushing or scraping to sound material and applying two coats of the coating material.

The carrier pipe shall be prevented from contact with the casing pipe by means of polyethylene spacers, placed at a maximum spacing of 10 feet along the carrier pipe. (20 foot joints of pipe will require 3 spacers for each pipe lengths, while 13 foot joints will require 2 spacers for each pipe length.) Polyethylene spacers shall be RACCI Type F60, Ranger II, APS or other approved equal. HDPE force main may be installed without the use of casing spacers.

303.17 Polyethylene Pipe Fusion License – C906 polyethylene pipe fusion operations must be conducted by an individual in possession of a valid City of Wentzville Fusion License.

303.18 Polyethylene Pipe Fusion. Sections of polyethylene pipe should be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion

method and shall be performed in strict accordance with the pipe manufacturer's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe manufacturer, including, but not limited to, temperature requirements of 400 to 450 degrees Fahrenheit, alignment, and an interfacial fusion pressure of a minimum of 60 PSI to a maximum of 90 PSI. The butt fusion joining will produce a joint weld strength equal to or greater than the tensile strength of the pipe itself. All welds will be made using a Data Logger to record temperature, fusion pressure, with a graphic representation of the fusion cycle shall be part of the Quality Control records. A copy of all data logger records shall be provided to the City prior to the main being placed into service.

a. Securing the pipe: Each component that is to be fused must be held in position so that it will not move unless it is moved by the clamping device.

b. Facing the pipe: The pipe ends must be faced to establish clean, parallel mating surfaces. Facing is continued until a minimum distance exists between the fixed and movable jaws of the machine and the facer is locked firmly and squarely between the jaws. This operation shall provide for a perfectly square face, perpendicular to the pipe centerline on each pipe end and with no detectable gap.

c. Aligning the pipe: The pipe profiles must be rounded and aligned with each other to minimize mismatch (high-low) of the pipe walls. This can be accomplished by adjusting clamping jaws until the outside diameters of the pipe ends match. The jaws must not be loosened or the pipe may slip during fusion.

d. Melting the pipe: Heating tools that simultaneously heat both pipe ends are used to accomplish this operation. These heating tools are normally furnished with thermometers to measure internal heater temperature so the operator can monitor the temperature before each joint is made. However, the thermometer can be used only as a general indicator because there is some heat loss from internal to external surfaces, depending on factors such as ambient temperatures and wind conditions. A pyrometer or other surface temperature-measuring device should be used periodically to insure proper temperature of the heating tool face. Additionally, heating tools are usually equipped with suspension and alignment guides that center them on the pipe ends. The heater faces that come into contact with the pipe should be clean, oil-free and coated with a nonstick coating as recommended by the manufacturer to prevent molten plastic from sticking to the heater surfaces. Remaining molten plastic can interfere with fusion quality and must be removed according to the tool manufacturer's instructions. Plug in the heater and bring the surface temperatures up to the temperature range (400-450°F) (204-232°C). Install the heater in the butt fusion machine and bring the pipe ends into full contact with the heater. To ensure that full and proper contact is made between the pipe ends and the heater, the initial contact should be under moderate pressure. After holding the pressure very briefly, it should be released without breaking contact. Continue to hold the components in place, without force, while a bead of molten polyethylene develops between the heater and the pipe ends. When the proper bead size is formed against the heater surfaces, the heater should be removed. The bead size is dependent on the pipe size.

The approximate melt bead sizes shall be as follows:

Pipe Size	Approximate Melt Bead Size
2" through 3"	1/16"
3" through 8"	1/8" – 3/16"
8" through 12"	3/16" – 1/4"
12" through 24"	1/4" – 7/16"
24" through 36"	7/16"

e. Joining the pipe: After the pipe ends have been heated for the proper time, the heater tool is removed and the molten pipe ends are brought together with sufficient force to form a double rollback bead against the pipe wall. The fusion force is determined by multiplying the interfacial pressure, 60-90 psi (4.14-6.21 bar), by the pipe area. For manually operated fusion machines, a torque wrench may be used to accurately apply the proper force. For manual machines without force reading capability of a torque wrench, the correct fusion joining force is the force required to roll the melt beads over to the pipe surface during joining. For hydraulically operated fusion machines, the fusion force can be divided by the total effective piston area of the carriage cylinders to give a hydraulic gauge reading in psi. The gauge reading is theoretical; the internal and external drag need to be added to this figure to obtain the actual fusion pressure required by the machine.

f. Holding the pipe: The molten joint must be held immobile under pressure until cooled adequately to develop strength. Allowing proper times under pressure for cooling prior to removal from the clamps of the machine is important in achieving joint integrity. The fusion force should be held between the pipe ends until the surface of the bead is cool to the touch. The pulling, installation or rough handling of the pipe should be avoided until the joint cools to ambient temperature (roughly an additional 30 minutes).

g. Electro-Fusion Couplings/Saddles: Electro-fusion couplings and saddles may only be used as may be approved by the City Engineer.

303.19 Testing. Each manhole and reach of sewer shall meet the requirements of the following acceptance tests. All defects shall be repaired to the satisfaction of the City Engineer. Contractor shall furnish, at no additional cost to the owner, all necessary equipment and appurtenances to perform the acceptance tests.

a. Deflection Testing: Gravity Mains. 100% of the total projects footage will be mandrel tested. This test must be completed prior to air and vacuum testing. Not less than thirty (30) days after final backfill, or City approved jetting, the Contractor shall perform a deflection test with a City of Wentzville inspector present. Testing shall be completed by using a rigid ball or mandrels with diameters equal to ninety-five percent (95%) of the diameter of the pipe. The Mandrel must have nine (9) or more odd number of flutes or points. Tests shall be performed without mechanical pulling devices. No pipe shall exceed a deflection of five percent (5%).

b. Low-pressure air testing: Gravity Mains. 20% of the total projects footage, but a minimum 300', will be air tested. The 20% will be identified by City Staff at 100% completion of the project and before testing begins. All testing must be completed in accordance with ASTM F1417. After completion of the system but prior to the connection of residential units, low-pressure air testing shall be performed on sewer lines and laterals. Isolate the section of sewer line to be tested. All branches, laterals, tees, and wyes must be plugged and braced adequately to withstand the test pressure. Air pressure must be introduced into the system to achieve four (4) psi and then stabilized to a minimum of three and one-half (3 ½) psi in excess of ground water pressure above the top of the sewer for at least two (2) minutes and then the air supply disconnected. The test will be considered as passing, if after one minute, the pressure has not dropped more than 1 psi.

c. Vacuum Testing: For the purpose of insuring that all manholes are constructed watertight, 100 percent of the all sanitary sewer manholesshall be vacuum tested. Manholes to be vacuum tested will be identified by City Staff at 100 percent completion of the project and before testing begins.

All vacuum testing shall be in accordance with Standard Test Method for Concrete Sewer Manholes by Negative Air Pressure (Vacuum) Test, ASTM C-1244 (latest revision). Sanitary sewer lines within the manhole must be plugged during the testing. A vacuum of ten (10) inches of mercury shall be drawn on the manhole. After the pressure has stabilized, a maximum of 1 inch of mercury drop in a minimum of one minute will be allowed. If the vacuum test fails to meet the above requirements, repeat the test after all defects have been repaired. Each failure will require testing of an additional 20 percent of the project manholes. A third failure of vacuum testing, including repeat tests, will require testing of 100 percent of the project manholes.

d. Pressure Test: All sanitary sewer force mains must be pressure tested in accordance with the requirements of ASTM F2164, Field Leak Testing of Polyethylene Pressure Piping Systems Using Hydrostatic Pressure. A pressure of the greater of 1.5 times the normal operating pressure at the lowest point in the system or 50 psi over the normal operating pressure will be achieved and maintained for two hours without any pressure drop. The City may require a higher pressure for this test if deemed necessary. All connections made to existing mains which are currently in service shall have the integrity of the saddle tested under pressure to the rating of the saddle, prior to making the tap on the main.

e. Continuity Test: The tracer wire installed along the entire length of water main, shall be tested by a method acceptable to the City Engineer which should show that the wire is continuous without break in the wire, and that the fore the main can be easily located by the City. Failure to pass the test may result in the Contractor being required to find and replace breaks in the wire, or alternatively replace the wire, as required by the City Engineer.

f. Blasting: Should blasting be conducted within 100 feet of any sewer main, lateral, forcemain, or manhole, after said improvement has been tested, the previously tested improvement will need to be retested.

Note: Sanitary Sewers shall not be connected to a live sewer line until the sewer system has passed all inspections and testing.

END OF SECTION

SECTION 304

Sanitary Sewer Laterals

304.1 Description. This section covers installation of all sanitary sewer laterals. Except where modified by specific requirement in this section, the written installation recommendations of the sewer pipe manufacturer shall be strictly followed.

304.2 Materials. Pipe and fittings, jointing materials, and appurtenant materials shall be shown on the drawings and as specified herein.

a. New Laterals: All new sewer lateral pipe shall be 6" diameter, SDR35 Polyvinyl Chloride (PVC) pipe conforming to the requirements of ASTM D-3034 (latest revision) Standard Specifications for the PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings, SDR35. Where main is installed as C900, due to depth, laterals should be installed using the same material, extending to the tail stake.

b. Replacement Laterals: All replacement sewer lateral pipe shall be SDR35 Polyvinyl Chloride (PVC) pipe conforming to the requirements of ASTM D-3034 (latest revision) Standard Specifications for the PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings, SDR35. Replacement laterals may be 4" diameter if the existing lateral is 4" diameter, otherwise, the minimum diameter must be 6". A rubber boot may be used for connection to the existing pipe, if not PVC, such as Vitrified Clay Pipe. Concrete must be poured over and under the boot to prevent the joint from moving.

c. Joints: Joints shall be elastomeric gasket joints providing a water tight seal. They shall conform to the requirements of the Specification for joints for Drain and Sewer Plastic Pipes and Fittings Using Flexible Elastomeric Seals, ASTM D3212 (latest revision).

Care shall be taken to assure that no PVC pipe be installed to remain exposed to sunlight or any other conditions that may allow it to deteriorate.

304.3 Sanitary Sewer Lateral Construction. All sanitary sewer lateral connection to the City of Wentzville sanitary sewer system shall be made at an approved connection point to the sanitary sewer main. For new construction, this connection should be made at the "wye" location installed with the sanitary sewer main. Where no "wye" is available, the connection to the main shall be made by the following methods

a. Plastic Main (PVC): Connection shall be made with an approved plastic saddle tee or wye fitting (see SCD 302.13a, 302.13b, or 302.14)

b. All Other Material Mains: Connection to sanitary sewer mains without an available connection, constructed of materials other than PVC, shall be made by the "roll-in" method (see SCD 302.13.c).

All sanitary sewer laterals shall be constructed such that the minimum vertical distance from the low point of the basement to the flow line of the sanitary sewer at the corresponding house connection shall not be less than two and one half feet (2-1/2') plus the diameter of the sanitary sewer.

All laterals 100 feet in length and longer shall have a cleanout installed every 100' and at any change in alignment. 90° elbows will not be allowed on sanitary sewer lateral construction.

All sanitary sewer laterals shall be constructed with a minimum of 2% slope unless otherwise approved by the City of Wentzville.

All connections to the sanitary sewer main shall be made at locations as shown on SCD 302.13a or 302.14. Connections shall be made on the same side of the main facing the service location.

Each new sanitary sewer shall have the tailstake location marked clearly for location when the final service connection is made.

Each new or replacement sanitary sewer lateral shall have a trace wire installed from the wye/tee connection to the main and then extending to the connection at the house, when constructed. The trace wire shall be run with the wye/tee using coated 12awg copper wire, taped to the lateral pipe, and should then be accessible at an Access Box, SCD 302.17, then continuing to the tail stake location. On new construction, at the tale stake, a sufficient length of wire should be rolled up, to allow for the wire to be extended to the house, without the need to splice an additional length of wire onto the wire. The Access Box, as shown in SCD 302.17, should be located on top of the lateral, at approximately the point at which it crosses the Public Right of Way, to the private property line, on which the lateral is to serve.

END OF SECTION

SECTION 305

Grouting

305.1 Description. This section covers grouting miscellaneous baseplates and other uses of grout as indicated on the drawings. Unless otherwise specified, all grouting shall be done with non-shrinking grout.

305.2 Materials.

Non-shrinking Grout:	Master Builders "Masterflow LL-713 Grout", Sauereisen Cements "F-100 Level Fill Grout", U.S.Grout "Five Star Grout", or USM "Upcon", or equal.
Water:	Clean and free from deleterious substances.

305.3 Non-shrinking Grout. Non-shrinking grout shall be furnished factory premixed so only water is added at job site. Grout shall be mixed in a mechanical mixer. No more water shall be used than is necessary to produce a flowable grout.

a. Preparation: The concrete foundation to receive non-shrinking grout shall be saturated with water for 24 hours prior to grouting.

b. Placement: Grout shall be placed in strict accordance with the direction of the manufacturer so all spaces and cavities are completely filled without voids.

c. Edge Finishing: The grout shall be finished smooth in all locations where the edge of the grout will be exposed to view after it has reached its initial set.

d. Curing: Non-shrinking grout shall be protected against rapid loss of moisture by covering with wet rags or polyethylene sheets. After edge finishing is completed, the grout shall be wet cured for at least 7 days.

Holes shall be prepared for grouting as recommended by the grout manufacturer.

END OF SECTION

DIVISION 400
SANITARY SEWAGE PUMP STATIONS

SECTION 400

General Requirements

400.1 Location. Sanitary Sewage Pump Stations and related appurtenances shall be placed in accordance with the approved plans. Gas, water, and other underground utilities shall not conflict with the depth or horizontal location of existing and proposed sanitary and storm sewers including laterals.

400.2 Sanitary Sewage Pump Station Easements. All Sanitary Sewage Pump Stations shall normally be constructed in easements granted to the City of Wentzville, and as shown on the approved set of improvement plans. Pump Stations installed as a part of a development may record the easements on the record plat. All other easements will require easement documents.

400.3 Shop Drawings. Shop drawings shall be furnished for approval by the City. The submittals shall include all materials, equipment, fittings, structures including reinforcement, complete, so as to show conformance with these specifications, the approved improvement plans, and Standard Construction Detail's (SCD's) 400.01, 400.02, 400.03 and 400.04. Approval of the submittals in no way relieves the developer/contractor from the responsibility of providing a working system, nor from insuring that all components are compatible with other components of the system.

400.4 Pre-construction Meeting and Construction Permit. No construction of pump stations or modifications shall begin before improvement plans and shop drawings are approved for construction, and a Construction Permit is granted by the Engineering Division through a Pre-Construction Meeting coordinated by the City. Any construction done prior to this notice may be summarily rejected or refused without further investigation.

400.5 Inspections. All construction work, involving pump stations, force mains, and sanitary sewer extensions and/or modifications shall be inspected by the City of Wentzville, in accordance with the requirements contained in Section 102.9. Any work performed without inspection shall not be accepted by the City of Wentzville. The City of Wentzville shall be notified 48 hours in advance of any construction for coordination and inspections

400.6 As-built drawings. As-built drawings shall be required for all new construction. See Division 1100 for as-built requirements.

400.7 Field Changes. Small field changes may be accepted by the City Inspector. Larger changes shall require a submittal to the City for approval.

END OF SECTION

SECTION 401

Structure Requirements

401.1 Description. This section covers the pump station structure construction consisting of the wet well, valve vault, control panel pad, and retention pipe (storage) to be furnished complete with all jointing materials and appurtenances.

401.2 Design of Concrete Structures. All reinforced concrete structures shall be designed using the Working Stress Method. At a minimum this includes the wet well, valve chamber, and control panel pad. The structures may be either pre-cast or cast-in-place as approved by the City. Structure shall be installed so that it is off no more than 3 inches per 25 vertical feet.

401.3 Joining Chambers. The valve chamber shall rest on a haunch poured integral with the wet well walls. Both chambers shall be tied together with a minimum of two (2) threaded tie bolts. The designing engineer shall specify the bolt diameter and material strength. Bolts are to be 18" down from top of structure. For top slab thicknesses greater than 10", place the bolts down 6" from bottom of top slab. One-half inch (1/2") thick 6"x6" backing plates shall be used as washers on each of the tie bolts. Both structure tops shall be at the same elevation and drawn tightly together against a 1" square "E.Z." stick expansion strip. The tie bolts and the 6"x6" backing plates shall be stainless steel.

401.4 Access Hatches. Access lids shall be cast in the top sections of each chamber. The top elevation of structures shall be 1" higher than the surrounding ground elevation. Surrounding ground shall be sloped away from the structure for proper drainage. The hinged side of the valves and pump chamber lids shall be located on the walls opposite from each of their respective common tie walls so that they open from the chamber tie walls. Hatch specifications may be found in Section 404.7.

401.5 Access Openings. In addition to the openings for the incoming gravity lines and pump discharge lines, the following accesses will be included:

a. A 3" and 6" PVC couple shall be cast in the center of the wet pit tie wall and a corresponding 4" and 8" hole cast in the valve chamber tie wall; centerline shall be located 20" down from the structure top. After the two chambers have been tied together a 3" and 6" PVC stub shall be glued in the coupler on the valve chamber side through the 4" and 8" holes. The annular space of the conduit between the pump and float wires shall be sealed using Polywater FST Duct Sealant or Engineer approved equivalent. The 3" opening will be used for low voltage wire passage between the chambers. The 6" opening will be used for high voltage wire passage between chambers.

b. A 6" hole shall be centered at the bottom of the valve chamber floor in the tie wall. A 4" PVC coupler shall be cast in the wet pit tie wall and centered with the valve chamber 6" hole. After the two chambers have been tied together, two 4" PVC stubs shall be glued into the coupler on each side of the tie wall. These stubs will be used for the valve chamber drain piping.

c. Two 3" holes and 2" hole shall be placed on each side of the valve chamber side walls 18" from the tie wall and 18" from the top of the structure. For top slab thicknesses greater than 10", place the holes down 8" from bottom of top slab. Two 2-1/2" and one 1-1/2" PVC coupler shall be cast in the respective holes. One set of the openings is to be used for the power, control wires, and flow meter from the control panel. Two opening sets are provided for flexibility. The openings not used shall be stubbed and capped with a piece of 1-1/2" or 2-1/2" PVC or grout filled/plugged. The annular space of the conduit between the wires shall be using Polywater FST Duct Sealant or Engineer approved equivalent.

401.6 Gravity Pipes. All incoming gravity lines and discharge piping will have a "Z-lok" or "A-lok" type compression fitting cast in place where the piping passes through the valve and wet well chamber walls. The maximum angle of deflection allowed for pipe gaskets is as follows:

a. "Z-lok" $\leq$ 25 degree

b. "A-lok" $\leq$ 7 degree

All openings for pipe shall be located a minimum of 1 foot above or below structure joints.

401.7 Valve Chamber Floor. The valve chamber floor shall be sloped with a three-sided invert towards the 4" drainpipe using a 2" fillet. Gravity and retention pipes may not be run beneath the valve chamber.

401.8 Valve Chamber Supports. Valve chamber piping shall be supported as follows:

a. After discharge piping and valves have been installed in the valve chamber, adjustable pipe cradle jacks shall be placed under the gate valves and tees, so that they have a 10" clearance between the floor and valve flanges. The supports shall be firmly bolted to the valve chamber floor.

b. An adjustable pipe cradle jack shall be placed against the back of the discharge tee and then bolted to the common chamber tie wall to prevent piping thrust movement. The thrust jack shall be shown on the chamber plan drawing.

401.9 Entrance Steps. Precast wet well entrance steps shall comply with SCD 302.12 and shall be located as follows:

a. They shall not be placed in front of incoming gravity lines.

b. They shall not be placed in conflict with floats.

c. They shall not be located under or next to any obstructions.

d. Entry steps should provide a clear-in-line visible unobstructed access from the top of the chamber to the bottom of the station.

e. Steps should be placed on one (1) of the station sidewalls approximately centered with the hatch cover.

401.10 Sealing of Wet Well & Valve Chamber. The inside and outside of the wet well and the outside of the valve chamber shall be sealed with a commercial grade water proofing sealer.

Acceptable manufacturer and model: SS1H, Slow Setting Emulsion, as manufactured by Missouri Petroleum, Bi-State Emulsions, Inc., or approved equal.

END OF SECTION

SECTION 402

Piping and Valves

402.1 Description. This section covers installation of the pump station piping and valves. Flanged end and grooved piping shall be the acceptable means of connecting piping, valves and fittings.

The standard pump station piping arrangements called out in this specification book has proven to be of sound design in typical pump station installations. Special bracing or water hammer protection devices have not been included or called for. However, when the surrounding terrain or station site is such that extreme hydraulic conditions may be created, it is the responsibility of the designing engineer to anticipate such conditions and design for the probability of excessive pressure, stress and/or movement in the piping system. The engineer shall be responsible for including whatever restraints, relief valves or surge protection, deemed necessary for the protection of the valve and piping system.

402.2 Discharge Riser Piping Material. The piping from the individual pump discharge bases, through the header tee and out of the valve vault to the connection point to the force main, shall be in accordance with the following:

a. Four inch (4") diameter piping and larger: Flanged Installation – Ductile Iron pipe ANSI A-21.51 (AWWA C151), Class 53.

   Grooved end installation – 4" diameter and above, ductile iron pipe Class 53 A.N.S.I. A-21.51 (A.W.W.A. C 151) with rigid radius grooves for end preparation in accordance with A.W.W.A. C606. Mechanical couplings shall be of ductile iron conforming to ASTM A-536, grade S nitrile gasket compounded to conform to ductile iron pipe surfaces with stainless steel nuts and bolts.

b. Three inch (3") diameter piping and smaller: Flanged Installation – ASTM D 1785 Schedule 80 PVC.

   Grooved installation – 3" diameter and below, ASTM 1785 schedule 80 PVC roll grooved pipe in accordance with C-606. Mechanical couplings shall be of ductile iron conforming to ASTM A-536, grade T nitrile compound gaskets conforming to ASTM D-2000 designation 5BG615A14B24 with stainless steel nuts and bolts.

c. When plastic pipe is utilized for the pump discharge riser and the riser exceeds 12 foot in length, a stainless steel support brace must be installed between the riser and wet well wall. The brace shall be placed approximately on the middle of the riser but kept above the normal operating level of the well. Two (2) braces will be need on lengths in excess of 20 feet.

402.3 Force Main Material. Specifications for the force main from the transition piping to the discharge point are included in Division 300.

402.4 Transition Piping. A transition pipe must be used to make the transition between the header tee inside the valve chamber and the C906 polyethylene force main outside the station structure. The following methods shall be used:

a. Four Inch (4") diameter piping and larger: Both pump discharge lines shall be joined to a ductile iron flanged tee. A ductile iron flanged x plain end pipe shall be bolted to the tee and then passed through the A-Lok or Z-Lok gasket installed in the valve chamber discharge wall. The C906 polyethylene force main shall be attached to the DIP at an MJ Gate valve, located on the outside of the Valve vault. The MJ adopter end of the HDPE pipe will be restrained by use of the restraining gland and the plain end of the DIP will be restrained by use of a Mega-Lug retainer on the DIP.

b. Three inch (3") diameter piping and smaller: Both pump discharge lines shall be joined to PVC flanged tee. A PVC flanged x plain end pipe shall be bolted to the tee and then passed through the A-Lok or Z-Lok gasket installed in the valve chamber discharge wall. The C906 polyethylene force main shall be attached to the PVC at an MJ Gate valve, located on the outside of the Valve vault. The MJ adopter end of the HDPE pipe will be restrained by use of the restraining gland and the plain end of the PVC pipe will be restrained by use of a Mega-Lug retainer on the PVC pipe.

402.6 Gate and Check Valves.

a. Valves located inside the valve vault shall be provided with flanges meeting the requirements of ANSI/AWWA C509.01, and ANSI/AWWA C110/A21.10, Class 125 Flanges. Valves located outside the valve vault shall be provided with MJ ends meeting the requirements of ANSI/AWWA C509.01, and ANSI C111/A21.11 Mechanical joint ends.

b. Gate valves: Gate valves shall be ductile iron body resilient seated gate valves conform to AWWA C509 (latest revision), Resilient-Seated Gate Valves for Water Supply Service. The gate valve shall be of the non-rising stem, open left (counterclockwise), bronze stem type. The interior and exterior surfaces shall be coated using a fusion epoxy, 10 mil thickness. Epoxy shall meet or exceed ANSI/AWWA C550 Standard, and certified to ANSI/NSF 61.. Valve operators shall be by manufacturer's standard hand wheel. All valve hardware, stem extensions and guides shall be stainless steel.

Acceptable manufacturer and model: Mueller Co., Series 2360, or approved equal.

c. Check valves: Check valves shall be full body flanges type, with a domed access cover and only one moving part, the flexible disc, conforming to AWWA C508 (latest revision), Swing-Check Valves for Waterworks Service, 2 inch (50 mm) Through 24 inch (600 mm) NPS. Valves shall be provided with flanges in accordance with ANSI B16.1, Class 125.

The valve body shall have full flow equal to nominal pipe diameter at all points through the valve. The seating surface shall be on a 45-degree angle to minimize disc travel. A threaded port with pipe plug shall be provided on the bottom of the valve to allow for field installation of a backflow actuator without special tools or removing the valve from the line.

The top access port shall be full size, allowing removal of the disc without removing the valve from the line. The access cover shall be domed in shape to provide flushing action over the disc for operation in lines containing high solids content. The disc shall be of one-piece construction, precision molded with an integral o-ring type-sealing surface, and contain steel and nylon reinforcement in the hinge. The flex portion of the disc shall be warranted for 25 years. Non-slam closing characteristics shall be provided through a short 35-degree disc stroke and a memory disc return action.

The valve body shall be construction of ASTM A126 Call B cast iron. Optional body material includes ASTM A536 Grade 65-45-12 ductile iron. The disc shall be precision molded Buna-N (NBR), ASTM D2000-BG.

Valves shall be provided with flanges in accordance with ANSI B16.1, Class 125.

The interior and exterior surfaces shall be coated using a fusion epoxy, 10 mil thickness. Epoxy shall meet or exceed ANSI/AWWA C550 Standard, and certified to ANSI/NSF 61.

Acceptable manufacturer and model: Val-Matic, Swing-Flex Check Valves Series #500.

402.7 Valve Chamber Drain Valve. A backwater check valve shall be installed on the valve chamber drain line. The valve shall be installed as follows:

A 4" diameter PVC stub shall be glued into the 4" diameter coupler cast into the wet pit wall at the valve chamber floor line. A 90° elbow shall be glued to this stub and directed toward the wet well floor. A (4"x3') PVC stub shall be glued into the other end of the elbow. The check valve shall then be slipped on to the stub and attached with 2 stainless steel clamps to be supplied by the vendor.

Acceptable manufacturer and model: The valve shall be a "Tide Flex" series TF-2, 4" (slip on) check valve, by Red Valve Co., EVR Type CPO-4".

402.8 Gravity Lines Entering the Station. Ductile iron pipe shall be used on sections of gravity lines running from:

a. The last manholes preceding the station up to the station.

b. The outfall of the retention pipe up to the station.

Concrete or PVC gravity lines in these areas will not be acceptable.

402.9 Retention Pipe. Retention pipe shall be Class 2-O'ring type RCP. Class 3-O'ring type RCP shall be used at installations where there will be vehicular traffic over the pipe. The retention pipe ends shall be bulk-headed using pre-cast bulkheads with an "A-Lok" gasket installed in the outfall side for the 12" gravity line of the station. The inside & outside of the pipe shall be sealed with a commercial grade water proofing sealer. All joints shall be sealed using Fernco flexible coupling, Mar Mac brand Mac Wrap, or approved equivalent.

Acceptable manufacturer and model: SS1H, Slow Setting Emulsion, as manufactured by Missouri Petroleum, Bi-State Emulsions, Inc., or approved equal.

402.11 Emergency Bypass Connection. The Valve Chamber shall include a 4" bypass connection with cam lock and gate valve. Emergency bypass shall be oriented toward the hatch of the Valve Chamber.

END OF SECTION

SECTION 403

Submersible Wastewater Pumps

403.1 Description. This section covers the specifications for submersible wastewater pumps installed in pump stations. Sewage pumps shall meet the following requirements.

Acceptable manufacturer(s): Flygt Company, Fairbanks Morse Company, ABS Company, or pre-approved equal.

403.4 Pump Construction. Major pump components shall be of gray cast iron, Class 30, with smooth surfaces devoid of blowholes and other irregularities. Where watertight sealing is required, O-rings made of nitrile rubber shall be used. All exposed nuts and bolts shall be of ASTM A 167 304 stainless steel. All surfaces coming into contact with sewage, other than stainless steel, shall be protected by an approved sewage resistant coating.

All mating surfaces where watertight sealing is required shall be machined and fitted with nitrile O-rings. Fitting shall be such that sealing is accomplished by metal-to-metal contact between machined surfaces. This will result in controlled compression of nitrile rubber O-rings without requirement of a specific torque limit. No secondary sealing compounds, rectangular gaskets, elliptical O-rings, grease or other devices shall be used.

The cable entry water seal design shall preclude specific torque requirements to insure a watertight and submersible seal. The cable entry shall be comprised of a single cylindrical elastomer grommet, flanked by washers, all having a close tolerance fit against the cable outside diameter and the entry inside diameter and compressed by the entry body containing a strain relief function, separate from the function of sealing the cable.

The assembly shall bear against a shoulder in the pump top. The cable entry junction chamber and motor shall be separated by a stator lead sealing gland or terminal board, which shall isolate the motor interior from foreign materials gaining access through the pump top. Epoxies, silicones, or other secondary sealing systems shall not be considered acceptable.

The junction chamber, containing the terminal board, shall be sealed from the motor by elastomer compression seal (O-rings). Where a seal junction chamber is not used, the motor chamber shall be fitted with a moisture detection probe. The probe shall be connected to and activate a warning light in the control panel. Specialized relays/sensors, if required by the pump manufacturer, shall be supplied to the control panel manufacturer by the pump manufacturer prior to panel construction.

Connection between the cable conductors and stator leads shall be made with threaded compressed type binding post permanently affixed to a terminal board and thus perfectly leak proof.

Each unit shall be provided with an adequately designed cooling system. When thermal radiators (cooling fins) are used, they shall be integral to the stator housing and shall be adequate to provide the cooling required by the motor. When water jackets are used, the water jacket shall encircle the stator housing. The water jacket shall be provided with a separate

circulation of the pumped liquid. Cooling media channels and pars shall be non-clogging by virtue of their dimensions. Provision for external cooling and flushing shall be provided. Regardless of the cooling system used, the motor must be capable of pumping under full load continuously with the water level only to the top of the volute. Motors with intermittent full load ratings or motors requiring oil for cooling will not be allowed.

When double shrouded impellers are used, a wear ring system shall be installed to provide efficient sealing between the volute and impeller. The wear ring shall consist of a stationary ring made of nitrile rubber molded with a steel ring insert which is drive fitted to the volute inlet and rotating stainless steel ANSI 304 ring which is drive-fitted to the impeller eye.

When single shrouded impellers are used, the volute shall be fitted with an adjustable replaceable front plate. The front plate shall be designed with a wave shaped inlet and an outward spiraling V-shaped groove on the side forcing the impeller to shred and force stringy solids outward from the impeller and through the pump discharge.

The volute shall be of single piece design and shall have smooth fluid passages large enough at all points to pass any size solid which can pass through the impeller.

The pump motor cable, installed, shall be suitable for submersible pump application. Cable sizing shall conform to National Electric Code (NEC) specifications for pump motors.

Thermal sensors shall be used to monitor stator temperatures. The stator shall be equipped with three (3) thermal switches, embedded in the end coils of the stator winding (one switch in each stator phase). These shall be used in conjunction with and supplemental to external motor overload protection and wired to the control panel. Specialized relays/sensors, if required by the pump manufacturer, shall be supplied to the control panel manufacturer by the pump manufacturer prior to panel construction.

The pump motor shall be squirrel-cage, induction, shell type design, housed in an air-filled watertight chamber. The stator winding and stator leads shall be insulated with moisture resistant NEMA Class F insulation, which will resist a temperature of 311° F (155° C). The stator shall be dipped and baked three times in NEMA Class F varnish. The motor shall be designed for continuous duty; capable of sustaining a minimum of ten (10) starts per hours. The rotor bars and short circuit rings shall be made of aluminum.

Each pump shall be provided in an oil chamber for the shaft sealing system. The drain and inspection plug, with positive anti-leak seal, shall be accessible from the outside.

The pump shaft shall rotate on two (2) permanently lubricated bearings. The upper bearing shall be a single row deep groove ball bearing and the lower bearing a two row angular contact ball bearing.

The pump shaft shall be stainless steel or hard chrome plated carbon steel.

Each pump shall be provided with a tandem mechanical shaft seals system consisting of two totally independent seal assemblies. Seals shall run in an oil reservoir. Lapped seal faces must be hydrodynamically lubricated at a constant rate. The lower seal unit, between the pump and oil chamber, shall contain one stationary and one positively driven rotating silicon carbide or tungsten carbide ring. The upper seal unit, between the oil sump and motor housing shall

contain one hard metal ring and one carbon ring, or angled to the shaft lip type seal in grinder pump applications. Each interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable. The following mechanical seal types shall not be considered acceptable:

a. Shaft seals without positively driven rotating members
b. Conventional double mechanical seals containing either a common single or double spring acting between the upper and lower units. This conventional system requires a pressure differential to offset external pressure and to effect sealing.

The impeller shall be of gray cast iron, ASTM A48 Class 30, dynamically balanced, single or double shrouded non-clogging design having a long thrulet without acute turns. The impeller shall be capable of handling solids, fibrous materials, heavy sludge and other matter found in normal sewage applications. The pump manufacturer shall, upon request, furnish mass moment of inertia data for the proposed impeller. Excluding grinder pump applications, the impeller shall be capable of passing a minimum 3-inch solid sphere. The fit between the impeller and shaft shall be a sliding fit with one key.

END OF SECTION

SECTION 404

Interior

404.1 Description. This section covers pump station interior appurtenances.

404.2 Slide Rails. All pump lifting slide rails shall be made of 316 or 304 schedule 40 stainless steel pipe. Slide rails shall be installed and sized per manufacturer's instructions. The slide rails shall be firmly braced to the wet well wall with stainless steel support brackets placed every 15 feet.

404.3 Lifting Chain. Pump lifting chain, clevises and shackles shall be made of 316 or 304 stainless steel. The chain shall be sized to accommodate the installed pump weight, but shall not be sized smaller than 1/4" stainless steel diameter links.

404.4 Bolts. All field installed bolts, nuts and washers used inside either the pump or valve chamber shall be made of 316 or 304 stainless steel.

404.5 Fasteners. All concrete fasteners used for installation of braces, brackets or boxes shall be stainless steel wedge type stud anchors. Anchor holes shall be drilled to the manufacturer's recommended depth. Pump base anchor studs shall be sized as follows:

a. Grinder and 4" pumps = 5/8" minimum diameter

b. 6" and 8" pumps = 1" minimum diameter

c. Pumps larger than 8" shall be installed with stainless steel anchors sized per the pump manufacturers instructions.

Acceptable manufacturer and model: Anchors shall be Hilti Kwik Bolt Three.

404.6 Floats and settings. Floats and settings shall conform to the following requirements:

a. Floats shall not be located near steps.

b. All floats shall be located away from the turbulence of the incoming flow.

c. Sewage shall not rise to the level of the incoming gravity lines or the twenty-four hour retention pipe during normal pump operation for either single or dual pump operation.

d. The following levels shall guide the setting of float levels:

1. Twenty-four hour retention alarm – Set to a level equivalent to 75% of the retention tank capacity.
2. High Level Alarm – No less than 2-1/2' above the top of pump motor and no more than 1" below the 12" pipe to the twenty-four hour retention mark.
3. Second Pump – No less than 2 feet above top of pump motor.
4. First Pump – No less than 1-1/2' above top of pump motor.

5. Off Float – The entire pump shall be covered at the off level.

e. Float leads shall be hung with stainless steel kellum grips from a stainless steel bracket supplied by Halliday. The bracket shall be firmly bolted to the concrete immediately below the wet well hatch cover.

f. Floats shall be provided with sufficient length cord to run between the sensors and the valve chamber junction box unspliced.

g. Float wires shall be neatly routed away from the pump access hatch opening then through the chamber access sleeve, without excessive wire strain or pull. Wire length on all float wires shall be such that each float may be adjusted to the bottom of the station wet well. Excess wire shall be coiled & neatly hung on a bracket.

h. Installed pump top and bottom elevations as well as the float elevations shall be shown on the pump station interior drawing.

Acceptable manufacturer and model: Flygt model ENM-10, or Anchor Scientific Roto floats, Type S.

404.7 Access Hatches. All pump and valve chambers shall be provided with aluminum access hatches as follows:

a. The access hatches shall be aluminum accesses rated for a 300 pound loading. Door size shall be as indicated on the drawings. The access frame and cover shall be flush with the top of the concrete, complete with hinged and flush locking mechanism, upper guide holder and level sensor cable holder. Frame shall be securely placed, mounted above the pumps. Hatches shall be equipped with form skirts, sized for the slab top thickness. Doors shall be provided with padlock lugs.

b. All access hatch construction materials and appurtenances shall be manufactured from stainless steel, aluminum or brass.

c. All access hatches shall be provided with a fall protection grating panel from the hatch manufacturer.

Acceptable manufacturer and model: Bilco Type PCM or PDCM, or Halliday Series S1S or S2S.

404.8 Locking Hardware. All equipment enclosures, access hatches, entrance gates and service disconnect arms shall be provided with locks manufactured by "Best Access Systems". Locks shall have 2" high shackles with 5/16" diameter shanks. Temporary construction cores and keys will be provided by Best Access Systems until such time as the facility is inspected and accepted for maintenance by City. All temporary keys and cores will be turned over to City personnel.

Acceptable manufacturer and model: Best Access Systems. Best stock 21B772 with brass body.

404.9 Pressure Sensor Units. Pressure sensors may be of the full flange design with thru bolt holes or one-piece water style with carbon steel flanges. Sensors shall clamp between standard ANSI pipeline flanges. All exposed surfaces to be epoxy painted or a non-corrosive material. Sensor shall be flow thru design with flexible Buna-N Elastomer Sensing Ring around the full circumference.

Pressure switches shall have NEMA-7 Housings with Single Pole Double Throw, snap-action switching elements. Switches shall be wired normally closed (open on pressure), with adjustable pressure settings. The pressure range shall be specified for each specific installation.

Sensors shall be provided to the installer, assembled complete, from the supplier. The units shall be filled with a 50/50 ethylene glycol and water mixture and have no entrapped air in the system. The supplier shall send the unit out pretested at the minimum operable sensing level of the switch.

Acceptable manufacturer and model: Gauges to be 2-1/2" dial, SPAN model LFS 220 with ¼" connection. Switches shall be Neo-dyn model 132P4-8C. Pressure sensors shall be Red Valve series 40 flanges or series 48 wafer sensor or EVR Products series WPS. Accessory piping and fittings to be ½" or ¼" Parker hex stainless steel with reducing fittings where necessary to connect instruments.

404.10 Intrinsic Barriers. The wet well area of the pump station is considered by the NFPA to be a hazardous area. Therefore, intrinsic barriers shall be installed where the level floats terminate in the control panel. This will prevent any explosions from occurring due to electrical arcing in the wet well area.

404.11 Pump Chamber Inspection. Following placement of the wet well pumps and prior to allowing sewage into the pump station, the pump station floor shall be inspected by the City. The wet well floor and retention chamber must be clean and dry for this inspection. The contractor/developer shall be responsible for coordinating the inspection with the City.

END OF SECTION

SECTION 405

Electrical

405.1 Description. This section covers the requirements for pump station electrical work and associated appurtenances.

405.2 Pump Station Control Panel. The selected pump supplier shall be directly responsible for all panel fabrication, component installation, and integration into the City's existing SCADA system. The pump control panel shall meet the following specifications:

405.2.1 General Control Panel Requirements.

a. It is the intent of these specifications that all motor control and control components be supplied by a single supplier/Systems Integrator. Controls shall not be assembled on site. Systems Integrator/control panel manufacturer shall be a UL 508 certified facility and shall be regularly engaged in the manufacture of controls for the municipal water/wastewater industry. The pump control panel shall be assembled by a company having at least ten years experience in the construction of such control equipment. The City shall be the sole judge as to whether the alternate equipment is to be considered as an approved equal. Approval of an alternate system by the City will not relieve the alternate system of strict adherence to these specifications.

b. The control panel with SCADA system integration shall be the responsibility of a single manufacturer/supplier, hereafter designated as the Systems Integrator. All aspects of the system including fabrication, programming, start-up, and training shall be by one entity. Sub-letting of work shall not be accepted. The Systems Integrator shall provide a fully complete system operating in a satisfactory manner including adding the site to the existing SCADA computer.

405.2.2 Control Panel Operation.

a. Demand: Basic operation of the pumps shall be as a pump-down, lead/lag, common off system with high level alarm. Panel shall accommodate connection of floats (level sensors to be provided by pumping equipment supplier) with the following functionality at a minimum:

Retention Tank High Level
Wetwell High Level
Lag Demand
Lead Demand
Stop

b. Control: Each pump shall be controlled through a "Hand-Off-Auto" switch. In the Hand position, the pump shall run continuously until the selector switch is turned to Off or Auto.In the Off position, the pump shall not run.

In the Auto position, the pump shall be controlled by the floats in the wetwell. A demand for each pump shall be delayed through adjustable time delay relays

with a range of .1 - 10 seconds. Initially, the time delay for the first pump demand shall be set at 8 seconds, with required additional pump demand time delays being staggered 8 seconds apart. Operation of the lag pumps shall not be run through the lead demand float.

c. Control Panel Alarms: The following alarms shall operate individual pilot lights as described under General Control Panel Equipment.

1. Pump Fail: A pump failure (timed from pressure switch indicating pressure after pump is demanded) shall be annunciated only by the individual pilot light. This alarm shall stop the pump from running, and only be resettable when the pump Hand-Off-Auto selector switch is placed in the "Off" position.

2. Seal Fail: A pump seal failure shall be annunciated only by the individual pilot light. This alarm shall not stop the pump from running.

d. SCADA System Annunciated Alarms/Status: The following alarm points shall be connected to the MOSCAD unit for display on the City's SCADA System computer network. Any discrete input shall cause a change-of-state transmission to the central SCADA unit except for pump run. Pump run/elapsed time (cumulative and previous day), and flow/totalization (where applicable) indication shall be transmitted when any other point causes a transmission, or when interrogated by the central.

Discrete Input:

1. Points #1,2,3, and 4 – Pump Run

These four (4) points are reserved for up to four different pumps. Each pump shall have an auxiliary contact closure from the motor starter to indicate pump running. The run indication is used to maintain pump elapsed time for display on the City's SCADA computer.

Point #1 - Pump 1 Running
Point #2 - Pump 2 Running
Point #3 - Pump 3 Running
Point #4 - Pump 4 Running

2. Points #5,6,7, and 8 – Pump Failure

These four (4) points are reserved for up to four different pumps. Each pump shall have a pressure switch flow indicator or check valve proximity switch to indicate a positive flow has been established when a pump has been called upon to start. The flow indicator will be wired to a one-five minute adjustable time delay relay. If a positive flow has not been established in the present time, the pump will be wired to shut down and lock out. A pump failure signal will be transmitted to the central station through a closed set of contacts from the time delay relay.

Point #5 - Pump 1 Failed

Point #6 - Pump 2 Failed
Point #7 - Pump 3 Failed
Point #8 - Pump 4 Failed

3. Point #9 - Retention Alarm

   This point is to indicate that the retention tank has reached 75% capacity. A float with contacts shall be hung in the wet well at an elevation which is equivalent to a 75% level in the retention tank. Connection shall be directly to the MOSCAD in the pump control panel without the use of an interposing relay.

4. Point #10 – High Water Level

   If the influent water level rises above the normal maximum operating level, a float with a normally open set of contacts shall close. The contact closure will indicate a failure on Point #10. Connection shall be directly to the MOSCAD in the pump control panel without the use of an interposing relay.

5. Point #11 – Intrusion

   There shall be a set of contacts placed on the pump control panel door(s) with the contacts positioned to close when the door is opened. This contact will indicate entry into the station by a signal on Point #11 of the central station indicator. Connection shall be directly to the MOSCAD in the pump control panel without the use of an interposing relay.

6. Point #12 – SPD Fault

   SPD failure via dry contact closure on the SPD.

7. Points #13 - Generator Run, (for stations that have a permanent generator)

9. Points #14-#16 - Spare

   All spare discrete inputs shall be wired to terminal blocks for future use by the City.

10. Additionally, via software programming, communication status and AC-Power fail of the Moscad unit shall be displayed on the Intellution SCADA computer.

11. Connection of the 12 alarm points shall be considered as the minimum requirement for all pump stations. Additional alarm points may be required on certain individual pump station locations. Any additional alarm points that may be required will be requested when the pump station plans are submitted for review.

Analog Input:

1. Channel #1 – Station Flow (where applicable)

   This Channel is to indicate station flow via a 4 – 20 ma analog input from flow meter.

e. Automatic or Manual Transfer Switch: All lift stations with backup generators shall have an automatic transfer switch. All other lift stations shall incorporate a double throw, UL 1008 listed, manual transfer switch with a generator quick-connect plug. Install the switch in a NEMA 4X stainless steel enclosure. Coordinate with the City to determine the type of quick connect plug required. The manual transfer switch shall be rated for the same electric load as the Service Disconnect. The automatic transfer switch or manual transfer switch with the generator receptacle shall be located on the back of the center section of the "H" panel.

405.2.3 General Control Panel Equipment. Pump control panels shall meet the following specifications:

a. Enclosure: Enclosure shall be a multi-door NEMA 3R enclosure constructed from 12 gauge 304 stainless steel with #4 finish, open bottom construction in sections 1 and 3, with 2" x 2" x 1/4" (304) stainless steel angle iron frame on inside bottom of sections. Holes shall be drilled in this frame as indicated in drawing. Enclosure shall consist of three sections in an "H" shape cabinet, with total overall dimension of 64" high by 70" wide by 30" deep. All sub-panels shall be constructed from 12 gauge mild steel painted white. All seams and sections shall be welded together such that a weathertight seal exists between the three sections and at all seams. All seams shall be continuously welded, with the exception of exterior inside corner seams. All exterior seams shall be M.I.G. welded then ground smooth and brushed finished. Exterior inside corner seams shall be T.I.G. welded (i.e. seams connecting section 2 to sections 1 and 3). Drip shields shall be an extension of the enclosure. All exterior doors shall be held closed with door latch mechanism fastened to enclosure.

   All hardware on exterior of panel shall be stainless steel with the exception of the lifting eyes on top of the enclosure. No screws, bolts, etc. shall protrude through the exterior of the enclosure with the exception of the temporary lifting eyes on top of the enclosure. Enclosure shall have removable lifting eyes (5/8" - 11tpi, 1" long threaded shaft) as shown on top of enclosure sections #1 and #3. Stainless steel nuts which the lifting eyes are screwed in to shall be welded to the inside top of the enclosure. Note: provide gasketed stainless steel bolts (5/8" - 11 tpi, 1" long threaded shaft) for eye replacement after installation. All exterior handles shall be stainless steel, Austin #48-5655SSX or pre-approved equal. Pressure sensitive adhesive gasket shall be supplied for sections 1 and 3 to seal between bottom of sections and concrete pad. Gasket shall be 1/4" x 2", Rubatex corporation #R425N or pre-approved equal.

Panel edges shall be turned down to form a 3/4" lip. All sub-panels shall be mounted on 3/8" - 16 standoff studs per NEC and UL-508. Gasket to seal between all outer doors and enclosure shall be self gripping to the flange around door opening in enclosure. Gasket shall be made of EPDM material with wire reinforced base - EMKA #1011-05, or self-adhesive neoprene (PSA type, no retainers), or pre-approved equal.

Section #1 shall have a drip shield and an exterior door hinged from the left hand side with full length continuous stainless steel hinge welded to enclosure and a white painted steel inner sub-panel. A section of the back of section #1 shall be cut out allowing access to section #2. When the sub-panel of section #1 is removed. The cut out section shall be approximately 38" X 10" to provide a 1" stiffening perimeter around section 1 and adjacent side of section #2 for enclosure stability. Exterior door shall have full length stainless steel hinge welded to enclosure. Door held shut with three-point latching mechanism on interior of door and stainless steel latching padlockable handle on exterior of door. Section shall be open bottom construction with 2" x 2" x 1/4" (304) stainless steel angle iron frame around inside bottom opening. Provide stainless steel drip shield for section T.I.G. welded continuously along top and sides. Bottom of door shall be 8" above bottom of enclosure. Two pieces of formed 14 gauge T304 light channel welded open face towards top, shall be mounted to the interior top of section running from front to back (used to mount fluorescent light). Spacing shall be 11 7/8" center to center. A full size inner door shall be mounted 2.5" from outer door with continuous hinge on left side of door. Inner door held shut with single point latch/knob EMKA #1000-U78 AND CAM #1000-50.

Section #2 shall be a single door stainless steel NEMA 3R enclosure with stainless steel drip shield T.I.G. welded continuously to enclosure along top and sides, steel sub-panel painted white. Exterior door hinged from the left hand side shall have full length continuous stainless steel hinge welded to enclosure, and be able to be opened more than 90 degrees. Outer door held shut with three-point latching mechanism on interior of door and stainless steel latching padlockable handle on exterior of door. A section of each side of section #2 shall be cut out allowing access to section #1, and section #3. When the sub-panel of section #1 and section #3 is removed. The cut out section shall be approximately 38" X 10" to provide a 1" stiffening perimeter around side of section #1, 2, and #2, 3 for enclosure stability. Two pieces of formed 14 gauge T304 light channel welded open face towards top, shall be mounted to the interior top of section running from front to back (used to mount fluorescent light). Spacing shall be 11 7/8" center to center. Front of this exterior door shall be flush with sections 1 and 3.

Section #3 shall have a drip shield and an exterior door hinged from the right hand side with full length continuous stainless steel hinge welded to enclosure and a white painted steel inner sub-panel. A section of the back of section #3 shall be cut out allowing access to section #2. When the sub-panel of section #3 is removed. The cut out section shall be approximately 38" X 10" to provide a 1" stiffening perimeter around section #3 and adjacent side of section #2 for enclosure stability. Exterior door shall have full length stainless steel hinge welded to enclosure. Door held shut with three-point latching mechanism on

interior of door and stainless steel latching padlockable handle on exterior of door. Section shall be open bottom construction with 2" x 2" x 1/4" (304) stainless steel angle iron frame around inside bottom opening. Provide stainless steel drip shield for section T.I.G. welded continuously along top and sides. Bottom of door shall be 8" above bottom of enclosure.

A hole 10 11/16" wide x 7 3/16" high shall be cut in the exterior door to provide a space for a window to be mounted. The center of this cut-out shall be 12 1/4" from the top and 8 3/4" from the right side of section #3. Mount Electromate window #E-PWK95NFSS in this hole.

Intrusion switch mount: A piece of metal 3" x 3" shall be installed for exterior doors in section 1, 2 and 3. Metal shall hang vertically from top of enclosure and run front to back. Metal shall be mounted in door opening 6" from side opposite hinge. Front edge of metal shall be 4" back from exterior door.

Section #1 shall be used as an entrance point from beneath the concrete mounting pad for:

i. Below ground pump, control, and flow meter conduits coming from the valve chamber.
ii. Below ground antenna alarm coax conduit running from the antenna pole.
iii. Below ground phase converter conduit, if using external converter option.

Section #3 shall be used as an entrance point from beneath the concrete mounting pad for incoming power from the utility.

b. Power Distribution Block: Provide a main power distribution block sized for incoming power to the panel, and other power distribution blocks as required. Each pole of the block shall be supplied with a clear cover for operator protection. Power distribution block shall be Ferraz Shawmut series 63000, 67000, or 69,000, ABB, Mersen, or equal, as required.

c. Phase Monitor: Where three-phase motors are controlled, provide a plug-in or base-mount style phase monitor designed to monitor phase loss, under voltage, and phase sequence with a SPDT contact to interrupt all control power in the event of phase loss. Phase monitor shall be supplied with fused protection of the three phase sensing circuit. Phase monitor shall be Diversified Electronics SLU series, Symcom or approved equal. Fuseholder shall be three-pole Ferraz Shawmut USM_3 series, or approved equal. Fuses shall be fast-acting Ferraz Shawmut ATM series, or approved equal.

d. Surge Suppression Device: A surge arrestor shall be provided and connected to the incoming power distribution block or externally to the incoming power disconnect. The SPD shall be sized to incoming power and shall be provided in addition to the SCADA SPD. Surge suppressor shall be as manufactured by Innovative Technologies, Surge Suppression Incorporated, Cutler-Hammer,

Eaton, Atlantic Scientific, or approved equal. A contact closure indicating SPD failure shall be connected to the SCADA system.

e. Power Conditioning: Control systems utilizing microprocessor technology shall have power conditioning for incoming power to these pieces of equipment. The power conditioning equipment shall be Amber Industries model AI-102A-CM or Islatrol model IC+102. The TELEMETRY UNIT, at a minimum, shall be protected by this surge suppressor.

The following equipment, at a minimum, shall be protected by this surge suppressor (where applicable):

i. Intrinsically safe relays
ii. Level display/process controller
iii. Solid state starter 24 VDC power supply
iv. PLC
v. Telemetry Unit
vi. Flow Meter

f. Circuit Breakers: All pump station control panels shall be provided with a minimum 100-amp service.

Provide individual, properly sized, thermal-magnetic circuit breaker for each motor. Combination circuit breaker and overload mechanism shall not be allowed. Circuit breakers for motors and other loads shall have a minimum rating of 14,000 AIC (480 vac breakers).

Provide 1-pole, 15-amp circuit breakers for the following loads:

1. Control circuit
2. Panel GFI receptacle, condensation heater, service lights

g. Interior Service Light: Incandescent light fixtures shall not be acceptable. Provide 15 watt interior fluorescent service light(s) w/ safety lens fastened to the inside top of the enclosure with integral "Off-On" control. Light(s) shall be mounted without penetrating the panel outer skin with screws or fasteners in enclosure Sections #1 and #2.

h. Motor Starter: A magnetic across the line horsepower/current rated motor contactor with ambient temperature compensated overload relay shall be provided for each motor load served that is less than 20 H.P. Contactor shall be Cutler-Hammer CE 15 Series, Eaton XTC Series, ABB Series A, or approved equal. Overload relay shall be Cutler-Hammer #C316, Easton XTO Series, ABB Series TA or approved equal.

Pumps 20 HP and larger shall be supplied with soft starters and or VFD's with bypass contactors. Solid state starter shall be Cutler-Hammer IT series with line side surge protector, PST series, Danfoss or approved equal.

If VFD's are used, (VFD) rated for 50 degrees C operation shall be supplied for each motor as required. VFD's shall be provided with 6-year manufacturer's

warranty, including component failure and surge damage to the VFD. VFD shall be Danfoss VLT Aqua series or pre-approved equal. An appropriately sized air condition shall be provided for VFD's that are installed in an exterior control panel.

i. Transformer: If 120 volt, single phase is not available, a minimum 5 KVA, dry-type transformer shall be supplied with primary and secondary circuit breaker protection. Control power shall be 120 volt. Control circuit shall be connected so that a power outage of any duration does not require manual re-start of system.

j. Receptacle: Provide a 15-amp G.F.I. duplex receptacle connected to a separate circuit breaker, and mounted on the control panel inner door.

k. Condensation Heater: Provide a 100 watt, 120 vac silicone rubber self-adhesive condensation heater mounted on a flange with integral 40° F. thermostat. Heater shall be Watlow #020100C1-EV11B, or equal. Heater(s) shall be mounted in enclosure Sections #1, #2, and #3. If VFD's are used, approx. 800 watt heater shall be provided in VFD section of enclosure.

l. Fuseholders and Fuses: Provide a fuse for the control circuit, minimum rating 5 amps (ampacity not to exceed relay contact rating). Fuseholders for control fuses shall be fingersafe with neon light indication for a blown fuse. Control fuse fuseholders shall be Gould USM_I series, or approved equal. Control fuses shall be Ferraz Shawmut TRM series or equal for 250 vac and under. Circuit breakers may be used in lieu of fuses.

m. Terminal Blocks: Numbered terminal blocks shall be supplied for all field terminations. Current capacity of terminal strips shall be equal to the load served. Terminal blocks shall be suitable for minimum 12 AWG wire at not less than 300 volts. Terminal blocks for control interface shall be Entrelec model 115116.07, Curtis 2PSWTC, PWH or approved equal.

n. Time Delay Relays: Time delay relays shall be dial or DIP switch selectable, and shall have contact ratings of not less than 5 amps. Switch settings shall be labeled on the relay. Time delay relays shall be Diversified Electronics TB series, Finder series 85, or approved equal.

o. Relays: Relays shall be general purpose plug-in relays with standard mounting configurations. The relays shall have the number of poles as shown on the drawings with neon indicating lamp and test button integral to each relay. Relay contact ratings shall be minimum 10 amps. Control relays shall be Finder series 55, or equal.

p. Alternator: Provide an automatic electronic alternator for alternating pump operation on successive automatic cycles. Relay shall incorporate LED position indicators and a toggle switch to select pump #1 or pump #2 as the lead pump, or to allow automatic alternation. Alternator shall be Diversified Electronics AR series, Symcom, or approved equal. Alternation may be accomplished via intrinsically safe pump controller in lieu of dedicated alternator.

Intrinsically Safe Relays:

i. Relays provided for float level sensors shall be the intrinsically safe type, and shall be properly barriered from other system components. Intrinsically safe devices within the panel shall be mounted and wired in accordance with NEC, Article 504, with all required voltage barriers in place. Submittals should indicate the relative position of all such components and the panel manufacturer's recommended area for conduit entrances for power and intrinsically safe wiring. Contractor shall adjust the conduit arrangement entering the enclosure and the terminal box below to coincide with the panel manufacturer's recommendations, if necessary, to insure that power and intrinsically safe wiring remain separated and do not cross. Alternation function and lead select capability shall be included in intrinsically safe relay controller, where possible.

ii. Intrinsically safe relay controller shall be Diversified Electronics ARM series, Symcom ISS-105, or approved equal, as pertains to the quantity of pumps being controlled.

q. Selector Switches: Selector switches shall be 30 mm oil tight type with lever operators and 10 amp contacts. Knob operators will not be accepted. Contact blocks shall be provided as required and shall be rated for a nominal voltage of 500 vac and 10 amps. Control switches shall be Cutler-Hammer Series E34 or equal. Contact blocks shall be Cutler-Hammer type 10250T. Provide selector switches for the following functions (per pump where applicable):

Pump "Hand-Off-Auto"	Three-position

r. Pilot Lights: Pilot lights shall be push-to-test, oil-tight industrial units utilizing 120 volt bulbs (unless otherwise specified). Lenses shall be colored as shown on the drawings. Control panel lights shall be modular construction as manufactured by Cutler Hammer E34RPB* or approved equal. Contact blocks shall be Cutler-Hammer type 10250T. LED type lights will not be acceptable. Provide pilot lights for the following functions (per pump where applicable):

Pump Run	Green
Pump Seal Fail	Amber
Pump Fail	Red

s. Elapsed Time Meters: Provide an elapsed time meter for each pump controlled. Meter shall be 6-digit, non-resettable, reading in hours and tenths of hours. Elapsed time meter shall be Fourth Dimension, ECC, or equal.

t. Seal Fail Relay: Provide a conductance actuated moisture sensing relay for each submersible pump controlled with field adjustable sensitivity. Seal Fail Relay shall be Syrelec/Crouzet model PNRU110A, Diversified Electronics, SymCom, or approved equal.

u. Ground Buss/Lugs: Provide a ground lug sized for incoming power ground near the power distribution block. Provide a ground lug sized for pump ground near pump power wire terminations. Provide a ground buss for control equipment grounding, minimum 6 termination points.

v. Wiring: Power distribution wiring on the line side of panel fuses or circuit breakers shall be sized for the load served, minimum 12 AWG. Control wiring shall be minimum #16 gauge switch board wiring type stranded wire for internal control panel circuits. All control wires shall be numbered at each termination corresponding to the master wiring diagram with clip-sleeve or heat-shrink type wire markers. Wrap-on or adhesive wire markers shall not be allowed. 120 vac wiring (except for neutrals) shall have red insulation. 120 vac neutral wiring shall have white insulation. 50 vac or less shall have yellow insulation. 12/24 vdc wiring shall have blue insulation.

w. Nameplates: Provide adhesive backed printed labels for all internal devices such as contactors, circuit breakers, and relays. Labels shall be adhered to the subpanel. No labels shall be adhered to wire cover. Provide engraved phenolic nameplates, with black letters on white background, for door-mounted devices such as selector switches, push-buttons, circuit breaker toggles, and pilot lights. Nameplates shall be secured firmly to the panel.

x. Entry Switch: An entry switch shall be mounted in the panel, which will close a contact wired to the telemetry unit when the exterior door of the enclosure is not closed. Switch shall be HoneyWell-MICROSWITCH #1AC2, or equal.

y. Telemetry Unit: Each pump station shall have a Motorola ACE RTU conforming to the City's existing system. All hardware components for the RTU shall be supplied, installed, and programmed as an integral component of the control panel. The City's SCADA system operates on 159.600 MHZ utilizing a Motorola MOSCAD Central Station Transceiver for interrogation and acknowledgement of alarms.

The following telemetry equipment shall be supplied in the control panel, unless otherwise indicated:

(1) Motorola-ACE RTU with 20 watt conventional radio
(1) Mixed I/O Card (4 AI, 16 DI, 4 DO), Motorola #V245 OR 16 DI Card, Motorola #V265
(*) Other I/O cards as required to meet this specification
(1) 6.5 AH battery, Motorola #V261

(1) Coaxial Surge Arrestor, Polyphaser #IS-50NX-C2-ME

The following telemetry equipment shall be supplied loose for installation by the electrical contractor:

(1) Antenna: A radio antenna with N-connection shall be supplied, utilizing antenna types as appropriate for the site at which the antenna is located. Antenna shall be capable of being mounted to

a 1.5" to 2.5" diameter mast. Acceptable types are omni-directional and yagi. Antenna shall be as manufactured by Decibel, Comtelco, or equal, as recommended by radio manufacturer.

(1) Antenna Mast: Stainless steel or aluminum heavywall conduit firmly secured at a minimum of at least two points along the length of the pole may be used. Pole shall be mounted to stainless steel strut on back of control panel enclosure section. Mast shall extend about 10 feet above panel.

(*) Coaxial Cable Type RG213/U: Belden #8267, Laird #LMR-400/Belden #9913 or equal,
quantity as required*.

(*) Coaxial cable connectors: RF Industries #RFN-1002-1S (Male), #RFN-1024-1 (Female), Andrew 400APNM-C (male) or 400APNF-C (female) quantity as required*.

(1) Cold Shrink: 3M #8425-8 (or as required for coaxial cable size)

z. Flow Meter:

i. For lift stations with pump's that are 25 hp and greater, provide a flow meter with 4 – 20 mA transmitter providing instantaneous flow indication for installation by the Contractor. Flow transmitter shall be mounted in the control panel, mounted to the subpanel, or on bracket for wall-mount installation by the Contractor (if in building). Where the flow transmitter is installed separately from the flow tube, two types of cable (standard cable and special cable) shall be supplied for installation between the flow tube and flow transmitter. Where the flow tube is to be installed in an area where it may become wet or submerged (such as in a metering vault), a submersible kit shall be provided and installed by the Contractor after wiring terminations are complete.

ii. Equipment shall be as manufactured by Siemens, series 5000, or approved equal.

iii. Provide equipment for the following flows:
   a. Station Flow

405.2.4 Software Programming/Start-up Services. All programming and start-up services shall be included and completed by the Systems Integrator, such that the MOSCAD in the control panel communicates all information as specified to the central MOSCAD, and that the information is displayed in the computer central and other SCADA network computers. It shall be the responsibility of the Systems Integrator to obtain/update the radio frequency license(s) necessary for the installation and successful operation of the SCADA site.

405.2.5 Documentation.

a. Submittals: A master wiring diagram for the control panel(s) shall be submitted for City review and approval before beginning construction. This diagram shall be drawn in standard ladder logic format. All ladder rungs shall be numbered in the left hand margin, and all relay contacts referenced to these numbers in the

right hand margin. Each electrical node in the control schematic shall have a different wire number. A bill of materials and a layout drawing of the enclosure and inner door layout components shall appear on this drawing with a listing of nameplates pertaining to the components. Included in the submittal package shall be data sheets of all equipment used in the control panel, as listed in the bill of materials. Submittal drawings may be on 11" x 17" paper.

b. As-Built Drawing: Final As-Built drawings shall be on full-size 17" x 22" or 24" x 36" paper, as required. A waterproof reduced copy of the master "as built" wiring diagram shall be laminated in clear plastic and permanently fastened to the inside of the panel door. A full-size as-built drawing shall be placed in the panel.

405.3 Power Requirement/Phase Convertor.

a. There are two possible avenues for the electrical distribution at the pump station. First, is the Ameren-UE/Cuivre River Electric supplied 3 phase source which is preferred, and the other is the Ameren-UE/Cuivre River Electric supplied single-phase source.

b. All pumps will operate using 480 VAC three phase power.

c. Any site requiring a total three phase station load in excess of 50 HP will require Ameren-UE/Cuivre River supplied three-phase power.

d. Any site requiring a total three-phase load less than 50 HP may use a phase converter design upon approval of the City. Approval of such a system will be based on the cost analysis presented by the designer/owner, with approval granted on a case-by-case basis. The analysis shall compare the cost and feasibility of having three-phase power brought onto the site, as compared to the use of a phase converter. The Ameren-UE/Cuivre River Electric three-phase power shall be used unless installation costs overwhelmingly justify the use of the phase converter. If a converter is to be used, submitted plans shall detail the converter installation. The converter shall be sized to meet the load demand of the station, supplied in a NEMA 3R aluminum enclosure and installed external to the control panel by the electrical contractor.

405.4 Alternate Backup Power Supply and Transfer Switch. When an alternate power supply is required, the following shall be the minimum requirements:

a. An alternate power supply may be provided through service from a alternate electrical supplier (Ameren-UE or Cuiver River Electric), or by service from one supplier via two separate primary feeds.

b. If an alternate power supply is not available, then a backup power supply shall be furnished by way of a Diesel Generator system. This system shall meet the following requirements:

1. Generator shall be designed and built at ISO 9001 certified facility.
2. Generator system shall be fully factory tested to design specifications.

3. Size of generator shall be such that the current and future loads at the lift station can be satisfied, without causing an overload of the generator. Unit should be able to supply 10 percent overload power for 1 hour in 12 hours.
4. Generator shall come equipped in a heavy duty sheet steel weather protective enclosure, with lockable hinged doors.
5. Generator that shall be capable of starting under all weather conditions.
6. Generator shall be furnished with LCD display, AC metering, DC metering, Fail to stat shutdown, low oil pressure shutdown, high engine temperature alarm, low/high battery voltage, underspeed/overspeed, loss of engineer speed detection, 2 spare fault channels, 20 event fault log, 2LED status indicators, lockdown emergency stop push button.
7. Generator shall be furnished with a digital control panel, which enables local or remote operation of unit, as well as automatic operation during a power outage from the primary power source. An integral power transfer switch shall be furnished to allow for an automatic switching of power, when the primary power source is lost during lift station operation.
8. Sound levels shall not cause existing City Codes to be exceeded at property lines.
9. A submittal shall be made showing all features included for approval by the City.

Acceptable manufactures: Kohler, Onan, Caterpillar or approved equal.

405.5 Station Interior Wiring. The following electrical requirements shall be followed for wiring installed in the station interior:

a. Wet well level control float leads shall be hung with stainless steel kellum grips from a series J Halliday stainless steel cable holder. The bracket shall be bolted to the inside of the wet well hatch, immediately below the hatch cover. The bracket shall be located so as not to interfere with the pump chamber entrance steps. Pump power cables shall be hung by separate series J Halliday stainless steel brackets. All wires shall be neatly passed from the bracket to the 4" PVC raceway. Excess wire shall be rolled up and left inside the valve chamber.

b. Passage of the pump and float wires from the pump chamber to the valve chamber shall be made through the open ended length of a 3" and 6" PVC conduit installed between the valve and pump chamber. The 3" PVC conduit shall convey the low voltage wires and the 6" PVC conduit shall convey the high voltage wires. The annular space of the conduit between the pump and float wires shall be sealed using Ryachem Rayflate duct Sealing System RDSS, Polywater FST Duct Sealant, or approved equivalent.

c. There shall be no electrical connections made in the pump chamber. All wiring shall run unbroken from the pump chamber to the valve chamber through the 3" and 6" PVC raceways and terminated at a properly sized terminal board inside of two provided 16" x 14" x 6" stainless steel hardware, NEMA 4X Nonmetalic, watertight junction boxes.

Acceptable Manufacturer: General Electric Enclosure #VJ1614HWLL2 or approved equal.

d. Valve chamber junction box connections are to be made with plastic rubber gromited portable cord connectors Thomas & Betts #2521.

e. All wiring in the valve chamber shall be routed and fastened securely along the chamber walls with non-corrosive wire straps and fasteners.

405.6 Check Valve Pressure Switch Wiring. Wiring from the pressure switches shall be #18 AWG STO portable cord. Thomas & Betts #2521 portable cord connectors shall be used on the switch end as well as the junction box end of the wire. The cord shall be neatly routed along the discharge pipe with ties, to the chamber joining walls and then run along the walls to the junction box.

405.7 Field Wiring Specifications. Control panel wiring shall be as follows:

a. All wiring installed on the line and load side of the electric meter shall be THHN insulated copper wire.

b. Electric service to the station shall be sized to provide the maximum total station amperage with all installed pumps running under a fully loaded condition.

c. All pump station control panels shall be provided with a minimum 100 amp service.

405.8 Conduit specifications. The following conduit sizes are to be used on any combination of pumps with a total station power requirements of less than 60 HP. For larger HP stations, the proposed conduit sizes shall be approved by the City.

a. A 2 1/2" conduit shall be used to run from the power supply to the electric meter and through the disconnect mounted in control panel section #3.

b. A 2" conduit shall be used to run all pump cord wires from the bottom of section #1 in the control panel, to the back of the junction box in the valve chamber.

c. A 1" conduit shall be used to run all flow meter from the bottom of section #1 in the control panel, to the valve chamber.

d. A 2" conduit shall be used to run all phase converter wires between control panel and phase converter, if phase converter is required and supplied external to the control panel.

e. A 2" conduit shall be used to run all float wires from the bottom of section #1 in the control panel, to the back of the junction box in the valve chamber. A separate 1" conduit shall be used to run non-intrinsically safe wiring to the control panel.

f. A 1" conduit shall be used to run the antenna coax from beneath the antenna pole to section #1 of the control panel.

g. All conduit running to or from the control panel, shall be run underground at a minimum depth of 18 inches below finished grade.

h. All below ground conduit and fittings shall be PVC schedule 80 conduit, unless a phase converter is utilized, then the conduit shall be PVC coated rigid steel including all fittings and transition points.

i. Gas and water seal all electrical conduit between wet well and valve vault, and between the valve vault and the control panel, using a silicone seal.

405.9 Control Panel Mounting. The station pump control panel shall incorporate the pump controls, alarm system and incoming utility power into one pre-fabricated stainless steel structure. The panel shall be placed as follows:

a. The control structure shall be set on a 4" thick poured concrete pad reinforced with 8 gauge, 6"x6" welded wire mesh. The concrete shall be laid over a well-compacted 4" thick stone base.

b. The pad shall be poured next to the pump station, shall be located in accordance with the approved plans. Pad dimensions shall be a minimum of 6'x11'x4" thick.

c. Conduits shall be run into the power supply cabinet from beneath the structure.

d. The panel shall be centered on the concrete pad and be set 4" in from the rear edge of the pad.

e. Prior to setting and securing the panel to the concrete mounting pad, a strip of 2"x1/4" solid rubber gasket material shall be placed against the bottom angle iron frame to create a seal between the concrete mounting pad and the panel bottom.

f. A minimum of four (4), Hilti Qwik bolts shall be used to secure the panel to the concrete pad.

405.10 Telemetry Equipment Installation. The following specifications shall be used for installation of the pump station telemetry equipment:

a. Antenna:

1. The minimum acceptable transmission strength shall be determined as +20 db. above the threshold of the closest satellite receiver.
2. The antenna azimuth shall be in the direction of the nearest satellite receiver $\pm$ 15 degrees.

The actual working antenna height is to be determined by the Motorola Company. The minimum height allowable per City is 10' from finished grade. If the 10' height does not

provide for an adequate and functioning system an alternative design must be submitted for approval by the City.

b. Antenna Mast: The antenna shall be mounted a minimum of 20' from finished grade on a minimum 24' long fiberglass street light type pole. The pole base shall be set 4' below ground with 4 ½' deep and 1 ½' round concrete base poured around it. The pole must be installed so that it is vertical + 1 degree. The top of the pole shall be sealed against water penetration with a cover cap. All antennas must be protected by a grounding rod installed at the base of the tower. Grounding rod length shall follow national electric code requirements.

Antenna poles shall be installed to the rear of the control panel as indicated on the control panel drawings.

c. Coaxial Cable: The radio coaxial cable is to be run in one continuous length with no splices. The coax shall be terminated at the antenna connector on one end and a lightning arrestor on the other end. Another cable shall be connected from the Polyphaser to the connector on the outside of the radio cabinet as indicated on the approved plans. All R.F. cable connectors outside of the radio cabinet shall be properly terminated and sealed with 3M Cold Shrink.

END OF SECTION

SECTION 406

Station Paving, Fencing, and Other Requirements

406.1 Description. This section covers the paving of the area around the pump station as well as the access road to the pump station site, site fencing, entrance road barrier & yard hydrant. SCD's 400.01, 400.02, 400.03 & 400.04 should be used as a guide, in addition to the approved plans for layout of required pump station site improvements.

406.2 Paving

a. Pump Station Area: All pump and valve chambers shall have a 6' (minimum width) paved apron placed around the pumping structures. The pavement shall be sloped so as to permit surface water to drain away from the station. Pavement shall extend a minimum of 1 foot beyond the fence perimeter.

b. Pump Station Access Road: Any pump station located farther than 7' from the center of the wet chamber to the edge of a service road shall have a 12 foot wide paved access road provided to the station. The access road shall:

1. Be designed to limit the access road grade to a 10% maximum.

2. Protection barriers will be required.

3. Have a turn around area at the station end of the access road large enough to accommodate a 16 foot service van when:

   i. The access road exceeds 75' in length.
   ii. The access road exceeds a 3% grade.
   iii. The access road does not travel to the pump station in a straight line.

4. Shall have a platform located at the entrance to the pump station, a minimum length of 20 feet, which should not exceed a slope of greater than 2%.

5. If the access road is not constructed in a straight line, and there is a turn around area, the minimum radius of curves should not exceed 32 feet, measured on the inside of the pavement.

The centerline of the entrance road should bisect the gated entrance, valve and wet pit structures. Should this type entry not be feasible for a particular site, the closest structure to the gate and road will be the wet pit.

c. Pavement Specifications: Pavement design may be either asphaltic concrete or Portland Cement Concrete, as specified hereafter.

1. Asphaltic concrete: The access road and area surrounding the station shall be paved with 2" of type "C" asphaltic concrete laid over 6" of type "X" asphaltic concrete, on a 6" compacted crushed limestone base.

2. Portland Cement Concrete: Concrete pavement shall be Class A 6" thick, six sack mix with a maximum 4" slump. Pavement shall be reinforced with 8 gauge, 6 x 6 welded wire mesh. The concrete shall be laid over a well compacted 4" stone base.

406.3 Fencing

a. General Requirements: Fencing shall be located around the pump station so that:

1. There should be a minimum 4' space between all auxiliary pump station equipment, panels, alarm poles, etc. and the perimeter fence.

2. The access gate shall be located so that hoisting or cleaning equipment can easily access the valve and wet pit chambers.

b. Materials:

1. Wire fabric for the fence shall be brown or green vinyl clad 6' high chain link fabric. Wire shall be No. 11 gauge woven in a 2" mesh. Fencing shall not be barbed.

2. All post and other appurtenances used in the construction of the fence shall be green or brown vinyl clad schedule 40 steel pipe. All posts shall be equipped with tops. Fiberglass fencing components will not be acceptable.

3. A 12' wide entrance gate and service gate will be provided for access to the station grounds.

4. Poles shall be sized and set as follows:

TYPE	SIZE	PULL
Top Rails & Brace	1 ¼" Nominal (1.66" O.D.)	2.27 lb./ft.
Line Post & Gate Frame	1 ½" Nominal (1.9" O.D.)	2.72 lb./ft.
End corner or Pull Post	2" Nominal (2.375" O.D.)	5.79 lb./ft.
Gate Post	3 ½" Nominal (4" O.D.)	9.11 lb./ft.

CONCRETE BASES:

TYPE	DIAMETER	DEPTH
Line Post	12"	3' 6"
End Corner Gate	16"	4'
Pull Post	16"	4'

Poles shall be set in the concrete bases so that the pole bottom rests 6" higher than the concrete base bottom.

5. Horizontal support bars shall be installed half way between the top rail and the ground on all fence sections.

6. A #7 tension wire shall be installed at the bottom of the fencing fabric and stretched taught enough so as to not allow the bottom of the fencing fabric to be lifted away from the fencing poles and/or ground.

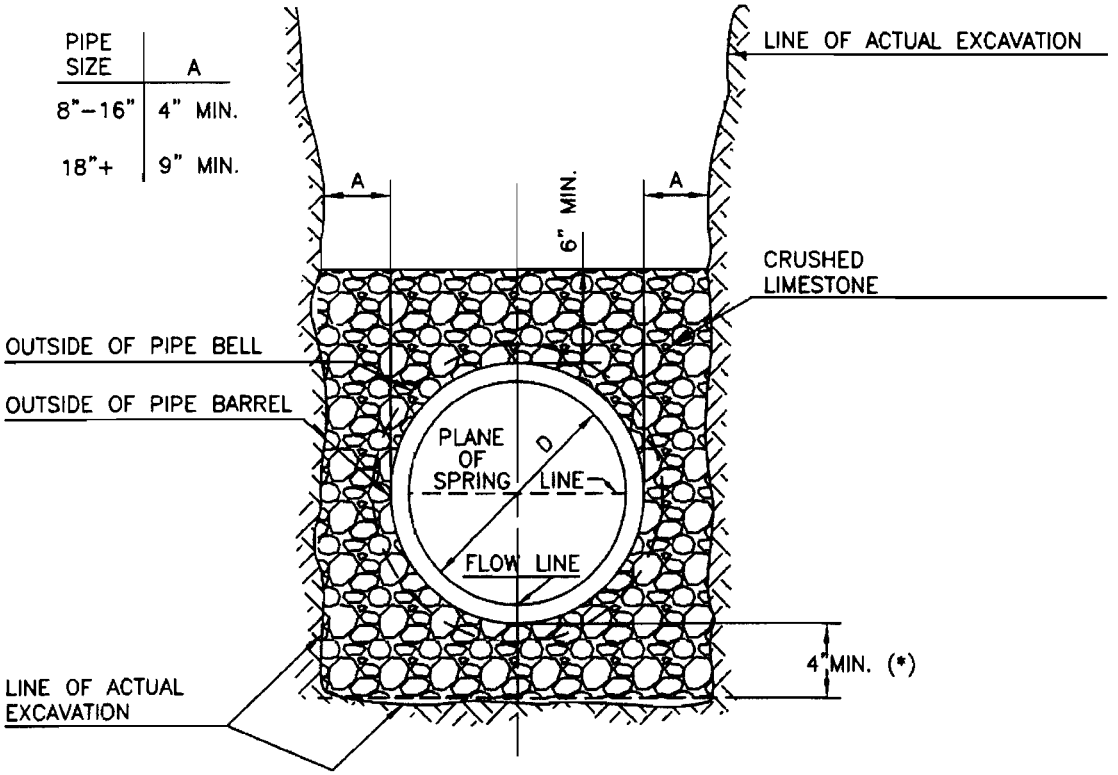
7. Privacy slats shall be installed in all fence sections, with color to match that of the fencing material.

406.4 Entrance Road Barrier. All stations requiring entrance roads shall have two 36" tall removable bollards installed at the road entrance. Removable posts shall not exceed 40 pounds in weight. Post holes shall be stainless steel and locking. The post hole cover shall be flush mount when the post is removed. For safety purposes, a 4"x12" reflective plate shall be attached to the chain at the span center.

Acceptable manufacturer and model: Trafficguard Locking Round Post Lock Series [RPL4] Bollard or approved equal.

406.5 Yard Hydrants. All stations shall be equipped with a Freezless Yard Hydrant as shown on SCD 502.11, located as shown on SCD 400.01. Installation shall include the installation of a 1" meter setting, and necessary length of 1" Type "K" Copper Service line to the Yard Hydrant.

END OF SECTION



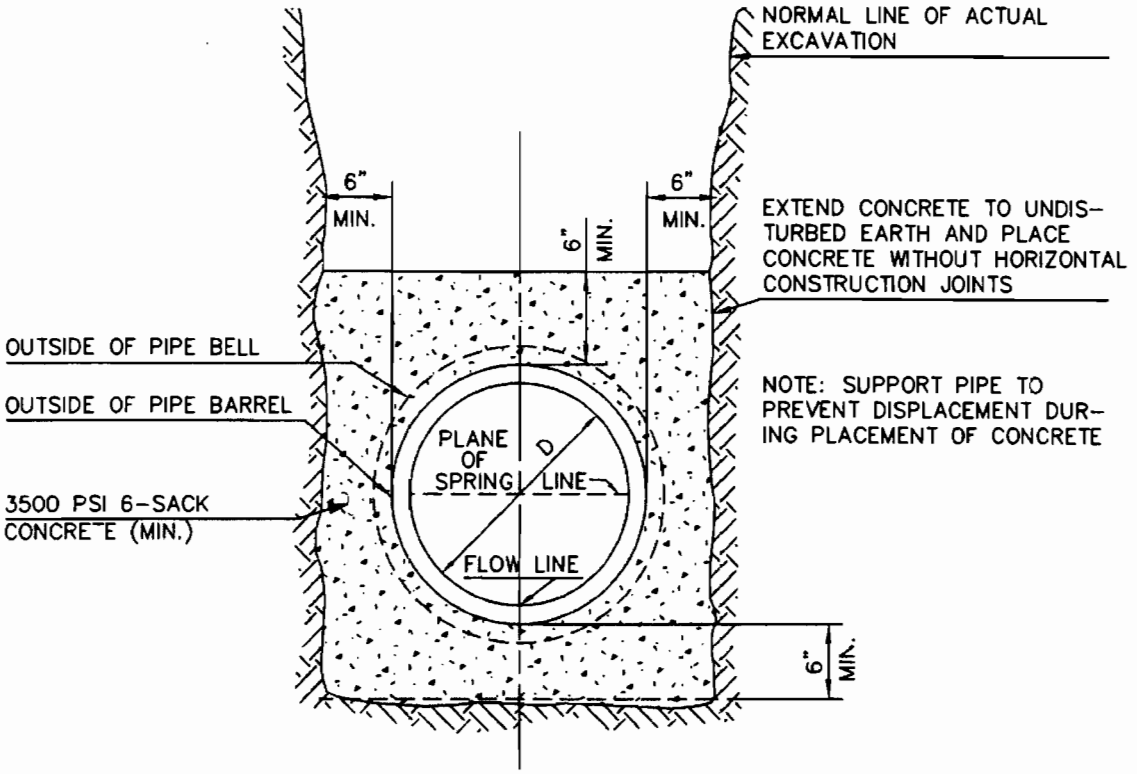
(*) WHEN A TRENCH IS CUT THROUGH ROCK, IT SHALL BE EXCAVATED 6" BELOW THE PLANNED PIPE BOTTOM GRADE, AND BEDDED AND INITIALLY BACKFILED WITH NON–ANGULAR GRANULAR BEDDING MATERIAL.

IN HIGHLY ORGANIC OR OPENLY FLOWING SOILS, THIS DEPTH SHALL BE INCREASED AS REQUIRED BY THE CITY.

NOTES:

1. CHECK GRADE OF PIPE AFTER BACKFILL TO INSURE THE DESIRED FLOWLINE HAS NOT CHANGED
2. DURING JETTING PROCESS, NOZZLE SHALL NOT BE INSERTED CLOSER THAN TWO FEET FROM TOP OF PIPE.
3. ANY TRENCH BRACING USED BELOW THE TOP OF PIPE SHALL BE LEFT IN PLACE.
4. FOR INSTALLATIONS IN HIGHLY ORGANIC OR OPENLY FLOWING SOILS, THE ENTIRE PERIMETER OF THE PIPE BEDDING SHALL BE WRAPPED WITH AN APPROVED FILTER FABRIC OR THE "MINIMUM TRENCH WIDTH" SHALL BE EXPANDED BY INCREASING THE DISTANCE BETWEEN THE SIDE OF THE PIPE AND THE LINE OF ACTUAL EXCAVATION OR TRENCH BRACING TO A MINIMUM OF ONE PIPE DIAMETER.

Wentzville Missouri - USA The Crossroads Of The Nation	City of Wentzville Public Works Department Engineering Division 200 East Fourth Street Wentzville, MO 63385	STANDARD PIPE BEDDING FOR SANITARY SEWER	Approved: W.E.B. Date: June 10, 2009 300.01



NOTES:

1. CONCRETE ENCASEMENT OF THE SANITARY SEWER IS REQUIRED WHEN:

   A. THE SANITARY SEWER IS UNDER A STORM SEWER WITH LESS THAN 2 FEET OF VERTICAL SEPARATION. THE ENCASEMENT SHALL EXTEND 10 FEET ON EACH SIDE OF THE CROSSING.

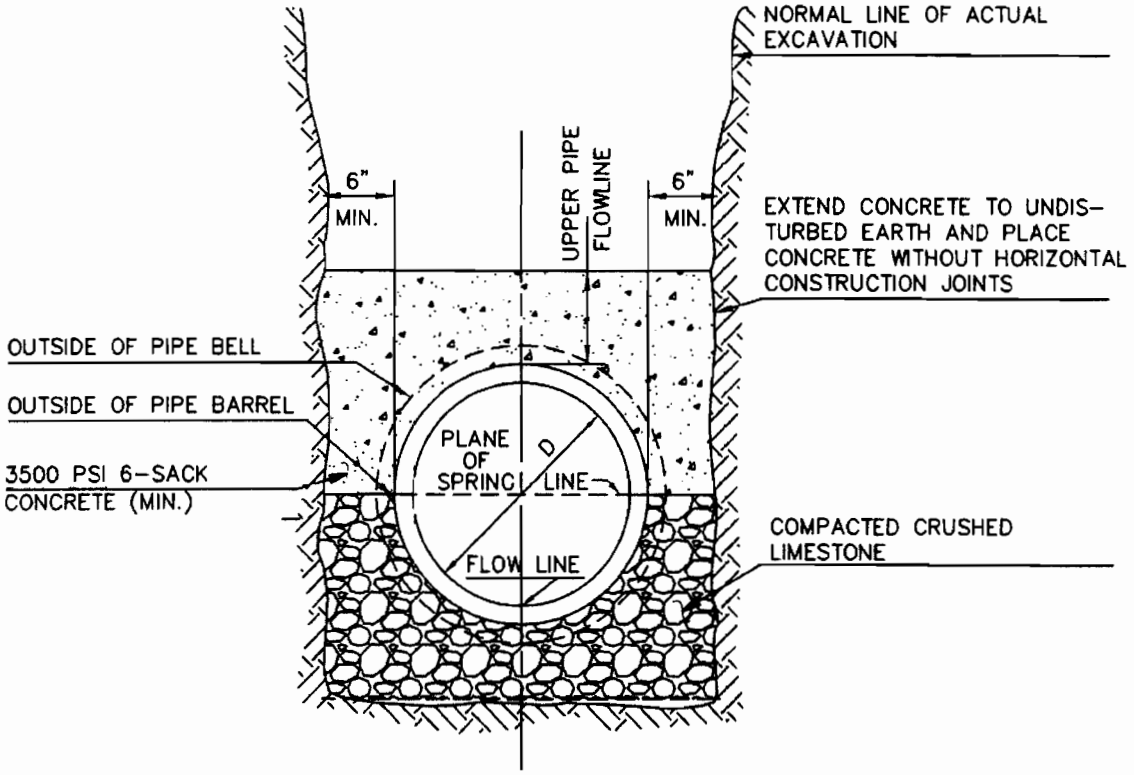
   B. THERE IS LESS THAN 3 FEET OF COVER OF THE TOP OF PIPE. THE ENCASEMENT SHALL EXTEND FOR THE LENGTH OF THE TRENCH WHERE COVER IS LESS THAN 3 FEET.

   C. THERE IS INSUFFICIENT SEPARATION FROM THE WATER MAIN AS SHOWN ON SCD 502.02

2. WHERE CONCRETE ENCASEMENT IS REQUIRED THE PIPE SHALL BE SUPPORTED AT NO MORE THAN TWO PLACES WITH MASONRY SUPPORTS OR SELECTED HARDWOOD AS APPROVED BY THE CITY OF MINIMUM SIZE SUFFICIENT TO PROVIDE THE REQUIRED CLEARANCE AND TO PREVENT DISPLACEMENT DURING PLACING OF CONCRETE.

3. WHEN SANITARY SEWER IS ABOVE A STORM SEWER WITH LESS THAN 2 FEET OF VERTICAL SEPARATION A CONCRETE CRADLE SHALL BE POURED OVER THE STORM SEWER PIPE, FROM THE SPRINGLINE OF THE STORM SEWER UP TO THE FLOWLINE OF THE SANITARY SEWER, FOR THE WIDTH OF THE STORM SEWER TRENCH.

Wentzville — The Crossroads Of The Nation	City of Wentzville Public Works Department Engineering Division 200 East Fourth Street Wentzville, MO 63385	CONCRETE ENCASEMENT	Approved: W.E.B. Date: June 10, 2009 300.02



NOTES:

1. CONCRETE SHALL ACROSS THE FULL WIDTH OF THE TRENCH.

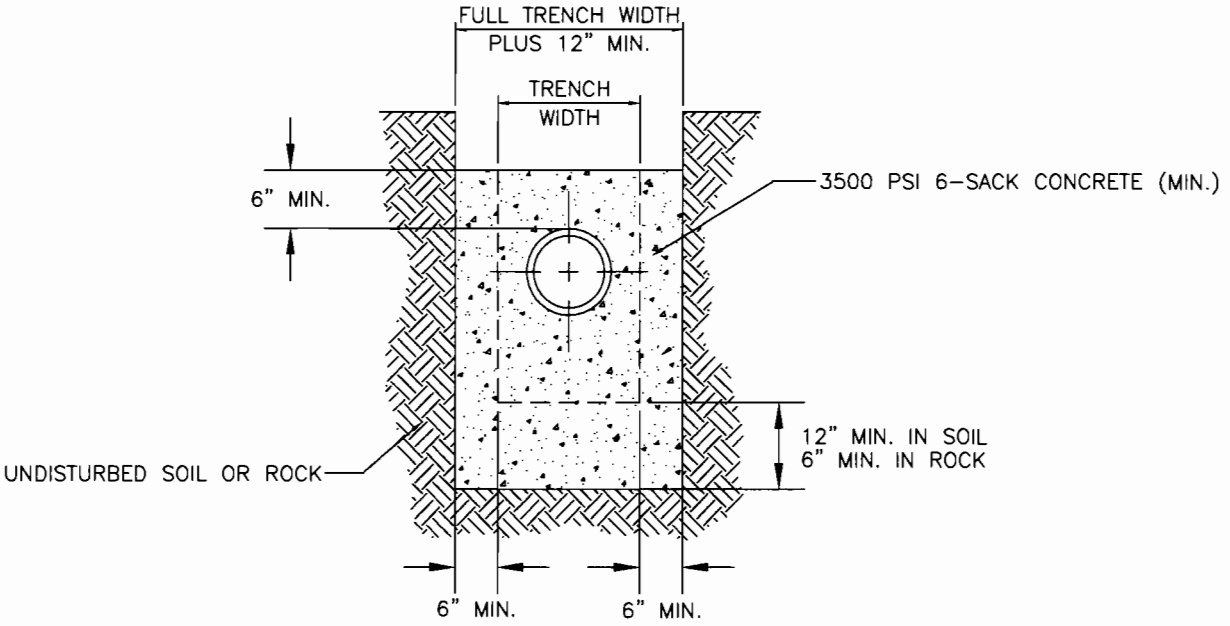
2. THE CRADDLE SHALL BE FROM THE SPRINGLINE OF THE LOWER PIPE UP TO THE FLOWLINE OF THE UPPER PIPE.

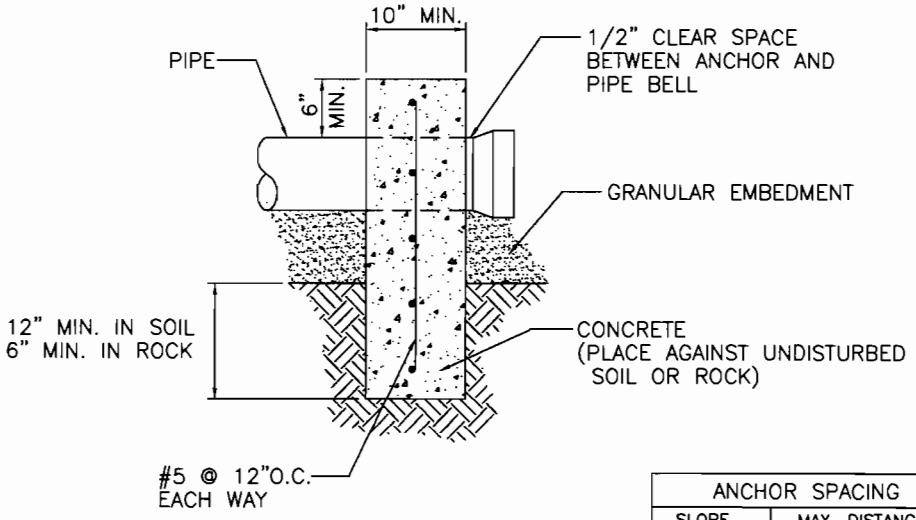
Wentzville
The Crossroads Of The Nation
City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

CONCRETE CRADLE

Approved: W.E.B.
Date: June 10, 2009

300.03





SIDE ELEVATION

ANCHOR SPACING	
SLOPE	MAX. DISTANCE
20%–35%	36'
35%–50%	24'
>50%	12' OR ONE PER JOINT OF PIPE

NOTE:
AT THE DOWNSTREAM MANHOLE FROM PIPE WHICH HAS COLLARS/ANCHORS, DUE TO EITHER SLOPE OR VELOCITY, THE MANHOLE SHALL BE BLOCKED, ON THE DOWNSTREAM SIDE WITH A MINIMUM OF 4 CY OF CONCRETE.

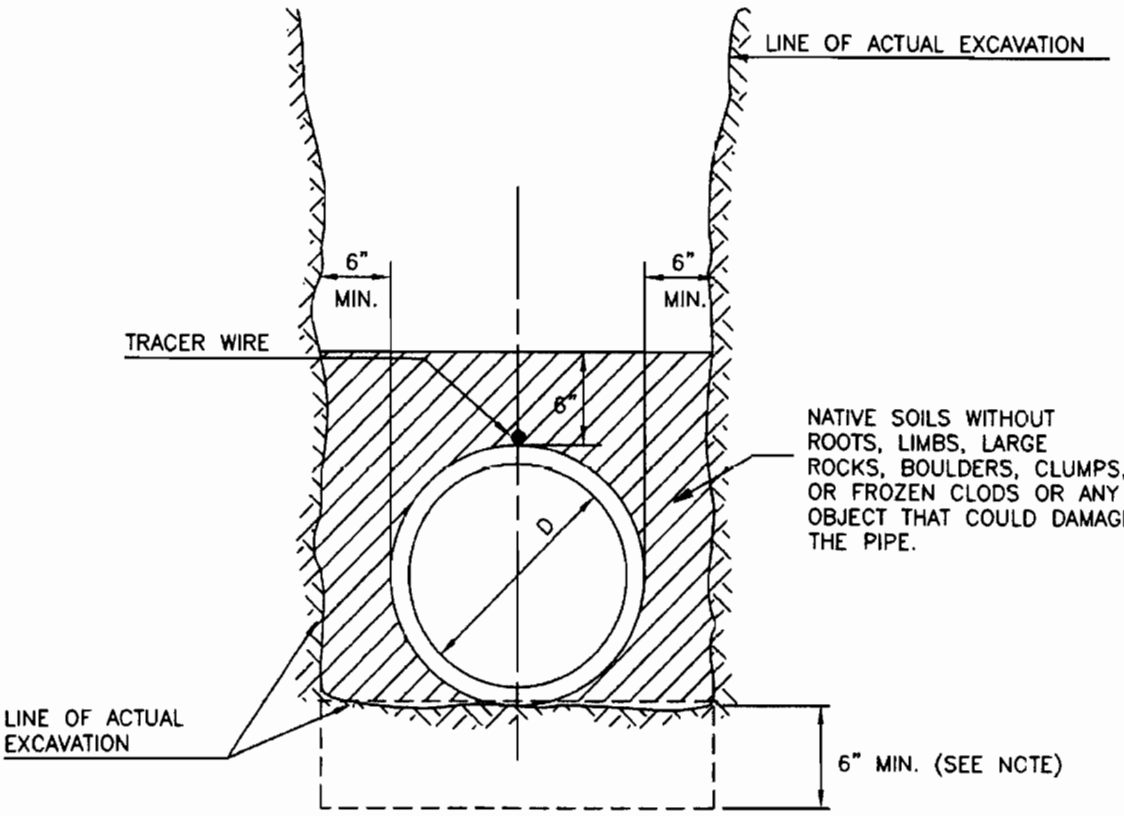
Wentzville
Missouri - USA
The Crossroads Of The Nation

City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

CONCRETE COLLAR

Pending
Date: January 26, 2016

300.04



NOTE: WHEN A TRENCH IS CUT THROUGH ROCK, IT SHALL BE EXCAVATED 6" BELOW THE PLANNED PIPE BOTTOM GRADE, AND BEDDED AND INITIALLY BACKFILLED WITH NON-ANGULAR GRANULAR BEDDING MATERIAL.

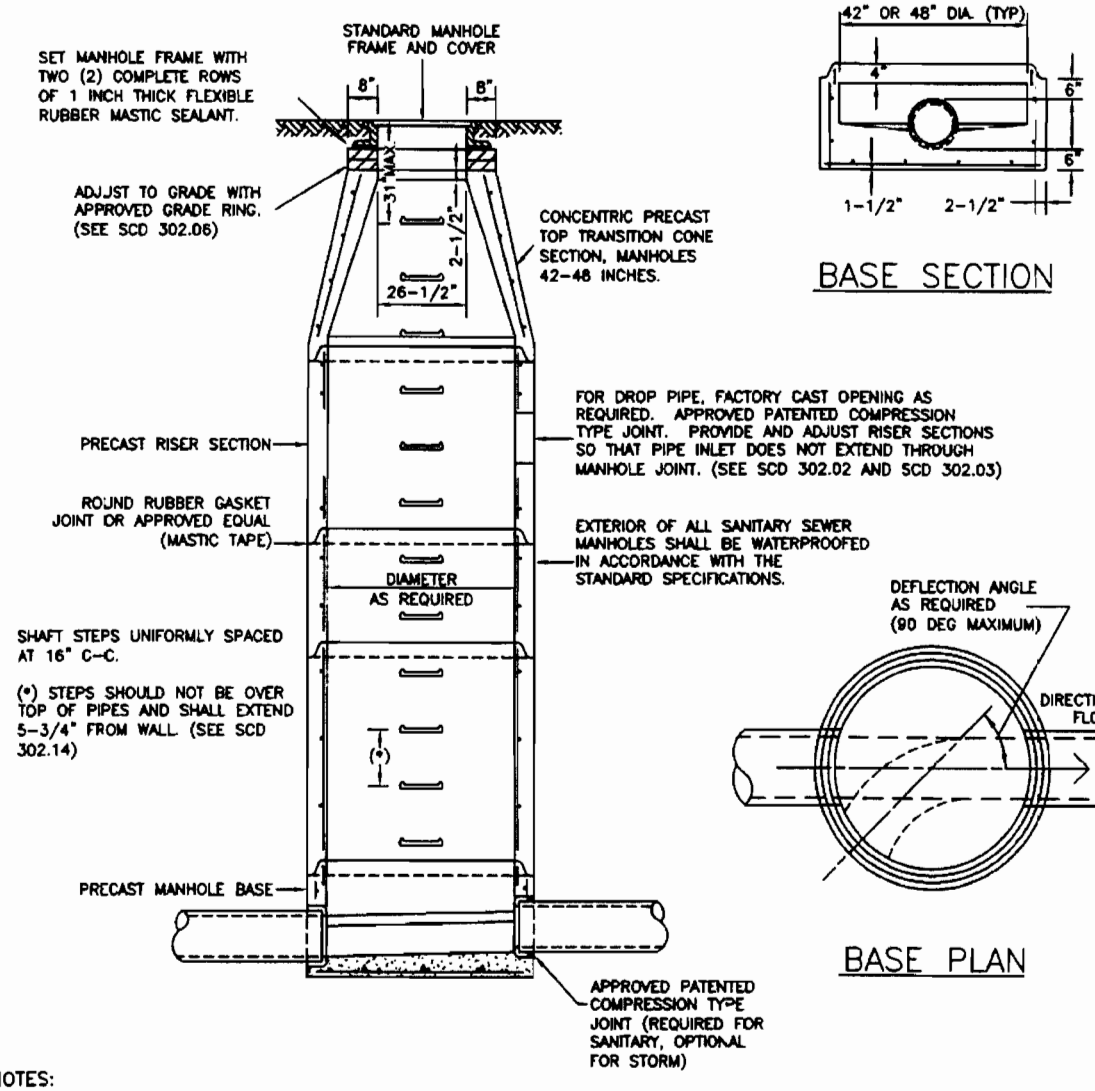
Wentzville
The Crossroads Of The Nation

City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

STANDARD PIPE BEDDING FOR C906 POLYETHYLENE FORCE MAIN PIPE

Approved: W.E.B
Date: June 10, 2009

300.05



NOTES:

1. THE MINIMUM INSIDE DIAMETER FOR THE BASE AND RISER SECTIONS SHALL BE 42 INCHES FOR 8 DIAMETER SEWERS. THE MINIMUM INSIDE DIAMETER FOR SEWERS LARGER THAN 8 INCH DIAMETER IS 48 INCHES. MANHOLE SHALL MEET ASTM C-478 REQUIREMENTS.
2. FLOWLINE ELEVATION OF INCOMING PIPES SHALL BE 0.2 FEET HIGHER THAN THAT OF OUTGOING PIPE (SANITARY SEWER ONLY).
3. PIPE SIZES 24 INCHES IN DIAMETER AND LARGER REQUIRE MANHOLE DIAMETERS OF 60 INCH MINIMUM AND MAY REQUIRE, 72 INCH, OR 96 INCH AS DETERMINED BY OUTSIDE DIAMETERS AND ORIENTATIONS OF CONNECTING PIPES.
4. ECCENTRIC CONES SHALL BE USED ON DIAMETERS 60 INCH AND LARGER. STEPS SHALL EXTEND DOWN VERTICAL WALL OF CONE.
5. PRIOR TO FABRICATION, SHOP DRAWINGS SHALL BE SUBMITTED TO THE CITY FOR APPROVAL OF MANHOLES ON PIPE DIAMETERS LARGER THAN 24 INCH AND ALSO FOR THOSE STRUCTURES WITH A DROP PIPE CONNECTION.
6. REINFORCEMENT IS REQUIRED IN ALL SECTIONS PER ASTM C 478M-06b
7. BRICK IS NOT ALLOWED IN SANITARY SEWER MANHOLES.

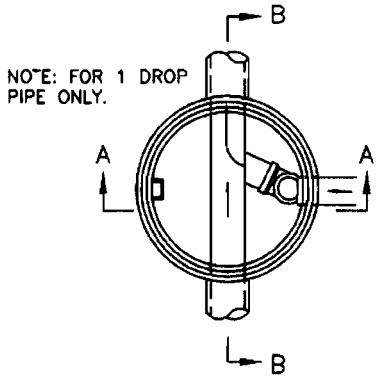
Wentzville
Missouri - USA
The Crossroads Of The Nation

City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

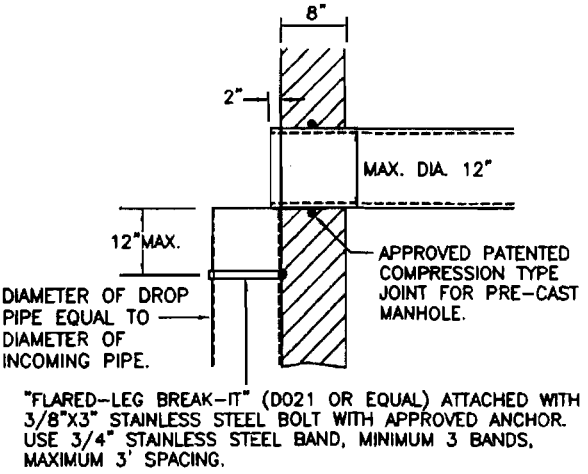
STANDARD MANHOLE

Approved: W.E.B.
Date: June 10, 2009

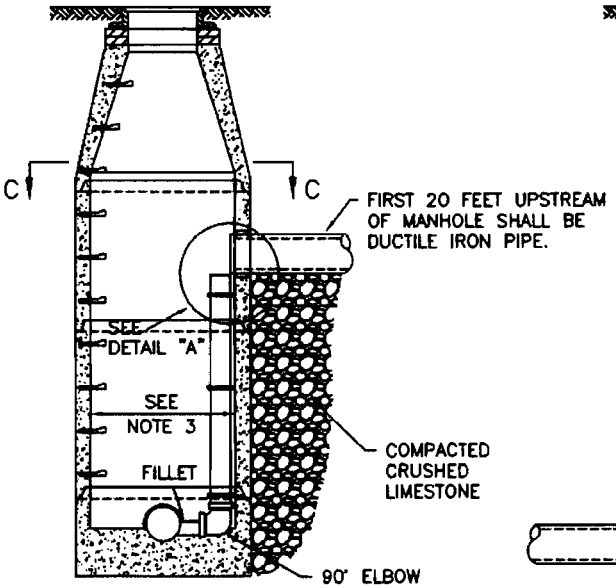
302.01
602.01



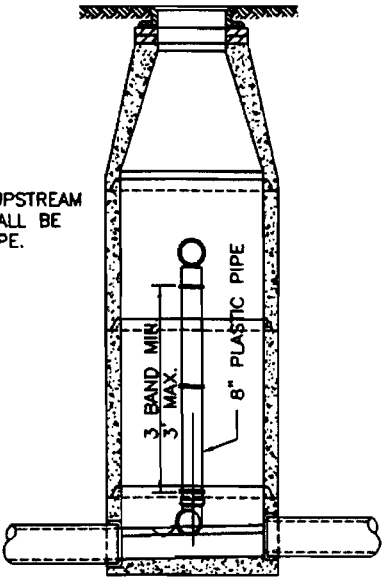
SECTION C–C



DETAIL "A"



SECTION A–A



SECTION B–B

NOTES:

1. NEW INSIDE DROP ON EXISTING MANHOLE REQUIRES THAT THE FLOWLINE OF THE NEW DROP PIPE ELBOW BE CONSTRUCTED AT THE SAME ELEVATION AS THE SPRINGLINE OF THE EXISTING SEWER MAIN AT THE CENTER OF THE EXISTING MANHOLE. A CONCRETE FILLET AND INVERT SHALL BE CONSTRUCTED FOR DROP PIPE (3500 PSI 6 SACK MINIMUM).
2. PROVIDE DUCTILE IRON PIPE FOR 20 FEET UPSTREAM OF MANHOLE ON INCOMING PIPE.
3. INSIDE DROP MANHOLES SHALL BE 48" DIAMETER, MINIMUM, FOR SINGLE DROPS AND 60" DIAMETER FOR DOUBLE DROPS. THE MAXIMUM NUMBER OF ALLOWABLE DROPS IS TWO.
4. FACTORY CAST DROP OPENING AS REQUIRED. AN APPROVED, PATENTED COMPRESSION TYPE JOINT MUST BE INCLUDED. PROVIDE AND ADJUST RISER SECTIONS SO THAT PIPE INLET DOES NOT EXTEND THROUGH MANHOLE JOINT.
5. OUTSIDE DROP MANHOLES ARE NOT ACCEPTABLE.

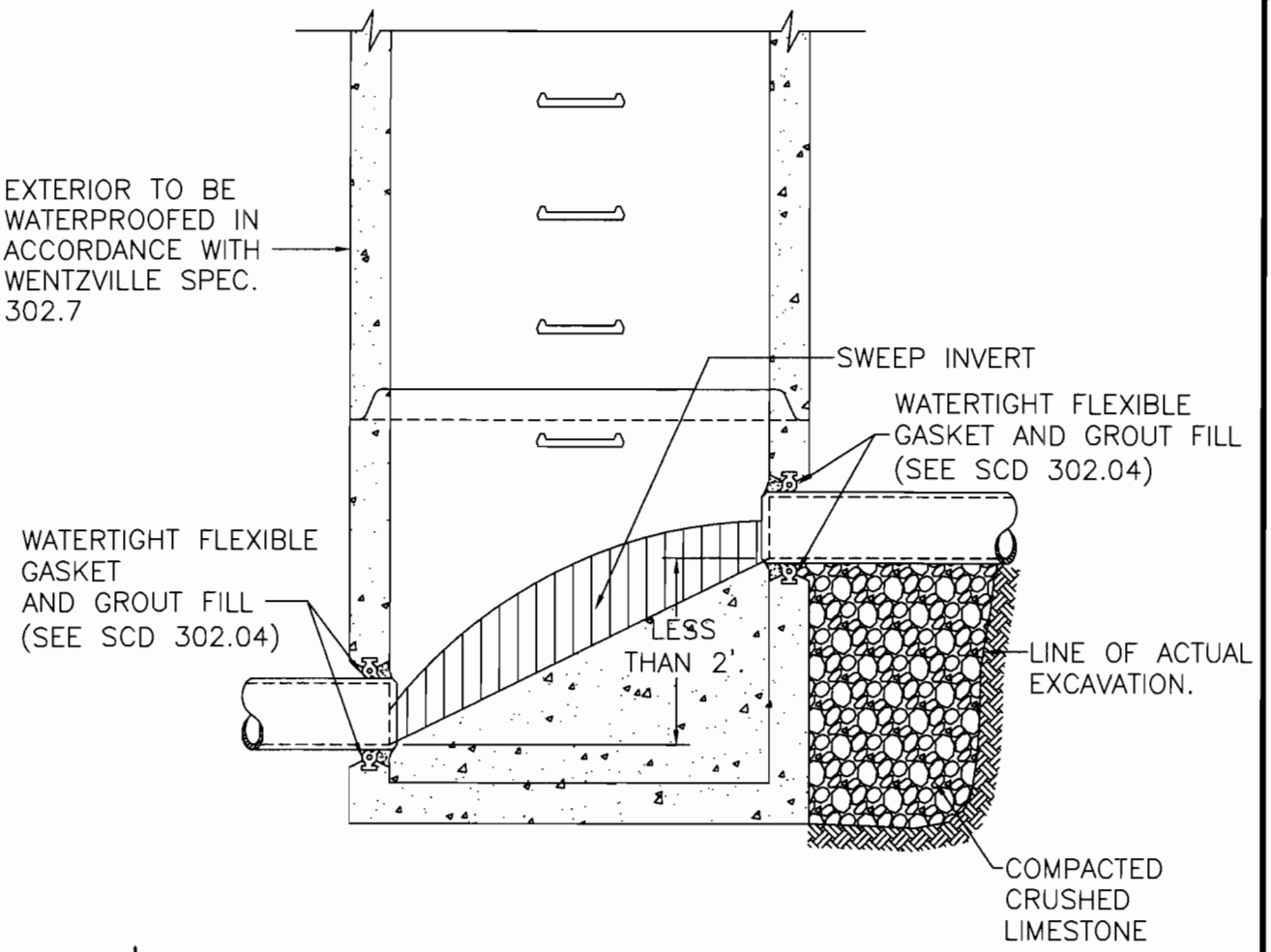
Wentzville Missouri · USA The Crossroads Of The Nation

City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

INSIDE FOUL WATER DROP MANHOLE (2' DROP OR GREATER)

Approved: W.E.B.
Date: June 10, 2009

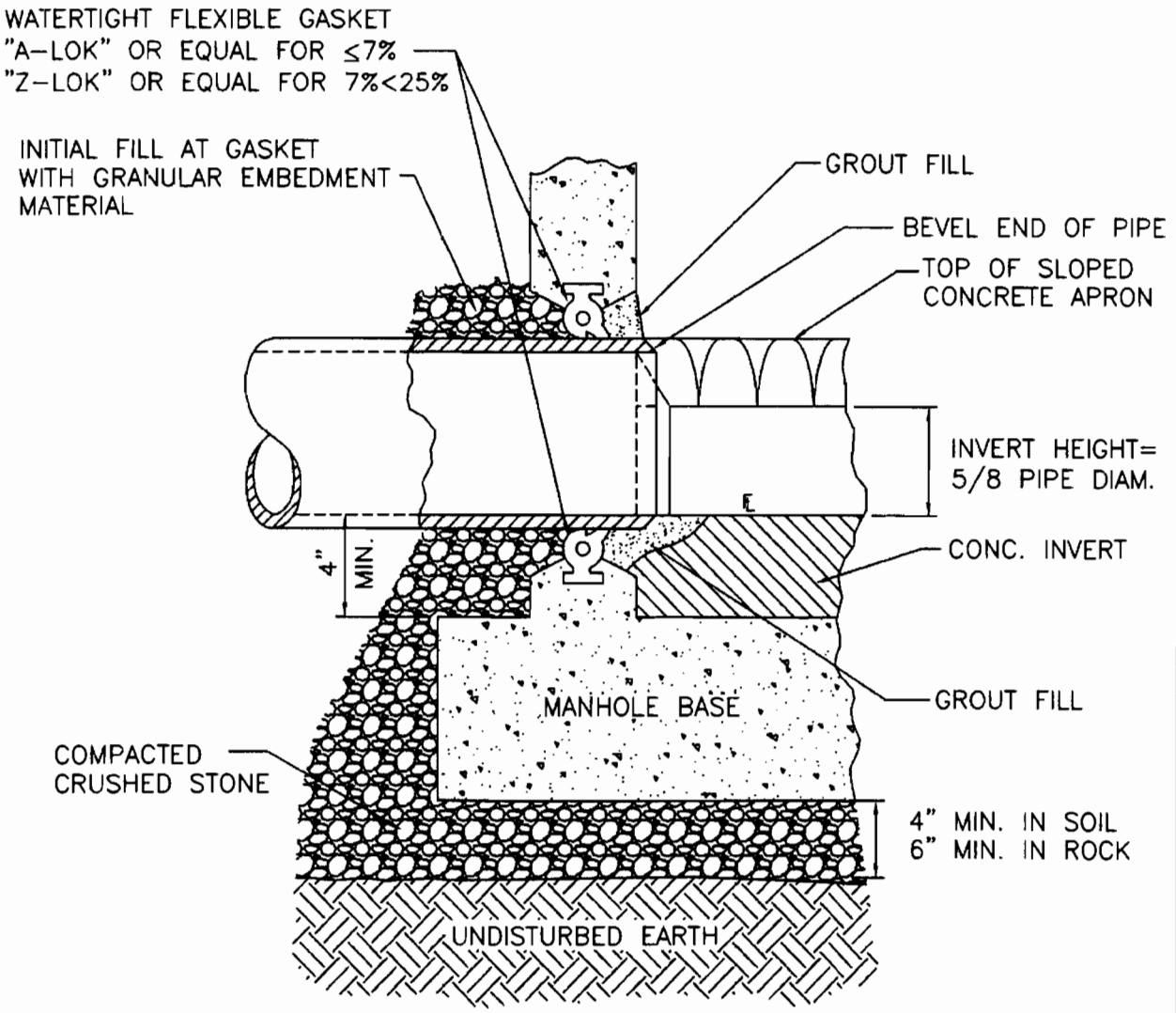
302.02



NOTE:

THE MINIMUM INSIDE DIAMETER FOR THE BASE AND RISER SECTIONS SHALL BE 42 INCHES FOR 8" DIAMETER SANITARY SEWERS. THE MINIMUM INSIDE DIAMETER FOR SANITARY SEWERS LARGER THAN 8" DIAMETER IS 48 INCHES.

Wentzville Missouri · USA The Crossroads Of The Nation	City of Wentzville Public Works Department Engineering Division 200 East Fourth Street Wentzville, MO 63385	INSIDE FOUL WATER DROP MANHOLE (LESS THAN 2' DROP)	Pending Date: January 26, 2016 302.03



NOTE:

1. BITUMINOUS COATING ON EXTERIOR SURFACE OF MANHOLE SHALL NOT COME IN CONTACT WITH PIPE GASKET.
2. FOR CAST-IN-PLACE CONCRETE MANHOLES OR PRE-CAST WITH BOX-OUTS, THE PIPE GASKET SHALL BE A RUBBER LABYRINTH WATERSTOP WITH STAINLESS STEEL CLAMPING BANDS LOCATED AT CENTER OF WALL AND THE SPACE BETWEEN PIPE & WALL COMPLETELY GROUTED WITH NONSHRINKING MORTAR.
3. PIPE TO BE INSTALLED PAST GASKET SUCH THAT ANNUALAR SPACE AROUND PIPE MAY BE GROUT FILLED.

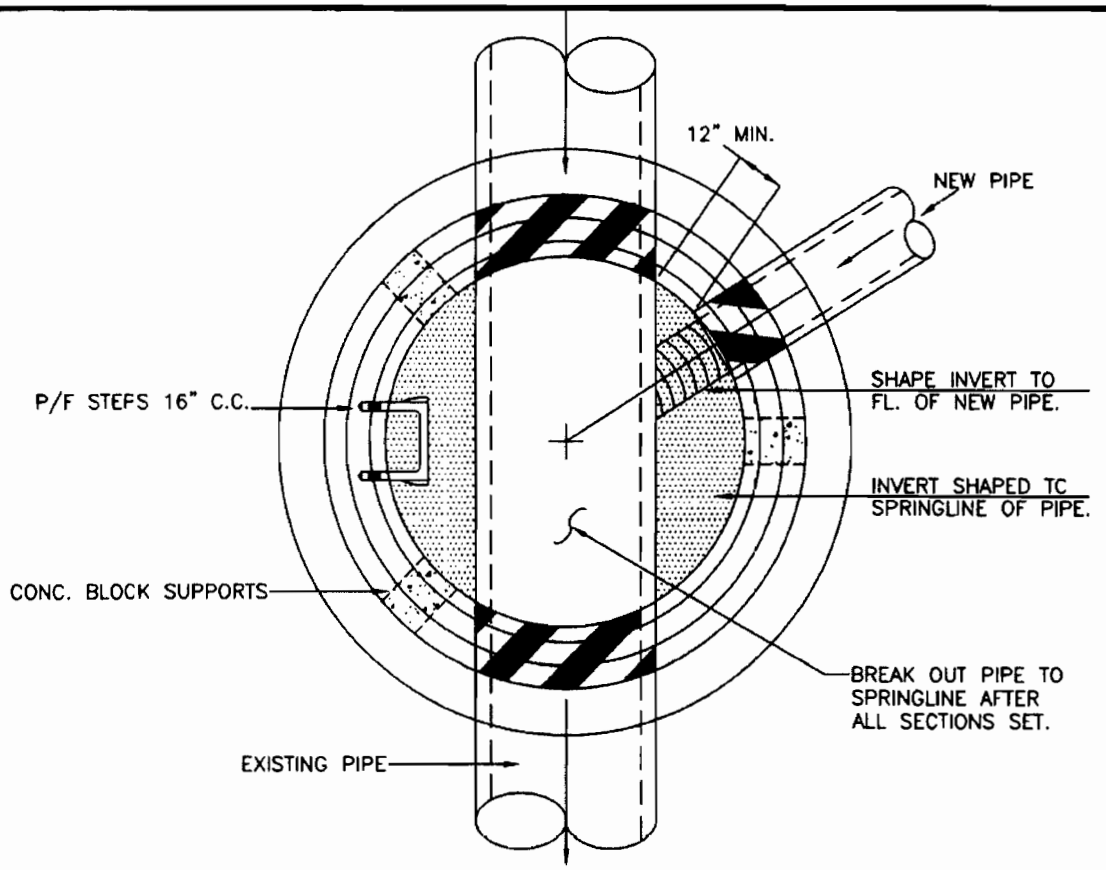
Wentzville
The Crossroads Of The Nation

City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

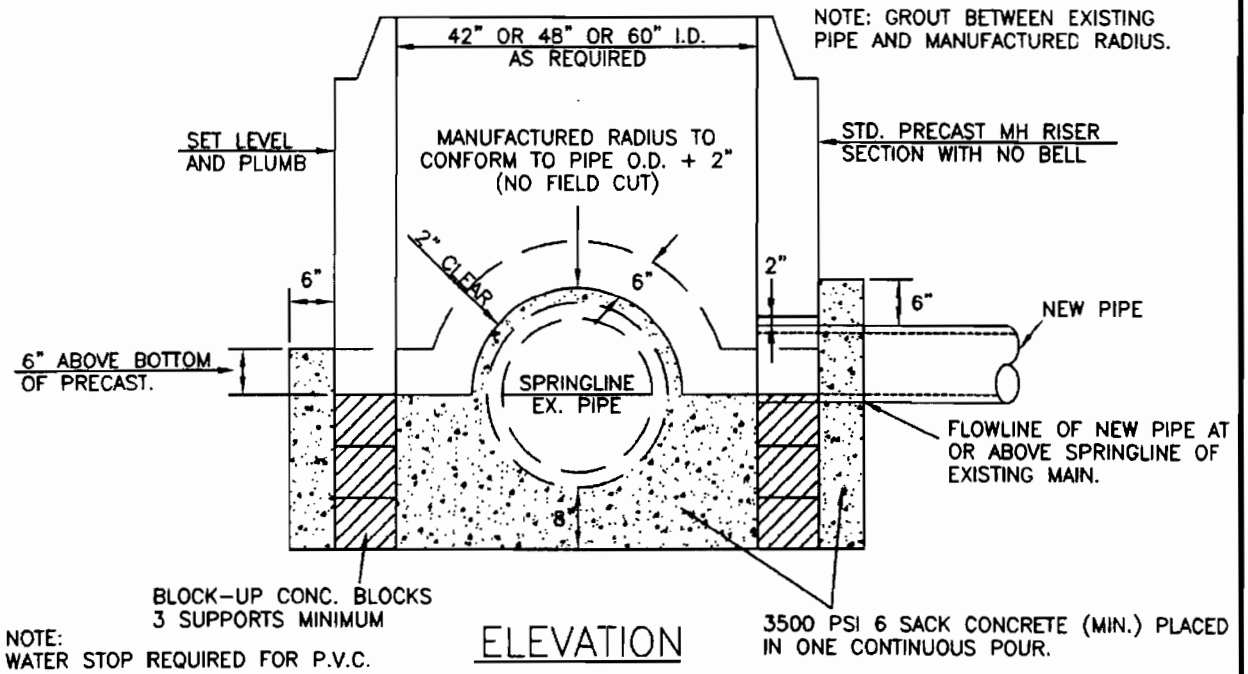
MANHOLE GASKET

Approved: W.E.B.
Date: June 10, 2009

302.04



PLAN



ELEVATION

Wentzville
Missouri - USA
The Crossroads Of The Nation

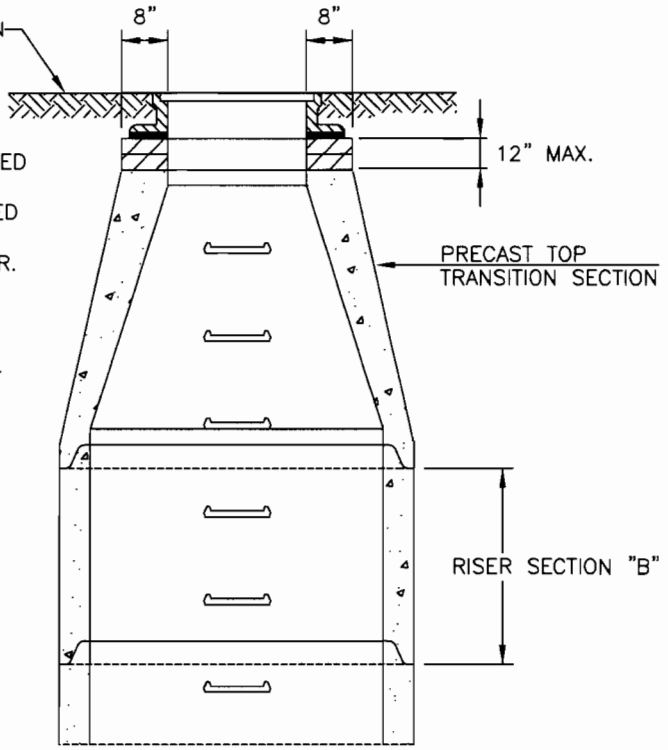
City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

PRECAST MANHOLE ONTO EXISTING PIPE WITH CONTINUOUS FLOW

Approved: W.E.B.
Date: June 10, 2009

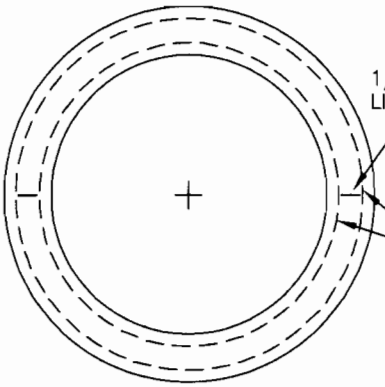
302.05

STANDARD MANHOLE
FRAME AND COVER.
(SEE SCD 302.07)

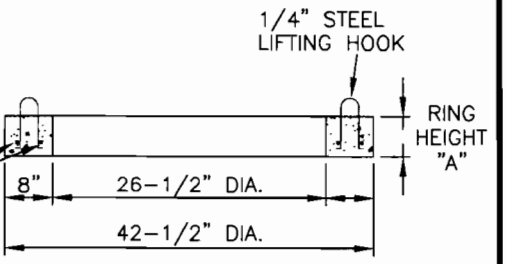


ADJUST TO GRADE WITH APPROVED GRADE RING(S). NO MORE THAN ONE GRADE RING SHALL BE USED PER ADJUSTMENT UNLESS THE TOTAL HEIGHT IS 6" OR GREATER. A MAXIMUM OF 2 GRADE RINGS AND A MAXIMUM OF 12", TOTAL, OF GRADE ADJUSTMENT IS ALLOWED. METAL, PLASTIC, AND BRICK GRADE RINGS ARE NOT ALLOWED.

ELEVATION



PLAN



GRADE RING SECTION

NOTES:

1. IF MANHOLE CANNOT BE ADJUSTED TO GRADE WITH GRADE RINGS AS DESCRIBED ABOVE A RISER SECTION WILL HAVE TO BE ADDED.
2. DIMENSION "A" STOCK GRADE RING MAY BE 3 INCHES MINIMUM TO 12 INCHES MAXIMUM.
3. DIMENSION "B" STOCK RISER SECTION SHALL BE 12 INCH MINIMUM.

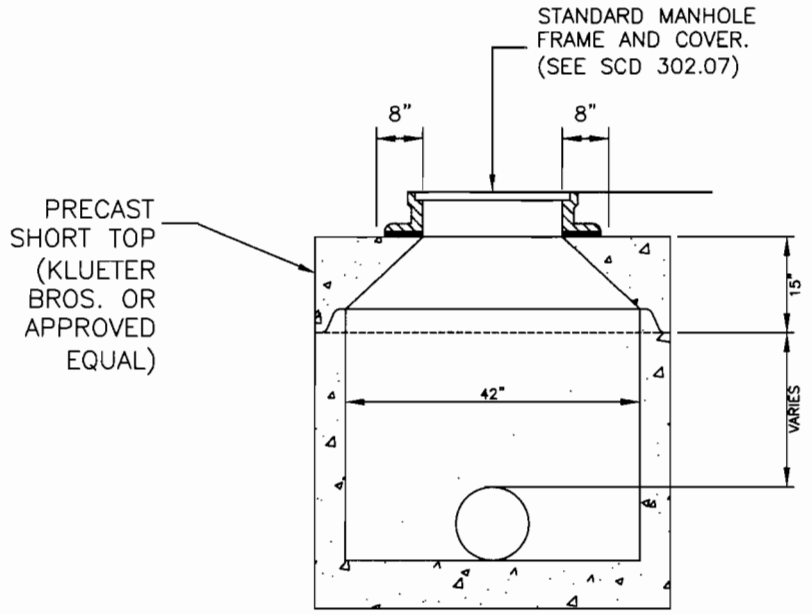
Wentzville
Missouri - USA
The Crossroads Of The Nation

City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

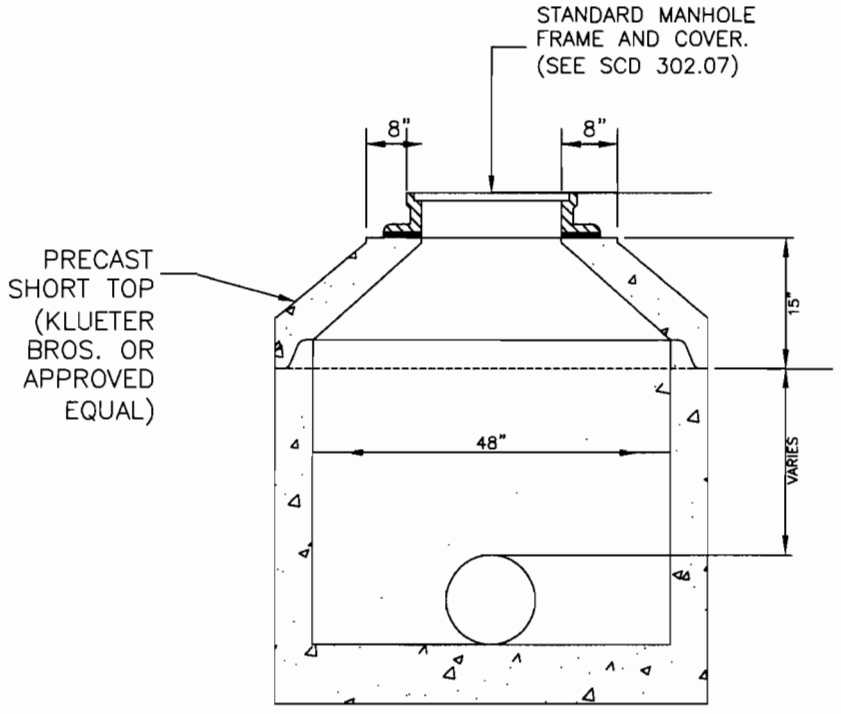
ADJUST TO GRADE

Pending
Date: January 26, 2016

302.06A



ELEVATION



ELEVATION

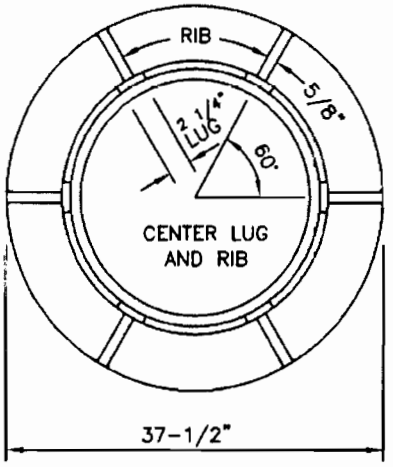
Wentzville
Missouri · USA
The Crossroads Of The Nation

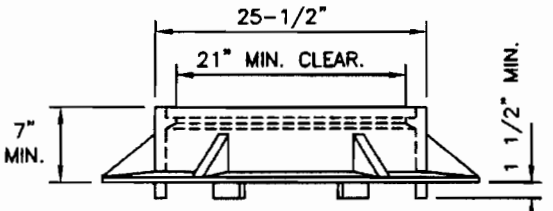
City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

SHALLOW MANHOLE TOP

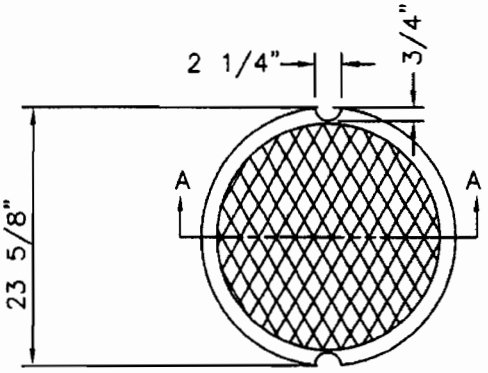
Pending
Date: January 26, 2016

302.06B

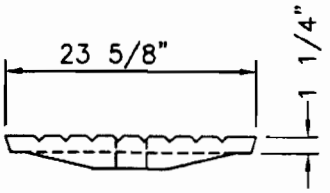




CAST IRON MANHOLE FRAME



TYPE "A" 120 LBS.

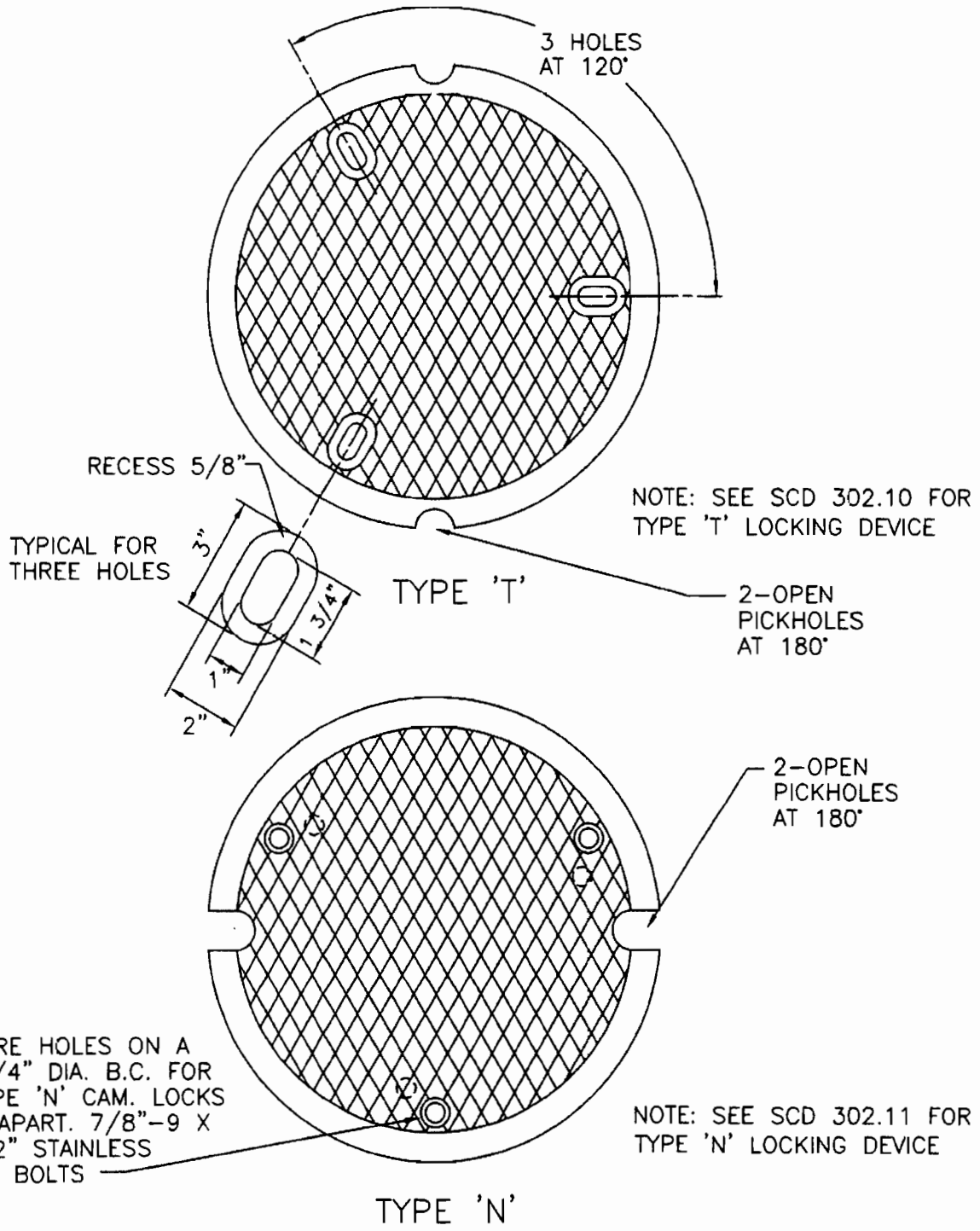


SECTION A–A

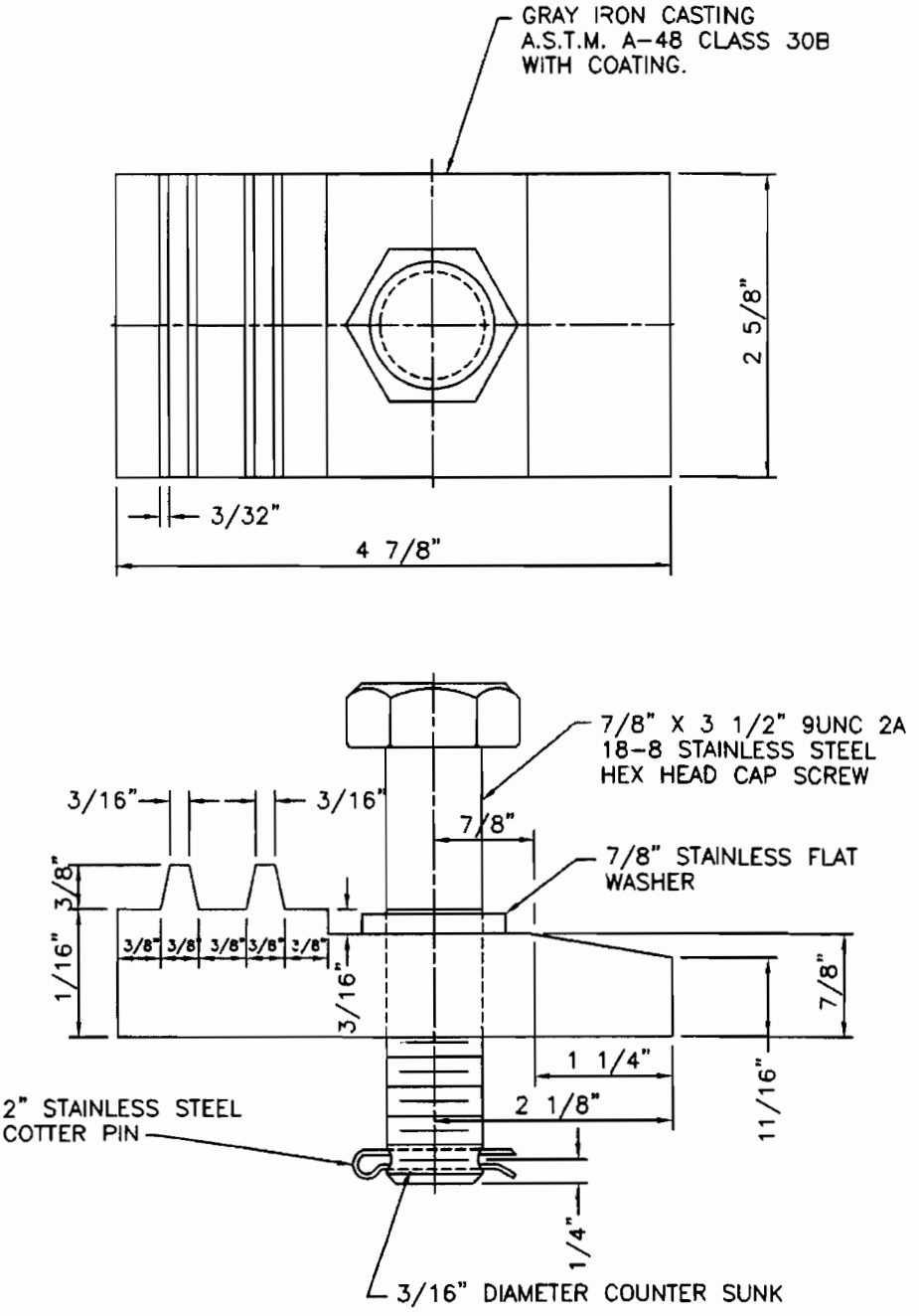
CAST IRON MANHOLE COVER

NOTE: MANHOLE FRAME AND COVER SHALL BE NEENAH FOUNDRY COMPANY R-1775 OR EQUIVALENT.

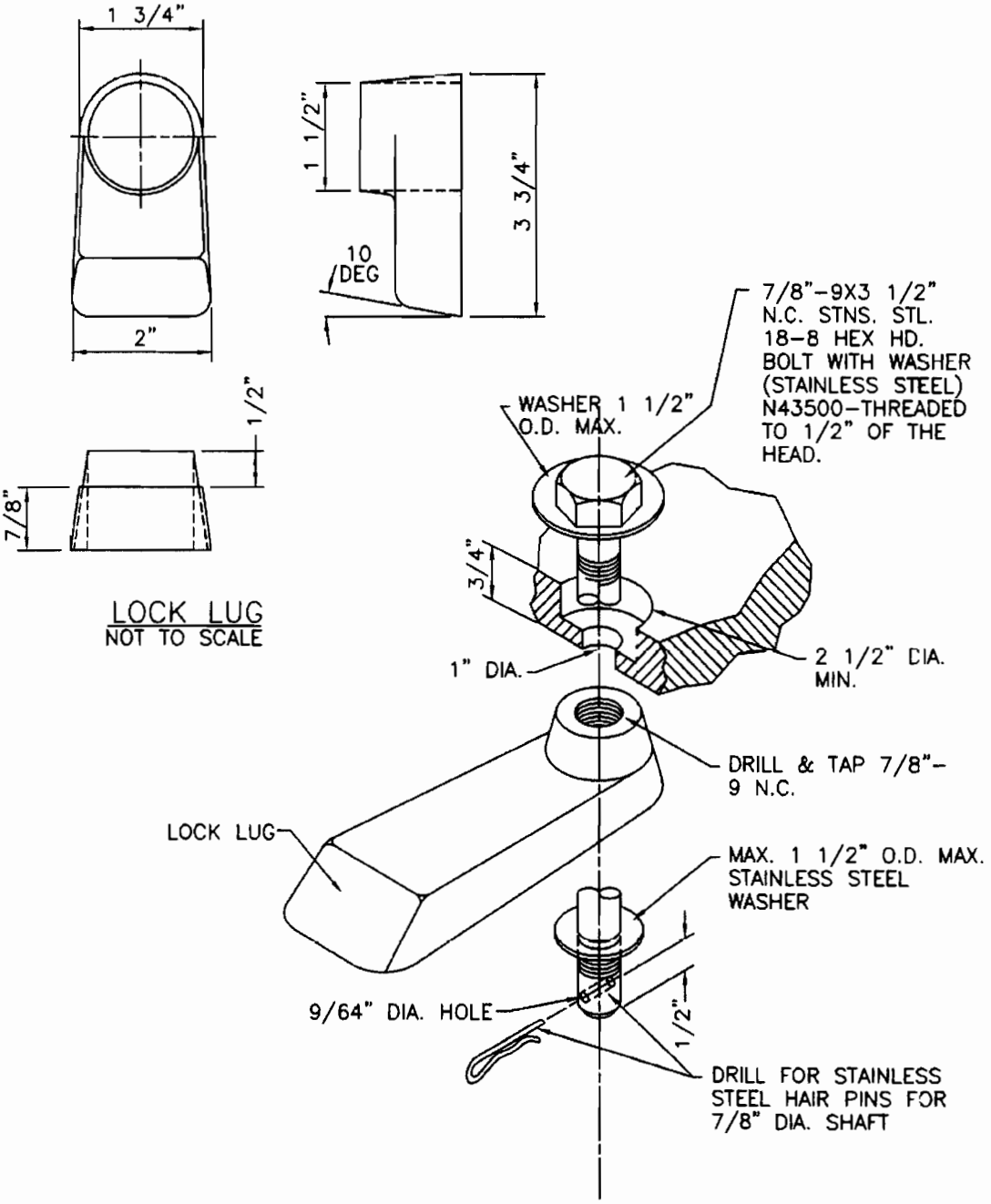
Wentzville Missouri USA The Crossroads Of The Nation	City of Wentzville Public Works Department Engineering Division 200 East Fourth Street Wentzville, MO 63385	CAST IRON MANHOLE FRAME AND COVER	Approved: W.E.B. Date: June 10, 2009 302.07



Wentzville The Crossroads Of The Nation	City of Wentzville Public Works Department Engineering Division 200 East Fourth Street Wentzville, MO 63385	STANDARD CAST IRON MANHOLE COVER (LOCK TYPE)	Approved: W.E.B. Date: June 10, 2009 302.09



Wentzville The Crossroads Of The Nation	City of Wentzville Public Works Department Engineering Division 200 East Fourth Street Wentzville, MO 63385	STANDARD LOCKING DEVICE FOR TYPE "T" LOCK TYPE MANHOLE COVER	Approved: W.E.B. Date: June 10, 2009 302.10



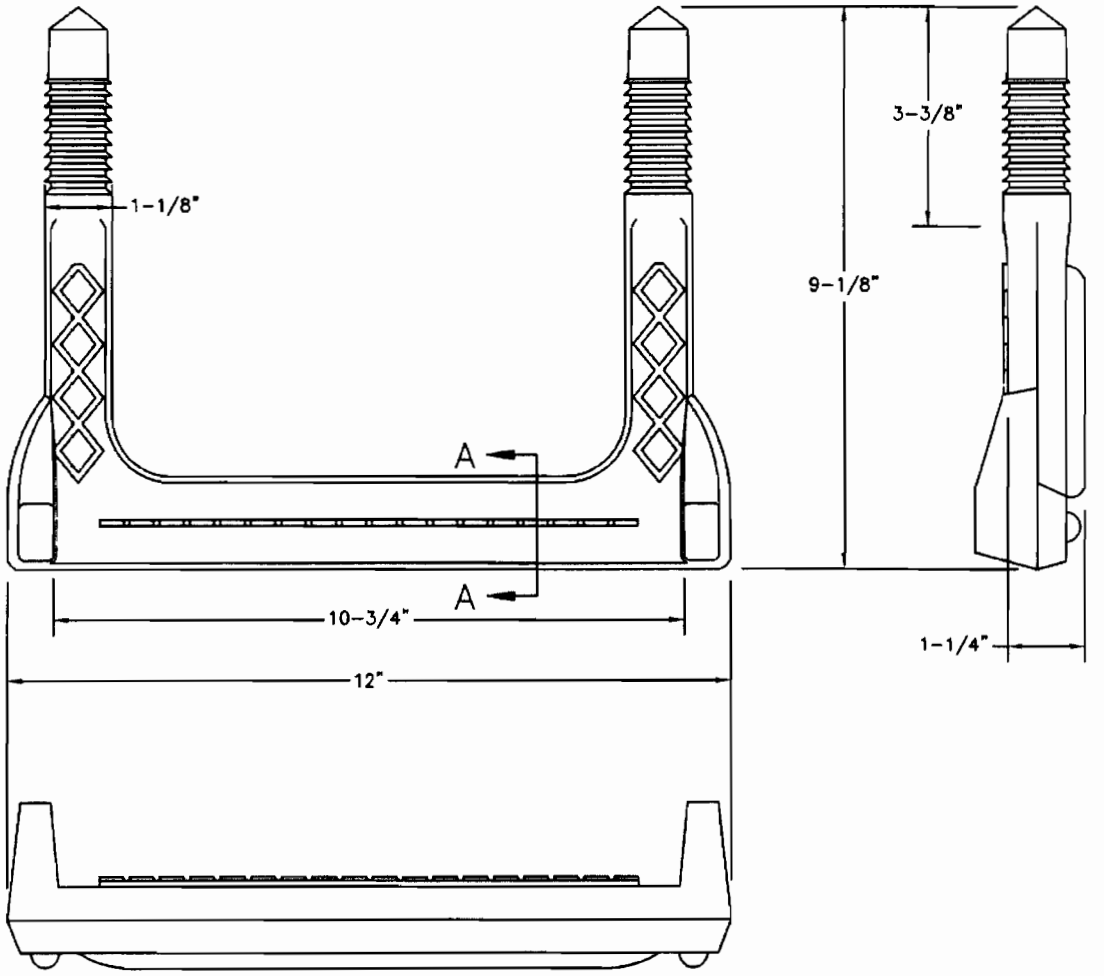
Wentzville
The Crossroads Of The Nation

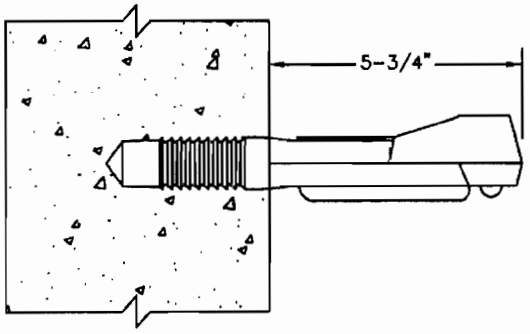
City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

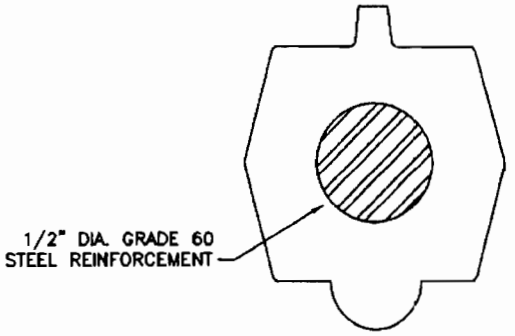
STANDARD LOCKING DEVICE FOR TYPE "N" LOCK TYPE MANHOLE COVER

Approved: W.E.B.
Date: June 10, 2009

302.11







SECTION A-A

COPOLYMER POLYPROPYLENE PLASTIC

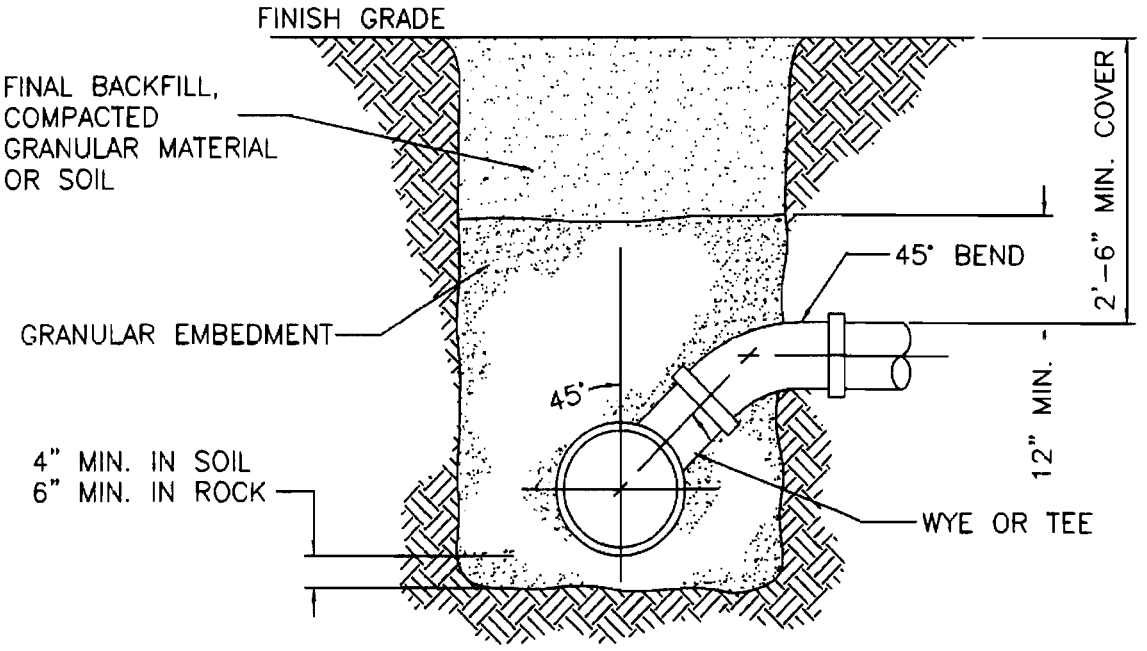
Wentzville
The Crossroads Of The Nation

City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

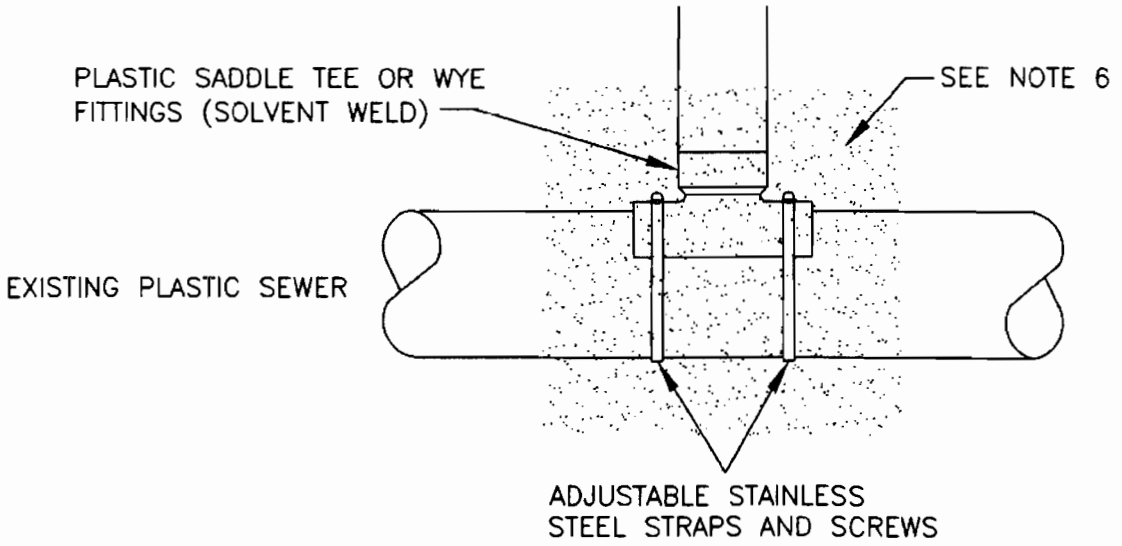
STANDARD MANHOLE STEP

Approved: W.E.B.
Date: June 10, 2009

302.12



Wentzville Missouri - USA The Crossroads Of The Nation	City of Wentzville Public Works Department Engineering Division 200 East Fourth Street Wentzville, MO 63385	STANDARD NEW SERVICE CONNECTION	Approved: W.E.B. Date: June 10, 2009 302.13a



WHEN A CONNECTION TO AN EXISTING PLASTIC PIPE IS ALLOWED, A SOLVENT WELD SADDLE TEE OR WYE FITTING OF A SIMILAR MATERIAL MUST BE USED.

THIS IS ACCOMPLISHED BY CAREFULLY CUTTING A HOLE IN THE MAIN AT THE REQUIRED LOCATION. AFTER CUTTING AND SHAPING THE HOLE TO THE SIZE OF THE FITTING, THE FOLLOWING STEPS SHOULD BE TAKEN.

1. CLEAN AND DRY BOTH THE INSIDE SADDLE WYE AND PIPE SURFACE TO BE SOLVENT CEMENTED.

2. APPLY A LIBERAL COAT OF ONE-STEP SOLVENT CEMENT TO THE INSIDE SURFACE OF THE SADDLE WYE AND TO THE EXTERIOR SURFACE OF THE PIPE.

3. DO NOT USE OLD SOLVENT THAT HAS BECOME JELLED OR LUMPY.

3. WITHOUT DELAY, MATE THE SURFACES AND STRAP DOWN TIGHTLY. A BEAD OF SOLVENT SHOULD APPEAR AFTER THE SADDLE HAS BEEN STRAPPED DOWN TIGHTLY.

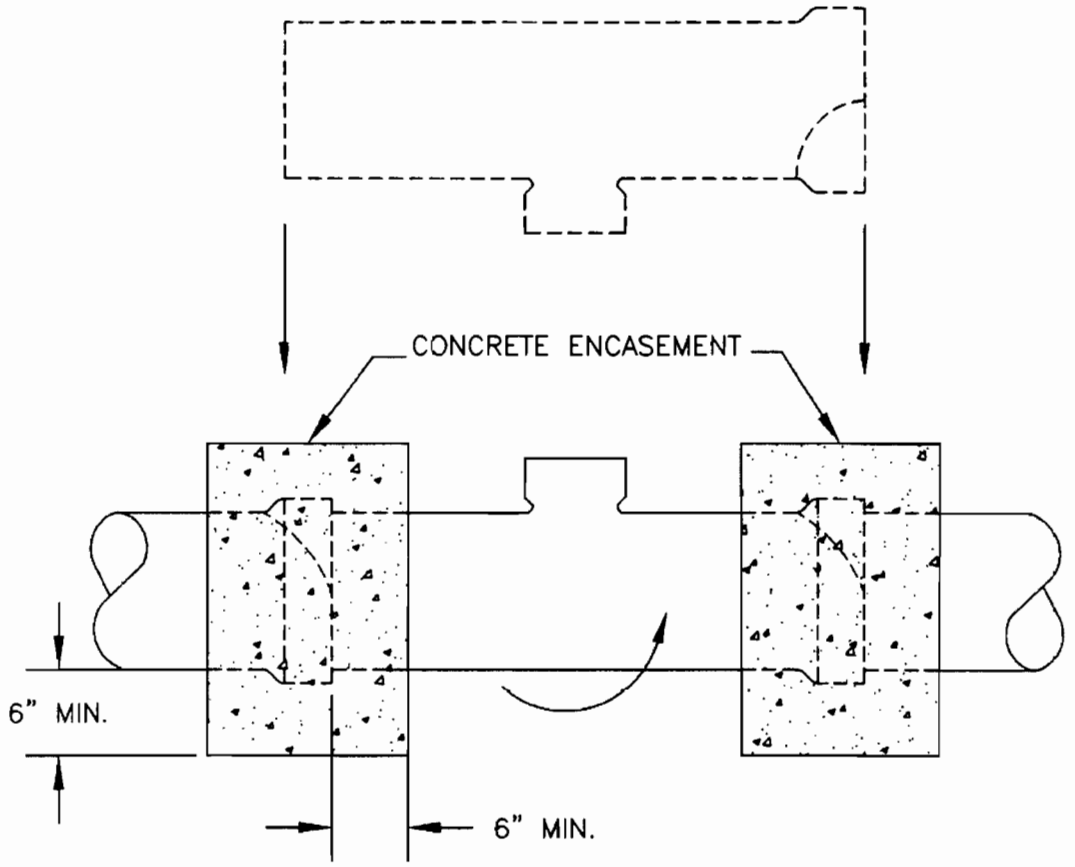
4. USING A RAG OR TOWEL, WIPE BEAD AND ANY EXCESS SOLVENT CEMENT OFF PIPE AND SADDLE.

5. ALLOW 30 – 60 MINUTES FOR SET-UP TIME BEFORE ENCASEMENT. CURE TIME DEPENDS ON SIZE AND FIT OF MATERIALS BEING INSTALLED AND WEATHER CONDITIONS.

6. THE COMPLETED CONNECTION SHALL BE COMPETELY ENCASED WITH 1 TO 3 CEMENT TO SAND MORTAR MIX OR "PRE-MIX" CONCRETE PRIOR TO BACKFILLING.

7. THE CEMENT SAND MORTAR MIX OR "PRE-MIX" CONCRETE SHALL BE ALLOWED SUFFICIENT TIME TO CURE BEFORE BACKFILLING.

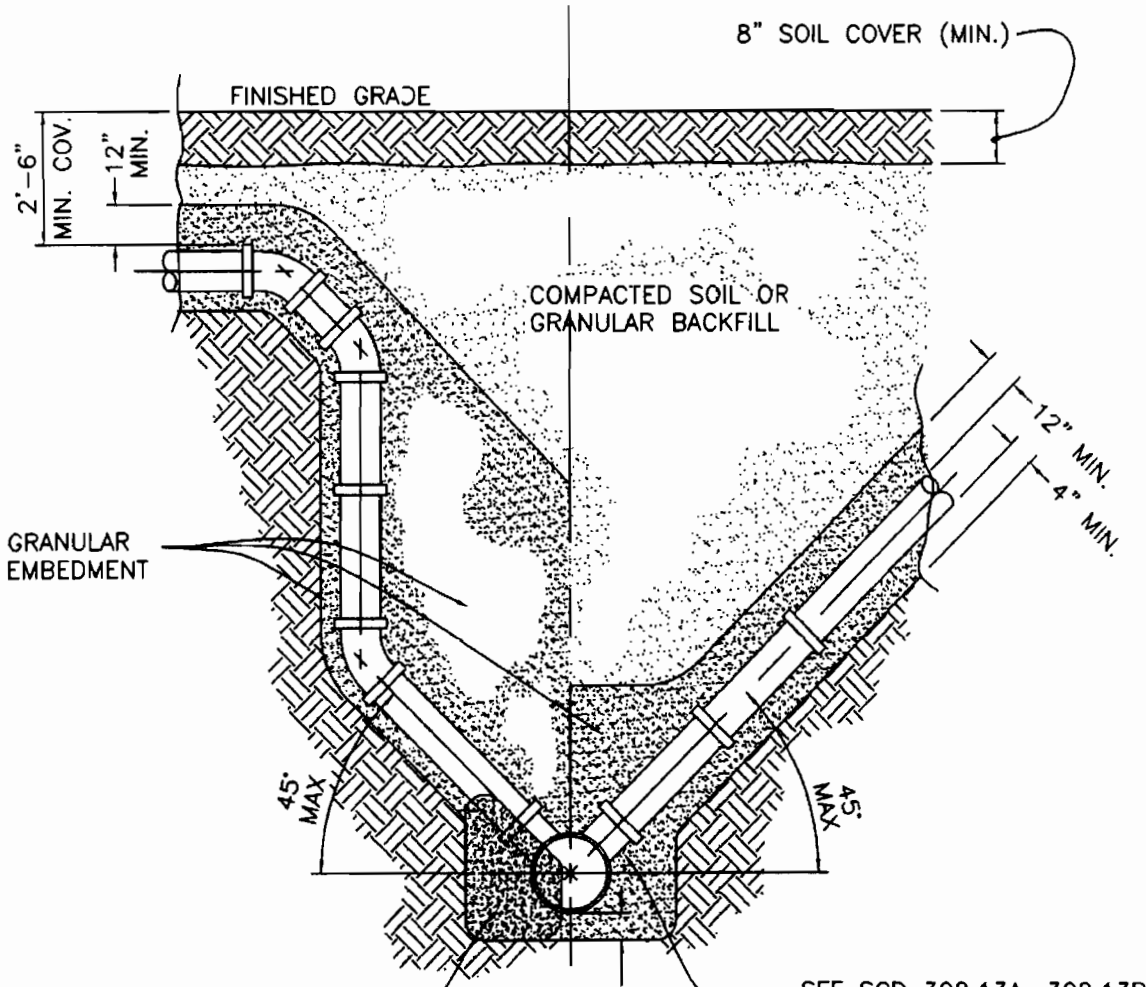
Wentzville Missouri - USA The Crossroads Of The Nation	City of Wentzville Public Works Department Engineering Division 200 East Fourth Street Wentzville, MO 63385	SADDLE TEE CONNECTION TO EXISTING PLASTIC MAIN	Approved: W.E.B. Date: June 10, 2009 302.13b



THE PIPE INSTALLATION IS ACCOMPLISHED BY BREAKING AWAY AND REMOVING ONE SECTION OF PIPE. THE TOP HALF OF THE BELL ON THE PIPE LYING ADJACENT TO THE GAP IS CAREFULLY BROKEN OFF. THE TOP HALF OF THE BELL ON THE MAIN REPLACEMENT SECTION (WITH A "TEE"/"WYE" FITTING) IS ALSO BROKEN OFF. THE REPLACEMENT PIPE IN THEN PLACED IN THE LINE GAP WITH THE STUB POINTED IN THE WRONG DIRECTION. THE BROKEN BELLS ON THE REPLACEMENT AND ADJOINING PIPE MAKE POSSIBLE FOR THE REPLACEMENT SECTION TO FIT INTO THE SEWER LINE WITHOUT DISTURBING THE ADJOINING PIPE SECTIONS. THE REPLACEMENT SECTION IS THEN ROTATED TO THE DESIRED POSITION AND THE BROKEN BELLS ARE ENCASED WITH A 6" 3500 PSI (MIN) CONCRETE ENCASEMENT.

PVC PIPE MAY BE USED AND WILL REQUIRE FULL CIRCUMFERENCE RUBBER FERNCO BOOTS WITH STAINLESS STEEL CLAMPS AND CONCRETE ENCASEMENT AS DESCRIBED ABOVE.

Wentzville Missouri - USA The Crossroads Of The Nation	City of Wentzville Public Works Department Engineering Division 200 East Fourth Street Wentzville, MO 63385	"ROLL-IN" FOR EXISTING CLAY OR CONCRETE PIPE	Approved: W.E.B. Date: June 10, 2009 302.13c



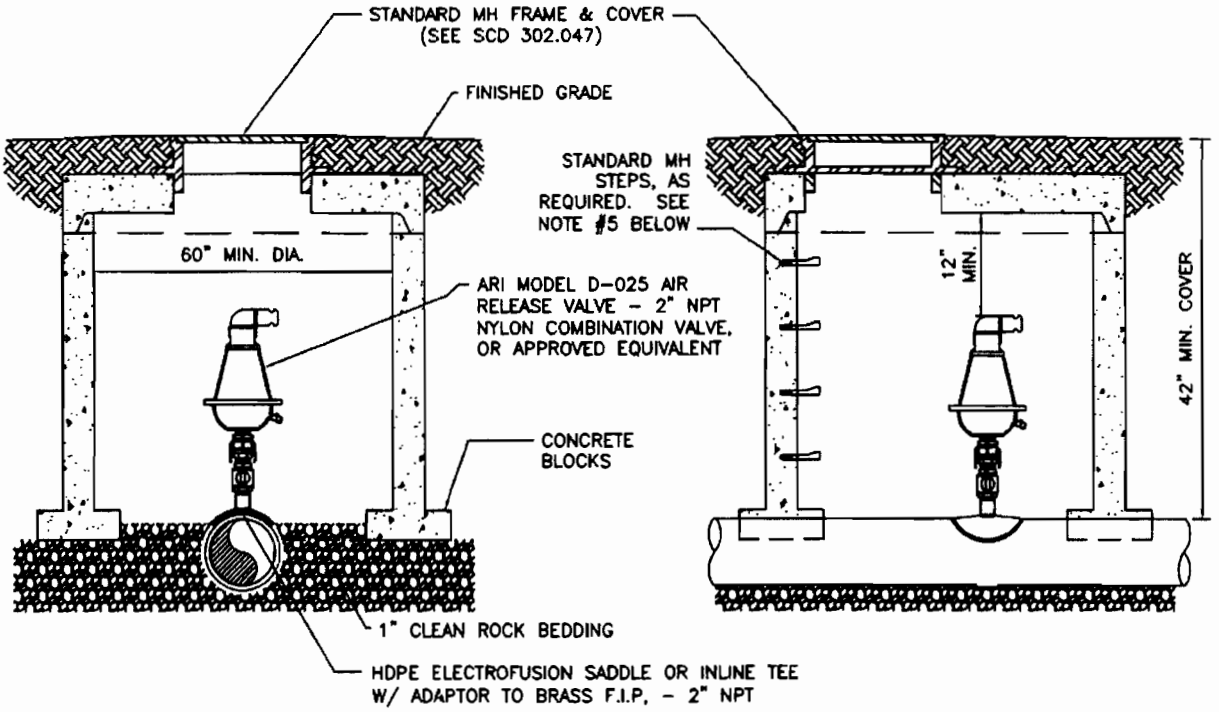
Wentzville
The Crossroads Of The Nation

City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

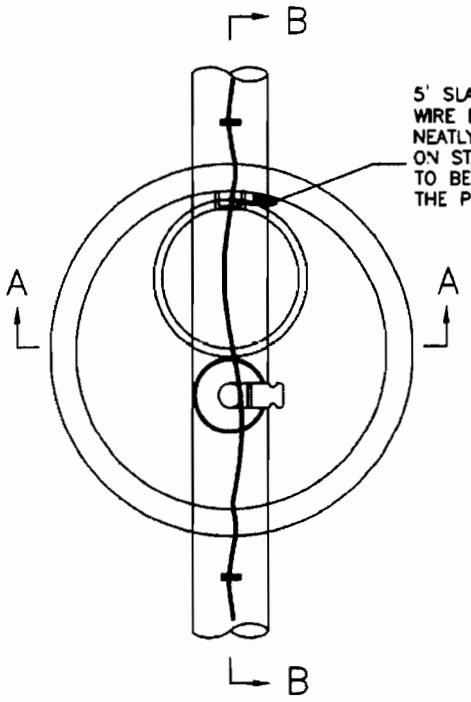
STANDARD DEEP SERVICE CONNECTION

Approved: W.E.B.
Date: June 10, 2009

302.14

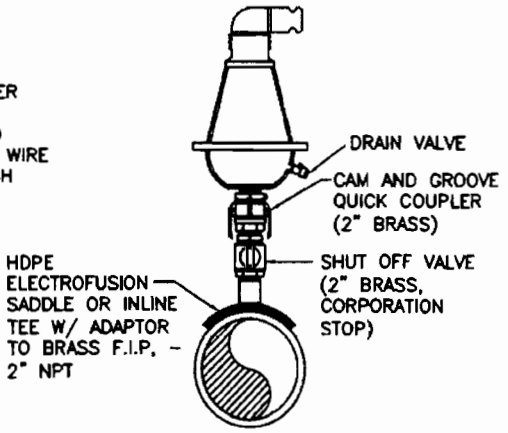


SECTION A-A



PLAN

SECTION B-B



NOTES:

1. ALL FITTINGS AND PIPE VALVES SHALL BE BRASS

2. ALL AIR RELEASE VALVES FOR FORCE MAINS SHALL BE SUPPLIED WITH A BACKWASH ACCESSORY KIT.

3. ALL AIR RELEASE VALVES SHALL BE INSTALLED IN THE VERTICAL POSITION. FORCE MAINS 4" AND SMALLER SHALL REQUIRE BRACING TO KEEP THE AIR RELEASE VALVE VERTICAL.

4. FINISHED GRADING SHALL PROVIDE DRAINAGE AWAY FROM THE ACCESS LID.

5. STEPS SHALL BE UNIFORMLY SPACED AT 16" CENTER TO CENTER, AND SHALL EXTEND 5-3/4" FROM WALL.

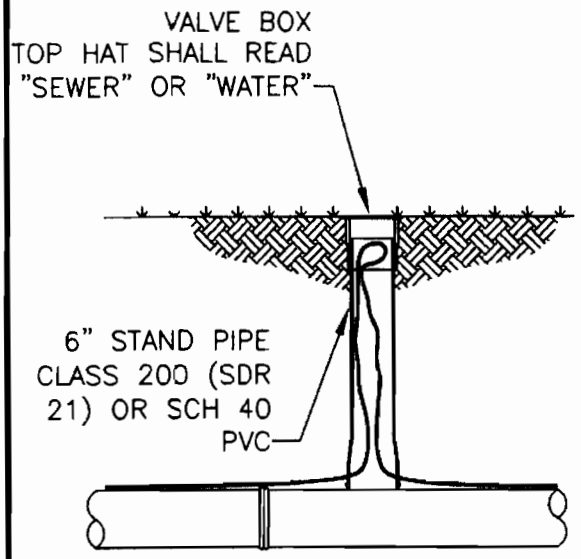
Wentzville
Missouri - USA
The Crossroads Of The Nation

City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

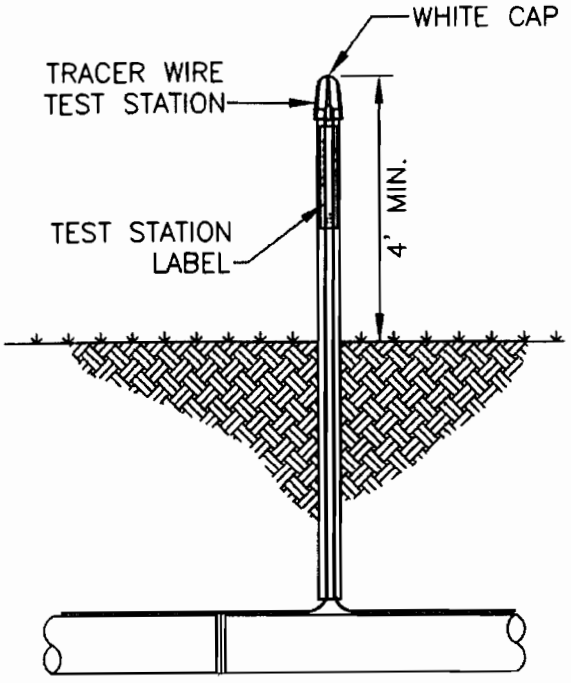
STANDARD FORCE MAIN AIR RELEASE VALVE

Approved: W.E.B.
Date: June 10, 2009

302.16



TRACER WIRE ACCESS BOX



TRACER WIRE TEST STATION

NOTES:

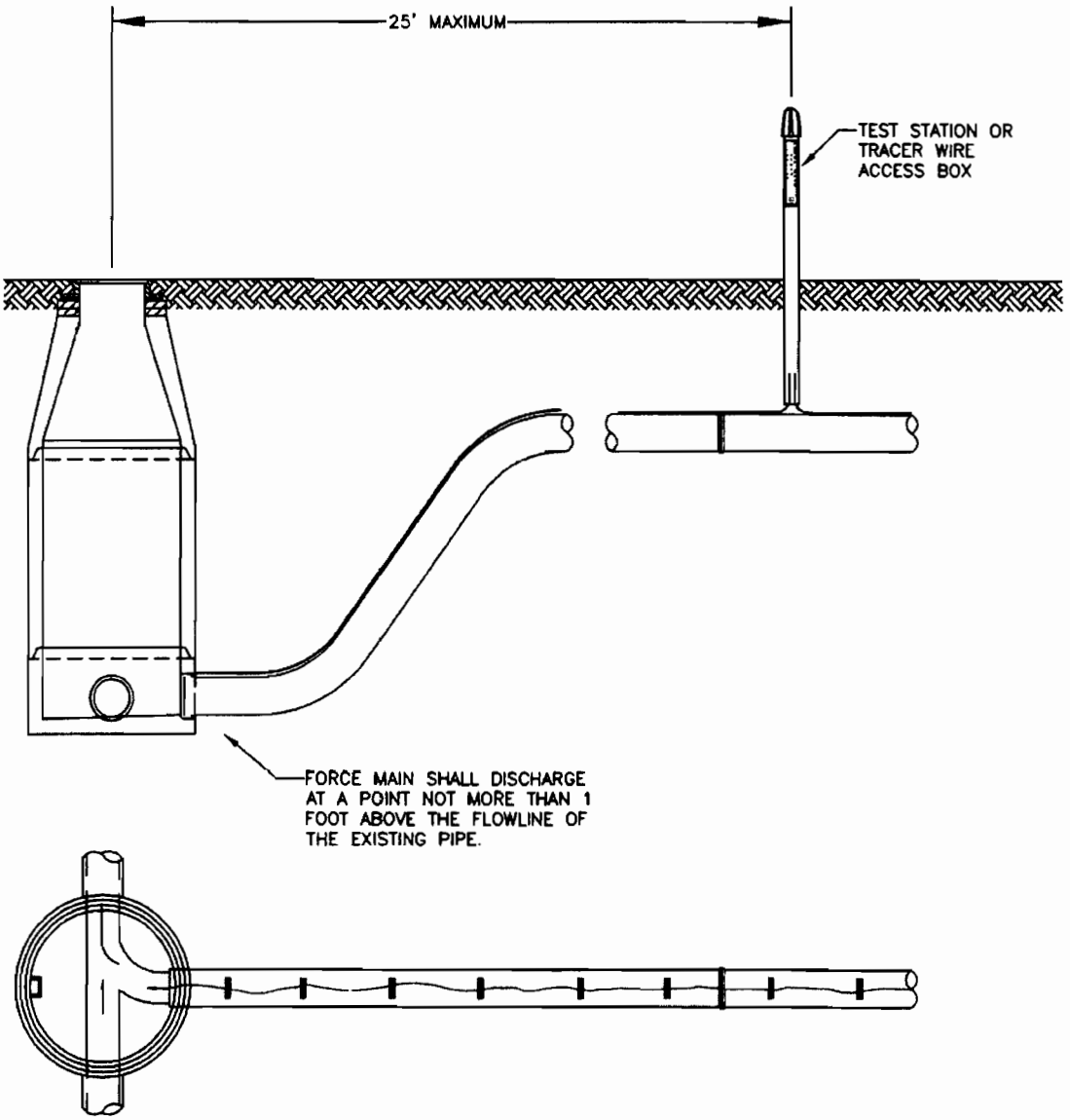
1. ALL SPLICING OF TRACER WIRE MUST BE MADE WITH APPROVED 3M WATERPROOF SPLICE KITS.
2. TEST STATIONS OR ACCESS BOXES SHALL BE PLACED AT THE PC AND PT OF ALL RADII, AT ALL BENDS AND EVERY 500' ON STRAIGHT RUNS OF PIPE. CURVE LENGTHS GREATER THAN 150 FEET REQUIRE INTERMEDIATE TEST STATIONS OR ACCESS BOXES IN ADDITION TO THE PC AND PT.
3. TRACER WIRE ACCES BOXES SHALL BE USED IN IMPROVED AREAS, SUCH AS IN THE EASEMENT OR RIGHT-OF-WAY OF A RESIDENTIAL DEVELOPEMENT. TRACER WIRE TEST STATIONS SHALL BE USED IN UNIMPROVED AREAS, SUCH AS IN AREAS WITH HEAVY BRUSH OR TALL GRASSES.
4. TRACER WIRE SHALL BE CONNECTED TO THE TEST STATION AS DIRECTED BY THE MANUFACTURER'S INSTRUCTIONS.
5. A MINIMUM OF 3' OF EXCESS TRACER WIRE SHALL BE ROLLED UP AND BE AVAILABLE AT THE TOP OF THE TRACER WIRE ACCESS BOX.

TEST STATIONS SHALL BE CARSONITE SCEPTER TEST STATIONS.

SEWER TEST STATION LABEL (GREEN)

WATER TEST STATION LABEL (BLUE)

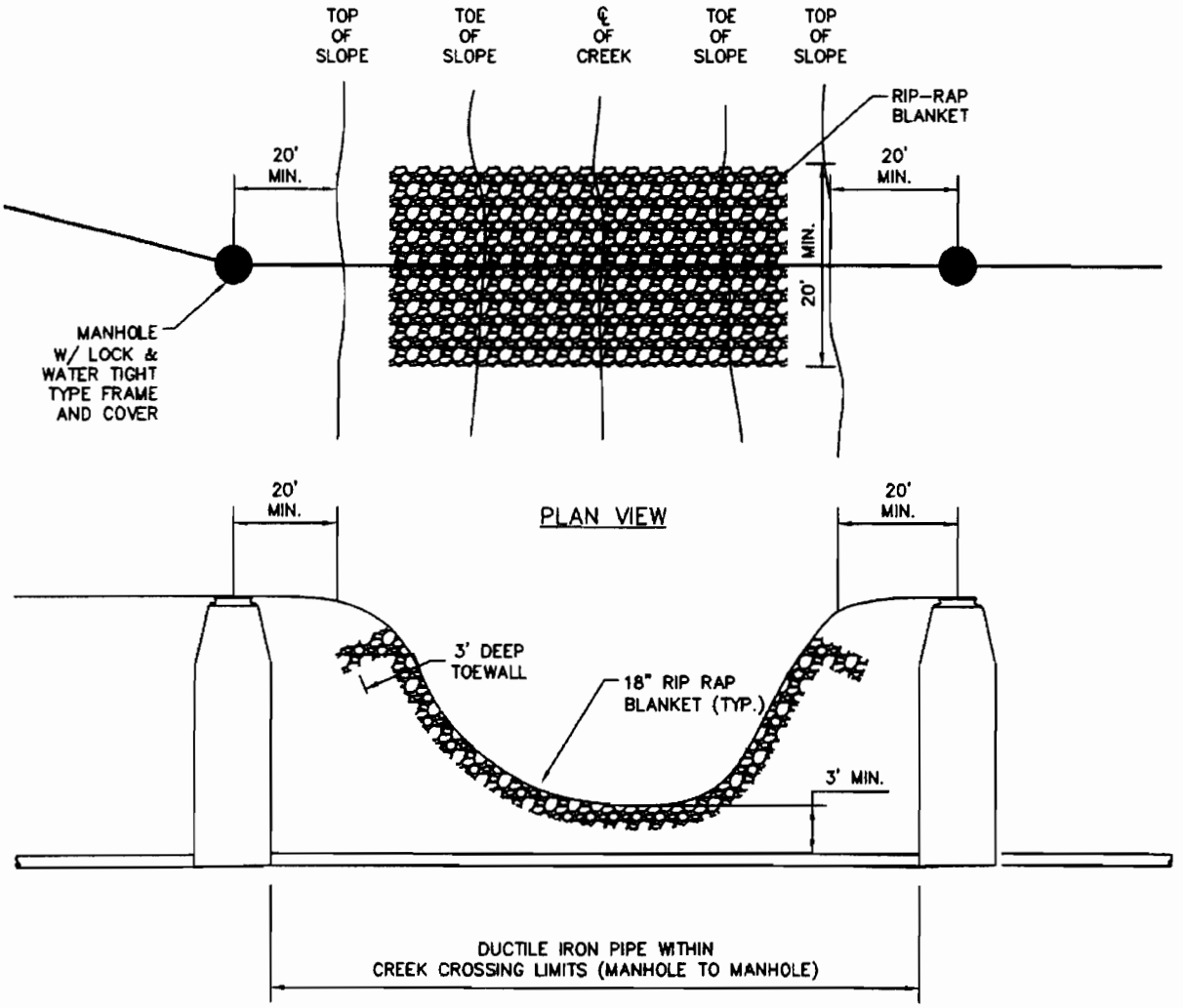
Wentzville The Crossroads Of The Nation	City of Wentzville Public Works Department Engineering Division 200 East Fourth Street Wentzville, MO 63385	STANDARD TRACER WIRE TEST STATION AND ACCESS BOX	Approved: W.E.B. Date: June 10, 2009 302.17 500.03



NOTES:

1. ALL SPLICING OF TRACER WIRE MUST BE MADE WITH APPROVED 3M WATERPROOF SPLICE KITS.
2. SEE SCD 302.17/500.03 FOR STANDARD TRACER WIRE TEST STATION.
3. TRACER WIRE SHALL BE DUCT TAPED TO THE TOP OF THE FORCE MAIN PIPE TO PREVENT MOVEMENT OF THE WIRE DURING BACKFILLING OPERATIONS.
4. THE RECEIVING MANHOLE AND THE NEXT TWO (2) DOWNSTREAM MANHOLES, AT A MINIMUM, SHALL BE PROTECTED BY AN EPOXY COATING ON THEIR INTERIOR SURFACES.

Wentzville Missouri - USA The Crossroads Of The Nation	City of Wentzville Public Works Department Engineering Division 200 East Fourth Street Wentzville, MO 63385	STANDARD FORCE MAIN DISCHARGE AT RECEIVING MANHOLE	Approved: W.E.B. Date: June 10, 2009 304.01



PROFILE

NOTES:

1. RIP RAP IS REQUIRED AT ALL CREEK CROSSINGS.
2. PLACE RIP RAP ON THE LOWER 3/4 OF SLOPE. THE UPPER 1/4 OF SLOPE SHOULD BE TREATED AS FOLLOWS BASED ON INCLINATION OF THE SLOPE:
   A. 3H:1V OR LESS – SEED AND STRAW
   B. STEEPER THAN 3H:1V – RIP RAP
3. INCORPORATE A 3 FEET DEEP TOE WALL ON EMBANKMENT'S UPPER EDGE OF RIP RAP.
4. TOP SURFACE OF RIP RAP SHOULD BE AT OR HIGHER THAN SURROUNDING GROUND SURFACE.
5. IF PIPE HAS LESS THAN 3 FEET OF COVER, THE PIPE MUST BE CONCRETE ENCASED.
6. DUCTILE IRON PIPE IS REQUIRED IN CREEK CROSSING, FROM MANHOLE TO MANHOLE.

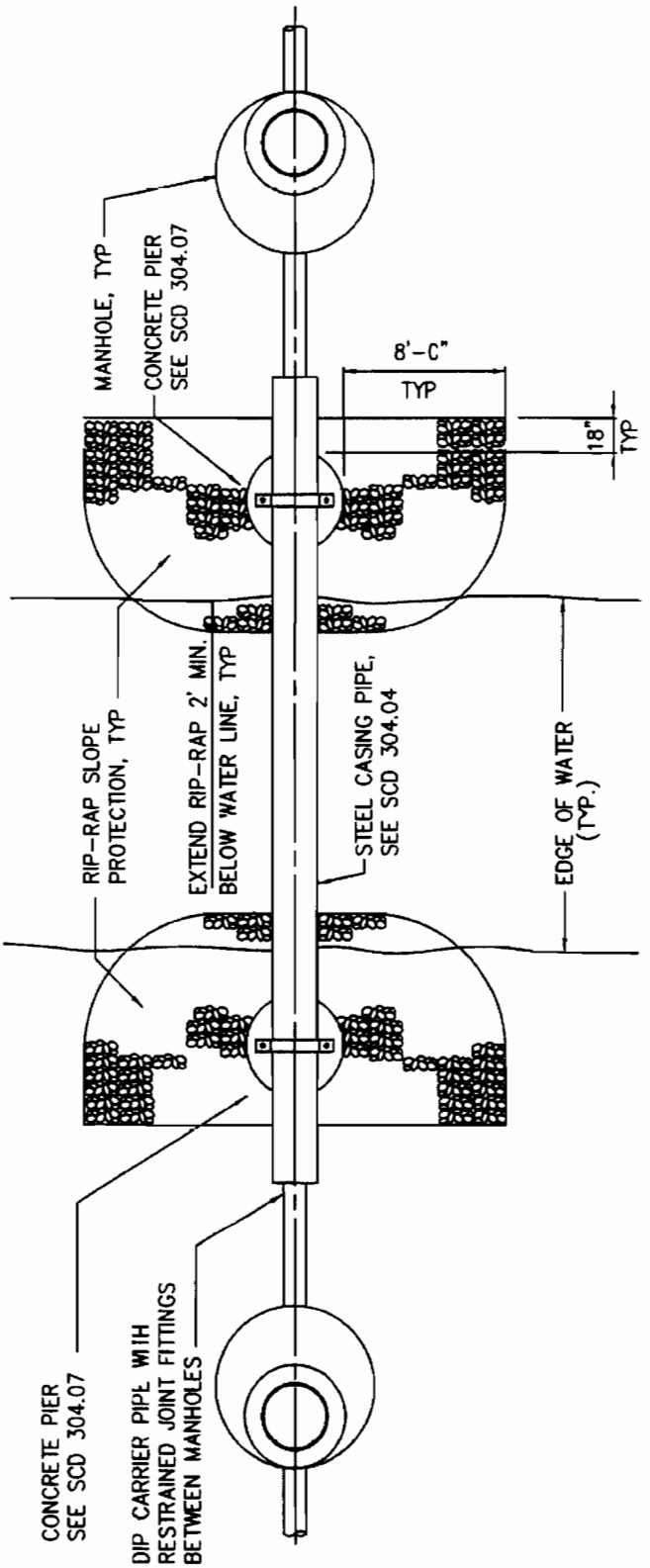
Wentzville
The Crossroads Of The Nation

City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

GRAVITY SANITARY CREEK CROSSING (BELOW FLOWLINE OF CREEK)

Approved: W.E.B.
Date: June 10, 2009

304.02



Wentzville
Missouri - USA
The Crossroads Of The Nation

City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

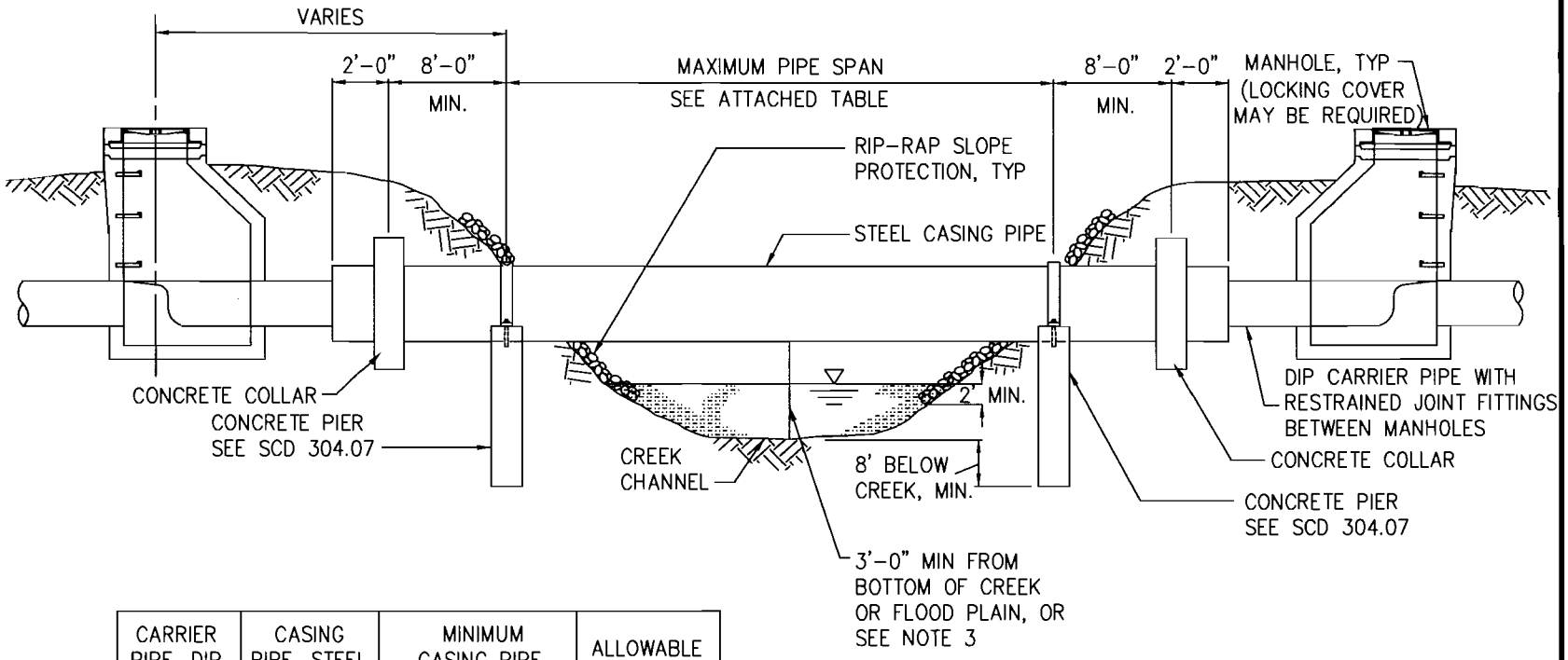
AERIAL PIPE CROSSING TYPICAL PLAN

Approved: W.E.B.
Date: June 10, 2009

304.03

City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

AERIAL PIPE CROSSING
TYPICAL PROFILE



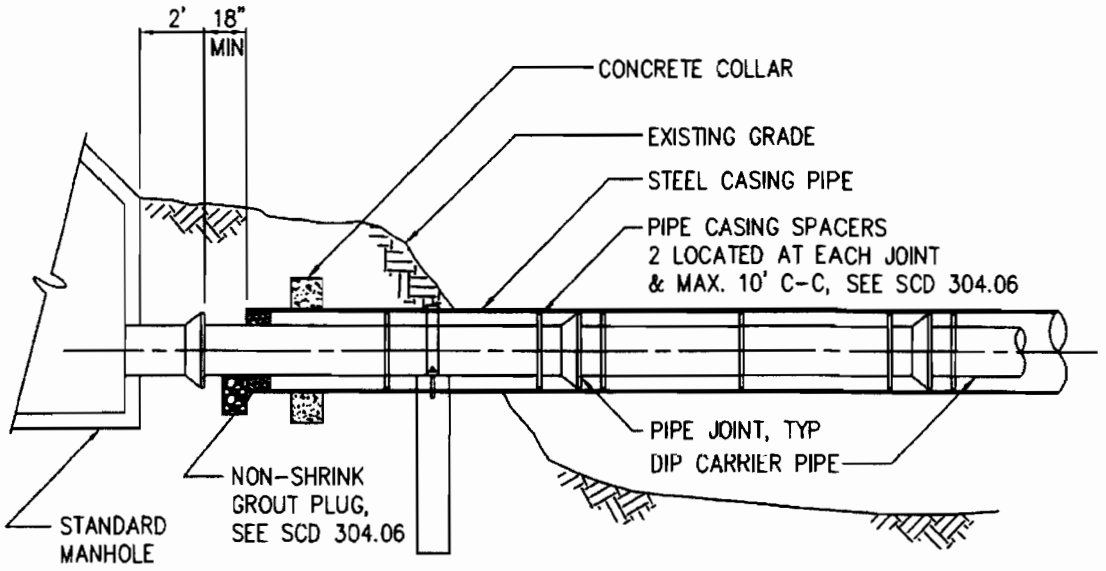
CARRIER PIPE, DIP DIAMETER (IN.)	CASING PIPE, STEEL DIAMETER (IN.)	MINIMUM CASING PIPE WALL THICKNESS (IN.)	ALLOWABLE SPAN (FT.)
8	16	0.2500	45
10	18	0.3125	50
12	20	0.3125	50
14	24	0.3125	55
16	26	0.3750	55
18	30	0.3750	60
20	32	0.3750	60
24	36	0.4375	65
30	42	0.4375	65

NOTES:

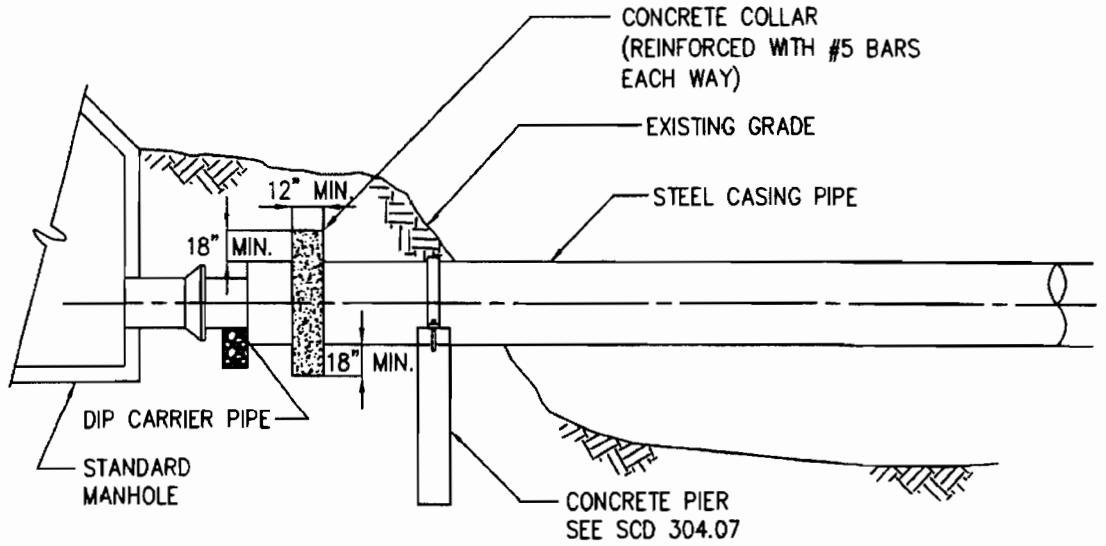
1. STEEL PIPE SHALL BE EITHER SPIRAL WELDED OR SMOOTH WALL SEAMLESS WITH A MINIMUM YIELD STRENGTH OF 35,000 PSI.
2. DUCTILE IRON PIPE SHALL BE SUPPORTED WITH TWO CASING SPACERS AT EVERY JOINT WITHIN THE CASING PIPE USING APPROVED PIPE ALIGNMENT GUIDE. ALL JOINTS SHALL BE RESTRAINED.
3. BOTTOM OF CASING PIPE TO BE AT A MINIMUM OF 1' ABOVE THE 100 YEAR FLOOD ELEVATION.

304.04

Pending
Date: January 26, 2016

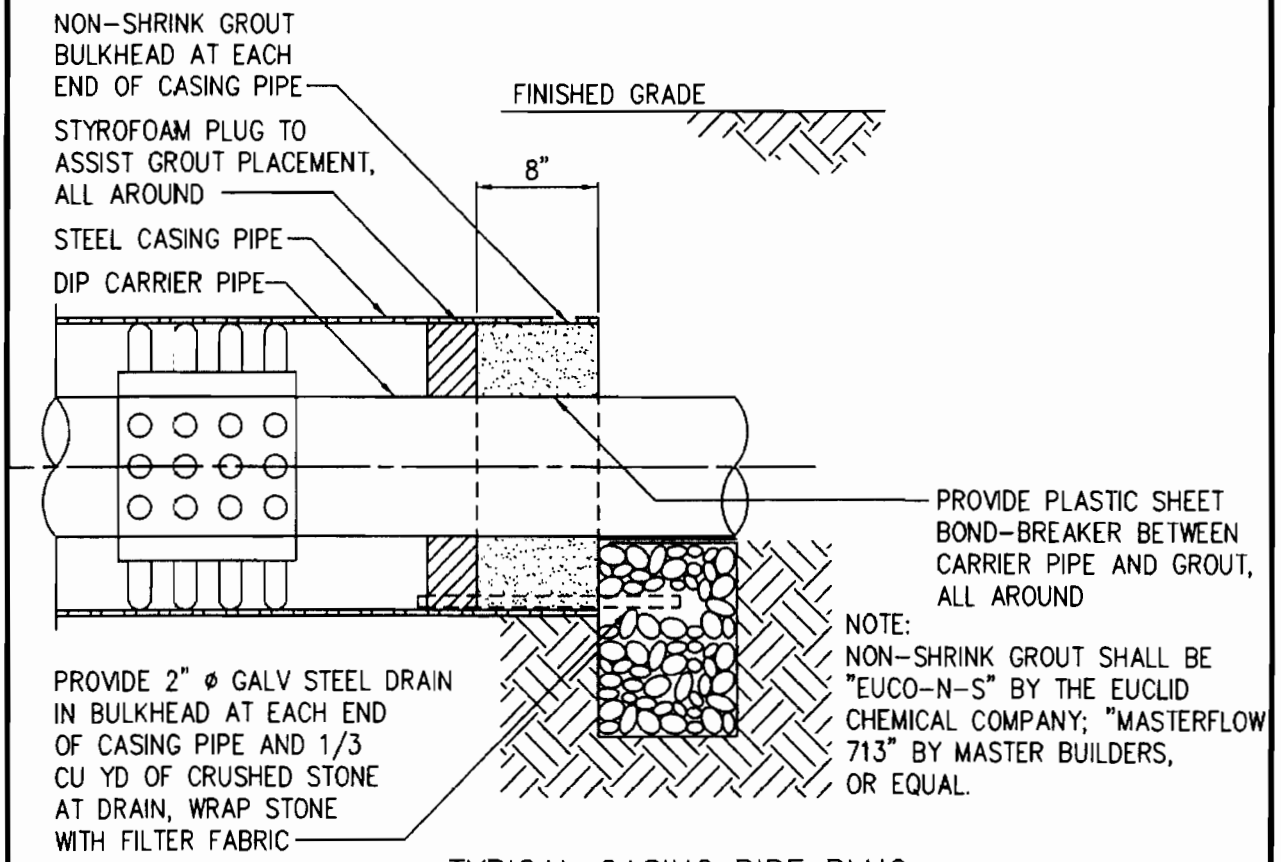


SECTION

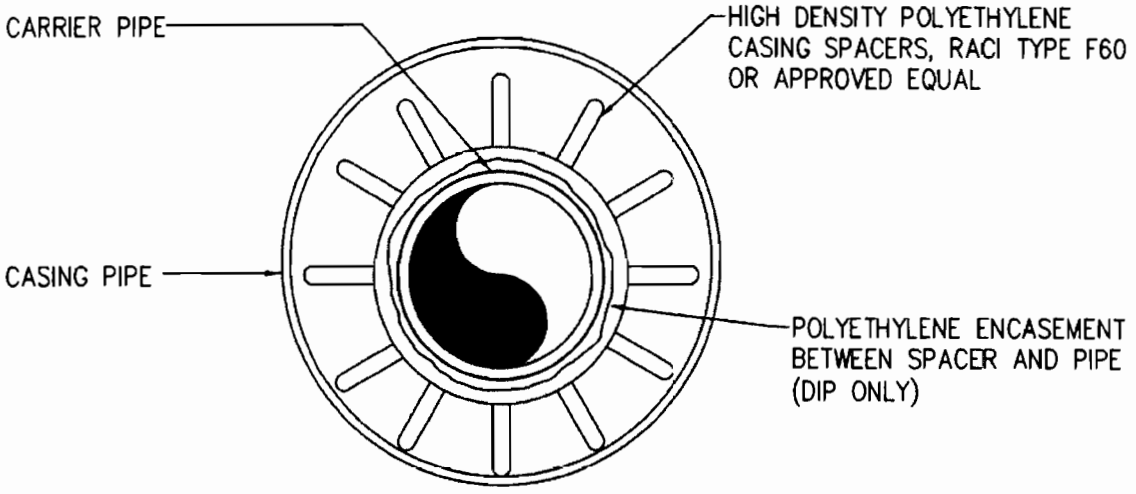


ELEVATION

Wentzville The Crossroads Of The Nation	City of Wentzville Public Works Department Engineering Division 200 East Fourth Street Wentzville, MO 63385	AERIAL PIPE CROSSING TYPICAL PIPE SECTION AND ELEVATION	Approved: W.E.B. Date: June 10, 2009 304.05



TYPICAL CASING PIPE PLUG



PIPE ALIGNMENT GUIDE

Wentzville
Missouri · USA
The Crossroads Of The Nation

City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

AERIAL PIPE CROSSING CASING PIPE DETAILS

Approved: W.E.B.
Date: June 10, 2009

304.06

NOTES:

1. DEPTH OF PIER AND SUPPORT SHALL BE IN ACCORDANCE WITH THE APPROVED PLANS AND GEOTECHNICAL REPORT.

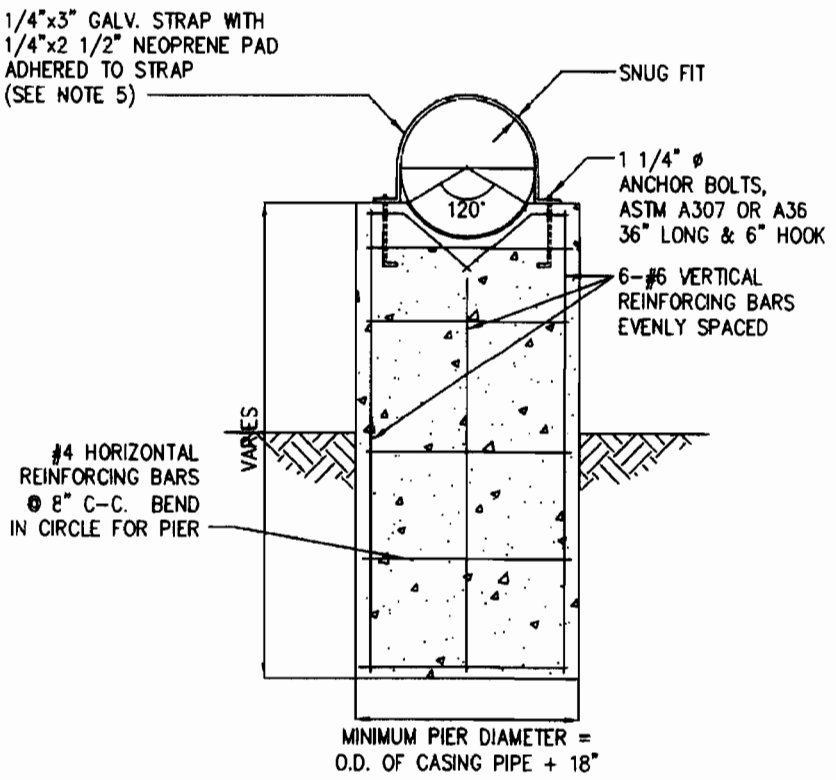
2. IF ROCK IS ENCOUNTERED, PIER SHALL BE SET AS SPECIFIED ON THE APPROVED PLANS AND GEOTECHNICAL REPORT.

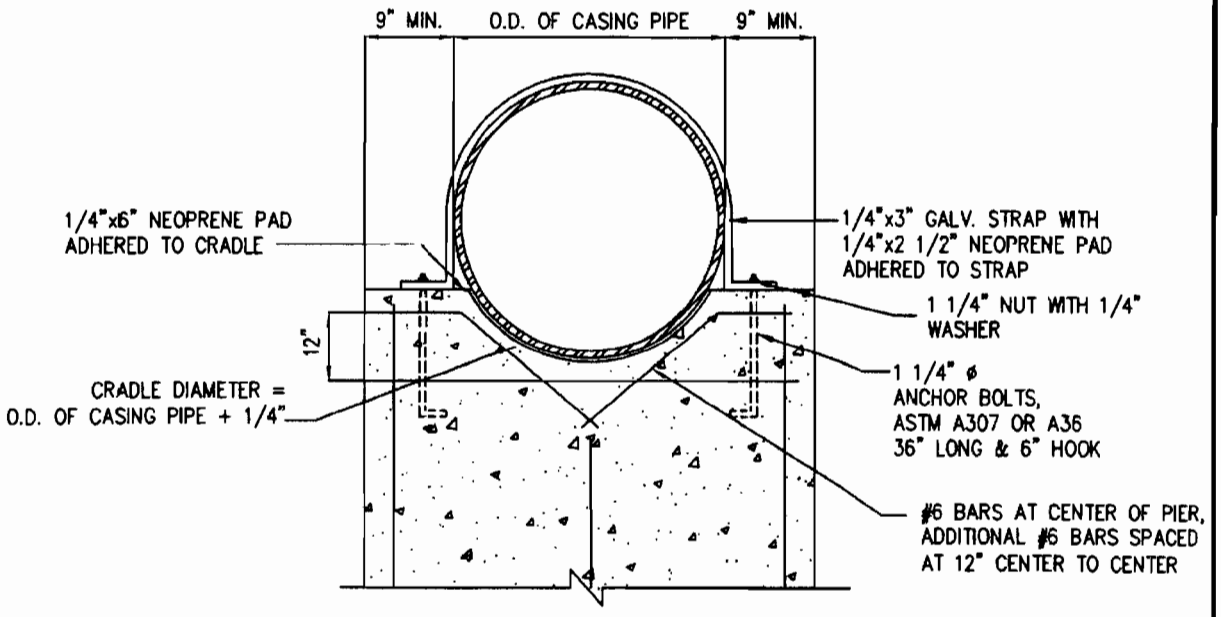
3. ALL SPLICES IN REINFORCING STEEL SHALL BE 30 X BAR DIAMETER IN LENGTH MINIMUM.

4. MINIMUM COVER OVER PRIMARY REINFORCING SHALL BE 2".

5. CONCRETE ULTIMATE COMPRESSIVE STRENGTH OF 3,000 PSI MINIMUM.

6. REINFORCING STEEL SHALL BE GRADE 60.





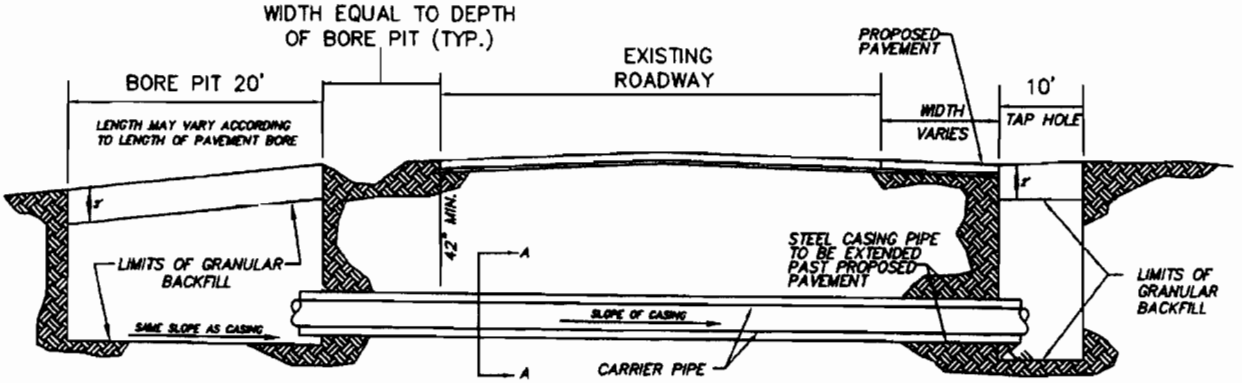
Wentzville
The Crossroads Of The Nation

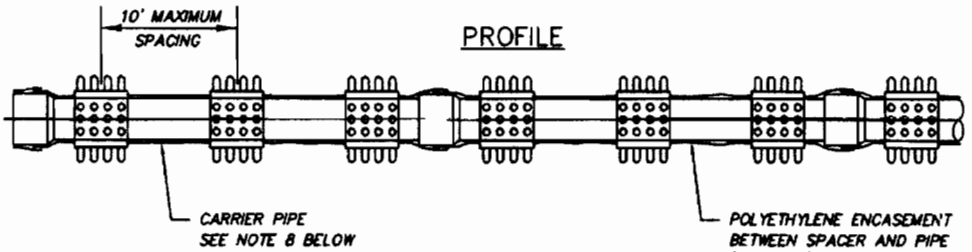
City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

AERIAL PIPE CROSSING CONCRETE PIER DETAIL

Approved: W.E.B.
Date: June 10, 2009

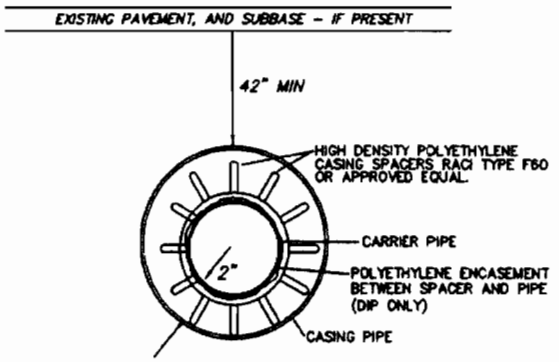
304.07



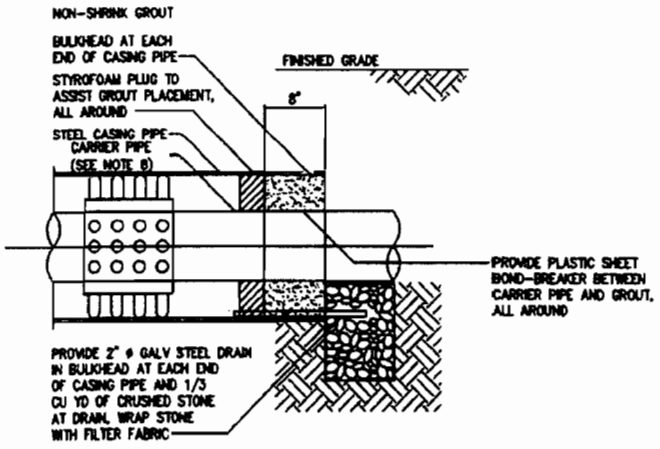


PROFILE

SPACING DETAILS



SECTION A-A



TYPICAL CASING PIPE PLUG

NOTES:

1. DO NOT SCALE DRAWING. FOLLOW DIMENSIONS.
2. ALL JOINTS IN THE CASING PIPE SHALL BE WELDED AND COLE TAR EPOXY COATED.
3. STEEL CASING PIPE USED IN THE INSTALLATION OF WATER OR SEWER MAINS MUST HAVE A MINIMUM YIELD STRENGTH OF 35,000 P.S.I.
4. HIGH DENSITY POLYETHYLENE CASING SPACERS SHALL BE RACI TYPE F60 OR APPROVED EQUAL.
5. POLYETHYLENE SPACERS SHALL BE PLACED EVERY 10 FEET ALONG THE CARRIER PIPE AND 2 AT EVERY JOINT.
6. BORE PIT AND TAP HOLE SHALL BE BACKFILLED WITH GRANULAR BACKFILL.
7. STEEL CASING PIPE SHALL HAVE A MINIMUM WALL THICKNESS AS INDICATED ON THE TABLE BELOW.

CASING PIPE DIAMETER	CASING PIPE MINIMUM WALL THICKNESS
6" THRU 12"	0.188"
14" THRU 22"	0.250"
24" & 26"	0.281"
28" THRU 34"	0.312"
36" THRU 48"	0.344"

8. CARRIER PIPE MATERIAL SHALL BE AS FOLLOWS. FOR WATER MAINS AND SANITARY SEWER FORCE MAINS, THE CARRIER PIPF SHALL BE C906 POLYETHYLENE. FOR SANITARY SEWER GRAVITY MAINS, THE CARRIER PIPE SHALL BE SDR 35 PVC OR DIP.
9. SPACERS MAY BE OMITTED FOR C906 CARRIER PIPE, WHEN APPROVED BY ENGINEERING. IF SPACERS NOT USED, CASING PIPE SHALL BE A MIN. 4" DIA LARGER THAN CARRIER PIPE.

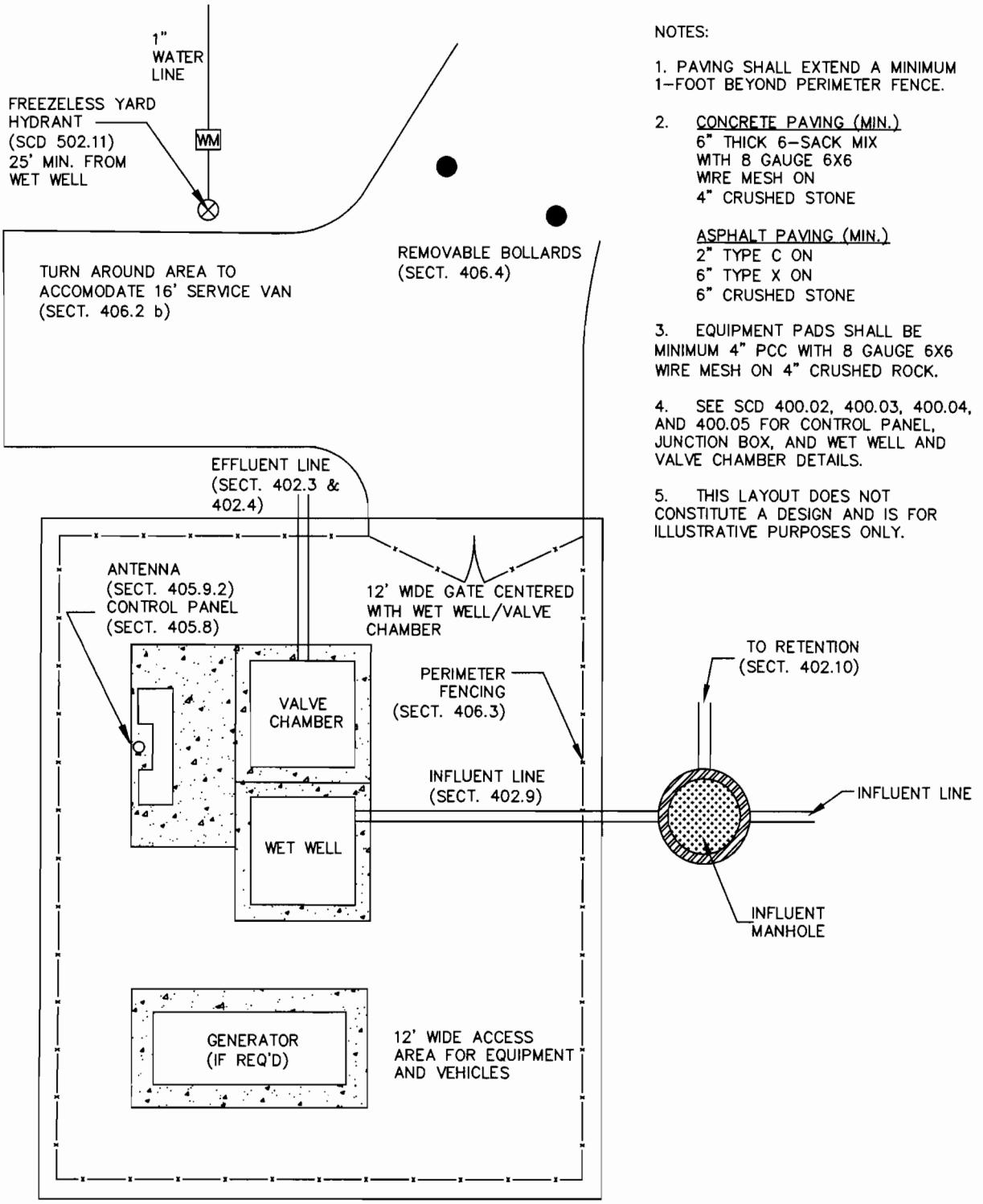
Wentzville
Missouri - USA
The Crossroads Of The Nation

City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

TYPICAL BORE DETAIL

Approved: W.E.B.
Date: June 10, 2009

304.10
502.10



NOTES:

1. PAVING SHALL EXTEND A MINIMUM 1–FOOT BEYOND PERIMETER FENCE.

2. CONCRETE PAVING (MIN.)
   6" THICK 6–SACK MIX WITH 8 GAUGE 6X6 WIRE MESH ON 4" CRUSHED STONE

   ASPHALT PAVING (MIN.)
   2" TYPE C ON
   6" TYPE X ON
   6" CRUSHED STONE

3. EQUIPMENT PADS SHALL BE MINIMUM 4" PCC WITH 8 GAUGE 6X6 WIRE MESH ON 4" CRUSHED ROCK.

4. SEE SCD 400.02, 400.03, 400.04, AND 400.05 FOR CONTROL PANEL, JUNCTION BOX, AND WET WELL AND VALVE CHAMBER DETAILS.

5. THIS LAYOUT DOES NOT CONSTITUTE A DESIGN AND IS FOR ILLUSTRATIVE PURPOSES ONLY.

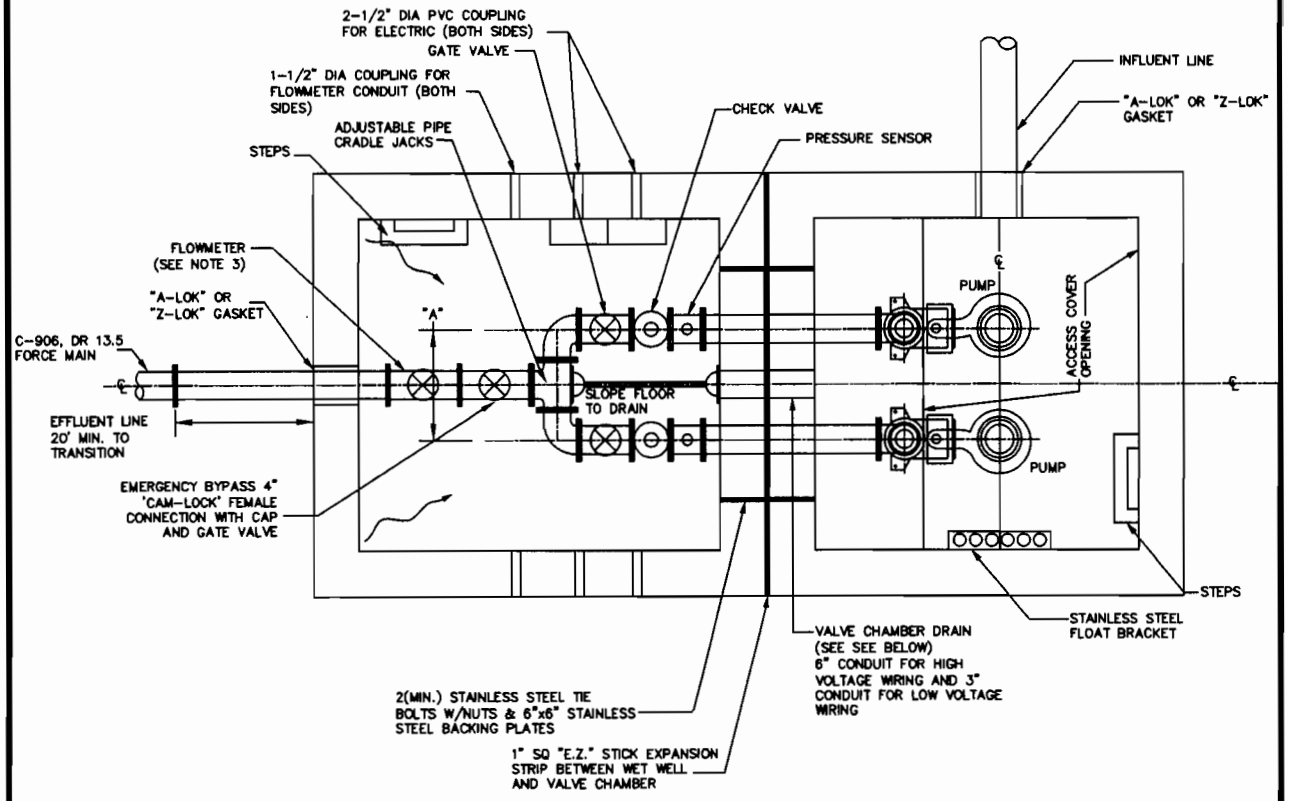
Wentzville
Missouri - USA
The Crossroads Of The Nation

City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

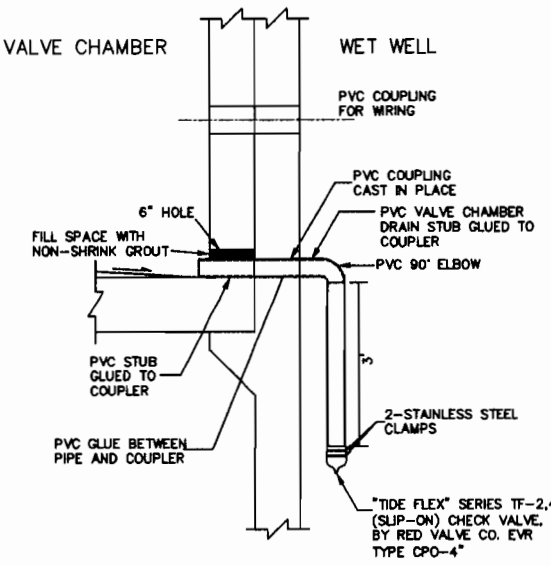
SANITARY SEWAGE PUMP STATION LAYOUT

Approved: BOA
Date: October 15, 2015

400.01



MIN. "A" DIMENSION (INCHES)	PIPE DIAMETER (INCHES)
22	3
26	4
32	6
36	8
44	10
48	12



NOTES:
1. ACCESS HATCHES FOR WET WELL AND VALVE VAULT SHALL BE SIZED PER THE ENGINEERING DESIGN CRITERIA 4.04.01-2 AND AS SHOWN ON THE APPROVED PLANS.
2. LOW VOLTAGE CONDUIT SHALL RUN THROUGH A SEPARATE CONDUIT FROM HIGH VOLTAGE WIRES TO SEPARATE JUNCTION BOXES.
3. FOR PUMPS 25 HORSE POWER AND LARGER, A FLOWMETER IS REQUIRED. PROVIDE 5 PIPE DIAMETERS UPSTREAM AND 3 PIPE DIAMETERS DOWNSTREAM OF FLOWMETER OF STRAIGHT PIPE. (SECT. 405.2.3.Z)

THIS LAYOUT DOES NOT CONSTITUTE A DESIGN AND IS FOR ILLUSTRATIVE PURPOSES ONLY.

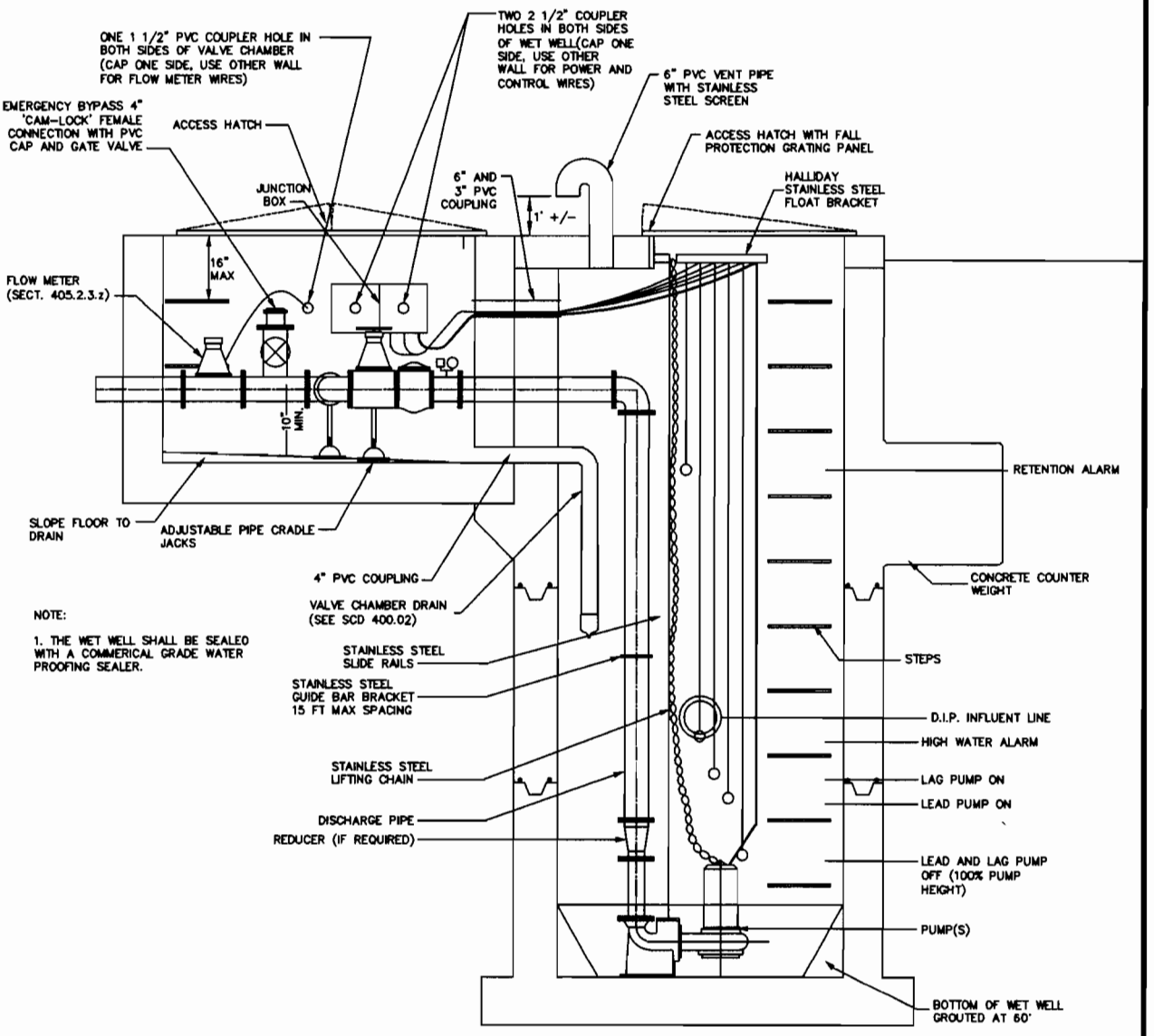
Wentzville
The Crossroads Of The Nation

City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

WET WELL AND VALVE CHAMBER

Approved: BOA
Date: October 15, 2015

400.02



THIS LAYOUT DOES NOT CONSTITUTE A DESIGN AND IS FOR ILLUSTRATIVE PURPOSES ONLY.

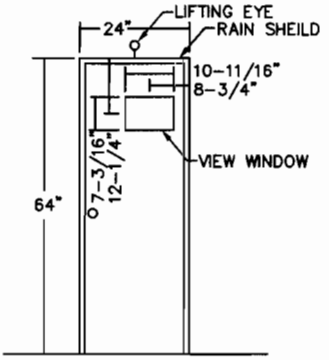
Wentzville
Missouri - USA
The Crossroads Of The Nation

City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

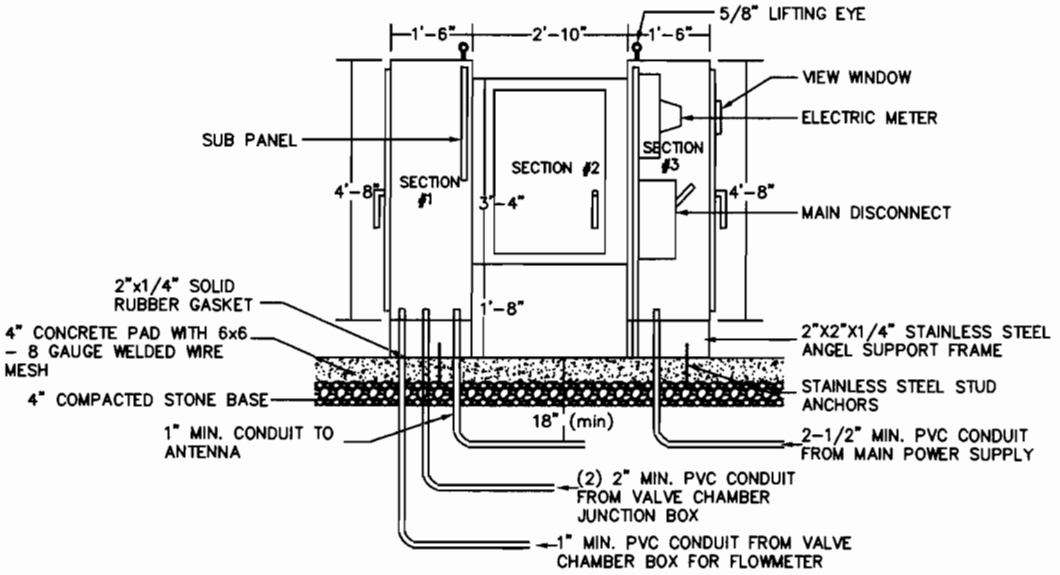
WET WELL AND VALVE CHAMBER CROSS SECTION

Approved: BOA
Date: October 15, 2015

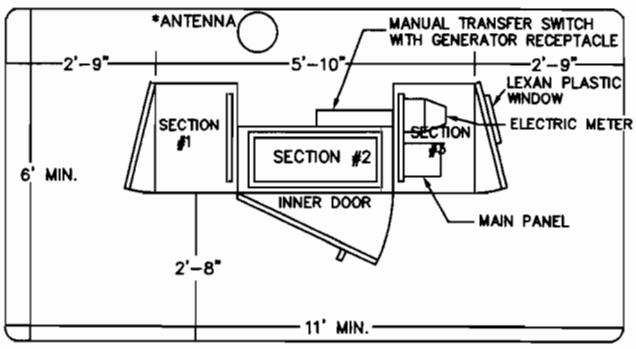
400.03



FRONT OF SECTION #3



ELEVATION VIEW



PLAN VIEW

*NOTE: ANTENNA MAY BE LOCATED DIRECTLY BEHIND THE CONTROL PANEL AND POURED MONOLITHICALLY WITH CONTROL PANEL PAD.

THIS LAYOUT DOES NOT CONSTITUTE A DESIGN AND IS FOR ILLUSTRATIVE PURPOSES ONLY.

Wentzville
Missouri - USA
The Crossroads Of The Nation

City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

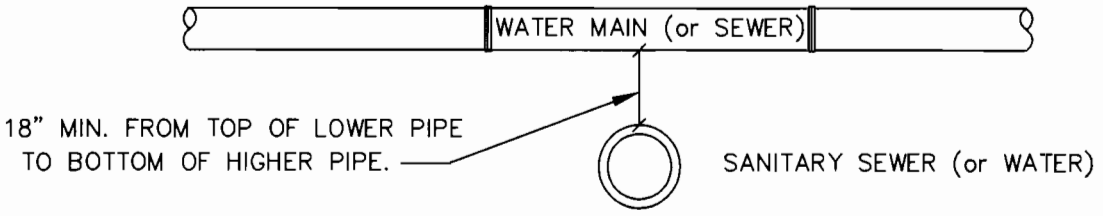
PUMP STATION CONTROL PANEL

Approved: BOA
Date: October 15, 2015

400.04

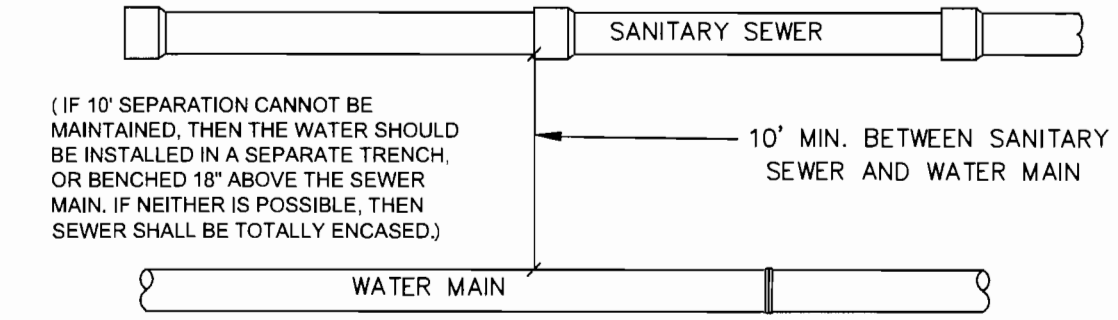
CENTER PIPE LENGTH

NOTE: HDPE PIPE DOES NOT HAVE JOINTS, EXCEPT AT VALVES.



STANDARD VERTICAL SEPARATION

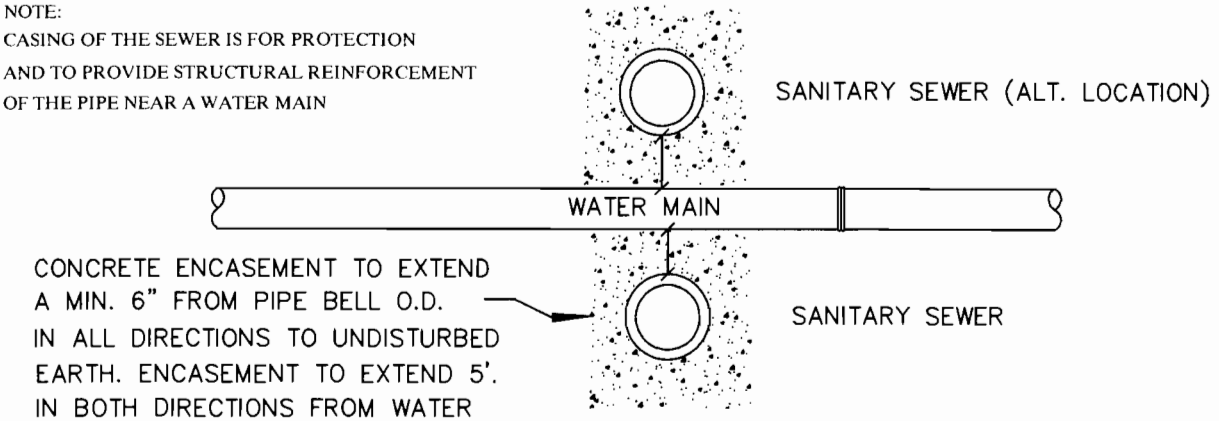
N.T.S.



STANDARD HORIZONTAL SEPARATOIN

N.T.S.

NOTE:
CASING OF THE SEWER IS FOR PROTECTION AND TO PROVIDE STRUCTURAL REINFORCEMENT OF THE PIPE NEAR A WATER MAIN



LESS THAN 18" SEPARATION

N.T.S.

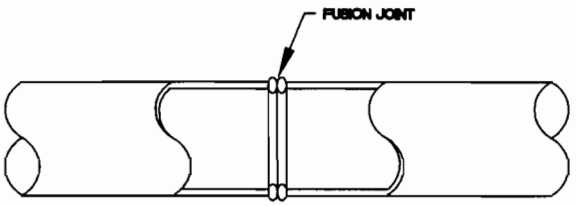
Wentzville
Missouri - USA
The Crossroads Of The Nation

City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

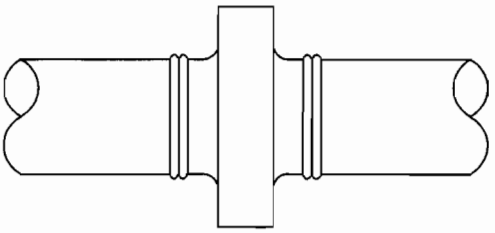
STANDARD WATER & SEWER SEPARATION

Approved: BOA
Date: October 15, 2015

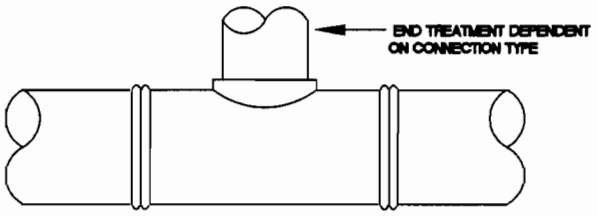
502.02



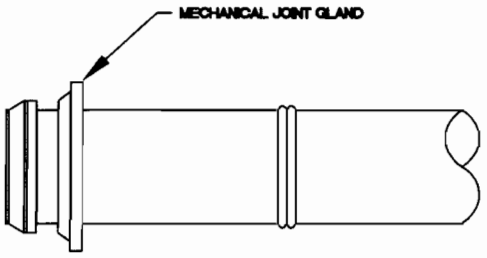
TYPICAL BUTT FUSION JOINT



THRUST–ISOLATOR / ANCHOR RING



TYPICAL FUSION TEE



TYPICAL M.J. ADAPTER

NOTES:

1. ALL JOINTS SHOULD BE BUTT FUSION JOINTS. THE USE OF ELECTROFUSION CONNECTIONS WILL ONLY BE APPROVED ON THE BASIS OF SITE CONDITIONS ON A CASE BY CASE BASIS BY THE ENGINEERING DEPARTMENT.

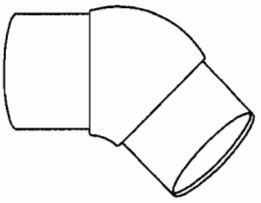
2. ALL CONNECTIONS TO VALVES SHALL BE MADE WITH MECHANICAL JOINTS. POLYETHYLENE WATER MAIN CONNECTION SHALL BE C906 MECHANICAL JOINT ADAPTER.

3. ALL TEES, REDUCERS AND BENDS SHALL BE MADE WITH POLYETHYLENE (C906) FITTINGS AS REQUIRED IN THE SPECIFICATIONS. CONNECTION TO THE C906 FITTINGS WILL BE MADE BY BUTT FUSION.

4. FABRICATED FITTINGS ARE NOT ALLOWED WITHOUT PRIOR APPROVAL FROM THE ENGINEERING DIVISION.

5. FITTINGS SHALL BE LOCATED A MINIMUM OF 3 FEET FROM THE NEXT CLOSEST FITTING.

6. ELECTROFUSION COUPLINGS MAY ONLY BE INSTALLED WITH THE APPROVAL OF THE ENGINEERING DIVISION AND WHEN APPROVED SHALL BE INSTALLED AT LEAST 3 FEET FROM THE NEAREST FITTING.



45° BEND

REDUCER

Wentzville
Missouri - USA
The Crossroads Of The Nation

City of Wentzville
Public Works Department
Engineering Division
200 East Fourth Street
Wentzville, MO 63385

STANDARD
C906 JOINTS & FITTINGS

Approved: BOA
Date: October 15, 2015

502.03