GRAVITY SANITARY SEWER SPECIFICATIONS SECTION 0 - GENERAL REQUIREMENTS PART 1 - GENERAL OVERVIEW

1.01 Definitions - For the purposes of these Gravity Sanitary Sewer Specifications ("Specifications") the following definitions shall apply À. "HSE" shall mean Hamilton Southeastern Utilities, Inc., the public utility which provides sanitary sewer service in the Project (as hereafter defined) area. HSE's address is 11901 Lakeside Drive, Fishers, Indiana 46038, and HSE's phone number is and in a timely manner as directed by the Engineer. (317) 577-2300. . "Engineer" shall mean the engineer for HSE, which is Sanitary Management & Engineering Company, Inc. ("SAMCO") or SAMCO's engineers. SAMCO's inspector shall be the Engineer's representative during construction of the Project. SAMCO's address is 11905 Lakeside Drive, Fishers, Indiana 46038, and SAMCO's phone number is (317) 577-1150.

"Subscriber" shall mean those signatories identified as Subscribers under a Special Contract for Extension of Sewer Mains and Facilities with HSE through which the Project is being undertaken. Subscriber is generally the Owner under a construction contract. This definition is intended to include all employees and/or agents acting in the interest of the Subscriber.

. "Contractor" shall mean any construction contractor approved by HSE to construct, install, maintain, repair and remove public or Private (as hereafter defined) Sanitary Sewer Facilities (as hereafter defined) within the HSE service area. This definition is intended to include all employees, sub-contractors and/or agents acting for or on behalf of the Contractor or the Contractor's company. E. "Design Engineer" shall mean the engineer sealing the Construction Plans (as hereafter defined), as opposed to the Engineer for HSE and the Record Drawing Engineer, both of whom are also defined under these Specifications. This definitio is intended to include all employees, sub-contractors and/or agents acting for or on behalf of the Desian Engineer or the Desian Engineer's company.

. "Record Drawing Engineer" shall mean the engineer who will certify the record drawings, as opposed to the Engineer for HSE and the Design Engineer, both of whom are also defined under these Specifications. The Record Drawing Engineer and Design Engineer may be the same person or represent the same company. This definition is intended to include all employees and/or agents acting for or on behalf of the Record Drawina Engineer or the Record Drawing Engineer's company. G. "Project" shall mean any Sanitary Sewer Facilities constructed under a distinct set of contract documents and shall include all work necessary for the Complete (as hereafter defined) and operable installation of all Sanitary Sewer Facilities and appurtenances in conformity with the HSE approved Construction Plans and the standards, specifications and details of HSE.

H. "Sanitary Sewer Facilities" shall mean any pipes, manholes, flow monitoring/metering manholes, clean-outs, arease traps, arit traps, oil/water separators, neutralization tanks, wyes, laterals and any other appurtenances which convey or process sanitary sewage. "Conveyed" with regards to Sanitary Sewer Facilities means Projects for which HSE has received title.

I. "Private" with regards to Projects shall mean Projects from which sewage flows into HSE's Sanitary Sewer Facilities, but for which title for the Sanitary Sewer acilities is not to be Conveyed to HSE. . "Completed" with regards to Projects shall mean any Projects which are acceptably constructed, tested and through which customer service has been

authorized by HSE, but for which HSE has not received title. All applicable fees must be paid to HSE and all requirements specified in HSE's "Sanitary Sewer Completion Specifications" must be addressed prior to a Project being deemed Completed "Construction Plans" shall mean primary plats, secondary plats, sets of

construction drawings, architectural plans, shop drawings, landscaping plans, record drawinas. easements. deeds. covenants and restrictions, contract documents and any other documentation to be submitted for the Project under these Specifications and HSE's "Design Specifications for Sanitary Sewer Facilities" Construction Plans must meet the applicable standards in effect at the time the documents are submitted. M. "Completion Documentation" shall mean record drawings and other

documentation to be submitted under HSE's "Sanitary Sewer Completion Specifications". Completion Documentation must meet the applicable standards in effect at the time the documents are submitted.

The purpose of these Specifications is to define the standards for engineering design, construction specifications and construction practices related to the Project which will allow for the orderly and proper installation of Sanitary Sewer Facilities constructed within HSE's service area.

1.03 Applicability These Specifications are applicable for all public and Private Sanitary Sewer These Specifications are applicable for all public and Private Sanitary Sewer System. This inc Facilities which will be connected to HSE's sanitary sewer system. This includes Private Projects which will not initially be connected to HSE's sanitary sewer system but at some future date may be connected to the system. 1.04 Liability and Costs for Project

No direction, field directive or other instruction contemplated by these Specifications and/or conducted by others shall accrue any liability, charge or cost to HSE, Engineer or Engineer's inspectors.

1.05 Standards, Specifications and Details A. HSE's Gravity Sanitary Sewer Details sheet, Duplex/Initial Triplex/Triplex Lift tation Plan sheets, Lift Station and Force Main Details sheet, Lift Station and Force Main Specifications sheets, Standards for Design and Construction of Building Sewers, Rules and Regulations, Master Plan, Design Specifications for Sanitary Sewer Facilities and Sanitary Sewer Completion Specifications are integral parts of these Specifications. The Contractor should become familiar with these documents prior o construction of any Sanitary Sewer Facilities within HSE's service area. . These Specifications, HSE's Gravity Sanitary Sewer Details sheet and HSE's Desigr Specifications for Sanitary Sewer Facilities are complementary in nature and should not be interpreted individually. C. These Specifications and HSE's Gravity Sanitary Sewer Details sheet, Master Plan and other standards, specifications and details are subject to revision at any time prior to the start of construction of the Project. These documents are also subject to revision at any time during construction when, in Engineer's opinion, those revisions materially affect the maintenance, operation or life of the Project. All such revised documents must replace the corresponding documents in the Construction Plans at the time when provided to the Contractor. D. HSE reserves the right to modify or waive any of these Specifications and/or it aster Plan and other standards, specifications and details in its best interest. . These Specifications are intended to define the construction requirements of

Sanitary Sewer Facilities which are constructed and operated under typical conditions in HSE's service area. Depending on field conditions and the omposition and characteristics of the sanitary sewer flow, different or unusual conditions may occur which cannot be anticipated in a document of this nature. ngineer may impose additional or special construction requirements under these 1.06 Drawing Discrepancies and Omissions A. Prior to the start of construction, the Contractor must notify Engineer of any

conflicts between the Construction Plans, any supplemental information supplied b HSE and/or these Specifications. Resolution of any such conflict will be at the Engineer's sole discretion. B. Any items which are not covered in the these Specifications, the Construction Plans or HSE's other standards, specifications and details, but are required for construction of this Project, must be approved by Engineer prior to installation ar must be made a part of this contract C. If construction practices are not described, but in the Engineer's opinion, will affect the quality of construction or long term maintainability of the Sanitary Sewer Facilities, then the Engineer must approve any construction practices proposed by the Contractor.

1.07 Governing Laws, Codes and Regulations A. Construction practices must meet all applicable laws, codes or regulations and be in accordance with the requirements of all governmental agencies and public

entities having jurisdiction. 3. These Specifications shall not be considered as a substitute, nor shall supersede any state or federal law, code or regulation related to the Project. In the event of a conflict between any state or federal law, code or regulation governing the Project and these Specifications, the more stringent requirement will apply. C. All persons on site must abide by all Indiana Occupational Safety and Health Administration ("IOSHA") standards including but not limited to "General Construction Practices" and "Trench Safety Standards."

1.08 Notices All notices required by these Specifications must be given to both HSE and Engineer at their respective business offices.

PART 2 - GENERAL CONSTRUCTION REQUIREMENTS

2.02 Submittals

Sanitary Sewer Facilities.

A. These Specifications cover all work necessary for the installation of Sanitary Sewer Facilities, access drives and other appurtenances to convey sewage to the receiving sewer in an acceptable and operable manner. B. Contractor must provide all necessary work to install the Sanitary Sewer acilities in a Complete manner in accordance with the Construction Plan C. All pipe, fittings and appurtenances must be the size, type, classification and grade shown on the Construction Plans and must meet all requirements of these ations. D. Contractor must not substitute materials which differ from the approved Construction Plans unless approved by Engineer. E. All pipe and fitting sizes and all references to pipe diameter on the Construction 2.12 Utilities Plans or in these Specifications are intended to be nominal size or diameter and must be interpreted as such. F. If a material type is shown on the Construction Plans, the material type must describe a general category of materials meeting these Specifications

. Contractor must submit only one model number or type per item for approval. Multiple submittals of model number or type for a single item will be cause for rejection of the shop drawing. B. Before delivery of products to the site (for standard yard stocked items) or before fabrication (for items which are not standard yard stocked items), Contractor must provide submittals to, and obtain acceptance from. Engineer ittals must be thoroughly reviewed by Contractor and certified to meet these Specifications (with all exceptions explicitly indicated) prior to submission to Ingineer. C. Certified copies of test reports on factory tests.

. Where required by the applicable manufacturing standards, provide a copy of th manufacturer's inspection or test report and a certified statement by the manufacturer that the material has been sampled, tested and inspected in accordance with the applicable manufacturing standards. 2. All factory inspections, tests and record keeping identified as mandatory or equired under the applicable standards for each product are required under these Specifications. Factory inspections and tests, which are identified as optional under applicable manufacturing standards, are not required unless otherwise specifically indicated in the Construction Plans or these Specifications. 3. An authorized agent of the manufacturer or distributor must sign each

certification and repor D. Catalog cuts with product data, including details of manufacture, for all manufactured items E. Manufacturer's recommendations on all materials and methods of installation. . Forms of warranty. G. Operation and maintenance instructions for all mechanical and electrical equipment. H. Contractor must provide to HSE copies of all contracts, invoices, statements

material lists, payment requests and all other related documents pertaining to the construction cost of the Project. The above documents must be provided monthly, A. Install all products in strict accordance with manufacturer's recommendations unless otherwise determined by HSE. I. Submit any other items required by the Engineer. 2.03 Initiation of Construction

. Construction Plan approval will be an authorization to proceed with construction of the Project, however, it shall not be construed as authority to violate, cancel of set aside any of HSF's requirements or the laws codes regulations and permit processes of governmental agencies or public entities. Approval will be evidenced by an "Approved Hamilton Southeastern Utilities, Inc." stamp on the Construction B. Construction Plan approvals will be valid for a period of six (6) months from

the date of the approval stamp. Extensions of this time limit may be requested from Engineer if extenuating circumstances exist. Engineer's decision regarding time extensions will be final C. Prior to start of construction, Design Engineer must receive formal written

approval from Engineer. At this time, Designe Engineer must have supplied Engineer with final complete set of Construction Plans as digital PDF or AutoCAD files. D. Contractor will not be permitted to initiate construction until the Construction Plans are formally approved and the Subscriber has entered into all necessary agreements and authorizations with, and all required fees have been paid to. HSE E. Contractor will not be permitted to initiate construction until all off-site easements have been reviewed, approved and recorded by Engineer. F. ALL Rough grading (on and off site) must be finished to within one (1) foot of final grade and verified by Engineer prior to the start of construction of the

G. The pipe lavers and foreman (superintendent) assigned to the Project must be approved by HSE prior to the start of construction I. Notice must be provided to Engineer twenty—one (21) days prior to the initiation . A pre construction meeting is required between the Engineer and Contractor prior to the initiation of construction. The pre-construction meeting must be completed no more than fourteen (14) days prior to the start of construction.

2.04 Continuity of Construction A. Once construction has commenced, the Project must be Completed promptly Contractor can not discontinue work on the Project, except for weather delays. without written approval from the Engineer and in this case no sanitary sewer structures including manholes, flow monitoring/metering manholes, clean-outs, grease traps, grit traps, oil/water separators, neutralization tanks, etc. ("Manholes") can be left open and incomplete.

A. The Engineer has the authority to direct the issuance of an order requiring the suspension of the pertinent construction activity ("Stop Work Order") whenever it is determined that construction activity: proceeding in an unsafe manner

Is proceeding in violation of a requirement or specification of the HSF s proceeding in a manner which is materially different from the application, lans, or supporting documents; or 4. For which a permit is required is proceeding without such a permit being in force. In such an instance, the stop work order shall indicate the effect of the order is terminated when the required permit is issued. The Stop Work Order shall be in writing by the HSE and shall state to what construction it is applicable and the reason for its issuance. One (1) copy of the Stop Work Order shall be conspicuously posted on the property, and one (1) copy shall be delivered via mail to the owner of the property or their agent. The Stop Work Order shall state the conditions under which construction may be resumed If a Stop Work Order is issued, the contractor shall restore the site to a safe condition prior to stopping the work pursuant to the order. The sanctions provided in this section shall in no way limit the imposition of penalties provided elsewhere in these Specifications.

2.06 Confined Space Entry All persons, including but not limited to Subscribers, Contractors, sub-contractors. Design Engineers, Record Drawing Engineers and surveyors must abide by HSE's 'General Procedures for Manhole Opening and Entry" or the most recent IOSHA confined space entry standards, which ever is more stringent.

A. The Project site must, at all times, be kept free of trash, rubbish, unsightly materials and other nuisances. B. All streets, alleys, pavement, parkways and private property must be thoroughly cleaned each day of all surplus materials, earth and rubbish placed thereon by the Project site must be cleaned at the end of each work day. Trash receptacles must be provided as necessary to dispose of waste items.

Product Delivery, Handling and Storage . The Contractor is responsible for the delivery, storage and handling of products. 3. Deliver products with manufacturer's tags and labels intact. Handle products in accordance with manufacturer's recommendations and with extreme care so as not to damage or shock. Load and unload all products by noists or skidding. Do not drop products. Do not skid or roll products on or against other products. Slings, hooks and pipe tongs must be padded.). Keep stored products safe from damage or deterioration in accordance with manufacturer's recommendations. Keep the interior of products free from dirt or foreign matter. Drain and store products in a manner that will protect them from damage by freezing. Store electronic and electrical products in a manner that will protect them from freezing and weather. Do not stack products unless allowed by the manufacturer's requirements. Store gaskets and other products affected by sunlight in a cool location out of direct sunlight. Gaskets must not come in ct with petroleum products. Use gaskets on a first-in, first-out basis . Promptly remove damaged or defective products from the Project site. Replace damaged or defective products with acceptable products. Contractor is responsible for verifying that the materials are free of defects and are the proper type, classification, grade, etc. complying with the Construction Plans and/or HSE's standards, specifications and details.

2.09 Quality Assurance A. The Contractor must test and perform quality assurance requirements on all Sanitary Sewer Facilities in accordance with these Specifications 3. Execute work in conformance with applicable sections of the latest published editions of American Association of State Hiahway and Transportation Officials ("AASHTO"), American National Standards Institute ("ANSI"), American Society of Mechanical Engineers ("ASME"), American Society for Testing and Materials ("ASTM") and American Water Works Association ("AWWA") standards or as indicated in these Specifications and/or the Construction Plans, whichever is more stringent. All Sanitary Sewer Facilities must be new and unused

Line and Grade Requirements The Contractor must provide assurance to the Engineer that the sewer is laid ccurately to the required line and grade as shown on the Construction Pla ne Contractor must constantly check horizontal and vertical alignment of the gravity sewer. Contractor may install either main line pipe between three (3) manhole structures or to a manhole structure which is one thousand (1000) lineal feet of main line pipe from the last verified (as-built) manhole structure, which ever is of the areater distance. The Contractor must coordinate verification of the Sanitary Sewer Facilities with the Record Drawing Engineer so as to provide an as—built record set as described later in these Specifications. Verification is defined as certification by an appropriately registered Indiana professional as to actual invert elevation, length of pipe and slope. Construction is not permitted to continue until the above stated erification conditions are satisfied. Variations from a uniform line and grade as shown on the Construction Plans and as described below are cause for the pipe to rejected and re-laid in compliance with the Construction Plans. The variance from design line and grade between manhole structures can not be greater than one thirty-secondth (1/32) of an inch per inch of pipe diameter, not to exceed one half (0.5) inch total: provided that such variation does not result in a level or reverse sloping of the pipe between joints; provided also that the variation in the invert elevation between adjoining ends of pipe, due to on-concentricity of joining surface and pipe interior surfaces, does not exceed one sixty-fourth (1/64) inch per inch of pipe diameter or one half (0.5) inch

. Engineer will not accept gravity sanitary sewers below minimum slope as Reconstruction of the sanitary sewers may be required at the utility's discretion.

2.10 Inspection and Rejection of Materials A. The quality of all materials, the process of manufacture and the finished ct are subject to inspection and acceptance by the Engineer. Such inspection

may be made at the place of manufacture and/or on the work site after delivery. ne products are subject to rejection at any time for failure to meet any of the manufacturer's specifications even though samples may have otherwise been iccepted as satisfactory Immediately prior to being incorporated into the Project, each product must be arefully inspected, and those not meeting these Specifications and HSE's Gravity Sanitary Sewer Details sheet will be rejected, immediately removed from the site nd replaced at Contractor's sole expense. . Contractor must not repair, or permit manufacturer to repair, any pre-cast ncrete structures with exposed steel or welded wire fabric reinforcemer Pre-cast reinforced concrete structures, risers and tops are subject to rejection or failure to conform with, but not limited to, any of the following requirements: . Fractures or cracks passing through the shell with a depth greater than or equal to one (1) inch. Defects that indicate imperfect proportioning, mixing and molding. Surface defects indicating honeycombed or open texture. Damaged ends where such damage would prevent making a satisfactory joint. Infiltration into the structure. . The internal diameter of the structure must not vary more than one (1) percent the nominal diameter. . Not clearly marked with date of manufacturer, trade name, size designation, ASTM number, etc 8. Having any visible steel bars or wire mesh along inside or outside surfaces of the structure

Evidence of patching. 2.11 Relation to Wells and Water Supplies

A. Sewers must be laid at least ten (10) feet horizontally from any existing or specific conditions prevent this separation, the Contractor must notify the Engineer for specific instructions. 3. Whenever the sewer crosses a water main, it should be laid at least eighteen

(18) inches below the main. When the above conditions cannot be obtained, the sewer must be constructed of ANSI/AWWA C905 waterworks arade pvc pipe SDR 21 PVC (ASTM D 2241) pressure sewer pipe or ANSI/AWWA C900 with compression fittings. The joints must be located qual distance in both directions from the water main. The sewer must be the type of pipe described above for a minimum of ten (10) feet beyond the cross point. pecial structural support for the water main and sewer may be required.). Sewer/water supply separations and pipe classifications must conform with the atest edition of the Indiana State Board of Health's ("ISBH") "On-Site Water Supply and Wastewater Disposal for Public and Commercial Establishments -

A. All existing utility systems that conflict with the construction of the Project which can be temporarily removed and replaced, must be accomplished at the expense of the Contractor. Work must be done by the respective utility unless

tility approved in writing that the Contractor can do the work. Permanent Relocation of Utilities Except as otherwise noted on the Construction Plans, it is the responsibility of the Contractor to move or pay for moving all utility appurtenances, including but not limited to, water mains, storm sewer inlets, gas lines, wire lines, service connections, water and aas meter boxes, water and aas valve boxes, light and raffic standards, cable ways, signals, etc. located in the public right—of—way or private easement which would permanently interfere with the Project. 2. It is understood and agreed that the Contractor has considered in his bid all of the permanent and temporary utility appurtenances shown or otherwise indicated on the Construction Plans. It is also understood and agreed that no additional sation will be allowed for any delays, inconvenience or damage sustained by the Contractor due to any interference from said utility appurtenances or the operation of moving them either by the respective utility company or the Contractor.). The Contractor must provide, at Contractor's expense, all electrical and aas

energy, water service (including water for flushing and testing) and telephone service required for the Project until the Project is Completed 13 Installation Service . The service of an experienced installation representative of the manufacturer

must be provided for a minimum of ten (10) days at no additional cost to the Subscriber. The representative must be available when installation problems arise, when requested by the Engineer to resolve installation problems or during testing B. The manufacturer of any Sanitary Sewer Facilities may be required to provide installation advice on bedding, haunching and backfill to the Contractor's work force. Engineer will determine the need for these services based on the experience of the Contractor's work force or field conditions encountered during construction 2.14 Product Installation

and these Specifications in a neat and workmanlike manner. B. Bring all conflicts between the manufacturer's recommendations and these ons to the attention of Engineer and obtain direction from Engineer as to the resolution of any conflict in installation directives.

2.15 As-Built Record Set A. Contractor must maintain, during the course of the Project, an up-to-date plan set which accurately reflects the actual, as—built dimensions, materials of construction, horizontal location, vertical elevation and other relevant information cessary to develop a set of as-built record drawinas in accordance with HSE's 'Sanitary Sewer Completion Specifications". As-built horizontal locations are required on all Manholes, wyes, lateral markers and end of stubs (if greater than twenty (20) feet). As-built vertical information is required for all Manhole top of casting/invert elevations, clean-out top of casting elevations and upstream invert elevation of stubs (if greater than twenty . Failure to provide as—built information as specified in HSE's "Sanitary Sewer Completion Specifications" may require excavation by the Contractor to obtain this

2.16 Completion Documentation A. HSE's "Sanitary Sewer Completion Specifications" specify the requirements which must be met prior to the time the Project is placed into service.

B. Contractor and Record Drawing Engineer must provide to HSE and Engineer in ubscriber's name the necessary Completion Documentation for the Project, including record drawings and a digital file. At the end of construction, Engineer will provide a Record Drawing Notification to the Subscriber and Record Drawing Engineer. Completion Documentation, including record drawings in a digital file ormat, must be delivered by Contractor and Record Drawing Engineer in the name of Subscriber to Engineer within thirty (30) days of the date of this notification. f the Completion Documentation has not been provided within sixty (60) days of the date of this notification. HSE will procure the services necessary to generate of therwise acquire the record drawings and other Completion Documentation at Subscriber's expense. . On a daily basis, Utility Inspector and Contractor must digitally submit a HSE Lateral Location form to HSE Utilities INC. Engineer detailing all wye connections, pipe type, stationing and pipe grade. Prior to being submitted, HSE Utility's Inspector and Contractor must digitally sign the Lateral Location Form. The aswilt location of the wye station can be supplied by measuring along the pipe section and assigning a station to each connection from the nearest downstream manhole structure. An accuracy of two (2) +/- feet is required. D. Record Drawing Engineer must also submit Sanitary Sewer Record Drawing nformation sheets or field notes for all Manholes that have not been prev as-built. These sheets must be submitted to Engineer within fourteen (14) days f the Record Drawing Notificatior

3.05 Punch Lists E. Contractor must complete all outstanding items detailed in Engineer's A. After all testing has been successfully completed. Engineer will perform an inspection of the Sanitary Sewer Facilities and provide Contractor a written correspondence and supply all necessary information (including, construction cost nentation, with all applicable change orders, Sanitary Sewer Inventory form, summary of items, or punch list, which reauire corrective action. 3. Contractor must complete all punch list items within twenty-one (21) days of Lateral Location forms, television logs, etc.) to Engineer within thirty (30) days. Contractor must also provide timely responses to Record Drawing Engineer for issuance. If in the opinion of the Engineer, the punch list has not been completed, then the Contractor must pay HSE \$100 per day damages until the questions associated with constructed conditions including, pipe sizes, pipe types, ontal location of concrete encasement/capping and bores, water tight castings, Engineer deems the punch list is complete. Type 2 clean—outs, fittings, etc.) F. If a Manhole top of casting is adjusted after as—builting, then the Contractor 3.06 Video Inspection must supply Engineer with a new measure down from the flow line to the top of casting. If the new measure down is not provided to Engineer, then the Contractor must pay Engineer, at their current rate, for all time required obtaining A. Sections of sewer will be inspected at Engineer's discretion. equired in the inspection operation at Contractors expense

B. HSE Utilities Inc. will furnish all equipment and personnel to perform all the work . HSE Utilities Inc. will furnish all equipment required for making a continuous 2.17 Inspection and Reimbursement video recordina at Contractors expense A. Full time inspection by Engineer is required for all repairs, maintenance or construction to Sanitary Sever Facilities. Engineer must approve, in writing, all methods of repair to Sanitary Sever Facilities as recommended by the Contractor D. All new sewers must be cleaned prior to the Contractor requesting testing and video inspection of mainline sewers. Failure to a adequatley perform this task will and manufacturer. Failure to comply will be grounds for removal from the HSE approved contractor list. B. If, for any reason, construction work is delayed or canceled, Contractor shall notify Engineer's inspector assigned to the Project and Engineer's chief inspector at PART 4 - OPERATION, CLEANING AND FINAL INSPECTION PRIOR TO CONVEYANCE least one (1) hour prior to the normal scheduled starting time on the day the work is delayed or canceled. Contractor will be charged \$74.25 for failure to 4.01 Operatio notify Engineer's inspector and Engineer's chief inspector per occurrence. No person, including but not limited to Subscribers, maintenance workers, C. Contractor must pay Engineer for all inspector's overtime cost. Contractors wil Contractors, sub-contractors and engineers shall, directly or indirectly, allow flow to occur from any Project which is not Complete to a Completed Project. be charged overtime costs at the current rates. D. If, at the sole discretion of Engineer, construction volume is less than what is deemed acceptable, then the Contractor may be required to pay \$200 per day for The Project must be cleaned as directed by Engineer by a jet-rodder with idditional inspection services. vactor truck at Subscriber's expense at least once prior to conveyance. The Engineer's decision on field changes or construction practices is final. Failure to comply is grounds for removal from the HSE approved contractor list B. This cleaning may be delayed for up to three (3) years (with applicable security deposit) at Engineer's discretion if all lots/facilities served by the Project are not developed and connected within three (3) months prior to conveyance. PART 3 - TESTING AND PUNCH LISTS

3.01 General Testing Requirements A. Notification must be provided at least five (5) days prior to any testing. B. At HSE's option, HSE or their agent may perform all testing of Sanitary Sewer Facilities within the HSE service area. Contractor shall reimburse HSE or its agent at HSE's current rate for all testing. . ALL testing (except manhole vacuum testing) must be conducted after the final backfill has been in place for at least thirty (30) days and after all other utilities have been installed D. At the Engineer's discretion, testing may be delayed or additional testing may be required, based upon weather conditions (inadequate precipitation to allow for adequate settlement, temperature variance between mandrel and pipe, etc.) Also testing may be delayed or additional testing may be required due to the nstallation of site improvements (including but not limited to fencing, signage, landscaping, site lighting and other sub surface improvements).

E. If the Subscriber requires sanitary sewer service prior to final testina. preliminary test may be performed, however, Subscriber must provide, in writing, a juarantee that all cleaning and testing will be performed per the Construction Plans and HSE's then current standards, specifications and details.

3.02 Deflection Testing A. At Engineer's discretion, prior to a mandrel test, the Project must be cleaned

with jet rodder and vactor truck to remove mud, silt and construction debris. B. If testing is delayed per Section 3.01E above due to the lack of precipitatio ind in the opinion of the Engineer the densification of the backfill is inadequate the Contractor may perform a mandrel test utilizing a mandrel sized to measure a leflection limit of three (3) percent. This may only be done with the permission, ir writing, of the Engineer and after all requirements of Section 3.01D have been met 2. All PVC (non-lateral) pipe must be tested for deflection with an acceptable o-no-go mandrel. No pipe can exceed a deflection of five (5) percent. The leflection test must be conducted using a mandrel having a diameter equal to ninetv-five (95) percent of the inside diameter of the pipe. The test must be performed without a mechanical pulling device and the rope used to pull the mandrel must be no stronger than one hundred fifty (150) pound test. Tag/trail rope may be of any size to allow removal of mandrel. A single individual of average size, weight and strength without the use of tools to gain leverage must Il the mandrel. All pipe exceeding the allowable deflection must be replaced o epaired and re-tested. . Engineer reserves the right to require an additional mandrel test of sections o flexible pipe which are crossed by storm sewers within fifteen (15) days prior to the initial mandrel test or at anytime after the initial test. . Engineer will not accept sewers with "sags" greater than one thirty-secondth /32) of an inch per inch of pipe diameter, not to exceed one half (0.5) inch 3.03 Sewer Water Tightness Testing

A. Acceptability Limits . Maximum infiltration/exfiltration limits for all new sanitary sewers will be fifty 50) gallons per inch of diameter per mile of pipe per twenty-four (24) hours. his standard is applicable to each discrete section of the Project and includes a Manholes and lateral service connections. All sections of the sewer must be tested and any sections not meeting these limits must be repaired and re-tested. 2. In the presence of groundwater or poor soil conditions, and if required by the Engineer, the sewer may be required to successfully complete a water tightness est before proceeding with any additional construction.

Tests for water tightness must be conducted on all sewers in the Project. Where the test results are in excess of the allowable limits, the Contractor must correct the construction of the sewer and retest so that the section tested is within the allowable limit. All methods and materials used in the repair must be accepted by the Engineer in writing. Grouting of joints is not an acceptable repai D. If ground water was present during the installation of the sanitary sewer mainline the contractor will install a dewatering well at each manhole. This well is to be a minimum of ten (10) inches in diameter and be located within excavated area surrounding the manhole. Aggregate must be placed on the on the outside of the pipe to prevent clogging. The dewatering well is to remain in place until all testing is satisfactorily completed. It will be utilized to determine the around water elevation at the time the air test is conducted. After all testing is completed the contractor will cut off the well eighteen (18) inches below finish grade and cap the

vell. During construction and until the tests are complete it is the contractors esponsibility to ensure the well is properly secured and safe. . At the Engineer's discretion, the following tests may be required: a. The infiltration test may be used where the natural groundwater table is a ninimum of two (2) feet over the top of pipe in the section being tested. b. The test must be conducted by plugging off the upper end of the pipe section being tested and placing a weir or other acceptable measuring device in the pipe at the lower end of the section. Sufficient time must be allowed for the water level over the weir to stabilize before reading the flow. Exfiltration Test for Leakage.

1. The exfiltration test for leakage may be used where the natural aroundwater table is less than two (2) feet over the top of pipe in the section being tested. . The test must be conducted by plugging off the ends of the pipe being tested nd filling the section with water. A standpipe must be provided at one end of the pipe section so that a minimum internal pressure of five (5) feet can be naintained above the higher of either the top of the pipe or the groundwater lev f a manhole or stub-out is included in the section tested, the manhole can be used in place of the standpipe; and the allowable leakage from the manhole riser and stub-out must be calculated as for the respective diameter pipe.

Air Test for Leakage The ends of the pipe being tested must be sealed and properly blocked to prevent displacement while the line is under pressure. The seal at one end mus have an orifice through which to pass air into the pipe. An air supply must be connected to the orifice at one end of the section. The air supply line will contain an off—on gas valve and a pressure gauge having a range from zero (0) to fifteen (15) psi. The gauge must have minimum divisions of five hundredths (0.05) psi nd have an accuracy of +/- five hundredths (0.05) psi. b. Clean pipe to be tested by propelling a snug fitting inflated ball through the pipe by water pressure or other adequate method. This step is important because flushes out construction debris.

manufacturer. All pipes entering and leaving manhole structures must have a resilient connector meeting the requirements of ASTM C 923 firmly clamped around the pipe. The resilient connectors must be PSX gasket or Press Wedge II as The aroundwater level surrounding the section of pipe under testing must be letermined by the procedure previously outlined. If the groundwater table is above the pipe, then test pressures must be increased according to the following formula: manufactured by Press-Seal Gasket Corp. or similar flexible manhole sleeves as 6. Without prior written consent of Engineer, pre-cast manhole sections must be the air pressure should be increased forty-three hundredths (0.43) psi for each oot of water over the lowest invert. I. Once the pipe outlet plugs are securely in place, pressurized air is introduced to steam cured and can not be shipped from the point of manufacture for at least five (5) days after having been cast. Upon written consent of Engineer, pre-cast the system. The air must be fed through a single control panel with three (3) dividual hose connections as follows: nanhole sections can be shipped prior to five (5) days if they were manufactured) From control panel to pneumatic plugs for inflation in sewer pipe. of early high strength concrete and are verified through testing to have achieved rength acceptable to Engineer.

From control panel to sealed line for introducing the pressurized air. 7. Manhole castings must be of good guality cast iron conforming to ASTM A 48) From sealed line to control panel. This line will enable continuous monitoring DI conforming to ASTM A 536, Grade 65-45-12 with concealed pick hole. the air pressure rise in the sealed line. Refer to HSE's Gravity Sanitary Sewer Details sheet for detailed information. Unless specifically designated otherwise, Manhole castings must be the non-locking type. e. The air must be introduced slowly to the section of pipe under evaluation until the internal air pressure is five (5) psi greater than the hydrostatic pressure head created by the groundwater over the pipe section 3. Manhole steps must be made from a steel reinforcing rod encapsulated in a copolymer polypropylene resin. The manhole steps must equal or exceed IOSHA f. A minimum of two (2) minutes must be provided for the air pressure to stabilize to conditions within the pipe. Engineer shall determine the stabilization time based on field conditions and weather. The stabilization period is necessary requirements. Manhole steps manufactured by M.A. Industries, Inc., American Step

 Company, Inc., or equal, are acceptable.
Any other special manholes and miscellaneous concrete structures must be for variations in temperature to adjust to the interior pipe conditions. Air can b constructed as detailed on the Construction Plans. idded slowly during the stabilization period to maintain a minimum pressure of fiv). Manhole bases must be cast-in-place concrete, reinforced as shown on the (5) psi greater than the hydrostatic pressure created by groundwater. Sanitary Manhole detail of HSE's Gravity Sanitary Sewer Details sheet, or g. After the stabilization period, when the pressure reaches exactly five (5) psi ation pre-cast concrete base and first section. Detailed drawings must be greater than the hydrostatic pressure created by groundwater, the stopwatch must submitted to the Engineer prior to casting or manufacture. be started; and when the pressure reaches three and a half (3½) psi greater than No interior surface applied materials can be used.
Fiber mesh reinforcement for Type 2 clean—outs: Application per cubic yard he hydrostatic pressure created by groundwater, the watch must be stopped. The must equal a minimum of one and a half (1.5) pounds. Fibers are for the control

portion of the line being tested will be acceptable if the time for the air pressure to decrease within the stated range is greater than the time shown in Table 1. the pipe length is between the specified lengths in Table 1, the time must be of cracking due to drving shrinkage and thermal expansion/contraction, to lower oncrete permeability and to increase impact capacity, shatter resistance and ased on the next areater length. Safety Precautions During Air Test abrasion resistance. Fiber mesh reinforcement must be manufactured by Fibermesh, 4019 Industry Drive, Chattanooga, Tennessee, 37416 or equal as approved by Engineer on a case by case basis. 1) The air test may be dangerous if, because of ignorance or carelessness, a line s improperly prepared. It is extremely important that the various plugs be installed and braced in such a way as to prevent blowouts. Contractor should realize the sudden expulsion of a poorly installed plug could be dangerous. Likewise, a plug that is partially deflated before the pipe pressure is released can e equally as dangerous (2) As a safety precaution, pressurizing equipment should include a regulator set it ten (10) psi to avoid over pressurizing and damaging an otherwise acceptable (3) No one is allowed in the manholes during testing. 3.04 Manhole Testing

acuum tested after installation, repair or modification Engineer may require additional vacuum tests if the manhole casting is not bolted to the prior to the test. Stub-outs, manhole boots and pipe plugs must be secured to prevent movement while the vacuum is drawn. Installation and operation of vacuum equipment and indicating devices must be n accordance with manufacturer's recommendations and performance specifications have been provided by the manufacturer and accepted by Engineer. With the vacuum tester set in place: Inflate the compression band to forty (40) psi to effect a seal between the vacuum base and the structure. Connect the vacuum pump to the outlet port with the valve open. 3. Draw a vacuum of ten (10) inches of mercury and close the valve.

A. All sanitary sewer manholes and flow monitoring/metering manholes must be

F. Acceptance standards for leakage will be established from the elapsed time for a negative pressure change from ten (10) inches to nine (9) inches of mercury. The maximum allowable leakage rate for a four (4) foot diameter manhole must be A. Each product to be incorporated into the Project must be handled into its Minimum Elapsed time for a

Manhole Depth Pressure Change of 1 Inch Mercury

10 ft or less 60 seconds >10 feet but <15 feet 75 seconds >25 feet but <30 feet 105 seconds >15 feet but <25 feet 90 seconds >30 feet but <35 feet 120 seconds For manholes five (5) feet in diameter, add an additional fifteen (15) seconds and for manholes six (6) feet in diameter, add an additional thirty (30) seconds to the time requirements for four (4) foot diameter manholes. For all manholes deeper than thirty—five (35) feet, Engineer will determine the applicable minimum elapsed . If the manhole fails the test, necessary repairs must be made and the vacuum est and repairs must be repeated until the manhole passes the test. H. If manhole joints are pulled out during the vacuum test, the manhole must be disassembled and the joints replaced. . Manholes will be subject to visual inspection with all visual leaks being repaired.

A. Within six (6) months prior to conveyance, Engineer will conduct an inspection ("Final Inspection") at Subscriber's expense. The Final Inspection will consist of a walk-through and television inspection of the Project to identify any defects. The Final Inspection may also consist of flow monitoring, and smoke, infiltration, exfiltration, vacuum, deflection or low-pressure air tests as determined by Engineer. summary, or punch list, of items which require corrective action. Subscriber must complete all punch list items within forty-five (45) days from the date of issuance of the punch list. If, after the above forty-five (45) day period has expired, and n sole opinion of Engineer, the punch list items have not been corrected, then the Contractor and/or Subscriber may be required to pay HSE \$100 per day damages ntil the items are corrected Subscriber must rectify all defects identified during the Final Inspection in a

SECTION 1 - MANHOLES, PIPE & FITTINGS PART 1 - PRODUCTS

A. Under general laying conditions, sewer pipe can be any one of the pipe materials specified in these Specifications, provided, the material is that pipe type and standard indicated on the Construction Plans.

All pipe and fittings must be clearly marked in accordance with the various standards under which they are manufactured. All pipe must be marked with durable printing according to ASTM/AWWA requirements. . A marking must be provided on the spigot of each pipe utilizing bell joints to indicate when the pipe is driven home.

5-inches; ASTM F 679 (T-1; T-2 as approved by Engineer) or AASHTO M278 or CAN/CSA-B182.2.M90, the more stringent must apply, for sizes greater than 15-inches: ASTM D 2241 (SDR 21) for sizes up to 24-inches: ANSI/AWWA C900 DR 18), for sizes 4-inches through 12-inches; ANSI/AWWA C905 (DR 25 or DR B), for sizes 14-inches through 24-inches.
B. Minimum cell classification of pipe 15-inches or less in size must be 12454-B or 12454-C or 13364-B or 12364-C as defined by ASTM D 1784. Minimum cell

strength of 34.50 MPa as defined by ASTM D 1784 insition to and from ASTM D 3034 to ASTM D 2241 must be with ductile iron, J solid sleeve fittings with transition gaskets. so that when assembled the elastomeric gasket inside the bell is compressed

adially on the pipe spigot to form a positive seal. The joint must be so designed o avoid displacement of the gasket when installed in accordance with manufacturer's recommendations. The joint must comply with ASTM F 477 and ASTM F 913 and the physical requirements of ASTM D 3212 and Uni-Bell PVC Pipe Association's UNI-B-1 "Recommended Specifications for Thermoplastic Pipe Joints, Pressure and Non-Pressure Applications". the more stringent must apply. gasket must be the only element depended upon to make the joint flexible and atertiaht . PVC pipe type to be ASTM 3034 (SDR 26) can be used to thirty (30) feet.

. All PVC pipe must be laid with in six (6) months of the date of manufacture 1.03 Fittinas A. Fittings such as wyes, tees and bends must be made in such a manner as will provide strength and water tightness at least equal to the class of the adjacent main line pipe to which they are joined. Fittings must conform to all other equirements specified for pipe of the corresponding class and diameter. Joints

must be of the same type as used on the adjoining pipe. All fittings must be bell B. Fabricated fittings (not molded as a single integral piece) and saddles will not be allowed except when specified by the Engineer. Plastic Trends, INC. fittings are recognized as an acceptable alternate to this standard. 1.04 Manholes and Other Structures

c sections. Pre-cast manhole sections must conform to the requirements of ASTM C 478. Manhole joints must conform to the requirements of ASTM C 443, except that the joint design of the pre-cast sections must consist of a bell or groove o one end of the unit of pipe and a spigot or tongue on the adjacent end of the ioinina section.

e following: I. Concrete for pre-cast manhole sections and monolithic manholes must use four Maximum size of aggregate must be one and a half (1.5) inches. orcing steel must conform to ASTM A 615, Grade 40 deformed bars or

4. Joints on pre-cast manhole sections must utilize rubber gaskets meeting the . The manufacturer of the pre-cast manholes must provide factory cut openings e resilient connector. Resilient connectors can be pre-cast-in-place by the

4.03 Final Inspection B. After the Final Inspection has been performed. Engineer will provide a written

manner acceptable to Engineer prior to Sanitary Sewer Facilities being conveyed t

1.01 General Requirements

1.02 Polyvinyl Chloride ("PVC") Pipe A. PVC pipe and fittings must be smooth wall inside and out and must conform o: ASTM D 3034 and ASTM F 1336 (SDR 26 or SDR 21), Type PSM or CAN/CSA-B182.2.M90. the more stringent must apply. for sizes up to

classification of pipe greater than 15-inches in size must be 12454-C or 1364-B or 12364-C as defined by ASTM D 1784. All pipe must have a minimum tensile

Joints on PVC sewer pipe must be the integral bell type gasketed joint designed

by bell. Bell by spigot fittings will not be permitted except by Engineers discretion.

A. Manholes must be constructed of monolithic concrete or pre-cast manhole

. Materials for Manholes and miscellaneous concrete structures must comply with thousand (4000) psi concrete. Ready-mix concrete must conform to ASTM C 94 Slump must be between two (2) and four (4) inches.

ASTM A 616, Grade 40 deformed bars. 3. Mortar Materials: a. Sand — ASTM C 144, passing a #8 sieve. o. Cement - ASTM C 150. Type Water - Must be potable.

requirements of ASTM C 443 and these Specifications, the more stringent will apply. O-ring gaskets must be confined in a groove in the spigot end of the pre-cast manhole section. Profile aaskets must bear on a lateral face of the tongue so as to provide positive positioning. The joint must be further sealed a noted on the Sanitary Manhole Detail of HSE's Gravity Sanitary Sewer Details sheet. to produce a smooth, uniform, cyindrical hole of the proper size to accommodat

2.01 Handling and Cutting Pipe

PART 2 - EXECUTION

osition, placed and supported only in such manner and by such means as the Engineer accepts as satisfactory. B. Pipe and fittings must be handled carefully to avoid cracking or abrasion of the coating. Handle in a manner to insure installation in sound and undamaged condition. Do not drop or bump. Use slings, lifting lugs, hooks and other devices designed to protect pipe, joint elements and catings. Ship, move and store with provisions to prevent movement or shock contact with adjacent units. Handle with equipment capable of performing the work with an adequate factor of safety against overturning or other unsafe procedures. C. Any fitting showing a crack and any fitting or pipe which has received a severe blow which could have caused an incipient fracture, even though no such fracture n be seen, must be marked as rejected and removed at once from the site. . In any pipe showing a distinct crack and in which it is believed there is no ture beyond the limits of the visible crack, the cracked portion, if so approved, may be cut off by the Contractor before the pipe is laid so that the pipe used is perfectly sound. The cut must be made in the barrel at a point at east twelve (12) inches from the visible limits of the crack. E. All field cutting of pipe must be done in a neat, trim manner. Field cut pipe ill only be allowed at Manholes, tees, wyes and at the connection of a new sanitary sever to an existing sanitary sever. The cut end must be beyeled using a file or a wheel to produce a smooth bevel of approximately fifteen (15) degrees and a minimum depth of one-third (1/3) of the pipe wall thickness.

1. PVC Pipe . PVC pipe must be cut with either a hand saw or power saw. b. Smooth cut by power grinding to remove burrs and sharp edges

2.02 Construction Staking A. The Contractor, shall contract with a Land Surveyor registered in the State of Indiana to furnish and set all line and grade stakes (HUB). The Land Surveyor will be required to set, or oversee the setting of, all bench mark stakes necessary for the installation of any sanitary sewer facility being constructed. Bench marks shall be set in strategic locations, but no more than one thousand (1000) feet from the project, to facilitate the installation of arade stakes. Horizontal and vertical control vill be required to be provided with the record drawings to be submitted to the HSE upon completion of the project. 2.03 Laying Pipe

A. Unless approved by the Engineer, Contractor must not install different sizes, B. No construction work will be permitted after dusk or in poor light conditions as letermined by Engineer. All rough grading (on-site and off-site) must be finished to within one (1) foot f final arade prior to the start of construction of the Sanitary Sewer Facilities. tractor must provide and protect survey grade stakes that enable Engineer to verify compliance with the rough grading requirement. Contractor must install all off-site laterals with a minimum cover of six (6) feet from the top of pipe to arade. Laterals will be considered off-site if they are constructed in an area that not be platted immediately upon Completion. The point of commencement for laying pipe should be the lowest point in the proposed line. Provisions for beginning construction at other than the lowest point the proposed line shall require approval by the Engineer. All bell and spigot pipe shall be laid with the bell end pointing up grade . The sewer segment downstream from any connection made to an existing sewer must be cleaned by a jet—rodder with vactor truck immediately after the connection to the existing sewer and plugging of the connection is finished. F. If, for any reason, live or in-service Sanitary Sewer Facilities must be plugged for more than four (4) hours, the accumulated wastewater must be pumped out at ne location of the plug and transported to a proper disposal site. Additionally, the upstream lines and Manholes must be cleaned and flushed to the location of

G. All pipe must be bedded as described in these Specifications under Pipe Bedding and Haunching and according to the Sanitary Sewer Trenching, Bedding and Backfill detail of HSE's Gravity Sanitary Sewer Details sheet. Bell holes must be excavated in advance of pipe laying so the entire pipe barrel will bear uniformly on the prepared sub-grade. H. The supporting of pipe on block will be permitted only where the pipe is to receive total concrete encasement. Encased pipe must also be accurately and effectively supported on a crossing re-bar "X". . All pipe must be laid accurately to the required line and grade in the manner prescribed by the pipe manufacturer and appropriate ASTM/AWWA specifications. section of pipe must be laid to form a close, concentric joint with the adjoining pipe at an elevation conforming to the required grade. PVC gravity sewer pipe and fittings must, at a minimum, be installed in accordance with the directions contained in ASTM D 2321.

I. Obtain approval of Engineer of method proposed for transfer of line and grade om control to the work. K. At a minimum, the Contractor must use laser beam equipment to maintain accurate alignment and grade. A qualified operator must handle the equipment during the course of construction. If bending of the laser beam occurs due to air perature variations or dust in the air, then a fan must be provided to circulate the air. However, air velocity can not be so excessive as to cause pulsating or brating of the beam. Before proceeding to the next joint, the last joint must be necked for proper line and grade. Survey instruments capable of third order

accuracy must be used for checking alignment and grade throughout the Project. It is the Contractor's responsibility to regularly test all equipment to assure compliance with manufacturer's specifications L. Clean interior of all pipe and fittings prior to installation M. When bell and spigot pipe is laid, the bell of the pipe must be cleaned of mud,

sand and other obstructions and wiped out before the clean spigot of the next pipe is inserted. The joint must be made in a satisfactorily manner in accordance with the recommendations of the manufacturer of that particular type of joint and the direction of the Engineer. The new pipe must then be shoved "home" firmly against the back of the bell and securely held until the joint has sealed. xperienced personnel must perform all joint work. Locate pipe joint to provide for differential movement at changes in type of pipe embedment or at changes in trench bottom material. Do not locate join within eighteen (18) inches of Manhole walls. Clean and lubricate all joint and aasket surfaces with lubricant recommended by manufacturer. Check joint feflection for specified limits

0. Do not let water fill trench. Do not lay pipe in water. Include provisions to prevent flotation should water control measures prove to be inadequate. P. Perform pipe installation only when weather and trench conditions are suitable. Allow pipe to reach trench air temperature prior to installation. The Contracto must discontinue pipe installation whenever there is a danger of the quality of work being impaired because of cold weather. The Contractor is responsible for heating the pipe and jointing material to prevent freezing of joints. Pipe must not be laid on frozen ground. Pipe must not be installed unless the outside temperature is areater than thirty-two (32) degrees Fahrenheit and rising unless proper precautions, per the manufacturer's recommendations, are taken. each work day, the open ends of all pipe must be protected against the entrance f animals, children, earth, debris, etc. by bulkheads or stoppers. Provide adequate ackfill to prevent flotation of the pipe. Any earth or other material that enters the Sanitary Sewer Facilities through any such open end or unplugged branch must

Install a temporary water tight plug at the end of the sewer whenever installed pipe is left unattended. Contractor must prevent all water, earth or other material from entering the Sanitary Sewer Facilities. An air tight, water tight plug must also be maintained in the Project at the point of connection with the existing sewer at all times from the initiation of construction to the Completion of the Project. At least once per day, the Contractor must inspect the plug for water tightness and pump out all accumulated water in excess of six (6) inches from the vert of the outgoing pipe. In the event any water, earth or other material enters the downstream sever the Contractor is responsible to HSE for the costs of ewage treatment, electrical power, equipment repairs, incidental damages, cleaning and any other costs or expenses related to such entry. Contractor shall pay HSE lamages of \$1000 per occurrence.

S. Pipe must be installed to cross storm sewers and other utilities at approximately ninety (90) degrees and must maintain a minimum horizontal separation (measured from the outer spring line of each pipe) of ten (10) feet from all storm and utility structures.

2.04 Bores A. Casing wall thickness as per Section 716 - Jacked Pipe of the "Indiana Department of Transportation 1999 Standard Specifications" or latest edition. . All work within right—of—ways must be in accordance with the requirements of ne governmental agency having jurisdiction. Where no procedures for a particula portion of the work are given, the recommendations of the "Indiana Department of ransportation Standard Specifications," latest edition, must be followed. C. At the Engineer's discretion Contractor must fill carrier pipe with water to prevent flotation and misalignment during grouting. . Engineer recommends preliminary low-pressure air and mandrel testing of the carrier pipe prior to grouting. 2. Upon completion of the bore, Contractor must coordinate with the Record ing Engineer to verify that the carrier pipe is on line and grade. Contractor

must submit invert elevations to Engineer. F. For further information refer to the Typical Boring detail of HSE's Gravity Sanitary Sewer Details sheet. Contractor may request alternate methods or materials such as the use of directional boring and/or polyethylene pipe. See horizontal bore specifications.

2.05 Pipe Bedding and Haunching

A. Each pipe section must be laid in a firm foundation of bedding material and haunched and backfilled with care. These materials must be placed and compacted in accordance with ASTM D 2321. B. The INDOT washed #8 crushed stone indicated on the Sanitary Sewer Trenching, Bedding and Backfill detail of HSE's Gravity Sanitary Sewer Details sheet must be shovel sliced or otherwise carefully placed and "walked" or hand tamped in to ensure B. compaction of the haunch area and complete filling of all voids. Material must be added in six (6) inch lifts "walked" in for compaction. C. Prior to pipe installation, carefully bring bedding material to grade along the entire length of pipe to be installed in accordance with the Sanitary Sew Trenching, Bedding and Backfill detail of HSE's Gravity Sanitary Sewer Details shee If in the opinion of the Engineer soil conditions are unstable, then the trench must be undercut until stable soil is encountered and #2 stone must be placed below the bedding zone in accordance with the Sanitary Sewer Trenching, Bedding and Backfill detail of HSE's Gravity Sanitary Sewer Details sheet. D. When the bedding material is placed in a "fill" area, all such "fill" must be compacted to ninety-five (95) percent standard proctor density prior to installing sewer, from undisturbed earth to the crown of the pipe. E. For flexible pipe such as PVC, the placement of embedment material o haunching around the pipe must be done with care. The ability of the pipe to withstand loading in a trench depends upon the method employed in its installation Objects that may cause point loading on the pipe must be removed. are should be taken to not compact directly over the top of the pipe. Where excavation occurs in rock or hard shale, the trench bottom must be undercut and a minimum of six (6) inches of #2 crushed stone must be placed below the bedding zone prior to pipe installation. G. All stone bedding above and below the Sanitary Sewer Facilities must be free of dirt, organic matter and frozen material. 2.06 Concrete and Concrete Caps, Cradles and Encasement

A. All concrete caps, cradles and encasement must be installed in accordance with ISE's Gravity Sanitary Sewer Details sheet. B. The strength of concrete indicated on all drawings, details and specifications is twenty—eight (28) day compressive strength. C. Concrete caps, cradles and encasement must be provided at all locations ndicated on the Construction Plans. When so ordered by the Engineer, concrete caps, cradles and encasement not shown on the Construction Plans must be nstalled. When storm sewers cross Sanitary Sewer Facilities with less tha eighteen (18) inches of vertical separation (from the outer edge of each pipe). the Sanitary Sever Facilities must be encased in concrete. The separation distance must be determined in the field and not be based on the Construction Plans. D. At the Engineer's discretion, Contractor must take four (4) cylinders per five (5) cubic yards of concrete and provide certified test results to Éngineer . If the outside temperature is between twenty (20) and thirty-two (32) dearees Fahrenheit and rising, then Contractor must use a fifty (50) percent ethylene-alycol/water mixture. If the outside temperature is forecasted to be pelow thirty—two (32) degrees Fahrenheit during the curing of any concrete or arout application, then the concrete must be protected from freezing with lation blankets acceptable to the Engineer. All concrete work must be performed at an outside temperature of over twenty (20) dearees Fahrenheit and

2.07 Manholes and Other Structures

A. All manhole structures to be coated with Tnemec Hi-Build Tneme-Tar® Series 46H-413 Polyamide Epoxy-Coal Tar for corrosion resistance nmend dry film thickness shall be no less than 16 to 20 mils. for all exterior surface of structures. B All manholes flow monitoring/metering manholes and clean-outs must be constructed in accordance with HSE's Gravity Sanitary Sewer Details sheet. C. In Manholes with multiple influent pipes, Contractor must install all pipe from the lowest elevation to the highest elevation. The lower elevation pipe must be extended to the next upstream Manhole before commencing installation on the next

D. Unless otherwise approved in writing by Engineer, all flow monitoring/metering manholes must be five (5) feet in diameter.

three-eighths (3/8) inch Red-Head anchors.

(12) inches from all pipes entering and leaving Manholes.

as shown on HSE's Gravity Sanitary Sewer Details sheet.

ight and structurally sound repair.

deemed Completed by HSE.

2.09 Existing Utilities, Structures, Property, Etc.

eplaced by an item of equal or better auality.

provided a copy of the consent to the Engineer.

ELECTRIC TRANSMISSION RIGHT-OF-WAY GUIDELINES/RESTRICTIONS

ock on the gate to ensure access. Duke Energy will supply a lock.

Parking may be permitted within the right of way, provided that:

the "Wire Zone". Tree species are not allowed within the "Wire Zone

specialist as the "Wire Zone" varies for

acialist for "Wire Zone"/"Border Zone" definitions

e different voltage lines

After grading/paving activity is complete, Duke Energy—approved barrier sufficient to withstand a

waterways, autters or storm sewers.

VALID FOR OHIO, INDIANA AND KENTUCKY

of ten (10) feet.

the pipe or conduit

connectors

marker

E. Manhole channels or inverts must be formed and poured with concrete to the

crown of the connecting pipe in accordance with HSE's Gravity Sanitary Sewer Details sheet. The finished invert must be a semi-circular shaped smooth channel directing the flow to the downstream sever. Changes in direction in base channels must be accomplished by smooth, constant radius turns in the channel joining the downstream channel tangentially. Concrete must be RE-CRETE twenty (20) minute set or approved equal incorporating Dayton Superior's J-40 or R-40 or approved equal liquid bonding agent. Patches over one (1) inch thick must use

F. Where approved by the Engineer, manholes added to an existing sanitary sewer must be constructed per the Sanitary Manhole Detail of HSE's Gravity Sanitary Sewer Details sheet. No "dog house" or "saddle" structures will be permitted. he upstream and downstream sanitary sewers between the new manhole and the xisting manholes must be low—pressure air tested and deflection tested. Also, the new manhole must be vacuum tested while maintaining continuous service G. Manholes must be placed and aligned to provide vertical sides within a tolerance

not exceeding one (1) inch up to ten (10) feet in depth and two (2) inches up to twenty (20) feet in depth, plus one-eighth (1/8) inch per foot over twenty (20) feet in depth. Tolerance to be checked with a plumb line. H. All cored holes, penetrations and/or other opening into a manhole or other sanitary structure must have a minimum separation of six (6) inches from any joint, as measured from the nearest joint shoulder (interior or exterior), to the

I. Any holes cut in the field must be smoothly and cleanly drilled with a core-drill or in a manner acceptable to the Engineer. All pipes entering and leaving Manholes must utilize a resilient connector as previously desc Specifications and indicated on HSE's Gravity Sanitary Sewer Details sheet. 2. For cored holes, penetrations and/or other opening through Manholes, a eparation of greater than eighteen (18) inches is required between the outer edge of resilient connectors. If a separation of less than eighteen (18) inches exists. en additional reinforcement must be supplied in the Manhole.

3 All cored holes penetrations and/or other openings through Manholes must have a minimum separation of eight (8) inches from the outer edge of resilient 4. All cored holes, penetrations and/or other opening into a manhole or other sanitary structure must have a minimum separation of six (6) inches from any ioint, as measured from the nearest ioint shoulder (interior or exterior), to the

. Contractor must install steps with a minimum horizontal separation of twelve I. Finished grade around Manholes and castings must be set at an elevation to K. All Manhole frames must be securely anchored to the cone or adjusting ring with bolts and concrete anchors adequate in length to penetrate into the

L. Flat top structures are generally not permitted. If a flat top structure is permitted, then Contractor must receive written approval from Engineer. In the case of flat top structures, no more than eight (8) inches of adjusting rings can . The Engineer has the right to cut cores from such pieces of concrete Manhole s he desires for such inspection and tests as he may wish to apply.

by the removal of cores must be filled in an acceptable manner to form a water N. Engineer may, for inspection or testing purposes, take samples of concrete after t has been mixed or as it is being placed in the forms or molds. 0. All grout used to seal or join structures must be non-shrink grout. 2.08 Laterals, Stubs, Connections, Bulkheads and Miscellaneous Items of Project

A. Where existing sewers carrying sanitary sewage are encountered, the Contractor must provide and maintain temporary connections or redundant pumping systems . Where called for on the Construction Plans, lateral connections and stubs for iuture sewer connections must be provided. Lateral locations must be recorded o a HSE Lateral Location Form. The upstream end of lateral connections and main line stubs must be field marked with a two by four (and #10 tracer wire wrapped

2" x 4") and field marked as shown on the Service Lateral detail of HSE's Gravity itary Sewer Details sheet. The depth to the lateral must be indicated on th C. Without written permission from the Engineer, the Contractor can not connect any existing sewers or house services into the Project prior to the Project being . Laterals must be installed to cross storm sewers and other utilities at

approximately ninety (90) degrees and must maintain a minimum horizontal separation of ten (10) feet from all storm structures and utilities. E. Contractor must notify Engineer at least twenty-four (24) hours prior to any construction of storm sewers that may affect previously constructed Sanitary Sewer Facilities. Storm sewers laid parallel to Sanitary Sewer Facilities must maintain a

minimum horizontal separation (measured from the outer spring line of each pipe) . All laterals must be installed with an insulated #10 copper tracer wire along top of pipe from the wve to the terminus. The mainline contractor shall install the wire from the wye to the lateral marker at the surface. The lateral contractor shall extend the wire from the terminus to the cleanout adjacent to the building. . All lateral tracer wire connections shall be soldered and a DryConn? Direct Bury

electrical insulating corrosion resistant wire splice kit to be used at ALL spliced A All improvements including but not limited to poles trees fences sewer gas water or other pipes, wires, conduits and manholes, railroad tracks, buildings, structures and property, etc. along the route of the Sanitary Sewer Facilities must be supported and protected from damage by the Contractor. 3. Movable items such as mail boxes can be temporarily relocated during construction, provided their function is maintained. Unless otherwise shown on the

Construction Plans, place movable items in their original location immediately afte backfilling is finished. Any movable items damaged during construction must be The Contractor must proceed with caution in the excavation and preparation of renches so that the exact location of underground utilities and structures, both known and unknown, can be determined. The Contractor is responsible for the repair of utilities and structures when broken or otherwise damaged. The Contractor must make explorations and excavations whenever. in the opinion of the Engineer, it is necessary to determine the location of any underground

. Wherever pipes or conduits cross the trench, the Contractor must support said pipes and conduits without damage to them and without interrupting their service The manner of supporting such pipes, etc. is subject to approval by the owner of When utility lines have to be removed or relocated for the Project, the Contractor must notify the Engineer and utility line owner in ample time for the

necessary measures to be taken to prevent interruption of the utility's service. The Contractor must conduct the work so that no equipment material or debri will be placed or allowed to fall upon private property in the vicinity of the Project unless the Contractor has first obtained the property owner's written consent and 4. All excavated material must be piled in a manner that will avoid obstructing sidewalks, driveways and thoroughfares. Hydrants under pressure, valve pit covers valve boxes, curb stop boxes, fire and police call boxes or other utility controls must be left unobstructed and accessible during the Project. Contractor must prevent runoff from stored piles of excavated material from entering ditches,

(Revised 11/20/14) This list of right—of—way restrictions has been developed to answer the most frequently asked questions about property owner use of Duke Energy's™ electric transmission rights of way. This list does not cover all restrictions or all possible situations. You should contact the Asset Protection right-of-way specialist if you have additional concerns about the rights of way. This list of restrictions is subjec change at any time and without notice. Duke Energy reserves all rights conveyed to it by the right-of-way agreement applicable to the subject property. All activity within the rights of way shall be reviewed by an Asset Protection right-of-way specialist to obtain prior written approval. Engineering plans may be required. Compliance with the Duke Energy Right-of-Way Guidelines/Restrictions or approval of any plans by Duke Energy does not mean that the requirements of any local, county, state

2.11 Restoration

or federal government or other applicable agency with governing authority have been satisfied. A. Structures, buildings, manufactured/mobile homes, satellite systems, swimming pools (and any associated equipment and decking), graves, billboards, dumpsters, signs, wells, deer stands, retaining walls, septic systems or tanks (whether above or below ground), debris of any type, flammable materia building material, wrecked or disabled vehicles and all other objects (whether above or below ground which in Duke Energy's opinion interfere with the electric transmission right of way are not allowed within the right-of-way limits. Transformers, telephone/cable pedestals (and associated equipment) and fire hydrants are not allowed. Manholes, water valves, water meters, backflow preventers and irrigation heads re not permitted. Attachments to Duke Energy structures are prohibited. B. Fences and gates shall not exceed 10 feet in height and shall be installed greater than 25 feet from poles, towers and aux anchors. Fences shall not parallel the centerline within the rights of way but may cross from one side to the other at any angle not less than 30 degrees with the centerline. If a fence crosses the right of way, a gate (16 feet wide at each crossing) shall be installed by the

property owner, per Duke Energy's specifications. The property owner is required to install a Duke Energy Grading (cuts or fill) shall be no closer than 25 feet from poles, towers, guys and anchors except for parking areas; see paragraph 7) and the slope shall not exceed 4:1. Grading or filling near Duke Energy facilities which will prevent free equipment access or create ground-to-conductor clearan iolations will not be permitted. Storage or stockpiling of dirt or any construction material is prohibite edimentation control, including re-vegetation, is required per state regulations. Streets, roads, driveways, sewer/water lines, other utility lines or any underground facilities shall

t parallel the centerline within the right of way but may cross, from one side to the other, at any angle not less than 30 degrees with the centerline. No portion of such facility or corresponding easement shall be located within 25 feet of Duke Energy's facilities. Roundabouts, cul-de-sacs and intersections (such as roads, driveways and alleyways) are not permitted. Any drainage feature that allows water to pond, causes erosion, directs stormwater toward the right of way or limits access to or around Duke Energy facilities is prohibited Contact Duke Energy prior to the construction of lakes, ponds, retention or detention facilities,

Prior to grading, concrete barriers shall be installed at a minimum of 9 feet from the Duke Energy facilities. During construction, grading shall be no closer than 10 feet to any Duke Energy

5-mph vehicular impact shall be erected 9 feet from any Duke Energy facility Any access areas, entrances or exits shall cross (from one side to the other) the right of way than 30 degrees with the centerline and shall not pass within 25 feet of any structure. Parking lot entrances/exits cannot create an intersection within the right of way. 4. Lighting within the right-of-way limits must be approved by Duke Energy before installing. Due to engineering design standards, lighting is not allowed in the "Wire Zone". Where lighting is approved

("Border Zone"), the total height may not exceed 15 feet. Contact your Asset Protection right-of-way Duke Energy will not object to certain vegetation plantings as long as: They do not interfere with the access to or the safe, reliable operation and maintenance of Duke

With prior written approval. Duke Energy does not object to low-growing shrubs and grasses "Border Zone" may not exceed, at maturity, 15 feet in height. Contact the Asset Protection right-of-way For compliant mature height species, refer to plantfacts.osu.edu/plantlist/index.html for reference

Engineering drawings must indicate the outermost conductors. Vegetation that is not in compliance is subject to removal without notice. Duke Fneray may exercise the right to cut "danger trees" outside the right-of-way limits as required to properly maintain and operate the transmission line.

A. De-watering . The Contractor must provide, install and operate sufficient trenches, sumps pumps, hoses, piping, well points, etc. to depress and maintain the groundwate evel below the base of the excavation until all Sanitary Sewer Facilities are

Completed. Provide sufficient dikes and de-watering equipment and make satisfactory arrangements for the disposal of the water without undue interference with other work, damage to property or damage to the environment. Water disposal must be in compliance with the regulations of the Environmental Protection Agency ("EPA"), Indiana Department of Environmental Management ("IDEM"), Soil Conservation Service ("SCS") and all other applicable agencies. 2. Contractor must prevent all water from entering the Sanitary Sewer Facilities. n the event any water enters Completed Sanitary Sewer Facilities, the Contractor is responsible to HSE for the costs of sewage treatment, electrical power, equipment repairs, incidental damages, cleaning and any other costs or expenses related to such entry. In addition, Contractor shall pay HSE damages of \$1000 per 3. Operate de-watering equipment ghead of pipe laving or to keep the water level below the excavation until structures are secured by backfill. 4. Contractor must, at Engineer's discretion, provide de-watering equipment. oring or other construction practices deemed necessary by Engineer. 5. All wells (potable, non-potable and de-watering) must be drilled, capped and abandoned in accordance with the requirements of the Engineer, the Indiana Administrative Code, Indiana Department of Natural Resources — Groundwater

Section, Hamilton County Health Department and all other governmental agencie and public entities having jurisdiction. In order to measure the static water leve wells must be accessible until successful completion of the low-pressure air tes As directed by the Engineer, Contractor must maintain the well casing in-place for all Sanitary Sewer Facilities that will be extended in the future. All excavation work must incorporate safety measures that comply with all

applicable IOSHA regulations and these Specifications. In the event of a conflict, e more stringent requirement will apply. . Trees, boulders and other surface encumbrances, located so as to create a hazard to employees involved in excavation work or in the vicinity thereof at any time during operations, must be removed or made safe before excavating is begun. Unless otherwise directed by the Engineer, do not open more than seventy-five (75) feet of trench in advance of the installed pipe. Unless otherwise directed, excavate the trench within six (6) inches of full depth for a distance of at leas thirty (30) feet. 4. Contractor must provide sloped side walls (provided that the bottom four (4) feet of trench will not be sloped), sheeting, shoring or trench boxes as safety measures for all excavations in accordance with all applicable IOSHA regulations. Contractor is responsible for the determination of the angle of repose of the soil in which the trenching is to be done. Except for greas where solid rock allows for ine drilling or pre-slitting or where sheeting, shoring or trench boxes are to be used, excavate all slopes to beyond the angle of repose, but not steeper than a 1) foot rise to each half (0.5) foot horizontally.

5. Sides, slopes and faces of all excavations must meet accepted engineering requirements by scaling, benching, barricading, rock bolting, wire meshing or other equally effective means. Give special attention to slopes that could be adversely fected by weather or moisture content. Flatten the excavation sides when an excavation has water conditions, silty materials, loose boulders and areas where erosion, deep frost action and slide olanes appear. 7. A competent Contractor's representative, as defined under IOSHA regulations. nust inspect excavations and approve trench safety measures for the excavati after every rain event or other hazard increasing occurrence. 8. Do not store excavated or other material nearer than four (4) feet from the edge of any excavation. Store and retain materials so as to prevent materials from folling or sliding back into the excavation. Install substantial stop logs or barricades when mobile equipment is utilized or allowed adjacent to excavations. 9. Minimize the amount of excavation around Manholes. 10. The design of the pipe and Manholes are predicated upon the width of trench as specified by the manufacturer and these Specifications, the more stringent of which will apply. If the specified trench width is exceeded, then the Contractor is esponsible for the provision and installation, at his own expense, of all remedial measures required by the Engineer. Test the air in excavations in locations where oxygen deficiency or gaseous conditions are possible. Establish controls to assure acceptable atmospheric

onditions. Provide adequate ventilation and eliminate sources of ignition when flammable aases may be present. Emergency rescue equipment, such as breathing apparatus, a safety harness and line and basket stretcher, must be readily available where adverse atmospheric conditions may exist or develop in an

2.10 Excavating (con't) 12. Provide walkways or bridges with guardrails where employees or equipment are required or permitted to cross over excavations. 13. Provide ladders where employees are required to be in excavations four (4) feet deep or more. Ladders must extend from the floor of the excavation to at least three (3) feet above the top of the excavation. Locate ladders to provide means of exit without more than twenty-five (25) feet of lateral travel. 4. Provide adequate barriers and physically protect all excavations. Barricade or cover all wells, pits, shafts and similar excavations. Backfill temporary wells, pits, shafts, and similar excavations upon termination of exploration and similar operations.

. Backfilling I. Backfilling must meet the requirements of ANSI/AWWA C605 unless otherwise

specified in these Specifications. 2. Do not backfill trenches and excavations until all utilities have been inspected by the Engineer and until all underground utilities and piping systems are installed in accordance with the requirements of the respective utility company, these pecifications and the Construction Plans. Place and tamp bedding and backfill in a manner that will not damage the pipe, pipe coating, wrapping or encasement. 4. Contractor must insure that all unstable trench bottom material is replaced with

uitable material and all voids are filled prior to placement of the pipe embedmen material. Excess dry replacement material without visible fines or mud will not be 5. When used in these Specifications, the term "clean backfill" shall mean any backfill material of any type which is free of roots, brush, sticks, debris, junk, ug rocks, cinders, broken concrete or brick, large lumps of clay, frozen material,

stones, etc. greater than six (6) inches in their largest dimensions. Not more than fifteen (15) percent of the rocks or lumps can be larger than two and a half 2.5) inches in their largest diameter. 3. All job excavated materials which are used for trench backfill above nine embedment and which are to be compacted by any method except settlement by water must be "clean backfill". The materials must be of such composition that it can be compacted to ninety (90) percent relative compaction by the compaction method used and with water added, if needed, to bring it to optimum moisture

7. Material excavated from an open trench can be used for backfilling from the pipe to six (6) inches below finished grade providing it meets the requirements of clean backfill" and providing a different type of backfill material has not been specified or shown on the Construction Plans. Where excavated material is used for backfilling and there is a deficiency due to the rejection of a part thereof, the ontractor, upon direction of the Engineer, must remove the rejected material from the site and furnish an additional quantity of "clean backfill" at his own expense. . Excavated material must be placed immediately after the hand backfill. Such backfilling can be done from the top of the trench by mechanical means or directly from trucks by depositing the backfill on a slope equal to the angle of repose of the material and allowing it to flow progressively forward in such a

manner as to prevent the formation of voids. The earth backfill must be compacted to at least ninety-five (95) percent proctor density or mounded six (6) iches for settlement 9. In no case must backfill be dropped from such height or in such volume that its impact damages Sanitary Sewer Facilities. The Engineer reserves the right to egulate and control the manner of depositing such backfill, but in any case, the contractor will be held liable for damage to the Sanitary Sewer Facilities. 0. Settling of backfill by flooding or puddling will not be permitted. 1. Excess trench material must be roughly graded over the trench in a timely

manner soon after the pipe is installed. This material must be mounded over the trench with a crown height of no more than six (6) inches, feathered to existing arade until final settlement has occurred and the trench is ready for grading an cleanup. An exception to this would be trenches in traveled pathways. Any excess must be hauled off and disposed of or stored by the Contractor. 12. After settlement of backfill and immediately before restoration of vegetated areas, grade and remove excess earth in unpaved areas. Remove to a depth of six (6) inches below finished grade. Place six (6) inches of topsoil over entire area to be restored.

A. This section pertains to the restoration of the Project site upon Completion of Restoration of improvements on public and private property must be in-kind and acceptable to the owner. oration of road surfaces, drainage ways and other similar improvements must be in accordance with the directions of the government agency or public

entity having jurisdiction. . All vegetated areas disturbed or damaged during construction must be re—vegetated with a stand of grass. Agricultural areas and areas currently under ruction do not require re-vegetation. I. Backfills, fills and embankments must be brought to a sub-arade level six (6) nches below finished grade. When sub-grades have settled, deposit and spread fine raked topsoil ready for seeding to a finished depth of at least six (6) inches. 2. Commercial fertilizer, 6-12-12 or equal, must be uniformly spread at the rate of thirty—five (35) pounds per one thousand (1.000) square feet over the topsoil by a mechanical spreader at least forty-eight (48) hours before seeding and mixed nto the soil for a depth of two (2) inches 3. A grass seed mixture comprised of thirty-five (35) parts Kentucky Blue Grass, thirty (30) parts Perennial Rye, thirty (30) parts Kentucky 31 Fescue and no more five (5) parts inert matter must be sown on the disturbed areas at a rate o three (3) pounds per one thousand (1.000) square feet. Seeding must be done only bètween April 1 and June 1 or Àugust 15 and October 15. Seeded areas must be mulched with straw, hay, wood cellulose fiber, or cane fiber. Straw or hay must be applied at a rate of two and a half (2.5) tons per acre. Wood cellulose or cane fiber mulch must be applied at a rate of one thousand (1,000) pounds per acre. On special areas of high water concentration, unstable soils or sloped surfaces, manufactured mulch materials such as soil retention blankets, erosion control netting or others may be required by Enginee

Manufactured mulch materials must be installed according to the manufacturer's . The seeded areas must be thoroughly watered with a fine spray to prevent wash Areas shall be maintained and patched as directed by Enginee A satisfactory stand of grass at least one (1) inch in height without bare spots E. Within three (3) months after Project Completion, the Contractor must correct defective work, such as settled areas, uneven road surfaces, bare spots in grass coverage, erosion and gullies.

DISCLAIMER THESE GRAVITY SANITARY SEWER DETAILS AND HSE'S GRAVITY SANITARY SEWER SPECIFICATIONS ARE COMPLEMENTARY

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IN NATURE AND SHOULD NOT BE INTERPRETED INDIVIDUALLY WITHOUT REFERENCE TO THE OTHER. REVISED 12/20/2018