



WEBER HILL TERRACE / WARREN WOODS
SANITARY SEWER IMPROVEMENT AREA

Technical Specifications

May 31, 2019

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General Information

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General Information

Section 10

10.01. ABBREVIATIONS

ADD	Addition	IDOA	Illinois Department of Agriculture
AI	Area Inlet	IDOT	Illinois Department of Transportation
ANSI	American National Standards Institute	IHPA	Illinois Historic Preservation Agency
ASA	American Standards Association	IN	Inches
ASTM	American Society for Testing and Materials	INF	Inflow
ATG	Adjust to Grade	INV	Invert
AVE	Avenue	IPS	Iron Pipe Size
AWWA	American Water Works Association	LA	Lane
BC	Back of Curb	LF	Lineal Foot
BM	Benchmark	MAX	Maximum
BK	Book	MH	Manhole
BLVD	Boulevard	MJ	Mechanical Joint
BLDG	Building	MIN	Minimum
BPS	Booster Pump Station	MIP	Male Iron Pipe
CB	County Highway Bore	N/F	Now and Former
CL	Centerline	NO	Number
CJ	Construction Joint	PG	Page
CONC	Concrete	PVMT	Pavement
CMP	Corrugated Metal Pipe	POC	Point of Commencement
CF	Cubic Foot	POB	Point of Beginning
CY	Cubic Yard	PC	Point of Curvature (Roads)
CI	Curb Inlet (Roads)	PC	Pressure Class (Water and Sewer)
CI	Cast Iron (Water and Sewer)	PE	Polyethylene
CIOD	Cast Iron Outside Diameter	PI	Point of Intersection
CTS	Copper Tube Size	PT	Point of Tangent
DR	Drive	PVC	Polyvinyl Chloride
DI	Ductile Iron	PE	Private Entrance (Roads)
ESMT	Easement	PE	Polyethylene Pipe
EJ	Expansion Joint	PL	Property Line
FT	Feet	PS	Pipe Stiffness
FES	Flared End Section	RR	Railroad
FB	Flat Bottom	RCP	Reinforced Concrete Pipe
FL	Flow Line	ROW	Right of Way
FIP	Female Iron Pipe	RPR	Resident Project Representative
GI	Grated Inlet	SAN	Sanitary
GST	Ground Storage Tank	SB	State Highway Bore
HDPE	High-Density Polyethylene Pipe	SDR	Standard Dimension Ratio

SF	Square Feet	TOC	Top of Curve
SY	Square Yard	TOA	Top of Asphalt
STA	Station	TBR	To Be Removed
SWPPP	Storm Water Pollution Prevention Plan	TBR&R	To Be Removed and Replaced
TB	Township Road Bore	TSM	Temporary Seed and Mulch
TBM	Temporary Bench Mark	UFR	Uni-Flange Restraint
TYP	Typical	VCP	Vitreous Clay Pipe

10.02. AWWA SPECIFICATIONS TITLES

- C-104-ANSI A21.4-Standard for Cement-Mortar Lining
- C-105-ANSI A21.5-Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems
- C-110-ANSI A21.10-Standard for Ductile-Iron and Gray-Iron Fittings
- C-111-ANSI A21.11-Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
- C-115-ANSI A21.15-Standard for Flanged Ductile Iron Pipe with Threaded Flanges
- C-150-ANSI A21.50-Standard for Thickness Design for Ductile-Iron Pipe
- C-151-ANSI A21.51-Standard for Ductile-Iron Pipe, Centrifugally Cast
- C-153-ANSI A21.53-Standard for Ductile-Iron Compact Fittings for Water Service
- C-502-Standard for Dry-Barrel Fire Hydrants
- C-509-Standard for Resilient –Seated Gate Valves for Water Supply Service
- C-515-Standard for Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
- C-550-Protective Epoxy Interior Coating for Valves and Hydrants
- C-606-Standard for Grooved and Shouldered Joints

10.03. DEFINED INFORMATION

OWNER – Jefferson County PSD

Selected Granular Backfill – CA-7 or equal

Compacted Granular Backfill – CA-6 or equal and the granular materials shall be compacted by vibratory compactors of sufficient capacity to obtain a minimum of 90% of the maximum dry density at optimum moisture content as determined by Standard Test Methods for Laboratory.

Drawings – The construction drawings issued with these Specifications

Standard Drawings – Division VI Standard Drawings of the Standard Specifications for Water and Sewer Main Construction.

10.04. REQUIRED SUBMITTALS

On Submittals, please mark the product model number and the options and/or sizes you will be using. Also, please mark all standards required in the specifications. If the specifications are not marked up, preferably by highlighter, then they will be returned as rejected. Please provide a copy of all standards that a material references for our review and concurrence. The minimum number of submittals is 4, one for the CONTRACTOR and 3 to remain with the ENGINEER. The ENGINEER will not make copies of the submittals to return to the CONTRACTOR.

10.04.01 Water Main

Intentionally Blank

10.04.02 Elevated Tank

Intentionally Blank

10.04.03 Booster Pump Station

Intentionally Blank

10.04.04 Ground Storage Tank

Intentionally Blank

10.04.05 Water Treatment Plant

Intentionally Blank

10.04.06 Pressure Reducing Station

Intentionally Blank

10.04.07 Force Main Sewer

SEWER MAIN AND APPURTENANCES		Manufacturer	Model No.	Equal Accepted	Section	Submittal Required
1	Anchor Coupling	---	---			No
2	Casing	---	---			YES
3	Casing Spacers				52.04.12	
	a	Sewer main 6-inch or smaller	CCI Pipeline Systems	---	YES	YES
	b	Sewer main larger than 6-inch	Cascade Waterworks Mfg. Co OR BWM Co.	---	YES	YES
4	Combination Air Release Valve					
	a	2"	Valmatic	802A	YES	52.04.08 YES

SEWER MAIN AND APPURTENANCES		Manufacturer	Model No.	Equal Accepted	Section	Submittal Required
5		Copper Tracer Wire			52.04.13	
	a	Bores	Copperhead Industries, Inc.	1245EHS	YES	YES
	b	Trenching	Copperhead Industries, Inc.	1430HS	YES	YES
	c	Connectors	Copperhead Industries, Inc.	3WB-01	YES	YES
6		End Seals	Method to be approved by OWNER and ENGINEER		YES	YES
7		Fittings			52.03 E	
	a	Ductile Iron - Compact Fittings	Tyler/Union		NO **	YES
	b	Ductile Iron - Flanged Fittings	Tyler/Union		Not Allowed	NO
	c	RJ-PVC Expansion Coupling	JM Eagle or North American Pipe Corp.		YES	YES
	d	PVC Fittings			Not Allowed	NO
9		Gate Valves				
	a	3 inch to 12 inch	American Flow Control	2500-1	YES	52.04.04 YES
	b	14 inch and up	---	---	Not Used	NO
10		Plug Valves				
	a	3 inch to 12 inch	Valmatic	2800R	Not Used	52.04.06 NO
	b	14 inch to 36 inch	---	---	Not Used	NO
11		Check Valves				
	a	Ball Check Valve	Flygt	Type-5087	Not Used	52.04.07 NO
	b	Swing Check Valve	Valmatic	7800	YES	52.04.05 YES
12		Pipe				
	a	HDPE	---	---	Not Used	NO
	b	PVC	---	---		52.03 YES
	c	Restrained Joint PVC	---	---		52.03 YES
	d	Ductile Iron	---	---		52.03 YES
13		Pipe Restraining Glands				52.04.11
	a	PVC	Ford 1500	---	YES	YES
14		Valve Box	Tyler Union	6850	YES	52.04.09 YES
15		Valve Box Marker	10' tall in fields		YES	52.04.10 YES
16		Special Requirements				
	a	Boring Plan				55 YES
	b	Seeding Mixture & Plan				32 YES
17		Meter/Air Release Box		(Depth x ID)		
	a		ADS N-12® ST IB PIPE	36" x 30"	YES	52.04.14 YES
18		Meter/Air Release Lid				
	a		18" Cast Iron Marked "Sewer"		YES	52.04.14 YES
19		Service Line Fittings				
	a	Saddle/Tee				YES
	b	Corp				YES
	c	Curb Stop Box				YES
	d	Swing Check Valve				YES
	e	Tracer Wire Access Box				YES
	f	Ball Valve				YES

* Respectively

** no like, equivalent, or "or-equal" item or substitution permitted.

10.04.08 Gravity Sewer Main

SEWER MAIN AND APPURTENANCES		Manufacturer	Model No.	Equal Accepted	Section	Submittal Required
1	Anchor Coupling	---	---	Not Used		
2	Casing	---	---			YES
3	Casing Spacers					
	a Sewer main 6-inch or smaller	---		YES		YES
	b Sewer main larger than 6-inch	Cascade Manufacturing	---	YES		YES
5	Concrete					
	a Rebar	---	---		22	YES
	b Manhole Mix Design	---	---		22	YES
6	End Seals	Method to be approved by OWNER and EN		YES		YES
7	Pipe					
	a PVC	JM Eagle or North American Pipe Corp.	---	YES	52.03	YES
	b Restrained Joint PVC	JM Eagle or North American Pipe Corp.	---	YES	52.03	YES
	c Ductile Iron	---	---		52.03	YES
8	Manhole					
	a Standard Cover	Neenah OR East Jordan	R-1772 OR 1022	NO **	52	YES
	b A-Lok			YES		YES
	c Structure			YES		YES
	d Floor			YES		YES
	e Walls			YES		YES
	f Lid			YES		YES
	g Link Seal					
	h Grade Rings			YES		YES
	i Cone			YES		YES
9	Special Rerquirements					
	a Boring Plan				55	YES
	b Seeding Mixture & Plan				32	YES
	c Sod			Not Used		
	d Manhole Sealing Plan				52	YES

* Respectively

** no like, equivalent, or "or-equal" item or substitution permitted.

10.04.09 Grinder Pump Station

Grinder Pump Station		Manufacturer	Model No.	Equal Accepted	Section	Submittal Required
1	Grinder Pump Station					
	a	Simplex	E-One	WH101-92 to 159	YES	YES
	b	Duplex	E-One		YES	YES
	c	Control/Alarm Panel	E-One		YES	YES
	d	Generator Hookup	E-One		YES	YES
2	Electrical Material					YES

* Respectively

** no like, equivalent, or "or-equal" item or substitution permitted.

General Requirements

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General Requirements

Section 15

15.01. SCOPE OF WORK

The work, as proposed, includes the furnishing of all labor, materials, equipment, transportation and performing of all operations required to construct the wastewater pumping and collection facilities (gravity main, lift stations, and force main) for the OWNER, all as shown on the Drawings and/or as herein specified. In case of conflict between the Drawings and these Specifications, the CONTRACTOR shall notify the ENGINEER, prior to bidding, to clarify the discrepancy and obtain a decision on which document governs. If the CONTRACTOR or any of their subcontractors fail to notify the ENGINEER prior to bidding, then the CONTRACTOR shall provide and install the intended material or equipment at no additional cost to the Contract Price.

Construction activities by the CONTRACTOR shall not cause any wastewater discharge which would violate the requirements of the OWNER'S National Pollution Discharge Elimination System (NPDES) Permit. Accordingly, at least ten (10) days after execution of the Agreement and along with submission of his progress and shop drawing schedules, the CONTRACTOR shall submit a detailed outline of his proposed construction sequence including tree clearing. At a minimum the contractor shall submit his/her schedule as to when the pump station will be in operation how the different parts of the project will be come online.

15.02. CONTRACTOR RESPONSIBILITIES

An attempt has been made to provide as much information on the Drawings as possible in regard to both existing and proposed conditions, although extreme accuracy in terms of dimensions and sizes of utilities, piping, etc., is not guaranteed. It is therefore the CONTRACTOR's responsibility to examine the Drawings, Specifications, and work site; to become familiar with the conditions and limitations applying to the work; and to verify all measurements, distances, levels, dimensions, quantities, etc., prior to making their bid, ordering materials, and/or starting work. By the act of having submitted a bid, the CONTRACTOR will be deemed to have made such examinations and verifications, and to have made allowances for such in their bid. If any major discrepancies occur between the Drawings and actual conditions, the CONTRACTOR shall notify the ENGINEER before submitting their bid and/or starting the work.

It shall be the responsibility of the CONTRACTOR to furnish and install complete and working systems to perform the intended purposes as required by the Drawings and these Specifications. The CONTRACTOR shall be responsible for all details which may be necessary to properly install, adjust, and place into operation the complete installation, and shall include the costs of all such details in the Contract Price.

The CONTRACTOR shall be responsible for all equipment and materials furnished under these Specifications and as required by the Drawings, and storage of same, within one (1) year from the date of substantial completion, in accordance with the General Conditions of this Contract. The CONTRACTOR shall replace at their expense all materials found to be defective or damaged in handling or storage. The CONTRACTOR shall, if requested by the ENGINEER, furnish certificates, affidavits of compliance, test reports or samples for check analysis for any of the materials specified herein. The CONTRACTOR shall guarantee that the equipment furnished shall be properly installed, and when properly operated, shall perform the duty for which it is intended. They shall guarantee all materials, workmanship, and completed installation to be first class in every particular and shall, at their own expense, furnish and replace any part or parts that may prove defective in material, equipment, or workmanship within one (1) year from the date of substantial completion, in accordance with the General Conditions of this Contract.

Although they may not be specifically shown on the Drawings or called for elsewhere in the Specifications, the CONTRACTOR shall include in their bid price the cost of all fittings, piping supports, equipment, safety devices, and miscellaneous appurtenances needed to provide a secure, workable sanitary sewer system.

15.03. REGULATORY AGENCIES AND PERMITS

A. MODNR – CONSTRUCTION PERMIT

This work shall be governed by an Missouri Department of Natural Resources permit for construction. This permit will be obtained for the CONTRACTOR by the OWNER before any construction operations begin.

B. MODNR – NPDES PERMIT

NPDES Permit Number _____ for Construction Site Activities governs the erosion protection practices of this work. The CONTRACTOR will be responsible for implementation and maintenance of all erosion control measures necessary for his/her respective contract. The CONTRACTOR shall familiarize himself/herself with the NPDES Permit and associated Storm Water Pollution Prevention Plan (SWPPP) prior to submitting his/her bid. The NPDES Permit and SWPPP has been included as a part of the Contract Documents. The SWPPP shall serve only as a guide to follow for erosion control measures. The SWPPP is intended to be a dynamic document and, as such, will likely be modified throughout the construction process and will vary with construction methods used. In addition to the erosion control measures shown on the Drawings and the requirements of the NPDES Permit and the SWPPP, the CONTRACTOR shall exercise all precautions and take whatever measures necessary to prevent soil erosion. Earthwork operations shall be planned so that the exposure of bare soil is minimized, both as to extent and duration. The CONTRACTOR shall install all erosion controls as shown on the Drawings, discussed in the SWPPP and as necessitated by field conditions. Prior to bidding, the CONTRACTOR shall notify the OWNER and ENGINEER of any changes in the SWPPP that will be required due to planned construction methods. The CONTRACTOR shall take care during construction to minimize the risk of soil erosion on the construction site. If, in the judgment of the OWNER or ENGINEER, the

CONTRACTOR disturbs more land than is necessary for the associated work he shall install erosion control measures in that area in accordance with the SWPPP at no additional cost to the OWNER. The Erosion control measures shall generally adhere to the SWPPP and Section 32.23. Payment for the erosion control measures implemented will be at the CONTRACTOR'S unit bid prices as discussed 32.23. However, maintenance of the erosion control measures, as required by the NPDES permit and outlined in the SWPPP will be incidental to the total contract price.

If, in the opinion of the OWNER or ENGINEER, any soil erosion is occurring due to construction methods or other factors that are controllable by the CONTRACTOR, the CONTRACTOR shall immediately remedy the problem under the ENGINEER'S direction. Remedial measures may include, but not be limited to the following: installation of drainage ditch checks, silt retention fences, construction of temporary sediment ponds, reseeded, intermediate mulching, regrading, and removal of earth stockpiles. In such instances, all remedial measures required to prevent soil erosion and the associated maintenance of such measures shall be incidental to the total contract price.

C. MOHPA

Based on the Phase I archaeological investigation reports for this project, no sites along the proposed sewer main route have been recommended for monitoring during construction. However, should any unknown significant finds be encountered during construction, it shall be the OWNER/ ENGINEER's responsibility to contact the archaeological consultant upon notification from the CONTRACTOR, where appropriate, to provide the required monitoring, and to pay for such services. In addition, the CONTRACTOR shall include in their bid all costs associated with time delays, remobilization, etc., due to potential work stoppages associated with site avoidances or further archaeological site investigations. No additional costs will be allowed for remobilization or delays on the sewer main construction due to archaeological issues.

D. EASEMENTS

The OWNER will obtain the necessary easements. The CONTRACTOR shall familiarize themselves with all requirements of the easements.

E. ROAD PERMITS

The OWNER will obtain the Highway Permits. It shall be the CONTRACTOR's responsibility to contact the city street commissioner, local township roadway commissioners, county highway engineer, and State Highway personnel to coordinate the installation of sewer mains, sewer main boring operations, etc., on public right-of-way under their jurisdiction. It shall be the CONTRACTOR's responsibility to be aware of specific roadway permits for other site-specific conditions. The CONTRACTOR shall include in their bid all costs associated with special roadway repair requirements, traffic flow requirements, construction scheduling requirements, flagmen/road signage, etc.

F. FEDERAL, STATE, AND LOCAL REGULATIONS

The CONTRACTOR is responsible for conforming to the requirements of all applicable health and safety regulations and precautions as required by local, state and federal regulatory agencies including, but not limited to OSHA and MODOL. In accordance with

the requirements of the OSHA regulations for construction, the CONTRACTOR shall provide and require the use of personal protective and lifesaving equipment for all persons working in or about the Project.

G. ENVIRONMENTAL REQUIREMENTS

The CONTRACTOR is responsible for conforming to the requirements of all environmental requirements as required by local, state and federal regulatory agencies. This includes the Endangered Species Act. Therefore, the CONTRACTOR cannot cut trees between March 31 and October 31 of each year.

H. RAILROAD REQUIREMENTS

There are no Railroad requirements for this project.

15.04. COORDINATION WITH RESIDENT PROJECT REPRESENTATIVE

The CONTRACTOR shall notify the Resident Project Representative or ENGINEER of the proposed work schedule prior to each day. Any work accomplished without the Resident Project Representative being present due to improper notification, shall be re-done, re-exposed, etc., to the satisfaction of the Resident Project Representative, and shall be incidental to the Contract Price.

15.05. STANDARD SPECIFICATIONS

The Standard Specifications referenced in these specifications refer to the current edition of the Standard Specifications for Water and Sewer Main Construction. In case of conflict with the Standard Specifications, the more stringent specification will be followed.

All sanitary sewer and sewer laterals shall be constructed in accordance with the Standard Specifications.

Sanitary sewer and water main separation shall be in accordance with Section 41-2.01 of the Standard Specifications.

All work performed shall be in accordance with the Standards of the State of Missouri Department of Natural Resources and Jefferson County Building Codes and all local codes.

15.06. EQUIPMENT AND PRODUCTS

Whenever equipment is identified on the Drawings or in the Specifications by reference to manufacturer's name and/or trade names, it is intended merely to establish a standard, and any equipment of other manufacturers which will perform adequately the services imposed by the general design will be considered equally acceptable provided in the opinion of the ENGINEER, the function, material, and service is equal.

The ENGINEER reserves the right to require a statement from the manufacturer of any products or equipment that the specific products or equipment have been inspected and tested and conform to the Specifications.

For the purposes of standardization all of the equipment for a single item or system shall be furnished by a single manufacturer except as noted or approved by the ENGINEER. Fabricated assemblies shall be shipped in the largest convenient section permitted by carrier regulations, and adequately match marked for proper assembly.

The CONTRACTOR shall be responsible for supplying spare equipment parts as provided in these Specifications and providing for the proper storage of same so that they are kept in operable condition.

15.07. SHOP DRAWINGS AND OPERATION AND MAINTENANCE MANUALS

The CONTRACTOR shall furnish for review complete equipment shop drawings in accordance with the General Conditions before installing any equipment. Drawings shall be provided by the equipment manufacturer and shall show all dimensions and details for correct installation of the equipment.

The CONTRACTOR shall review and approve/stamp all shop drawings for construction. Shop drawings submittals will not be accepted without these reviews. The CONTRACTOR has ultimate responsibility for all shop drawing review and approval, including sub-contractor submittals.

The CONTRACTOR must supply Operations and Maintenance manuals for all equipment.

15.08. PAYMENT FOR WATER USED

The CONTRACTOR shall supply all water needed for their construction practices including but not limited to boring operations, pressure testing, etc.

15.09. MANUFACTURER'S REPRESENTATIVES

The CONTRACTOR should arrange for all equipment manufacturers to provide a factory trained, qualified service engineer to oversee or inspect the complete equipment installation to assure that it is installed in accordance with the manufacturer's recommendations, make adjustments necessary to place the system in trouble-free operation, oversee initial start-up of the equipment and instruct the operating personnel in the correct care and operation of the equipment furnished. This shall not alleviate the CONTRACTOR'S responsibility for a complete working system. Such a service shall be a part of the Contract Price and no additional compensation shall be allowed.

15.10. SOIL BORING DATA

Soil boring data for test bores is available upon request.

15.11. CONTRACTOR REPRESENTATION AT MONTHLY BOARD MEETINGS

Upon request the CONTRACTOR shall have a representative present only at the monthly meetings of the JCPSD to answer questions presented by the Board of Trustees during construction and continuing through the completion of all final cleanup operations. Costs for attendance at meetings shall be incidental to the Contract Price.

15.12. OWNER'S STOP-WORK AUTHORITY

The OWNER shall have the authority to halt any work that is not being performed in accordance with the Drawings and Specifications for this project. In this event, the CONTRACTOR shall immediately stop work on the particular item until which time the Resident Project Representative or ENGINEER shall review the discrepancy, and all parties shall agree as to the proper construction method. No additional compensation shall be allowed for down time during a stop-work period initiated by the OWNER. In addition, if the CONTRACTOR fails to halt construction, they shall re-do the work properly at no additional cost to the OWNER.

15.13. COORDINATION WITH LOCAL UTILITIES

It shall be the CONTRACTOR's responsibility to contact all utilities (electrical, telecommunication, gas, etc.) to coordinate with the utility for needed services and equipment as shown on the plans and indicated in these Specifications. All work performed shall be in accordance with the standards of the National Electric Code, National Electric Safety Code and local codes.

Before ordering material and equipment, the CONTRACTOR shall determine from the local utility, which is intended to provide service for the herein described improvement, to determine that the service is available and will be supplied. Should any changes be required, the CONTRACTOR shall immediately notify the ENGINEER.

The CONTRACTOR shall be responsible for all necessary temporary service(s), and removal of same.

The CONTRACTOR shall further determine what service and material is being provided by the local utility and shall include as part of their proposal the equipment to be furnished, in place, all that is necessary to make a complete electrical service from the utility, for the improvement.

The CONTRACTOR shall determine what payment if any the utility will require for providing the service requested. The CONTRACTOR shall pay all such charges by the utility, including but not limited to an installation charges and monthly usage bills up to the time that the system(s) are accepted by and can be fully utilized by the OWNER. The CONTRACTOR SHALL include all such charges in the bid.

The CONTRACTOR will not be entitled to any extra for payment of the charges by the utility.

SURFACE REPLACEMENT AND SITE WORK

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SURFACE REPLACEMENT AND SITE WORK

Section 32

32.01. SCOPE OF WORK

The CONTRACTOR's attention is called to the fact that the sewer line construction will involve public Right-of-Way and private easements and that all improvements such as drainage ditches, plantings, culverts, active utilities, signs, outbuildings, field tiles, and any other miscellaneous, privately and/or publicly owned, property shall be restored to a condition equal to or better than their existing state of repair. Should it become necessary that the CONTRACTOR relocate/remove any obstruction encountered throughout construction he should consult with the ENGINEER's Resident Project Representative (RPR) before proceeding.

Surface restoration shall be as specified in Section 32.21 of these Specifications. All surfaces shall be restored to at least the original condition prior to construction. All lawn, pasture, and timber areas that are disturbed shall be final graded, fertilized, and seeded as specified in Section 32.22 of these Specifications. A rubber-tired skid steer or similar utility tractor shall be utilized for both initial and final grading work in residential yard areas to minimize property damage; backhoes, dozers, etc., will not be allowed in yards.

Temporary seeding will be paid as specified in Section 32.23.

The CONTRACTOR shall be responsible for obtaining all material storage locations, any vandalism (graffiti, etc.), damage, or contamination (due to crop spraying or otherwise) that may occur and for cleanup at said sites; all incidental to the Contract Price.

At the completion of all final cleanup operations, the CONTRACTOR shall place an approved valve marker at every valve, and air release valve for ease of identification for the OWNER and system operator. This work shall be incidental to the Contract Price.

32.02. EASEMENTS

It is intended that the sanitary sewer main extension be constructed on private easements and/or within the public right-of-way. The OWNER has secured the necessary easements and these documents are on file with the OWNER. The CONTRACTOR (successful bidder) shall be furnished copies of these documents prior to construction.

Some property owners have restrictive clauses in their easement regarding trees and shrubbery, fences, private utilities, width of easement, forcing construction in road right-of-way, etc. The CONTRACTOR shall comply with these restrictive clauses. It is entirely the CONTRACTOR'S responsibility to be aware of all restrictions and easements, and no increase in the Contract Price shall be allowed for any construction methods, landowner notifications, etc., necessary to comply with the restrictions. The CONTRACTOR shall refer to the individual easements for details regarding the restriction(s). The easements will be available for CONTRACTOR review at the ENGINEER's Office and at the pre-bid meeting.

When it is necessary that the CONTRACTOR proceed across/over property supporting a growing cash crop (example: corn, legumes, soybeans, and wheat), they should so advise the ENGINEER's RPR, whereby the RPR shall note/record and make an assessment of the affected area (crop damage). When the CONTRACTOR follows the above instructions relative to reporting areas of crop damage and adheres to other instructions by the ENGINEER's RPR and also uses good judgment, it is, therefore, the intent that the OWNER shall reimburse the property owner/renter an equitable amount for damage done by the CONTRACTOR to growing cash crops. Should, in the judgment of the ENGINEER and OWNER, it be determined that the CONTRACTOR occupied an area greater than necessary for their particular operation relative to crop damage and other construction efforts, the CONTRACTOR shall be held liable for the cost applicable to the excess area/damage caused by them. The CONTRACTOR shall apply lime and fertilizer to disturbed crop areas in accordance with Section 21 of the Standard Specifications. The same procedure, as for growing cash crops, shall be adhered to by the CONTRACTOR when it comes to ornamental trees, shrubs, flowers, fences, waterways, lawns, gardens, etc., relative to the need to affect, relocate, construct nearby, or transplant such items during the CONTRACTOR's operations. The CONTRACTOR shall be responsible and liable for all damages and claims caused by their operations to shrubs, trees, flowers, lawns, fences, gardens, orchards, nursery stock, etc., unless directed by the ENGINEER with the exceptions of growing cash crops (i.e., legumes, corn, soybeans, wheat). No additional compensation will be allowed for the above beyond the contract unit prices for the specified items of work listed in the Bid Schedule.

Agriculture field terraces shall only be crossed by a method approved by the land owner and will be paid for at the CONTRACTOR'S unit bid price for boring or trenching of the appropriate pipe class and diameter. In the event a terrace is "accidentally" cut, either with a hoe or trencher, the terrace must be reshaped, compacted, and protected from erosion within 72 hours after the terrace is cut. All work associated with a terrace that is "accidentally" cut shall be performed by the CONTRACTOR without any increase in the Contract Price.

32.03. PUBLIC RIGHT-OF-WAY

All crossings required under existing county and state highways will be made by boring a casing for the sewer line.

All crossings under asphalt and Portland cement concrete will be made by boring unless called out on the Drawings or as directed by the ENGINEER and/or OWNER.

The CONTRACTOR shall familiarize themselves with and abide by all requirements as to traffic flow, flagmen, maintenance of trench, advance warning signs, etc., as required in the various county, township, and state permits. The CONTRACTOR shall execute and maintain in force, all bonds as required by MoDOT, county, or township entities.

Should it become necessary to construct the sewer main on private property, the OWNER will obtain any necessary private easements.

32.04. JULIE LOCATES

It shall be the CONTRACTOR'S responsibility to locate any sewer main or service line installed as part of this project, prior to Substantial Completion. Any costs associated with these JULIE locates shall be included in the bid.

Before beginning work in an area, the CONTRACTOR shall contact JULIE at 800-892-0123 and any other non-JULIE member companies maintaining utilities, pipelines, transmission lines, and any other potential obstacles in the project area and request their assistance in field locating their utilities in that area. The CONTRACTOR, however, shall be solely responsible for the location of utilities. The utilities shown are for informational purposes only and the OWNER and the ENGINEER do not imply that the information is complete.

32.05. STRUCTURES AND UTILITIES ENCOUNTERED

Various underground and surface structures may or may not be shown on the Drawings. The location and dimensions of such structures where given do not purport to be absolutely correct. Some structures are plotted on the Drawings for the information of the CONTRACTOR but information so given is not to be construed as a representation that such structures will be found or encountered as plotted. Other structures may also be encountered which are not shown on the Drawings.

The CONTRACTOR shall maintain in operating condition all utilities encountered in this work. Any damaged existing utilities as a result of this construction shall be repaired to the satisfaction of the owner of the utility at the CONTRACTOR's expense, whether or not said utilities are shown on the Drawings. Existing utilities may be relocated with the approval of the owner of the utility. The relocation shall be at the CONTRACTOR's expense, done according to the requirements of the utility owner and shall be sufficient to clear the proposed improvement.

The CONTRACTOR shall be entirely responsible for all injuries to water pipes, electric conduits, existing drains or sewers, poles carrying currents, telephone or telegraph lines, railroad bridges and tracks, streets, pavements, sidewalks, curbs, fences, culverts, buildings, or other structures of any kind met with during the prosecution of the work, whether on public or private property.

All such structures or utilities which are removed to allow construction or damaged by it shall be restored to a condition at least equivalent to that which existed at the commencement of the work unless additional written arrangements are made satisfactory to the owner of said property. The CONTRACTOR shall care for and maintain all such structures or utilities encountered, and where service by them is interrupted, they shall provide and maintain temporary service until repair is complete and full service is restored. Repair of and restoration of service for essential structures or utilities shall be prompt; in these cases, if repair is unnecessarily delayed or unsatisfactory in the judgment of the ENGINEER, the OWNER or ENGINEER may have the repairs made and may deduct the cost thereof from payments due the CONTRACTOR. All costs associated with structure or utilities encountered, including removal, replacement, repair, temporary service, or complications to

proposed work shall be incidental to the project and shall be performed without any increase in the Contract Price.

Any field drainage tiles, drainage ditches, or storm sewers interfered with by the construction of the improvement shall be rerouted around the improvement in such a way as to maintain the drainage of areas upstream and downstream of the improvements; any such work shall be approved by the ENGINEER and shall be done by the CONTRACTOR without any increase in the Contract Price.

32.06. CLEAN UP

Due to the location of much of the work around private property and within public thoroughfares, the CONTRACTOR's attention is called to the General Conditions of these Specifications. It is imperative that the project sites be promptly maintained in a reasonably clean condition and that it not present any hazard or prolonged inconvenience to individual property owners or the public in general.

During construction the CONTRACTOR shall cleanup as the work proceeds. The premises, easements, and rights-of-way shall be kept free of accumulations of waste materials and earth, rubbish and other debris resulting from the work. The CONTRACTOR shall barricade and prevent access to all open trenches and holes by the end of each working day before leaving the site, especially along road right-of-way areas, livestock grazing areas, driveways and field entrances, and residential yard areas. Open burning of debris will not be permitted unless specifically authorized in writing by the OWNER, and then only following state, municipal or other local codes, ordinances, rules or regulations.

If, in the judgment of the OWNER, the CONTRACTOR fails to keep the sites clean as described hereinabove, the OWNER may halt the construction and/or construction payments until the sites have been cleaned up to the satisfaction of the OWNER. The CONTRACTOR has three (3) working days from notification from the OWNER and/or ENGINEER that the site conditions are unsatisfactory, and the situation needs remedied. If, after this period of time, the cleanup is still not satisfactory, the OWNER has the right to hire an outside agency to complete the cleanup in a timely manner, and these costs shall be withheld per the General Conditions.

Final clean-up, grading, and permanent seeding shall be performed in accordance with the dates specified in Section 32.22.B.

At the completion of the project, the CONTRACTOR will remove all waste materials, rubbish and debris from and about the premises as well as all tools, scaffolding and surplus materials, and will leave the site clean and ready for occupancy by the OWNER. Pipe banding and other construction debris may not be left on top of or buried in the trench. The CONTRACTOR shall be liable for any damage caused to farms, yards, livestock, pets, equipment, etc., due to construction debris left in, on, or around the project. The CONTRACTOR will restore to their original conditions those portions of the site not designated for alteration by the Contract Documents.

Payment for cleanup will be incidental to the unit price of sanitary sewer main installation. The OWNER shall withhold a sum equal to eight (8) percent of the installed cost of all sewer

main, until all final cleanup/seeding work is satisfactory. This Cleanup retainage is in addition to the standard overall project retainage and may be used by the OWNER to hire a local Contractor to complete any unsatisfactory cleanup/seeding work. Final Payment of the Cleanup retainage will only be approved when the OWNER is satisfied with final cleanup/seeding work.

32.07. CONSTRUCTION CLEARING

Existing trees and shrubs within private easement and right-of-way shall be protected from damage, and when such trees or shrubs are in the way of construction, the ENGINEER may recommend the CONTRACTOR prune branches interfering with the work, or remove and dispose of shrubs, or transplant trees or shrubs out of the way of the construction and the Contract Price shall not be increased for the performance of such work. All pruning shall be done using equipment designed for pruning. Excavation equipment shall not be used for pruning. The CONTRACTOR shall be liable for damage to trees and shrubs which were to have been protected as directed by the OWNER, unless such damages are determined by the OWNER to have been unavoidable, and moneys due the CONTRACTOR may be withheld to cover such damages.

All necessary work involved in the clearing of the sewer line routing, either in Public Right-of-Way or in private easements, of stumps, fences (not to be cut unless absolutely necessary and not restricted on the easement), brush, and other miscellaneous and various items of work as needed or as called for on the Drawings, or directed by the ENGINEER, shall be performed by the CONTRACTOR in a satisfactory manner and no additional compensation will be allowed over and above the unit bid price per lineal foot for sewer main installed of the various diameters, materials, and class as specified.

Trees marked on the plans to be removed, shall be removed and disposed of off-site. All stumps, fences, brush, and other miscellaneous material removed during clearing shall be properly disposed of off-site unless an agreement can be worked out between the property owner and CONTRACTOR. All arrangements made between the CONTRACTOR and landowner shall be done so in writing, signed by both the CONTRACTOR and the property owner, and a signed copy of the written arrangement shall be given to the ENGINEER. Disposal operations shall be continuous with the clearing work. Trees marked on the Drawings for removal shall be paid at the unit bid price for tree clearing.

32.08. MAILBOX RELOCATION

The CONTRACTOR shall temporarily relocate mail boxes to the opposite side of the roadway as is necessary to accommodate the construction process. As soon as is practical the CONTRACTOR shall relocate the mail box to its original location. All temporary mail box locations and permanent mail box relocations shall be done in accordance with the guidelines of and with the pre-approval of the United States Postal Service. All costs associated with relocating mail boxes, including coordination with the USPS, temporary and final relocation, shall be paid at the unit price for "Mailbox Relocation".

32.09. TRAFFIC CONTROL

When any section of road is closed to traffic, the CONTRACTOR shall provide, erect, and maintain barricades, red flags, signs and lights at each end of the closed section and at all intersecting roads, in accordance with the Manual of Uniform Traffic Control Devices.

If during the progress of the WORK it is necessary to provide access to private property along the road, the CONTRACTOR shall provide, erect, and maintain, within the closed portion of the road, such barricades, signs, flags, and lights as may be necessary to protect the WORK and to safeguard local traffic. Trenches shall be barricaded or fenced to safeguard the public.

The cost of furnishing and maintaining barricades, warning signs, red flags, and lights as required herein shall be incidental to the Contract Price and no extra compensation will be allowed.

32.10. SIGNAGE

All traffic/street signs in conflict with construction methods shall be salvaged and re-erected. They shall be stored indoors at the contractor's shop or at a location provided by the OWNER. The signs shall then be re-erected to meet MoDOT standards. All signs shall be re-erected to the original height and at the same location as found before construction began. Any signs damaged by the CONTRACTOR while being temporarily stored or while handling, removing, or reinstalling shall be replaced by the CONTRACTOR at no additional cost.

32.11. DEMOLITION, SALVAGE, AND ABANDONMENT

This work shall consist of the removal and satisfactory disposal of existing structures or portions thereof, as shown on the Drawings and specified herein. Removal operations, whether complete or partial, shall be conducted with the least interference to the sewer system, and shall not be started until permitted by the ENGINEER.

Materials that are to be salvaged shall be carefully inventoried, removed, and stockpiled on the site where designated by the OWNER. If the CONTRACTOR damages or destroys such material, they shall restore or replace it without additional compensation.

Piping, valves, and other miscellaneous items may be reused if specifically and individually approved by the ENGINEER. Items for reuse shall be cleaned, painted and reconditioned as required by the ENGINEER.

Materials that are not to be salvaged and stockpiled shall become the property of the CONTRACTOR, and they shall remove and dispose of the materials away from the site. The salvage value of the material shall be considered in determining the Contract Price.

Except as otherwise specified, existing structures to be demolished shall be removed to at least 2 foot below the proposed elevation shown for the subgrade or ground surface, and all portions below this elevation that interfere with construction, as determined by the ENGINEER, shall be removed.

When structures are to be partially removed, the CONTRACTOR shall be responsible for any damage done to the portions that are to remain. Old concrete or masonry shall be carefully removed by drilling, chipping, or other methods approved by the ENGINEER, leaving a surface that will permit a neat joint with new construction, or otherwise be satisfactory for the purpose intended. Expansion structures shall be as shown on the Drawings. Where existing bars are to extend from the remaining portions of the existing structures into new construction, the concrete shall be removed, leaving the projecting bars clean and undamaged. Where projecting bars are not to extend into the new construction, they shall be cut off flush.

All broken concrete free of metal reinforcement from demolition may be disposed of as riprap where called for on the Drawings.

All existing pipe that will no longer be used shall have the ends securely grouted and sealed with a lean concrete slurry for a distance of at least 10 feet from the ends of the pipe; or the pipe ends shall be properly capped.

32.12. SITE IMPROVEMENT AND/OR REPLACEMENT

A. CULVERTS

The CONTRACTOR shall furnish and install pipe culverts as shown on the Drawings, in accordance with the Missouri Standard Specifications for Road and Bridge Construction. All pipe culverts shall be corrugated steel culvert pipe of the gage required in the Missouri Standard Specifications for Road and Bridge Construction.

Metal end sections shall be furnished and installed where required in accordance with the Missouri Standard Specifications for Road and Bridge Construction or as required by the owner of the culvert.

Any existing pipe culverts damaged by the CONTRACTOR shall be repaired or replaced in accordance with the Missouri Standard Specifications for Road and Bridge Construction and no additional compensation will be allowed.

B. RIPRAP

Riprap shall consist of clean stone or clean broken concrete. It shall be free of shale, shaly stone, and other imperfections. The majority of the riprap shall be sized between one and one-half (1-1/2) inches to six (6) inches. The largest stones shall not exceed six (6) to eight (8) inches.

Riprap shall be placed uniformly and, unless otherwise shown on the Drawings, all void spaces shall be filled with smaller stones. Riprap shall, at a minimum, be placed where shown on the Drawings and as directed by the ENGINEER. Riprap shall be installed as shown on the Drawings, except that when not shown on the Drawings, width and length dimensions shall be as required for field conditions and installation methods.

Riprap shall be paid per square yard unit price for “Riprap Removal and Replacement”.

C. SOIL STABILIZATION FABRIC

The CONTRACTOR shall furnish and install on the earth subgrade where shown on the Drawings or 2' beyond trench where existing area has fabric, a nylon-polypropylene non-woven fabric to stabilize the ground surface. The fabric shall be Mirafi 500X as manufactured by Celanese Fibers Marketing Company, New York, N.Y.; Typar, Style 3401 by DuPont Company Explosives Products, Wilmington, Delaware, or equal.

Prior to placing the fabric, the subgrade shall be cleared of sharp objects which might damage the fabric. The fabric shall be unrolled directly on top of the earth subgrade. If overlapping is required to cover the area, the overlap shall be at least three (3) feet. Should the fabric be damaged during any step of installation, the torn or punctured section shall be covered by another piece of fabric cut large enough to cover the damaged area and meet the three (3) foot overlap requirement. At curves, intersections or other areas where fabric is overlapped, care shall be taken to spread the base course aggregate in the same direction as the fabric overlap. Metal tracked machinery shall not come in direct contact with the fabric.

Payment for Soil Stabilization Fabric shall be incidental to the Contract Price.

D. DRIVEWAY

The CONTRACTOR shall provide a driveway to the lift station that consists of fabric, 4-inches of CA7, capped with 4-inches of CA6. This driveway should be 12-feet wide and allow for a vehicle to turn around at the Lift Station.

E. FENCE

The CONTRACTOR shall carefully remove and replace any fences that interfere with the sewer main installation. The fence shall be replaced to a condition equal to or better than before construction commenced. If the land owner chooses not to have the CONTRACTOR replace a section of removed fence, the CONTRACTOR shall get the landowners requests in writing with their signature and give a copy to the ENGINEER.

32.13. SITE WORK VERTICAL ELEVATION CHANGES

A. SITE EXCAVATION

1. GENERAL

Excavation shall be done to the lines and slopes shown on the Drawings. Unstable or unsuitable materials shall be removed and replaced with approved material if, in the opinion of the ENGINEER, it would be a detriment to the excavation. The CONTRACTOR will be allowed a negotiated compensation for removal and replacement of unsuitable existing earth materials below natural topsoil. The quantity for this work shall be as determined by the ENGINEER; in determining the pay quantity for this work, natural topsoil shall be considered as 12 inches thick and no

additional compensation will be allowed for removal of topsoil. Unstable or unsuitable material shall be disposed of by the CONTRACTOR.

2. TOPSOIL EXCAVATION

The CONTRACTOR shall remove topsoil and soil with a high organic content from the area of immediate construction and shall stockpile it on the site for use in finish grading in accordance with Section 32.13.E.

3. BORROW EXCAVATION

Any soil in addition to that excavated at the site required to complete fill area shall be furnished by the CONTRACTOR at their expense. Borrow excavation shall not be placed in fills until the material is approved by the ENGINEER. See Section 32.13.B. Earth Fill.

4. WASTE

Any excess excavated material shall be removed from the site by the CONTRACTOR, or if permitted by the ENGINEER, wasted on the site. Areas of wasted soil shall be compacted in accordance with Section 32.13.B.4 and finish graded in accordance with Section 32.13.E.

B. EARTH FILL

1. GENERAL

This work shall consist of the construction of fills by the placement and compaction of specified or suitable materials above the natural ground or other surface. Unless otherwise specified in the plans, all fill shall be compacted.

2. SUBGRADE PREPARATION

The area upon which a fill is to be placed shall be prepared by removing all topsoil containing roots, vegetation and other deleterious materials. The surfaces of each portion of the foundation, immediately prior to placing the earth fill, shall have all water removed from depressions and shall be properly moistened and sufficiently clean to obtain a suitable bond with the earth fill. When directed by the ENGINEER, the subgrade shall be benched where fill is to be placed on a slope.

No material shall be placed in any section of the earth fill until the foundation for that section has been dewatered and suitably compacted and has been approved by the ENGINEER. When the existing earth foundation materials are determined by the ENGINEER to be suitable, the area shall subsequently be disked or otherwise scarified to a depth of at least six (6) inches and recompacted in accordance with Section 32.13.B.4 so as to assure compaction, bonding with successive lifts, and insure against a potential plane of seepage. If the existing earth foundation materials are determined by the ENGINEER to be unsuitable, the CONTRACTOR shall remove these materials and replace them with approved material as directed by the ENGINEER. The CONTRACTOR will be allowed compensation for such "Removal and Replacement of Existing Unsuitable Soils" in accordance with Section 32.13.A.1. Excessive moisture content shall not in itself form the basis for classifying a material

as "unsuitable"; suitability shall be judged on the physical and chemical makeup of the material, i.e., any material which contains excessive moisture but would otherwise be suitable shall not be eligible for additional compensation.

3. EARTH FILL MATERIALS

The material for fill construction shall consist of soil which is free of roots, vegetation, frozen material, material with high organic content, and other deleterious materials. Materials determined by the ENGINEER to be unsuitable for earth fill shall be disposed of in accordance with Section 32.13.A.4. The ENGINEER shall determine which materials are suitable for earth fill and shall have the authority to designate where in the fill certain earth materials shall be placed even to the extent of locating the placement of individual loads.

4. PLACING EARTH FILLS

To achieve uniform compaction, fill material should be deposited in horizontal lifts extending the entire width and length of the fill, as far as practical, having a thickness compatible with the equipment utilized. It is presumed the lift thickness shall not exceed 8" in loose condition unless demonstrated by the CONTRACTOR to the satisfaction of the ENGINEER that the stated compaction can be uniformly achieved with a greater thickness. Lifts shall be disked to thoroughly mix and blend the different soils or to obtain a uniform moisture content.

The moisture content of the soil, when placed, shall be within $\pm 3\%$ of the optimum moisture content of the material, except as otherwise approved by the ENGINEER, and shall be compacted to a density no less than 90% of the maximum dry density at optimum moisture content as determined by Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort, ASTM D698. The density of the compacted fill shall be determined by the independent testing agency at regular intervals. "Regular intervals" is a variable and shall be as determined by the ENGINEER for each specific fill site, depending upon the site and method of the fill operation and the degree of difficulty expected in obtaining compaction. The services, testing, and reports of the independent testing agency shall be furnished by the CONTRACTOR to the ENGINEER incidental to the cost of the Contract.

If the natural water content of the fill material does not fall within the range previously described, the CONTRACTOR shall mix, dry or moisten as necessary to achieve the specified moisture content.

The CONTRACTOR shall maintain the fill in an approved manner until the final completion and acceptance of all the work under the Contract.

C. EARTH FILL EQUIPMENT

During all earth fill operation, the CONTRACTOR shall have at the site the following pieces of equipment:

- a. Disk Harrow of the tandem type.
- b. Sheep's Foot Roller having a minimum weight of 4,000 lbs per foot of roller length when fully loaded.

- c. Hand Tamper of either the pneumatic or mechanical variety. All earth fill equipment shall meet the approval of the ENGINEER.

D. HAND COMPACTION

Fill inaccessible to compaction equipment adjacent to pipes or structures shall be compacted by hand. The soil shall meet the requirements under Section 32.13.B.3 and shall have a moisture content, when thoroughly mixed, corresponding to that specified under Section 32.13.B.4.

The soil shall be deposited in lifts not to exceed four (4) inches loose measure and thoroughly compacted over the entire lift area with a pneumatic or mechanical tamping hammer. Special precautions shall be taken to achieve the compaction required without damage to the pipe or structure. Tamping equipment shall be subject to approval by the ENGINEER.

E. FINISH GRADING

The CONTRACTOR shall grade all areas to the finish grade elevation shown on the Drawings, or as directed by the ENGINEER. If the existing surface has become hardened or crusted, it shall be disked or raked so it will blend with the topsoil.

The CONTRACTOR shall place a six (6) inch layer of topsoil on all areas to be seeded. The top three (3) inches of topsoil shall be worked to break it up into particles no larger than two (2) inches. The surface shall then be alternately raked and rolled until the soil is friable and the grades are smooth and continuous.

32.14. STRUCTURAL EXCAVATION AND BACKFILL

A. STRUCTURAL EXCAVATION

All footings shall be founded on firm undisturbed soil, and a six (6) inch minimum thickness of structural granular backfill shall be placed under all concrete bottom slabs of structures. Excavations shall be carried deep enough to permit the minimum thickness of granular material to be placed or until firm undisturbed soils are encountered, whichever requires greatest depth. For requirements for select granular backfill, see Section 10.03.

In no case shall any footings be founded above those elevations shown on the Drawings. If soft or unsuitable soil is encountered at elevations where footings are to be founded, the ENGINEER may direct the CONTRACTOR to remove the unstable materials and bring the excavation to grade with fill concrete or structural granular backfill (see Section 10). Additional compensation will be made to the CONTRACTOR for such removal and replacement work as described in Section 32.13.A.1.

Excavations carried below depths shown on the Drawings shall be brought to grade by the CONTRACTOR with fill concrete or structural granular backfill. No additional compensation will be allowed for excavations carried below depth shown on the Drawings unless such excavations are ENGINEER approved "Removal and Replacement

of Existing Unsuitable Soils" which will be compensated for in accordance with Section 32.13.A.1.

The excavation will be large enough to allow for installation and removal of forms. Side forms will not be required for footings or edges of base slabs below grade, provided the soil is stable and square corners and straight and plumb sides are maintained until concrete is placed and approval of the ENGINEER is obtained. All other excavation shall allow for placement and removal of forms and inspection.

Special care shall be taken not to disturb the bottom of excavations where the soil is to provide bearing for slabs, footing, etc. If the presence of subsurface water or other conditions, which may decrease the bearing strength of the foundation material, prevail then soil adequate to protect the foundation material shall not be excavated until just before reinforcing steel and concrete are to be placed. The bottom of all excavations shall be inspected and approved by the ENGINEER before the placement of any granular material, reinforcing steel, or concrete.

B. STRUCTURAL BACKFILL

No backfilling shall begin without the approval of the ENGINEER. Unless otherwise shown on the Drawings or specified herein, backfill shall be structural granular backfill except for structures on or in earthen dikes, then backfill shall be Class A compacted, select excavated earthen materials.

All form work, rubbish, bracing, and sheeting shall be removed from the excavation before any backfill is placed. The placement of backfill around structures or walls shall be done simultaneously on opposite sides in even lifts. No backfill shall be placed behind any wall until the entire main structure of which that wall is a part is complete and until all concrete in the main structure has reached its specified 28-day strength, unless approved otherwise in writing by the ENGINEER. Small flow channels and other such appurtenances will not be considered as being part of the main structure. Sloping sides of the excavation which would be liable to cause wedging action shall be stepped or serrated. Under no circumstances shall backfill be placed in water.

Around all structures where adjacent finished grade is to be exposed to the weather, backfill shall be carried to two (2) feet six (6) inches below finished grade. A two (2) foot layer of clayey soil approved by the ENGINEER shall be placed over the full area of the excavated space outside the structure, compacted, and pitched to drain water away from the structure. The area shall then be finish graded in accordance with Section 212 of the Missouri Standard Specifications for Highway Construction, unless amended herein.

Special care shall be taken in backfill adjacent to waterproofing or foundation walls to avoid damage to the waterproofing. Pipes and drains entering and leaving the structure shall be protected from settlement.

32.15. SEWER MAIN EXCAVATION

A. GRAVITY SEWER MAIN

Where a firm foundation is not encountered at the grade established, due to soft, spongy or other unsuitable soil, all such unsuitable soil under the pipe and for the width of the trench shall be removed and replaced per the recommendation of a third-party soil consultant.

The OWNER shall be responsible to set line and grade reference stakes at each manhole. The CONTRACTOR shall be responsible for checking and following said reference stakes. It will be the CONTRACTOR's responsibility to coordinate the staking activities with the OWNER. The CONTRACTOR shall provide a minimum of one week (seven (7) days) notice to the ENGINEER prior to the start of construction to allow the ENGINEER to begin coordination of the sewer main staking operations. Once the staking has been completed, it shall be the CONTRACTOR's responsibility to protect the stakes and the information contained at each station. If the CONTRACTOR requests that any part of the staking operation be redone for any reason, the restaking efforts will be performed at the CONTRACTOR's expense per Article 15 of the General Conditions.

The CONTRACTOR shall use a laser as a guide for construction. The CONTRACTOR shall check their grade as construction progresses to assure that their work is on line and grade. Any discrepancies from the Drawings shall be corrected by the CONTRACTOR. The CONTRACTOR shall record the measurements of actual sewer main invert elevations at manholes and between manholes at the end of every 4th pipe, providing the record information to the RPR daily.

The CONTRACTOR shall dig out around the bell of the sewer main to allow the entire length of the pipe to lay on a firm foundation.

B. FORCE MAIN

The trench shall be excavated so that the sewer main will have a minimum of 42 inches of cover, unless a road or easement permit requires a greater depth. The profile shall be generally followed to minimize the number of air release valves. The depth of utility lines is approximate. The CONTRACTOR shall adjust the force main depth as necessary to limit the number of air release valves to the number shown on the plans. Depth of cover shall be taken every 100 feet, providing the record information to the RPR daily. Record shall include X, Y, and Z information accurate enough to locate the main with a probe.

32.16. ROCK EXCAVATION

Rock excavation includes removal and disposal of rock material encountered that cannot be removed by conventional methods. Rock material includes boulders ½ Cu. Yd. or more in volume, and rock in beds, ledges, unstratified masses, and conglomerate deposits. When excavation of the rock material requires systematic use of pneumatic or hydraulic tools or a rock trencher, rock excavation shall be allowed under guidelines of this section of these specifications and paid for at the rate specified in the Bid Schedule. Shale, boulders (less than ½ Cu.Yd. in size), sandstone, gravel, and similar rocky material that can be removed by conventional methods **WILL NOT** be considered as rock excavation nor allowed for payment.

Blasting will not be allowed for this project.

For sewer main excavations for PVC pipe up to 12 inches in diameter, rock shall be excavated to a width of at least 18 inches more than the inside diameter for PVC pipe, for the entire depth of the excavation. Rock excavation for pipe will be at least six (6) inches below the bottom of the pipe and at least three (3) inches below the bottom of the bell of a joint. For sewer main excavations for PVC pipe 14 inches in diameter and greater, rock shall be excavated to a width of at least 24 inches more than the inside diameter for PVC pipe, for the entire depth of the excavation. Rock excavation for pipe will be at least nine (9) inches below the bottom of the pipe and at least six (6) inches below the bottom of the bell of a joint. Before the pipe is laid, the base of the excavation shall be replaced with a cushion of SELECT GRANULAR BACKFILL. All irregularities of the rock are to be filled with SELECT GRANULAR BACKFILL as well. In addition, "soft" rock (i.e., rock not allowed for payment as rock excavation, but that can be removed by conventional methods) shall be properly bedded with a cushion of SELECT GRANULAR BACKFILL, to avoid rough edges or other irregularities from damaging the sewer pipe.

The CONTRACTOR, on encountering rock via the trenching/open cut method, shall sufficiently uncover various spot locations to assure the overall extent of rock in that particular location. The CONTRACTOR, on encountering rock via the directional boring method, shall sufficiently prove the overall extent of rock in that particular location by either accurate records of the pressure at the bore head or uncovering spot locations as directed by the ENGINEER/OWNER. In either case they shall immediately notify the ENGINEER/OWNER, who either (1) will approve rock excavation in that area as necessary, or (2) will provide the CONTRACTOR with an alternate sewer line routing which could produce a location that eliminates the necessity of all/part of the rock excavation.

The CONTRACTOR must understand that if it is the ENGINEER'S/OWNER'S decision to relocate the sewer main to avoid the encountered rock, a reasonable time lapse to obtain alternate routing would be necessary. All direct costs involved in re-routing of the sewer line to a different location to avoid rock excavation will be borne by the OWNER.

It shall be the CONTRACTOR's responsibility to dispose of all excavated rock off site, to clean up debris, and to provide earthen or granular backfill to replace that rock material removed. This work is included in the unit price for Rock Excavation. The CONTRACTOR has five (5) working days from original excavation to remove the rock off site. If after this period of time the rock is not removed from the site, the OWNER has the right to hire an outside agency to remove the rock in a timely manner and these costs shall be withheld from the final Cleanup/Seeding retainage funds.

Rock excavation by the trenching/open cut method shall be paid for at the contract unit price per cubic yard determined by measuring the average length, width, and depth of the area of rock removal. However, the OWNER will pay for no more than 48 inches plus the I.D. of the sewer main for trench width, whether in rock or in a combination of rock and earth. In addition, only Rock Excavation as defined above will be included in the measurement for a particular vertical and/or horizontal profile (i.e., soil or soil/rock material overlaying,

intermixed with, or underlying solid rock will not be included), even if a rock trencher is utilized for the area of removal in question.

Rock Excavation by the directional boring method shall be paid for at the contract unit price per cubic yard determined by measuring/estimating the average volume (diameter of rock cutter & estimated length of rock) of the rock removal. However, the OWNER will pay for no more than 1.3 times the diameter of the pipe. In addition, only Rock Excavation as defined above will be included in the measurement for a particular vertical and/or horizontal profile (i.e., soil or soil/rock material overlaying, intermixed with, or underlying solid rock will not be included), even if a rock cutter is utilized for the area of removal in question. Once the quantity for rock excavation for a particular area has been measured in the field and submitted by the CONTRACTOR and approved for payment by the OWNER, the CONTRACTOR waives any and all rights to request a change in the quantity in the future.

32.17. DEWATERING

The CONTRACTOR shall, at all times, during construction, provide and maintain ample means and devices with which to promptly remove and properly dispose of all water entering the excavation in a manner that will keep the excavation dry and foundation bearing areas undisturbed until the pipe/structure is complete and all backfill has been placed. No extra compensation for dewatering or drainage necessary to meet this specification will be allowed.

Sumps, if used, shall be located outside of load bearing areas and at such distance that the bearing surfaces will not be damaged. Water containing silt in suspension shall not be pumped into any sewer lines or discharged to state waters.

If well pointing or the installation of temporary drains are required to complete the work, they shall be provided by the CONTRACTOR.

32.18. TRENCH PROTECTION

Trench protection shall be in accordance with all applicable Federal, State and local regulations, laws and rules, but shall not be less than the standards and regulations established by OSHA. Where construction is in close proximity to existing utilities and structures, proper excavation support systems shall be used to prevent any damage caused by excavation.

The CONTRACTOR shall furnish, install and remove all shoring, bracing, sheet piling, shielding, or other required work necessary to retain banks of excavation, prevent cave-in of adjacent ground, and support and prevent displacement of adjacent structures of piping. All trench protection shall be maintained in good condition and removed when no longer required. The CONTRACTOR shall make good any injury or damage resulting from failure of the shoring system or from not observing these requirements.

The CONTRACTOR is responsible for obtaining and the cost of a Missouri Licensed Professional Engineer to design trench protection per any Railroad, State, Local, or per OSHA requirements. The price shall be included in the Contract Price.

32.19. SEWER MAIN BACKFILL

A. GENERAL

1. RIGID PIPE (DUCTILE IRON, CAST, CONCRETE, VCP, STEEL)

All Rigid Pipe shall be installed using Class B Bedding and Encasement per ASTM C12 summarized in below.

2. FLEXIBLE PIPE (HDPE, PVC, PE)

All Flexible Pipe shall be installed using Class II Bedding and Encasement per ASTM D2321 summarized in below.

B. TERMINOLOGY

1. FOUNDATION

As needed or required due to soft or unstable soils. The depth and backfill material shall be designed by a third-party soil consultant and concurrence of the ENGINEER is required.

2. BEDDING

The depth shall be as shown on the plans. The material shall be based on backfill method used described below for rigid or flexible pipe.

3. HAUNCH ZONE

This zone begins at the bottom of the pipe to the springline of the pipe. The material shall be based on backfill method used described below for rigid or flexible pipe.

4. PIPE ZONE

This zone goes from the springline of the pipe to a height above the pipe as shown on the plans. The material shall be based on backfill method used described below for rigid or flexible pipe.

5. TRENCH ZONE

This zone begins at the top of the Pipe Zone and extends to the Surface Zone as shown on the plans. The material shall be based on type of existing surface and Section 32.20 below.

6. SURFACE ZONE

This zone begins at the top of the Trench Zone to finished grade. The depth as shown on the plans. The material shall be based on type of existing surface and Section 32.20 below.

7. SUITABLE INITIAL BACKFILL MATERIAL

Finely divided material free of debris; organic material; frozen material; and stones and clods larger than 3" in any dimension.

8. NOTE 1

Sufficient crushed stone or Select Granular Backfill shall be placed so that the bedding extends to a horizontal plane at the selected top of that layer of material.

C. BACKFILL CLASS A FOR RIGID PIPE

1. FOUNDATION

See 32.19.B.1

2. BEDDING AND HAUNCH ZONE

Shall be concrete with a thickness below the pipe a minimum of 4 inches, or diameter divided by 4, or as shown on the plans, whichever is greater. The width shall be a minimum of 4 inches on each side or diameter divided by 4 on each side, whichever is greater. It shall also include welded wire mesh near bottom of pipe.

3. PIPE ZONE

Select Granular Backfill and per Section 32.19.B.8.

D. BACKFILL CLASS B FOR RIGID PIPE

1. FOUNDATION

See 32.19.B.1

2. BEDDING AND HAUNCH ZONE

Shall be Select Granular Backfill and Note 1. with a thickness below the pipe a minimum of 4 inches or diameter divided by 8, or as shown on the Drawings, whichever is greater.

3. PIPE ZONE

The material shall be Suitable Initial Backfill Material and per Section 32.19.B.8.

E. BACKFILL CLASSES IA, IB, II, III FOR FLEXIBLE PIPE

1. FOUNDATION

See 32.19.B.1

2. BEDDING AND HAUNCH ZONE

Shall be Select Granular Backfill and Note 1. with a thickness below the pipe a minimum of 4 inches or diameter divided by 8, or as shown on the plans, whichever is greater.

3. PIPE ZONE

The material shall be Select Granular Backfill and per Section 32.19.B.8.

F. TRENCH ZONE ALL BACKFILL CLASSES FLEXIBLE AND RIGID PIPE

- a. Improved Surface – Select Granular Backfill.
- b. Unimproved Surface within two feet of improved surface - Select Granular Backfill.
- c. Unimproved Surface - Excavated material free of rocks or stones larger than 3” in any dimension, debris, frozen material, and organic material.

G. SURFACE ZONE ALL BACKFILL CLASSES FLEXIBLE AND RIGID PIPE

- a. Improved Surface – Select Granular Backfill and/or surface replacement per Section 1.
- b. Unimproved Surface within two feet of improved surface – Existing top soil free of rocks or stones larger than 3” in any dimension, debris, frozen material, and organic material.
- c. Unimproved Surface – Existing top soil free of rocks or stones larger than 3” in any dimension, debris, frozen material, and organic material.

H. PAYMENT

1. FOUNDATION

Rock Material will be paid per cubic yard as measured in the field per the Bid Item “Sewer Main Foundation”.

2. BEDDING, HAUNCH ZONE, AND PIPE ZONE

Incidental to the Contract Price including disposal of any excavated material.

3. TRENCH ZONE

- a. Improved Surface – This backfill will be paid per cubic yard per contract unit price “Select Granular Backfill” as measured in the field, with maximum width per details in the Drawings and depth for Trench and Surface Zones and including disposal of any excavated material.
- b. Unimproved Surface within two feet of improved surface – This backfill will be paid per cubic yard per contract unit price “Select Granular Backfill” as measured in the field, with maximum width per details in the Drawings and depth for Trench and Surface Zones and including disposal of any excavated material.
- c. Unimproved Surface - Incidental to the Contract Price including disposal of any excavated material.

4. SURFACE ZONE

- a. Improved Surface – Surfaces paid per Section 32.21 and including disposal of any excavated material.
- b. Unimproved Surface - Incidental to the Contract Price including disposal of any excavated material.

32.20. UNSUITABLE BACKFILL MATERIAL

Where there is a deficiency of suitable backfill material due to a rejection of part or all of the excavated material as unsatisfactory for backfill purposes, the CONTRACTOR shall furnish satisfactory backfill material wasted from trench excavation in other locations or from other sources furnished by the CONTRACTOR.

The CONTRACTOR shall be responsible for disposal (hauling away) of any/all unsuitable backfill material that may not be utilized on the job site. The CONTRACTOR has five (5) working days from original excavation to remove the unsuitable backfill material off site. If after this period of time the unsuitable backfill material is not removed from the site, the OWNER has the right to hire an outside agency to remove the unsuitable backfill material in a timely manner and these costs shall be withheld per Article 15.01.E of the General Conditions of these Specifications.

Backfill furnished and work performed (including disposal operations) under these circumstances shall be paid for at the contract unit price per Cubic Yard for “Unsuitable Backfill Material”, as determined by measurement in the field with maximum trench width as specified on the Drawings and excluding the following areas, bedding, haunch zone and pipe zone.

32.21. SURFACE REPLACEMENT

A. GENERAL

Restoration of surfaces shall include the removal of the existing surface, the disposal of surplus material, and the construction of new surfaces as indicated on the plans or specifications. The type of surface restoration required shall be shown on the plans.

The maximum trench width shall be as follows:

Five (5) feet deep and less, without protection -twelve (12) inches on each side of pipe

Five (5) feet deep and less, with protection -twenty-four (24) inches on each side of pipe

Greater than five (5) feet deep— twenty-four (24) inches on each side of pipe

B. UNIMPROVED SURFACE

1. GENERAL

Where sewer mains are crossing open areas where early settlement is not critical, backfill shall be made by any acceptable method which will not dislodge or damage the pipe or cause bridging action in the trench. Excavated material or material from other sources furnished by the CONTRACTOR. Excess material shall be neatly rounded over the top of the trench as directed by the ENGINEER to allow for settlement of the trench. In final cleanup operations, the CONTRACTOR shall reshape the surface to level out any uneven settlement that has occurred.

2. PAYMENT

Payment backfill is incidental to the Contract Price.

C. REMOVAL OF PAVEMENT, SIDEWALK, DRIVEWAY, AND CURB

1. GENERAL

Wherever the pipe is located along or across an improved surface, the width of the trench shall be held as nearly as possible to the maximum width specified above in

section 32.21.A. Where brick or concrete pavement, sidewalk, driveway or curbing is cut, the width of the cut shall exceed the actual width of the top of the trench by twelve (12) inches on each side or a total of two (2) feet. Exposed surfaces of Portland cement, oil and chip surface, asphalt, or asphaltic concrete shall be cut with a pavement saw before breaking. Care shall be taken in cutting to insure a straight joint is sawed.

2. PAYMENT

Work under this section is incidental to the Contract Price.

D. TEMPORARY SURFACE HOT MIX ASPHALT PAVEMENT OR BITUMINOUS TREATED SURFACE

1. GENERAL

Wherever pipes are constructed under traveled roadways, driveways, sidewalks, or other traveled surfaces, a temporary surface shall be placed over the top of the excavation within one week. The temporary surface shall be 6-inches of CA-6 or equivalent rock. The top of the temporary surface shall be smooth and meet the grade of the adjacent undisturbed surface. The temporary surface shall be maintained at the CONTRACTOR'S expense every Friday until final restoration of surface is completed as specified. The CONTRACTOR is required to inspect all temporary surfaces every Friday and after all rains. The temporary surfacing shall be required over the entire width of the excavation but any width in excess of the specified width shall not be used in computing payment quantities.

2. MEASUREMENT

Except as otherwise shown on the plans or directed by the ENGINEER, payment quantities for temporary surfaces shall be measured based off the actual or maximum width shown on the Drawings, whichever is less. Where the items are at a greater distance from the trench, any damage shall be replaced at the CONTRACTOR'S expense.

3. PAYMENT

Cost of furnishing, placing and maintaining and removing the rock surface as described will be paid for at the CONTRACT unit price per square yard for "Temporary Road Surface".

E. TRENCH INSTALLED UNDER ROCK DRIVEWAY, ROAD, AND PARKING LOT

1. GENERAL

Wherever pipes are constructed under rock roadways, driveways, sidewalks, parking lots, or other rock surfaces, the Surface Zone shall be filled with Compacted Granular Backfill. The top of the trench surface shall be smooth and meet the grade of the adjacent undisturbed surface. The CONTRACTOR is required to inspect and add Compacted Granular Backfill, as required, every Friday and after all rains. The temporary surface shall be maintained at the CONTRACTOR'S expense until the end of the warranty period.

2. PAYMENT

Cost of furnishing, placing and maintaining and removing the rock surface as described will be paid for at the CONTRACT unit price per cubic yard for "Select Granular Backfill".

F. REPLACEMENT OF PERMANENT TYPE PAVEMENT, SIDEWALKS, CURBS, GUTTERS, AND STRUCTURES

1. GENERAL

The CONTRACTOR shall restore (unless otherwise specified or ordered by the ENGINEER) all permanent type pavements, sidewalks, driveways, curbs, gutters, shrubbery, fences, poles and other property and surface structures removed or disturbed during or as a result of construction operations to a condition which is equal in appearance and quality to the condition that existed before the WORK began. The surface of all improvements shall be constructed of the same material and match in appearance the surface of the improvement which was removed.

2. P.C. CONCRETE PAVEMENT SURFACE

Where the existing pavement surface is Portland Cement Concrete, The pavement replacement shall consist of ten (10) inch unreinforced P.C. concrete pavement unless otherwise indicated on the plans. The ENGINEER can choose to match existing concrete thickness and reinforcement and require the new surface to be "doweled" to existing concrete pavement. Portland Cement concrete shall conform to the applicable provisions of these specification and shall have a compressive strength of thirty-five hundred (3,500) pounds per square inch at twenty-eight (28) days. Construction methods for Portland Cement Concrete pavement shall conform to the current requirements of the "Standard Specifications for Road and Bridge Construction" of the IDOT for Portland Cement Concrete pavement. Pavement joints in the replacement surface shall conform to and match the joints in the adjacent pavement area.

3. HOT MIX ASPHALT PAVEMENT SURFACE – RIGID BASE

Where the existing pavement surface is hot mix asphalt and the base consists of a rigid material such as brick, Portland Cement Concrete, soil cement, natural cement or a combination of these materials, the base replacement shall consist of eight (8) inch (200 mm) Portland Cement concrete base course unless otherwise indicated on the plans. Portland Cement concrete shall conform to applicable provisions of these specifications and shall have a compressive strength of thirty-five hundred (3,500) pounds per square inch at twenty-eight (28) days. Construction methods for Portland Cement Concrete base course shall conform to the current requirements of the "Standard Specifications for Road and Bridge Construction" of the IDOT for Portland Cement Concrete base course. The surface replacement shall consist of a bituminous prime coat and two (2) layers one and one half (1-1/2) minimum thicknesses totaling a three (3) inch minimum thickness hot mix asphalt surface course conforming to the IDOT current "Standard Specifications for Road and Bridge Construction" for Hot Mix Asphalt Surface Course. The CONTRACTOR shall submit a mix design to the ENGINEER for approval. The mix design shall have been used and approved on an

IDOT project. The ENGINEER can choose to match existing concrete thickness and reinforcement and require the new surface to be “doweled” to existing concrete pavement and minimum (2) layers of Hot Mix Asphalt meeting existing thickness.

This work shall be completed within two weeks of disturbance if HMA is available, otherwise see 32.21.D, unless OWNER agrees in writing with CONTRACTOR to wait till end of the project.

4. HOT MIX OR BITUMINOUS TREATED SURFACE OVER A FLEXIBLE BASE.

Where the existing pavement is hot mix asphalt or bituminous surface treatment and the base consists of a flexible material such as gravel or crushed stone, the base replacement shall consist of a minimum of eight (8) inch compacted thickness of material unless otherwise indicated on the plans and shall conform to either one of the following course aggregate materials as described in the MoDOT "Standard Specifications for Road and Bridge Construction."

- a. CA6
- b. CA9
- c. CA10

Placing and compacting of the base course material shall conform to the methods described in the above-referenced specifications for aggregate base course. The surface replacement shall consist of a bituminous prime coat and a two (2) layer hot mix asphalt surface plant mix totaling three (3) inches in thickness conforming to the MoDOT "Standard Specifications for Road and Bridge Construction".

This work shall be completed within two weeks of disturbance if HMA is available, otherwise see 32.21.D, unless OWNER agrees in writing with CONTRACTOR to wait till end of the project.

5. MEASUREMENT

Measurement for payment purposes will be computed by using the actual length, width, (maximum width as specified in the plan details) and 6-inches of depth of the trench for which rock surface is placed.

6. BRICK PAVEMENT SURFACE

Unless otherwise specified, when the existing pavement includes a brick surface, replacement shall consist of ten (10) inches Portland Cement Concrete pavement as previously described. When actual brick pavement is specified, it shall consist of the following:

An eight (8) inch Portland Cement Concrete base reinforced unless otherwise indicated on the plans. Portland Cement Concrete shall conform to applicable provisions of these specifications and shall have a compressive strength of thirty-five hundred (3,500) pounds per square inch in twenty-eight (28) days. Construction methods for Portland Cement Concrete base shall conform to the current requirements of the MoDOT's "Standard Specifications for Road and Bridge Construction" for Portland Cement Concrete base course.

A three-fourth (3/4) inch sand cushion.

Brick wearing surface. Sound brick which is removed shall be cleaned and reused. When additional bricks are required they shall conform as is reasonably possible, to the color, size and quality of existing brick. Jointing material for brick wearing surface shall be the same as used in the adjacent existing brick surface. The finished surface shall be smooth, well designed, and meet the grade of adjacent existing surfaces.

7. CONCRETE SIDEWALKS, DRIVEWAYS, CURB, CURB AND GUTTER, AND STEPS

Where necessary or shown on the plans, to remove and replace concrete sidewalk, driveways, curb and curb and gutter, replacements shall be made as follows:

Concrete sidewalks, driveways, curbs and curb and gutter shall be replaced with concrete meeting the applicable provisions of these specifications and having a compressive strength of not less than thirty-five hundred (3,500) pounds per square inch at twenty-eight (28) days. Minimum thickness shall be the greater of existing surface or four (4) inches for sidewalks and six (6) inches for driveways unless otherwise indicated on the Plans. Walks on slopes 10:1 or steeper shall be constructed with steps conforming to the slope. The steps shall have a six (6) inch riser and a twelve (12) inch minimum tread. Public sidewalks shall be replaced with sidewalks and ramps in full compliance with all ADA regulations. CONTRACTOR is responsible for any redesign needs to ensure the replacement sidewalk/s is/are in full compliance with all current ADA requirements including transition to existing sidewalk. This work shall be included in the contract bid price for "Sidewalk Removal and Replacement". No additional compensation will be allowed. Sidewalks shall be finished to match existing adjacent sidewalk surfaces, unless otherwise specified or directed by the ENGINEER.

Curb or curb and gutter dimensions and cross-sections shall conform, as nearly as possible, with the existing installations. One-half (1/2) inch preformed expansion joints shall be placed at intervals not exceeding fifty (50) feet and at the junctions with existing work or as shown on the plans. This work shall be included in the contract bid price for "Curb and Gutter Removal and Replacement".

Concrete mix, reinforcement, base, contraction joints, and curing shall conform to the current requirements of the MoDOT's "Standard Specifications for Road and Bridge Construction" for Portland Cement Concrete base course.

8. BRICK SIDEWALKS AND DRIVEWAYS

Brick sidewalks or driveways shall be replaced with brick, using salvaged materials that're in good condition. Where shown on the plans, or directed by the ENGINEER, brick sidewalks or driveways shall be replaced with concrete in accordance with Section 32.21.F.6, in which case payment shall be made at the unit prices bid for concrete sidewalk or driveway replacement.

9. MEASUREMENT

Removal and replacement of permanent pavements, driveways, and sidewalks will be measured for payment in square yards.

Removal and replacement of curb, or curb and gutter, crossing a pipe will be measured for payment in feet. The length will be measured along the flow line of the curb, or curb and gutter, and will be limited to the distance specified in Section 32.21.A.

Except as otherwise shown on the plans or directed by the ENGINEER, payment quantities for sidewalk; driveways; pavement; curb; and curb and gutter shall be measured based off the actual or maximum trench width plus 1-foot each side, whichever is less. Where the items are at a greater distance from the trench, any damage shall be replaced at the CONTRACTOR'S expense. Where sidewalk parallel to a proposed pipe line is to be removed and replaced, the ENGINEER will determine the extent of such removal and replacement. The CONTRACTOR may elect to construct the conduit in a tunnel with the approval of the ENGINEER. In such an event, he/she shall be compensated by payment of the amounts of driveways, sidewalks, or curbs and gutters which would have been measured for payment had open cut methods been employed.

10. PAYMENT

Payment for "Removal and Replacement of Permanent Type Pavements and Driveways" will be made at the CONTRACT unit price per square yard for either "Bituminous Pavement Removal and Replacement", "HMA Pavement Removal and Replacement" or "Portland Cement Concrete Removal and Replacement. Payment for removal and replacement of concrete or brick sidewalk will be made at the CONTRACT Unit price per square foot for "Sidewalk Removal and Replacement". Payment for removal and replacement of concrete curb or concrete curb and gutter will be made at the CONTRACT unit price per foot for "Curb and Gutter Removal and Replacement".

32.22. LANDSCAPING

A. GENERAL

The CONTRACTOR shall be responsible for the repair of any damage to structures or equipment resulting from landscaping operations, and shall remove excess soil and other debris from the site before final acceptance of the project.

The CONTRACTOR is responsible for keeping all plants in good growing condition until final acceptance of the project, including watering as necessary for seed germination and continued plant growth. Non-potable water may be used.

Plants that die before final acceptance must be replaced. The cost of replacement plants shall be borne by the CONTRACTOR except for replacement for loss from vandalism or physical damage by animals, fire, etc., or losses due to "Acts of God".

B. PERMANENT SEEDING EXCLUDING SOD

The work shall consist of furnishing all labor, equipment, and materials for seeding a permanent grass mixture on all road ditches, structure sites, permanent pasture, and all Crop Reduction Plan acreage within the work area limits which are disturbed during completion of work. The surfaces of earthen embankments shall also be seeded when necessary. All areas trenched/disturbed between May 1 and December 31 shall be cleaned up, final graded, and permanent seeded by May 21 of the following year. All areas trenched/disturbed between January 1 and April 30 shall be cleaned up, final graded, and permanent seeded by September 30 of the same year. Failure to meet these guidelines will result in Liquidated Damages being assessed against the CONTRACTOR, at the established daily rate.

Fertilizer

The CONTRACTOR can choose to either:

- a. Take a minimum of one soil sample for every 1000 lineal feet of sanitary sewer main installed to be tested by the Soil and Water Conservation to determine the amount of fertilizer actually needed at the CONTRACTOR's expense.
- b. Add fertilizer in the amounts listed in the following paragraphs.

Immediately prior to seeding preparation, fertilizer shall be placed over the areas to be seeded. The fertilizer shall be a complete commercial fertilizer of organic base containing, in available form by weight, 6% Nitrogen, 12% Phosphorous, and 12% Potash. It shall be free flowing and suitable for application with approved equipment, delivered to the site in bags or other convenient containers, each fully labeled with the following:

- c. Name and address of manufacturer.
- d. Name brand or trademark.
- e. Number of net pounds of ready mixed materials in the package.
- f. Chemical composition of analysis.
- g. Producer's guarantee of composition.

Fertilizer shall be evenly distributed with an approved mechanical spreader at a rate of 500 pounds per acre.

If a heavy or long rain (as judged by the ENGINEER) should fall on the plant site after fertilizer has been applied but before the seedbed has been prepared, the CONTRACTOR shall re-fertilize those areas affected, at no additional compensation.

2. SEEDBED PREPARATION

All gullies, rills, and washes shall be filled to conform to the desired shape and the entire area to be seeded shall be reasonably smooth before actual seedbed preparation is begun. Stones larger than four (4) inches in diameter, sticks, stumps, and other debris will be removed. At this point, the required fertilizer shall be applied uniformly. Immediately after application of the fertilizer, the area to be seeded shall

be finely pulverized to a minimum depth of three (3) inches, either by spading and raking or by plowing, discing, harrowing, or other methods approved by the ENGINEER. The CONTRACTOR shall suspend operations when the soil is too wet, too dry, frozen or otherwise untillable. Seeded areas shall not be compacted through their use for such purposes as access roads or parking areas after seedbed preparation is completed. If rain should pack the seedbed prior to seeding, it shall be prepared again at no additional compensation.

3. SEED

Seeding shall be done immediately after seedbed preparation. The seed shall be applied at a uniform rate over the entire area. Grass seed shall be fresh, clean, and new crop seed composed of the following varieties mixed in the proportion by weight as shown, and testing the minimum percentages of purity and germination indicated. All seed used shall be labeled in accordance with U.S. Department of Agriculture Rules and Regulations under the Federal Act in effect at the time of the installation of the work involved under seeding operations. All seed shall be furnished in sealed standard containers. Seed may be mixed by dealer or by an approved method on the site. Weed seed shall not exceed .35% by weight of the total amount supplied. If seed is mixed on the site, dealer's guaranteed analysis for each variety must be furnished. Individual varieties must be delivered in separate unopened original containers should the CONTRACTOR desire to mix the seed on the site.

The mixture of grass seed used for seeding areas flatter than 3:1 slopes shall consist of the following proportions by weight per acre:

<u>Name</u>	<u>Lbs Per Acre</u>	<u>Percent Purity</u>	<u>Percent Germination</u>
Turf Type Fescue	75	98	85
Perennial Ryegrass	20	98	90

Areas with slopes 3:1 or steeper shall have an additional seeding of the following kind and quantity of seed:

<u>Name</u>	<u>Lbs per acre</u>	<u>Percent Purity</u>	<u>Percent Germination</u>
Perennial Ryegrass	30	98	90

The mixture of grass seed used for seeding the inside area of the earthen water retaining structures shall consist of the following proportions by weight per acre:

<u>Name</u>	<u>Lbs per acre</u>	<u>Percent Purity</u>	<u>Percent Germination</u>
Reed Canary Grass	15	98	90
Tall Fescue	15	98	90

4. SEEDING MATERIALS

No seed shall be sown during high winds or when the ground is not in proper condition for seeding (as judged by the ENGINEER). The ENGINEER shall examine and approve any equipment to be used. Prior to starting work, seeders shall be calibrated and adjusted to sow seeds at the proper seeding rate. The ENGINEER shall

be notified 48 hours prior to beginning the seeding operations so the trial seeding runs can be made to insure the proper seeder calibration.

Within 12 hours after seeding, the area shall be rolled at right angles to the runoff with an approved type roller or cultipacker to compact the seedbed and place the seed in contact with the soil.

5. MULCHING

Immediately after rolling of the seedbed, mulch shall be applied to all the earthen embankments, road ditches, drainage swales and any slopes of 3:1 or steeper. Mulching will not be required on the remaining areas of the site. Mulch shall be straw of wheat, rye, oats, or other approved stalks and shall be air dried. Hay will not be permitted. Mulch shall be hand or machine applied in loose enough layers to permit air to circulate but compact enough to reduce erosion. If baled mulch is used, care shall be taken that the material is in a loosened condition and contains no lumps or knots of compacted material.

6. WATERING

Immediately after the seeding operation is complete, the CONTRACTOR shall maintain a daily sprinkling schedule of several hours until such time as the seed commences to grow. Sprinklers approved by the ENGINEER will be used. Dosing with open ended or nozzled hoses will not be permitted.

7. RESEEDING AND MAINTENANCE

Seeding operations shall be repeated until a satisfactory uniform stand of grass is secured. Damage resulting from erosion, gulleys, washouts, or other causes shall be repaired by filling with topsoil, tamping, refertilizing and reseeding by the CONTRACTOR at no additional compensation. The CONTRACTOR shall mow and maintain all seeded areas until final acceptance of the project.

8. CROP REDUCTION PLAN (CRP) SEEDING

The CONTRACTOR shall contact the local NRCS office and receive approval of grass seed and fertilizer mixtures prior to placing any seed or fertilizer on any CRP land.

C. TURFGRASS SOD

The work shall consist of furnishing all labor, equipment, and materials for sodding a permanent grass mixture on all yards within the work area limits which are disturbed during completion of work. Sodding for the sewer main and service line installation shall be completed within 60 days of last service connection for each extension. Failure to meet these guidelines will result in Liquidated Damages being assessed against the CONTRACTOR, at the established daily rate.

1. FERTILIZER

The CONTRACTOR can choose to either:

- a. Take a minimum of one soil sample for every 1000 lineal feet of sanitary sewer main installed to be tested by the Soil and Water Conservation to determine the amount of fertilizer actually needed at the CONTRACTOR's expense.
- b. Add fertilizer in the amounts listed in the following paragraphs.

Immediately prior to seeding preparation, fertilizer shall be placed over the areas to be seeded. The fertilizer shall be a complete commercial fertilizer of organic base containing, in available form by weight, 6% Nitrogen, 12% Phosphorous, and 12% Potash. It shall be free flowing and suitable for application with approved equipment, delivered to the site in bags or other convenient containers, each fully labeled with the following:

- c. Name and address of manufacturer.
- d. Name brand or trademark.
- e. Number of net pounds of ready mixed materials in the package.
- f. Chemical composition of analysis.
- g. Producer's guarantee of composition.

Fertilizer shall be evenly distributed with an approved mechanical spreader at a rate of 500 pounds per acre.

If a heavy or long rain (as judged by the ENGINEER) should fall on the plant site after fertilizer has been applied but before the seedbed has been prepared, the CONTRACTOR shall re-fertilize those areas affected, at no additional compensation.

2. SODBED PREPARATION

Add good quality topsoil (if needed) to achieve total topsoil depth of 4-6 inches, after firming. To the extent possible, practical, affordable, and available, incorporate humus (fully decomposed organic matter) into the topsoil. Many local companies offer nutrient-rich compost/topsoil blends.

Test the soil pH with a chemical soil test to determine if any pH correcting materials are required. Acidic soils (pH of 6 and below) can be improved with the addition of pelletized lime. Alkaline soils (pH of 7.5 and higher) can be improved with the addition of sulfur or gypsum.

Finish grade the entire site, maintaining the rough grading contours and slopes, with a tractor-mounted box blade or pulverizer for large areas or a heavy-duty rake for smaller areas. Final grade should be approximately 3/4 below driveways, sidewalks, etc.

Apply "starter fertilizer" that is high in phosphate ("P" or the middle number on a bag of fertilizer), at the recommended rate. Ideally, rake the fertilizer into the top 1-2 inches. Organic fertilizers make a good choice for this application.

If your soil is loose and fluffy, you may roll the area with a lawn roller one-third full of water to firm and settle the surface. Low spots revealed by this step should be filled to match the surrounding grade surface. If time permits, allow the area to settle further with rainfall or by applying irrigation.

All gullies, rills, and washes shall be filled to conform to the desired shape and the entire area to be sodded shall be reasonably smooth and shaped to drain water away to avoid ponding before actual seedbed preparation has begun. Stones larger than four (4) inches in diameter, sticks, stumps, and other debris will be removed. At this point, the required fertilizer shall be applied uniformly. Immediately after application of the fertilizer, the area to be sodded shall be finely pulverized to a minimum depth of four (4) inches, either by tilling, by plowing, discing, harrowing, or other methods approved by the ENGINEER. The CONTRACTOR shall suspend operations when the soil is too wet, too dry, frozen or otherwise untillable. Seeded areas shall not be compacted through their use for such purposes as access roads or parking areas after seedbed preparation is completed. If rain should pack the seedbed prior to sodding, it shall be prepared again at no additional compensation.

The edge or transition between sod and existing grass shall be a straight edge cut with edger or sod cutter to a depth of $\frac{1}{4}$ - $\frac{1}{2}$ inch and all existing grass, and debris removed or tilled into the existing soil. The CONTRACTOR shall not lay sod over existing grass.

3. SOD

Sodding shall be done immediately after seedbed preparation. The sod shall be applied in straight lines with offset joints over the entire area.

The landowner may request a different species of grass for their property. The CONTRACTOR shall provide the other species at no additional increase in contract price.

4. SODDING

Install sod immediately upon delivery. Begin watering lawn within 30 minutes of installation. Turf is a living plant that requires ground contact and moisture to survive! In hot weather, begin watering while you are installing. Do not wait until the entire lawn is installed before turning on the water. Begin installing turf along the longest straight line, such as a driveway or sidewalk. Butt and push edges and ends against each other tightly, without stretching. Avoid gaps or overlaps. Stagger the joints in each row in a brick-like fashion, using a sharp knife to trim corners, etc. Avoid leaving small strips at outer edges as they are more susceptible to drying. On slopes, place the turf pieces lengthwise across the slope. To avoid causing indentations or air pockets, avoid walking or kneeling on the turf while it is being installed or immediately after watering. After installing the turf, roll the entire area to improve turf-to-soil contact and remove air pockets.

5. WATERING

Give the new lawn at least 1 inch of water within 1/2 hour of installation. Water daily, or more often, keeping turf moist until it is firmly rooted (about 2 weeks). Then less frequent, deeper waterings should begin. Weather conditions will dictate the amount and frequency of watering. Be certain that the new lawn has enough moisture to survive hot, dry, or windy periods. Water areas near buildings more often where reflected heat dries the turf. The CONTRACTOR shall maintain a daily sprinkling schedule of several hours until such time as the sod grass commences to grow.

Sprinklers approved by the ENGINEER will be used. Dosing with open ended or nozzled hoses will not be permitted. The CONTRACTOR with a written signoff and signature from homeowner can have the landowner do the watering.

6. RESODDING AND MAINTENANCE

Sodding operations shall be repeated until a satisfactory uniform stand of grass is secured. Damage resulting from erosion, gulleys, washouts, or other causes shall be repaired by filling with topsoil, tamping, refertilizing and reseeding by the CONTRACTOR at no additional compensation. The CONTRACTOR shall mow and maintain all seeded areas until final acceptance of the project.

D. PLANTING

1. GENERAL

Planting shall be as specified in the Missouri Standard Specifications for Road and Bridge Construction except as amended herein. In case of conflict with the Standard Specifications for Road and Bridge Construction, the more stringent specification will be followed.

Ball rooted plants are designated BR, and balled and bur-lapped plants B&B. When plants of the kinds or sizes specified are not available within a reasonable distance, substitutions may be made upon request by the CONTRACTOR, if approved by the OWNER or the ENGINEER. Plants larger than specified in the plant list may be used if approved by the ENGINEER, but the contract unit price may not be increased. If larger plants are approved, the spread of roots or ball of earth shall be increased in proportion to the size of the plant.

2. FERTILIZING

Fertilizing shall conform to the Standard Specifications for Road and Bridge Construction, and shall contain six (6) percent Nitrogen, twelve (12) percent Phosphorous, and twelve (12) percent Potash by weight.

3. PLANTING MATERIALS

Materials used for planting trees shall be as follows:

- a. Bracing - materials used for staking, bracing, or guying shall conform to the Standard Specifications except as amended herein. Buying and staking trees shall be done as directed by the ENGINEER.
- b. Hose - Hose, if used, shall be two-ply fiber-bearing garden hose, not less than one-half (½) inch inside diameter.
- c. Wrapping Material - Wrapping material shall be first quality, heavy waterproof crepe paper manufactured for tree wrapping.
- d. Mulch - Mulch shall be wood chips or ground bark.

4. PRUNING

Each tree and shrub shall be pruned in accordance with AAN Standards of the Standard Specifications for Highway Construction.

5. MAINTENANCE

Plant care shall be in accordance with the Standard Specifications for Highway Construction and as specified herein. The CONTRACTOR shall be responsible for maintenance of each plant immediately after planting until final acceptance of the project.

32.23. EROSION CONTROLS

The CONTRACTOR shall install all erosion controls shown on the Drawings and as called for in the NPDES Permit and SWPPP. The CONTRACTOR shall exercise all precautions and take whatever measures necessary to prevent soil erosion. Earthwork operations shall be planned so that the exposure of bare soil is minimized, both as to extent and duration. The CONTRACTOR will be responsible for installing and maintaining the erosion control measures as specified Drawings and as necessitated by field conditions and construction methods. Erosion control measures shall generally adhere to this specification section with payment for each item described below. Maintenance of the erosion control measures, as required, will be incidental to the total contract price.

If, in the opinion of the OWNER or ENGINEER, any soil erosion is occurring due to construction methods or other factors that are controllable by the CONTRACTOR, the CONTRACTOR shall immediately remedy the problem under the ENGINEER'S direction. Remedial measures may include, but not be limited to the following: concrete truck washout, installation of pre-manufactured ditch checks, installation of drainage ditch checks, silt retention fences, construction of temporary sediment ponds, reseeding, intermediate mulching, regrading, and removal of earth stockpiles. In such instances, all remedial measures required to prevent soil erosion and the associated maintenance of such measures shall be incidental to the total Contract Price. Any and all fees, additional inspection costs, and fines received by the OWNER regarding NPDES noncompliance for this project will be passed to the CONTRACTOR and is incidental to the Contract Price.

A. TRENCH STABILIZATION

When slopes exhibit erosion, and as directed by the ENGINEER or OWNER or as shown on the Drawings, and described in the SWPPP, erosion checks shall be installed at necessary intervals to prevent ditch washout.

Erosion control shall be of the following types and payment will be as indicated:

1. RIPRAP BERM

Intentionally Blank

2. DIRT BERMS (A SHALLOW DAM OF DIRT 18" H X 24" W X 15' L)

Intentionally Blank

3. MULCH, STRAW, OR SOME OTHER MATERIAL APPROVED BY THE ENGINEER

Shall be spread on disturbed surface to provide protection for uncompacted earth, and shall be incidental to Temporary Seeding and Mulch and Permanent Seeding.

4. PRE-MANUFACTURED DITCH CHECKS

GeoRidge shall be installed perpendicular to the trench or ditch as per the manufacturers recommendations, including the toed in erosion control blanket (erosion control blanket used here shall be incidental to the bid price for ditch checks); straw wattles can be used in lieu of the pre-manufactured check dams (see Straw Wattles below). A sufficient number of check dams or wattles shall be supplied to serve as a sediment control for the entire width of the trench or ditch. The CONTRACTOR will be paid the unit bid price for each ditch check regardless of the number of check dams/sections or straw wattles needed.

5. SILT FENCE

Intentionally Blank

6. STRAW WATTLES

Straw wattles (rolled erosion control products) shall be trenched in and staked per manufacturers recommendations. Where straw wattles are used as ditch checks they shall be spaced so the low point of the wattles is equal to the toe of the upstream wattle. The wattle shall extend up the side slope a minimum of 6" above the low point of the wattle. Straw wattles shall be paid at the CONTRACTORS unit bid price.

7. URETHANE FOAM GEOTEXTILES (TRIANGULAR SILT DIKE)

Where indicated on the plans a Triangular Silt Dike shall be installed (toed in and stapled) per manufactures recommendations. Where indicated on the plans or as needed a triangular silt dike shall be placed adjacent to the terminus of the disturbed portion of a ditch. This type of placement is intended to act as a sediment basin. The silt dike shall extend to the top of the side slopes or 6" above the lowest point of the dike. All necessary triangular silt dike will be paid for as set forth in the CONTRACTOR'S unit bid prices.

8. TEMPORARY SEEDING

Temporary seeding of the trench lines may be used to control erosion provided the temporary seeding activity corresponds with effective seeding/germination time periods. Where temporary seeding is shown on the Drawings for ditch crossings, either with other erosion control measures or as a standalone measure, the CONTRACTOR shall bid a price for EACH site. The CONTRACTOR shall visit each site as necessary to determine the amount of material and labor required. The CONTRACTOR'S bid price for each site shall hold true if additional sites are added during construction. Where temporary seeding is required due to slopes in pastures and timbers, the temporary seeding shall be paid for at the CONTRACTOR'S unit bid price per lineal foot. Temporary seeding that is paid per lineal foot must be approved by the ENGINEER.

9. INLET PROTECTION

Culverts and storm sewer inlets must have sediment control in place before disturbing land surfaces UPSTREAM. Inlet protection shall be either straw wattles or silt fence style as appropriate for sediment control for the specific field condition. All necessary inlet protections will be paid for as set forth in the CONTRACTOR'S unit bid prices.

B. SLOPE STABILIZATION

Where slope stabilization cannot be maintained due to steepness of the grade and/or physical limitations encountered (flowing water at ditch crossing), erosion controls shall be installed as directed by the ENGINEER and/or as shown on the Drawings and described in the SWPPP:

1. RIPRAP

Shall be six (6) inches in depth (sized and placed as described in Section 32.05 B.), covering the entire slope. Where riprap is required, the riprap shall be paid for at the CONTRACTOR'S unit bid price per cubic yard. Riprap that is paid per cubic yard must be approved by the ENGINEER and/or RPR.

2. EROSION CONTROL BLANKET

Shall be constructed of 70% agricultural straw, 30% coconut fiber, encased between two natural fiber, biodegradable nets installed per the manufacturer's recommendation. This blanket is to be used where riprap is not an option. Erosion blanket is to be North American Green SC 150 BN, or equal. Placement of erosion blanket will be paid at the CONTRACTOR'S unit bid price per lineal foot of along sewer main or lateral (gravity or force), except when used with Geo Ridge ditch check. The erosion control blanket shall be incidental to the Geo Ridge ditch check

3. STRAW WATTLES

Straw Wattles shall be installed per manufacturers recommendation for trenching and staking in place. The wattles shall follow contours and be properly spaced. Where wattles are placed to contain sediment from runoff from slopes, hills, berms, or spoil piles, place the wattles along the contour of the slope, the base of the slope, or as shown on the Drawings and as necessary to prevent loss of sediment. Straw wattles shall be paid at the CONTRACTORS unit bid price.

4. TEMPORARY SEEDING

Temporary seeding of the trench lines may be used to control erosion provided the temporary seeding activity corresponds with effective seeding/germination time periods. Where temporary seeding is required due to slopes in pastures and timbers, the temporary seeding shall be paid for at the CONTRACTOR'S unit bid price per lineal foot along the sewer main and lateral (gravity or force). Temporary seeding that is paid per lineal foot must be approved by the ENGINEER.

C. PERIMETER PROTECTION

Where required by the site and/or construction practices, and as shown on the Drawings and described in the SWPPP, perimeter protection measures shall be implemented to prevent the migration of sediment off site.

1. SILT FENCE

Shall be installed per the NRCS specifications and shall be placed along slopes or the perimeter of the property as necessary to prevent loss of sediment. Silt fence shall be incidental to the contract.

2. STRAW WATTLES

Straw wattles (rolled erosion control products) shall be trenched in and staked per manufacturers recommendations. Straw Wattles when used as other than ditch checks shall be paid at the CONTRACTOR's unit bid price.

3. TEMPORARY SEDIMENT BASINS

Where indicated on the plans a triangular silt dike shall be installed (toed in and stapled) per manufactures recommendations. Where indicated on the plans or as needed a triangular silt dike shall be placed adjacent to the terminus of the disturbed portion of a ditch. This type of placement is intended to act as a sediment basin. The silt dike shall extend to the top of the side slopes or 6" above the lowest point of the dike. Silt dikes used as a "sediment basin" shall be paid at the CONTRACTOR's unit bid price for triangular silt dike.

Additional erosion control practices may be used with prior approval from the ENGINEER and OWNER. Payment for additional erosion control practices will be negotiated as necessary.

INSTALLATION OF SEWER MAIN AND APPURTENANCES

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INSTALLATION OF SEWER MAIN AND APPURTENANCES

Section 42

42.01. SCOPE OF WORK

The work to be performed under this section shall include all materials, labor, equipment, and all other facilities necessary for the installation of the sewer mains by the trench method and for the installation of appurtenances as shown on the Drawings and/or herein specified.

Backfilling operations at fittings, valves, and connections to manholes or other structures shall not occur until all materials and work have been viewed by the OWNER, ENGINEER, or the Resident Project Representative.

No wood shall be allowed in the trench to shim or block out the sewer main, control the bend of a pipe, or discarded in the trench.

42.02. CONSTRUCTION METHODS

Construction methods recommended in the current edition of the Standard Specifications for Water and Sewer Main Construction, as far as applicable, shall be followed. In case of conflict with the Standard Water and Sewer Specifications, the more stringent specification will be followed. Installation methods shall also conform to the manufacturer's recommendations for the type of pipe being installed, unless specified differently in this Section. All construction and installation shall also comply with the most recent version of the Missouri State Plumbing Code.

For material specifications to the material type of sewer main, fittings, and appurtenances to be utilized, refer to Section 52 "Sewer Main, Fittings, and Appurtenances" of these Specifications.

For installation criteria regarding the boring or boring and jacking of sewer mains and service lines, refer to Section 55 of these Specifications.

42.03. PIPE LAYING

A. General

HDPE and/or PVC Water Quality pipe installed for use as force main shall be clearly labeled/marked as sanitary sewer force main, either by color or label installed every 4 feet on the force main.

Pipe laying, jointing, and testing for sewer pipe shall be as specified in Section 2.3.8 of the MDNR Wastewater GSD except as herein supplemented or modified:

In addition to the requirements called for in Section 2.3.8 of the MDNR Wastewater GSD, the following shall apply:

The locations of the sewers, conduits, and structures, as shown on the Drawings, have been selected to provide the least possible interference with, or the crossing of, existing utilities. The OWNER reserves the right to make minor variations in the location of these items during construction, to make any change or differing conditions discovered during construction, and no additional payment will be allowed the CONTRACTOR for such shifts in alignment.

Only competent persons at laying sewer main pipe shall be employed on this phase of the work, and complete suitable equipment necessary for the execution of same is required. Any incompetency observed by the OWNER must be removed at their request, and where improper equipment or lack of same appears to be impairing the quality or speed of the work, such adjustments in same shall be made to the OWNER's satisfaction.

The pipe, structures, fittings, and valves shall be placed in the trench with care. Under no circumstances shall pipe or other materials be dropped or dumped into the trench. The pipe shall not be dragged in a manner which would cause scratching on the surface of the pipe and will be considered cause for rejection. Pipe shall be installed in accordance with the manufacturer's recommendations, and with the Standard Water and Sewer Specs.

Polyethylene encasement shall be used to wrap the ductile iron pipe prior to installation. See Section 52.03.C. for specifications on the polyethylene encasement.

B. Bypass Pumping

The CONTRACTOR shall be responsible for design, installation, and maintenance of bypass pumping during sanitary sewer construction operations if required. Design, maintenance plan, and equipment shall be submitted for review and approval of ENGINEER.

C. Pipe Cleaning During Laying Operation

The pipe shall be kept clean during and after laying. At the termination of pipe laying, the open end of the pipeline shall be closed off by a suitable cover until laying operations are resumed. All dirt, debris and moisture shall be removed from the surfaces to be jointed.

If dirt or dust has been introduced into the length of pipe, a thorough cleaning of the pipe shall be done just before the joint of pipe is installed. At this time, a visual check shall be made by placing the pipe in an inclined position to assure that all foreign matter and dirt is removed from the inside of the pipe.

D. Inspection of Material During Construction

Any materials not meeting the specifications, or obviously faulty material, shall be rejected by the ENGINEER and removed from the job site by the CONTRACTOR. When ordered by the ENGINEER, joints may be cut from the pipeline for inspection. All ductile iron installation, **whether pipe or fittings**, shall be reviewed by the RPR before the trench is backfilled. Failure to allow for this observation shall result in the exposing of the pipe for review and shall be incidental to the contract costs.

E. Fluid Tight Joints

Make sure the gasket is not twisted or turned to prevent proper sealing in the groove. Apply the lubricant to the gasket surface and to the spigot end of the pipe. The joint is made by

one quick easy motion making sure the guide mark has reached the end of the fitting. For RJ pipe, the CONTRACTOR should then insert the nylon spline through the spline hole in the assembled joint which engages with the spline groove in the pipe end.

F. Breaks in Pipe or Joints

All breaks in pipe and/or joints shall be repaired to the satisfaction of the ENGINEER and at the expense of the CONTRACTOR. The defective pipe or fittings shall be removed and replaced. Repair clamps will **not** be permitted on forced main.

G. Cutting Pipe

Cutting of RJ pipe shall **not** be allowed; only the installation of full length joints shall be allowed.

H. Bed and Cover

The CONTRACTOR shall follow Section 32 of these Specifications.

I. Measurement and Payment

Payment for all work described in this section shall be included in the CONTRACTOR's bid price for the respective sizes of lines, pressure class, depth, and material type, as shown in the Bid Schedule. Measurement in lineal feet shall be made along the centerline of the trench through all valves and fittings, starting and ending at the face of structures.

J. Service Connections

All service connections shall be made by means of tees, tapped couplings, service clamps and other fittings approved by the ENGINEER. The use of solvent weld plastic saddles will not be permitted.

42.04. UTILITIES ENCOUNTERED

All utilities, including wiring, light standards, signal lights, sewers, private water lines, buried telephone cable, underground gas lines, etc., affecting the construction of the proposed improvement shall be adjusted at the CONTRACTOR's expense. It shall be the CONTRACTOR's responsibility to determine the exact location of all utilities. All adjustments shall be done as specified by the owner of the utility.

If the CONTRACTOR damages any utility not requiring adjustment, they shall replace or repair it as required by the owner and no additional compensation will be allowed. No attempt has been made on the Drawings to show all utilities or their exact locations. (See Section 15.02 of these specifications.)

The OWNER reserves the right to make minor variations in the location of these items during construction, to make any change or differing conditions discovered during construction, and no additional payment will be allowed to the CONTRACTOR for such shifts in alignment.

42.05. TESTING OF SEWER MAIN AND EQUIPMENT

A. Gravity Pipe

All sewers not passing any of the following referenced tests shall be considered unsatisfactory and shall be repaired by the CONTRACTOR at no additional compensation.

All tests and testing equipment, including a pressure gauge with maximum graduations of 0.5 psi and approved by the Resident Project Representative (RPR), shall be provided by the CONTRACTOR at no cost to the OWNER.

When pressure tests are to be conducted, the CONTRACTOR shall have the full test pressure applied to the sewer main segment and verify that the sewer main segment is holding pressure, prior to notifying the RPR to observe the formal pressure test for the duration required. Pressure test observation requests after 3:30 P.M. will be performed the next working day.

Payment for "Sewer Line Testing" will be paid for at the CONTRACTOR's unit bid price per lineal foot of gravity main as measured in the field. Payment will not be made for any segment until passing all required testing.

RPR shall be present for all testing.

1. Air/Leakage Test

In reference to Section 2.3.9 of the MDNR Wastewater GSD, "Testing and Inspection for Acceptance of Sanitary Sewers," **all** (100%) of the wastewater sewers shall be tested for leakage using the pressure air testing method. Air testing shall be incidental to the total Contract Price.

2. Infiltration Test

If approved by the ENGINEER, the infiltration test may be used if the water table is 18 inches or higher above the crown of the pipe and the exfiltration by water test may be used if the water table is less than 18 inches above the crown of the pipe.

3. Video Taping

In addition to the leakage test **all** sewers shall be subjected to Video Taping. The ENGINEER can request the lines to be videotaped at any time during construction. All lines will be televised by the end of the project. Each section of sanitary sewer line shall be cleaned of dirt and debris. All dirt and Debris shall be captured and removed at the next downstream manhole. The CONTRACTOR shall add water to the pipeline prior to the video inspection to help identify deficiencies. The recording shall be made using a color camera, self propelled or other, having sufficient light to show detail of problem areas and joints. The camera shall have a swivel head to look up each service connection. Camera speed shall not exceed three (3) feet per second. If problem areas or concerns are seen by the camera operator, then the camera shall be backed up, and an extended look at the area will be recorded. All recordings will have location (i.e. manhole # to manhole #), time, date, and footage displayed. A minimum of two (2) copies of the tapes and two (2) copies of the written inspection reports shall be

furnished to the ENGINEER and OWNER. The Video Taping will be paid for on a unit price per installed footage basis.

4. Lamping Test

Lamping tests may be required by the ENGINEER/OWNER at any time during construction an/or testing of the sanitary sewers. All sewers not passing the lamping tests shall be considered unsatisfactory and shall be repaired by the CONTRACTOR at no additional compensation.

5. Mandrel/Deflection Test

Deflection testing shall be conducted in accordance with Section 3.4 of the MDNR Wastewater GSD.

B. Pressure Pipe

Pipe laying, jointing, and testing for pressure pipe shall be as specified in Section 2.3.8 of the MDNR Wastewater GSD, except as herein supplemented or modified. Where laying and jointing methods for an allowable type of pipe are not covered by the Standard Water and Sewer Specs, the pipe shall be installed in accordance with the manufacturer's recommendations and applicable standards of the AWWA, ASTM, ASA or ANSI.

Payment for "Force Main Testing" will be paid for at the CONTRACTOR's unit bid price per lineal foot of force main as measured in the field. Payment will not be made for any segment until segment has passed all required testing.

1. Preliminary Pressure Testing: At the ENGINEER's option during the general construction period the following pressure testing procedure shall be followed:

After the PVC pipe is assembled trench side or in the trench, a test of not less than fifty percent (50%) above the system's anticipated working pressure shall be applied with either air or water. After two consecutive tests have been performed without any failure, the CONTRACTOR at their option and with the ENGINEER's approval may discontinue testing until the system is completed. A hydrostatic test shall then be run as outlined in 42.05.B.2, below.

If there is a change of laying conditions, technique or personnel after the testing has been discontinued, the CONTRACTOR should, and at the ENGINEER's request will, test additional sections to provide assurance that this change is satisfactory.

2. Pressure Testing: Hydrostatic and pressure testing shall conform with Section 3.4.1 of the MDNR Wastewater GSD; the basic provisions of AWWA C600 and C605 shall apply. The leakage test is not an acceptable formal test for passing a pressurized sewer main, only the pressure test is allowable.

Prior to performance of the test all air shall be expelled from the pipeline to the satisfaction of the ENGINEER. If required, taps shall be made at high points where air relief valves are not called for on the Drawings. Such taps shall be plugged after testing is complete.

Pressure 50 percent in excess of working pressure, as measured at the point of lowest elevation, shall be applied for not less than one (1) hour, and all pipe, fittings, valves,

and joints shall be carefully examined for defects. Leaking joints shall be remade and then retested.

C. Manholes

Manholes shall be tested before the ring and cover and grade adjustment rings are installed, and before backfill and compaction is complete. Conduct test in conformance with ASTM C1244. Payment for “Vacuum Testing Manhole” shall be paid for at the CONTRACTOR’s unit bid price for each manhole passing all required testing.

1. Preparation for tests:

- a. All pipes entering the manhole shall be temporarily plugged beyond the boot seals, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manholes.
- b. The test head shall be placed at the top of the manhole in accordance with the manufacturer’s recommendation.

2. Test Procedure:

- a. A vacuum of 10-inches mercury shall be drawn in the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off.
- b. The manhole shall pass if the time for the vacuum reading to drop from 10-inches mercury to 9-inches mercury meets or exceeds the values indicated in the following table:

	Diameter		
	4 ft	5 ft	6 ft
Depth (feet)*	Time (Seconds)		
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73
20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30	74	98	121

* Round actual depth of manhole to next depth up (i.e., 11 ft deep manhole, use depth of 10 feet)

If the manhole fails any test, the CONTRACTOR, at no additional costs, shall make all necessary repairs by an approved method and the manhole shall be retested until a satisfactory test is obtained. Written test results shall be provided to ENGINEER/OWNER.

42.06. DRAINAGE DITCH / CREEK CROSSINGS

Where sewer mains cross drainage ditches or creeks, the main shall be installed within the easement under the drainage ditch bed or creek bed avoiding obstructions such as culverts, concrete wingwalls, paved ditches, etc.

Where restrained-joint (RJ) PVC pipe for drainage ditch or creek crossings is NOT specified, the CONTRACTOR shall excavate across all drainage ditches or creeks called for in the plans to a sufficient depth to still maintain a minimum of 48 inches of cover between the top of the pipe and the bed of the drainage ditch or streambed of the creek. The PVC pipe shall then be laid in the trench and weighted down with sufficient numbers of sandbags filled with sand to keep the pipe from springing (or floating) upward. The trench shall then be backfilled per these specifications. This method of drainage ditch or creek crossing work shall be incidental to the Contract Price.

Where restrained-joint (RJ) PVC pipe for drainage ditch or creek crossings IS specified on the Drawings, the CONTRACTOR shall install the pipe according to Section 52 of these specifications. A minimum of 60 lineal feet of RJ PVC pipe with expansion couplings at both ends (see Section 52 of these specifications) shall be required at each drainage ditch crossing. If field conditions warrant it, the length of RJ PVC pipe may be increased with ENGINEER approval. This method of drainage ditch crossing work shall be paid in a twofold manner according to the appropriate bid item. First, the amount of RJ PVC pipe required for the drainage ditch crossing, as measured in the field, shall be paid per lineal foot. Second, a lump sum fee reflecting set up time, mobilization, etc., shall be paid for each drainage ditch crossing requiring RJ PVC pipe.

Where a directional bore is specified on the Drawings, see section 55 of these Specifications.

42.07. SEWERS NEAR WATER MAINS AND WATER SERVICE LINES

There shall be no physical connections between a public or private potable water supply system and a sewer, or appurtenance thereto, which would permit the passage of any sewage or polluted water into the potable supply.

No sewer shall be located closer than 10 horizontalfeet from water works structures.

A. Horizontal and Vertical Separation

1. Sewer mains and connections shall be laid at least 10 feet horizontally from any existing or proposed water main or water service line.
2. Should local conditions exist which would prevent a lateral separation of 10 feet, sewer lines may be closer than 10 feet to a water main provided that the water main invert is at least 18 inches above the crown of the sewer line, and is either in a separate trench or in the same trench on an undisturbed earth shelf located to one side of the sewer.

3. If it is impossible to obtain proper horizontal and vertical separation as described above, both the water main and sewer must be constructed with water main quality pipe and joints: slip-on or mechanical joint cast or ductile iron pipe, asbestos-cement pressure pipe, prestressed concrete pipe, or PVC pipe. The pipes shall be pressure tested in accordance with "AWWA Standard for Installation of Ductile-Iron Water Mains and their Appurtenances," AWWA C600-93 (no later editions or amendments) for a working pressure equal to or greater than the maximum possible surcharge head to assure water tightness before backfilling.

B. Water-Sewer Line Crossings

1. Whenever possible, sewers crossing water mains shall be laid with the sewer below the water main with the crown of the sewer a minimum of 18 inches below the invert of the water main. The vertical separation shall be maintained on each side of the crossing until the perpendicular distance from the water main to the sewer is at least 10 feet. The crossing shall be arranged so that the sewer joints will be equidistant and as far as possible from the water main joints. Adequate support shall be provided for the water mains to prevent damage due to settling of the sewer trench.
2. Where a sewer crosses under a water main and it is not possible to provide an 18-inch vertical separation:
 - a. The sewer shall either be constructed with or shall be encased in a carrier pipe with the ends sealed that is, water main quality pipe and joints: slip-on or mechanical joint cast or ductile iron pipe, asbestos-cement pressure pipe, prestressed concrete pipe, or PVC pipe. The pipes shall be pressure tested in accordance with "AWWA Standard for Installation of Ductile-Iron Water Mains and their Appurtenances," AWWA C600-93 (no later editions or amendments) for a working pressure equal to or greater than the maximum possible surcharge head to assure water tightness before backfilling. The water main quality sewer or carrier pipe shall extend on each side of the crossing to a point where the perpendicular distance from the water main to the sewer is at least 10 feet.
 - b. For the required length of the water main quality sewer or carrier pipe, omit the select granular cradle and granular backfill to one foot over the crown of the sewer and use selected excavated material (Class IV) and compact to 95% of Standard Proctor maximum density.
 - c. Point loads between the sewer or sewer casing and the water main are prohibited.
Adequate support shall be provided for the water main to prevent damage due to settling of the sewer trench.
3. Where it is not possible for a proposed sewer to cross under an existing water main, the construction methods and materials described in 42.07.B.2 above, Sec 2.8.3 of the MDNR Wastewater GSD shall be followed. Where a proposed sewer must cross over a proposed water main, an 18-inch vertical separation shall be maintained.

C. Sewer Manhole Separation From Water Main

No water pipe shall pass through or come into contact with any part of a sewer manhole.

42.08. THRUST BLOCKS

Thrust blocking is required on all pressure pipe. All bends of 1 1/4 degrees or greater, and all other fittings shall be thrust protected to prevent movement of the lines under pressure. Blocking shall be Portland Cement Concrete poured in accordance with project plan details, or precast, solid blocking for small diameter pipe where the undisturbed soil is extremely firm and stable. Thrust blocking shall extend from the fitting to the undisturbed soil. Pipe and fitting joints shall remain accessible for repairs. Where unstable soil conditions exist, all deflections in the pipe from a straight line shall be provided thrust blocking in accordance with the manufacturer's recommendations. Concrete for reaction or thrust blocks shall have a 28 day compressive strength of not less than 3,000 psi.

No wooden wedges, treated or otherwise, shall be allowed for shims for the blocking in any circumstance. PVC pipe may not be used in lieu of concrete blocks.

Where a fitting is used to make a vertical bend, the fitting shall be anchored to a thrust block braced against undisturbed soil. The thrust block should have enough resistance to withstand upward thrusts at fitting.

42.09. CONNECTION TO EXISTING LIFT STATION OR MANHOLE

A portion of this work may require connection of the proposed sanitary sewer main to an existing lift station or manhole. The CONTRACTOR shall core drill the existing concrete lift station or manhole structure to accept the proposed sewer main. The core drill shall be of a sufficient size to allow for the use of a Calpico Pipe Lynx seal between the existing manhole and the sewer main. All fasteners/hardware shall be Type 314 stainless steel. The CONTRACTOR shall take care to accurately locate and drill the hole in the existing structure to ensure the proposed sewer main fits as intended. Any damage to the existing structure shall be repaired by the CONTRACTOR at no additional cost to the OWNER. Hammering, jack hammering, chiseling or other similar destructive methods shall not be allowed for making or altering the penetration.

42.10. SERVICE LATERALS AND RISERS

The service riser shall be constructed with a 6-inch wye, as shown on the project plan details, placed to receive the 6-inch service sewer. The riser pipe shall extend to the elevation as shown on the profile Drawings or as herein determined. The wye, or wye and riser combination shall be installed and bedded as shown on the Drawings. The CONTRACTOR will be paid for the service wye when placed into the new main based on their bid price for "Service connection to Gravity/Force Main".

The CONTRACTOR shall be responsible for connecting the existing residences to the proposed sewer main with a 6-inch PVC lateral after the sewer main has been installed, tested and is ready for service. The proposed 6-inch PVC lateral shall be extended from the 6-inch

service wye and connected to the building lateral or existing septic tank inlet piping. The CONTRACTOR shall sever the existing septic tank inlet piping and reconnect the lateral from the building to the new 6-inch service lateral. The CONTRACTOR shall be responsible for locating the existing service lateral or the septic tank inlet piping, and for closely checking its elevation and distance from the new sewer main in order to determine the necessary depths and slopes of the service riser. The service lateral shall be installed with a minimum 1% slope. The CONTRACTOR will be paid for the installation of the service lateral based on their unit bid price for "6 inch PVC Service Lateral". The CONTRACTOR shall include in their unit bid price all costs associated with locating the existing building lateral or septic tank inlet piping and making the necessary transition from the existing lateral to the 6 inch PVC lateral. The CONTRACTOR shall include this work in the CONTRACTOR's unit bid price for each "Connect Lateral and Decommission Existing Septic Tank". Payment will only be made after both, the lateral connection and decommission of the septic tank have been completed.

The CONTRACTOR is responsible for installing clean-outs at 100 foot intervals with one being within 50 feet of the sewer main. Clean-outs shall also be located at each bend in the service line. The CONTRACTOR will be paid for the installation of each clean-out based on their unit bid price for "Service Line Clean-out".

The CONTRACTOR shall keep an accurate record of service and service wye locations as installed and turn this record over to the RPR at the job site.

Excavation, backfill, restoration of surface, and laying of service lateral piping shall be the same as for the main line wastewater sewers.

At any time after substantial completion and during construction of building sewers at current residences of the municipality, if any additional costs are incurred by the OWNER because wyes, risers and service laterals have been installed to elevations too high to serve basements, the CONTRACTOR or his surety shall reimburse the OWNER for said costs.

42.11. SEPTIC TANK DECOMMISSIONING

Once the residences service laterals have been transferred from the existing septic tanks to the new sanitary sewer main, the CONTRACTOR shall decommission the existing septic tank(s) by pumping the tank(s) empty, penetrating the bottom to ensure tank does not hold water, caving in the tops, filling the tanks with sand to six (6) inches below existing grade, placing dirt in the top six (6) inches and re-seeding the disturbed area. This work shall be included the CONTRACTOR's unit bid price for "Connecting Lateral and Decommissioning Existing Septic Tanks". Payment will only be made after both, the lateral connection and decommission of the septic tank have been completed. Additional tanks are incidental to the unit bid price.

CONTRACTOR shall notify the local Health Department about each septic tank/system decommissioned.

42.12. DRAIN TILE REPAIR

The bid item for "Field Tile Repair," will be paid to the CONTRACTOR only when any tile or private drain line is not located or is improperly located, and the CONTRACTOR then

damages and properly fixes the tile. If a tile is located to within 18 inches on either side of the mark (as for JULIE locates) and the CONTRACTOR damages the tile, then the CONTRACTOR shall fix the tile and no payment will be allowed under this bid item. In addition, no payment will be allowed for CONTRACTOR down time to hand dig or otherwise search for a marked field tile, whether accurately located or not.

The bid price for “Field Tile Repair” shall include all necessary gravel backfill/support as shown on the Drawings and as defined in Department of Agriculture’s (DOA) requirements, included in these Specifications.

42.13. OPEN-CUT PVC OR STEEL CASING

Where called out on the plans, the sewer main shall be installed in PVC (See Section 52.03 and 52.04 for material requirements) or steel casing (see Section 55.04 for material requirements) of the size shown on the Drawings. The limits of the casing areas shall be staked by the ENGINEER. After the casing has been installed in the trench, the CONTRACTOR shall backfill portions of the trench with Select Granular Backfill as specified in Section 32.

The CONTRACTOR shall bid a lineal foot price for installing casing of the material and size specified on the Drawings. Earth backfill for Open-Cut PVC Casing Pipe or for the Open-Cut Steel Casing Pipe will be incidental to the unit price of the casing pipe installation and no additional compensation will be allowed. Measurement in lineal feet shall be made along the centerline of the casing as installed.

The sewer main installed through the casing pipe shall be restrained-joint pipe as specified in Section 52 of these specifications and sized as shown on the Drawings. End seals shall be used to seal the end of the casing. End seals shall be a pull-on type with change in diameter flush with end of casing. Wrapped and/or tapered seals are not allowed. All pipe placed in casing pipe shall utilize casing spacers as specified in Section 52.04.08. Casing spacers shall be used for the full length of the casing. Payment for the restrained joint pipe through the casing shall be as specified in Section 55.13.B.

Piping and Appurtenances

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Piping and Appurtenances

Section 52

52.01. SCOPE OF WORK

The work to be performed under this section of the specifications shall include all labor, materials, equipment and transportation necessary for furnishing and installing piping and appurtenances shown on the Drawings and specified herein.

The CONTRACTOR shall be responsible for all materials furnished under this section, and storage of same until the date of substantial completion. They shall replace at their expense all materials found to be defective or damaged in handling or storage. The CONTRACTOR shall, if requested by the ENGINEER, furnish certificates, affidavits of compliance, test reports or samples for check analysis for any of the materials specified herein.

Although they may not be specifically shown on the Drawings or called for elsewhere in the Technical Provisions, the CONTRACTOR shall include in their bid price the cost of all fittings, piping supports, and miscellaneous appurtenances needed to provide a secure, workable pipe and valve system. Equipment suction and discharge piping and other exposed piping shall be supported by concrete pedestals, piers, adjustable pipe supports, thrust restraints, hangers, and tie rods as necessary to insure a stable installation. Adjustable pipe supports or piers shall be arranged to relieve attached equipment of all strain due to the weight of the pipe, fittings, valves, and the contents of the pipe. Pipe supports shall be stanchion saddle type. Hanger shall be adjustable wrought clevis or adjustable wrought ring type.

52.02. GENERAL INFORMATION

A. Piping Systems

1. Gravity Pipe - The following items shall be considered gravity pipe: gravity mains, trunk lines, laterals, collectors, service lines, risers, and any other piping intended to carry wastewater or sludge by gravity flow or non-mechanically induced pressure. Where a specific pipe material or pipe joint is shown on the Drawings, only that material or joint shall be used.
 - a. Exposed or Unsupported Gravity Pipe - The pipe shall be considered exposed or unsupported whenever it is inside a structure, submerged above ground elevation, or any location where the pipe must be strong enough to span a distance between installed supports.
 - b. Buried Gravity Pipe - The pipe shall be considered buried if placed below grade and fully supported by the earth. (Other types of pipe not covered in these technical provisions will be considered for use as buried gravity pipe; in general, these pipes are recently developed and are not presently covered by specifications from national testing organizations such as ANSI, ASTM, or ASA. Examples include spiral wound PVC pipe and spiral wound Polyethylene pipe. Use of such

pipng shall require the written approval of the ENGINEER prior to bidding; this approval will be based on his/her review of the pipe specifications. These specifications shall be submitted no later than 14 calendar days prior to the bid date, and they shall provide complete information on pipe raw materials, design and stiffness, marking, workmanship, fittings, joints, and installation.)

2. Pressure Pipe - The following items shall be considered "pressure pipe": force mains, pump intake lines, potable and non-potable water lines, air mains, where pressure rating is required due to proximity of gravity sewer to existing water main, and any other pipe which generally operates under mechanically induced pressure flow. Where a specific pipe material or pipe joint is shown on the Drawings, only that material or joint shall be used.
 - a. Exposed or Unsupported Pressure Pipe - Pressure pipe shall be considered exposed or unsupported whenever it is inside a structure, in the walls of structure, above ground elevation, or any location where the pipe must be strong enough to span a distance between supports.
 - b. Buried Pressure Pipe - Any pressure pipe placed below grade and fully supported by the earth shall be considered buried pressure pipe.

B. Standard Drawings

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52.03. PIPE MATERIAL, FITTINGS, AND JOINTS

A. Polyvinyl Chloride Slip Joint Pipe

This section of the specifications covers rigid polyvinyl chloride pipe, hereinafter called PVC pipe.

The sewer main shall be PVC pipe with push-on gasketed joints, in accordance with Section 30 of the Standard Specifications.

ASTM Specification D1784 shall be conformed to in all respects.

1. PVC Slip Joint Pipe (4 to 16 inch)
 - a. Gravity and Drain Pipe: Minimum wall thickness shall be based on SDR 26. PVC sewer pipe shall conform to ASTM D3034. PVC sewer pipe joints shall be flexible elastomeric seals per ASTM 3212 and F 477.
 - b. Pressure Pipe: SDR (Standard Dimension Ratio) - PR (Pressure Rated) PVC pipe shall be Type I, grade 1 or 2, with a hydrostatic design stress of 2000 psi for water at 73.4°F, designated as PVC 1120 or PVC 1220.

PVC pipe with SDR ratings of 13.5, 17, 21, and 26 are to be used or as indicated on the Drawings, and shall conform to the latest revision of ASTM Specification D2241. All joints shall conform to the latest revision of ASTM Specification D3139 and F 477. PVC pipe shall be push-on gasketed.
 - c. For DR-PR (CIOD) PVC Pipe: DR (Dimension Ratio) - PR (Pressure Rated) PVC pipe shall be manufactured from unplasticized PVC compounds having a

minimum cell classification of 12454, as defined in ASTM D 1784, providing a hydrostatic design stress of 4000 psi for water at 73.4°F in accordance with the requirements of ASTM D 2837. PVC pipe with DR ratings of 18 (PR 235), 21 (PR 200), and 25 (PR 165) are to be used as indicated on the bidding schedule and shall conform to the latest revision of AWWA Specification C900.

2. PVC Slip Joint Pipe (18 to 48 inch)

- a. Gravity and Drain Pipe: Minimum wall thickness shall be based on SDR 26. PVC sewer pipe and fittings shall conform to ASTM F 679. PVC sewer pipe joints shall be flexible elastomeric seals per ASTM 3212 and F 477.
- b. Pressure Pipe: DR (Dimension Ratio) - PR (Pressure Rated) PVC pipe shall design with a hydrostatic design stress of 4000 psi for water at 73.4°F in accordance with the requirements of ASTM D2837 and AWWA C905. PVC sewer pipe joints shall be flexible elastomeric seals per ASTM 3212 and F 477.

SDR (Standard Dimension Ratio) - PR (Pressure Rated) PVC pipe shall be Type I, grade 1 or 2, with a hydrostatic design stress of 2000 psi for water at 73.4°F, designated as PVC 1120 or PVC 1220. PVC pipe with SDR ratings of 21 (200 psi) and 26 (160 psi) are to be used or as indicated on the bidding schedule, and shall conform to the latest revision of ASTM Specification D2241.

For DR-PR (CIOD) PVC Pipe: DR (Dimension Ratio) - PR (Pressure Rated) PVC pipe shall be manufactured from unplasticized PVC compounds having a minimum cell classification of 12454, as defined in ASTM D 1784, providing a hydrostatic design stress of 4000 psi for water at 73.4°F in accordance with the requirements of ASTM D 2837. PVC pipe with DR ratings of 18 (PR 235), 21 (PR 200), and 25 (PR 165) are to be used as indicated on the bidding schedule and shall conform to the latest revision of AWWA Specification C900.

B. PVC Restrained Joint

This section of the specifications covers restrained-joint PVC pipe, hereinafter called RJ pipe.

The CONTRACTOR must use RJ pipe for drainage ditch crossings, road crossings, and creek crossings as well as directional bores (including sewer main inside of casing pipe), as shown on the Drawings.

The RJ pipe shall be furnished with twin gasket couplings, nylon splines, rubber rings, and lubricant. The rubber rings shall be shipped in place in the coupling. The RJ integral bell is also acceptable.

The transition from RJ pipe to slip PVC or ductile pipe shall be made by the use of a manufacturer supplied expansion coupling. This coupling shall be Restrained Joint PVC by IPS. Only the installation of full joints of RJ pipe with factory grooves shall be permitted.

The pipe shall be PVC, with a hydrostatic design stress of 4000 psi for water at 73.4 degrees F, designated as PVC 1120 or 1220, Class 12454B and made to iron pipe size diameters. PVC sewer pipe joints shall be flexible elastomeric seals per ASTM 3212 and

F 477. SDR and DR rating shall be as shown on the Drawings and as called for in these specifications.

As shown on the drawings and specified herein, 4 to 16-inch PVC pressure RJ pipe shall be:

1. Restrained Joint (PVC) Pipe, SDR 26, PR 160, for installation in directional boring and/or bore and jacked casing installations.
2. Restrained Joint (PVC) Pipe, SDR 21, PR 200, for installation in directional boring and/or bore and jacked casing installations.
3. Restrained Joint (PVC) Pipe, DR 18, PR 235, for installation in directional boring and/or bore and jacked casing installations.
4. Restrained Joint (PVC) Pipe, DR 21, PR 200, for installation in directional boring and/or bore and jacked casing installations.
5. Restrained Joint (PVC) Pipe, DR 25, PR 165, for installation in directional boring and/or bore and jacked casing installations.

C. Ductile Iron Pipe

All ductile iron pipe shall be manufactured in accordance with all requirements of AWWA Standard C151, class thickness designed per AWWA C150, cement lined with bituminous coating per AWWA C104. Flanged ductile iron pipe joints shall be designed per AWWA C110 or C153. Standard laying length is either 18 feet or 20 feet.

Polyethylene encasement shall be used on all ductile iron pipes and the polyethylene encasement shall conform to AWWA C105/A21.5. Polyethylene material will deteriorate rapidly when exposed to direct sunlight. Store all polyethylene encasement out of the sunlight. If during the installation period it is anticipated that the polyethylene encasement will be exposed to sunlight for more than two (2) weeks (ie. Open trench) Type C (black) polyethylene material must be used.

Where/if the sewer main crosses an existing petroleum pipeline, restrained-joint ductile iron pipe with hydrocarbon resistant gaskets shall be used for a length as required to obtain at least 10 beyond each end of the PVC casing. The ductile iron pipe shall be installed within a PVC casing with the use of casing spacers and end-seals. The PVC casing shall extend a minimum of 25 feet (as measured perpendicularly to the petroleum pipeline) beyond each side of the Petroleum Pipeline easement limits.

All exposed or unsupported pipes shall be ductile iron with either flanged or grooved joints. Buried ductile iron pipe must have either mechanical or slip seal joints.

Pipe joints shall be manufactured in accordance with the following specifications:

1. Mechanical joint pipe shall be furnished with applicable gaskets, glands, and bolts. Bolts shall be stainless steel or corrosion resistant meeting the requirements of AWWA C111/A21.11 and ASTM A242. A manufacturer certification shall be included with all shop drawing submittals as to the corrosion resistant material utilized. Joint shall be in accordance with AWWA Standard C110 and C111.

2. Slip-joint pipe shall be furnished with gaskets and lubricant, and be in accordance with AWWA Standard C111 and C600.
3. RJ pipe joint shall be furnished with gaskets, restraining ring, and lubricant, and be in accordance with AWWA Standard C153 and C111.
4. Ductile iron pipe inside of casing pipe shall use a joint restraint similar to Griffin Snap Lok or approved equal.

Ductile iron pipe utilizing joint restraint gaskets is not allowed.,

5. Flanged ductile iron pipe joints shall be designed per AWWA C115 or C151.

D. Polyethylene Pipe

Pressure Pipe: SDR 9; Type III; Class C, Grade P33 or 34; thermal butt fused joint or grooved joint specifically adapted for PE pipe.

E. Fittings

All ductile iron fittings shall conform to AWWA C153, AWWA C 110, and AWWA C111, 2 inch to 48 inch, for 250 psi fluid pressure plus water hammer. All fittings except plugs and sleeves shall be cement lined to conform to AWWA C104 with a bituminous seal coat. Sleeves and plugs shall be bituminous seal coated. Application gaskets, standard transition gasket (SMJ gasket) for PVC, mechanical joint restraining glands, and bolts shall be furnished. All bolts shall be stainless steel or corrosion resistant meeting the requirements of ANSI/AWWA C111/A21.11 and ASTM A242.

1. Fittings include gate valves, tees, elbows, crosses, reducers, caps, plugs, and wyes.
2. All fittings associated with PVC or DI sewer force main installation shall be ductile iron. All ductile iron fittings shall mechanical-joint and utilize mechanical-joint restraining glands where anchor couplings are not required.
3. PVC fittings shall be used on gravity mains at service wyes and on service lines. The PVC fittings shall be Push-on gasketed PVC fittings and meet the requirements of ASTM D2729 .
4. Pressure rating of fittings shall be equal to or greater than the specified pipe.
5. Backfill operations at fitting and gate valve locations shall not occur until all materials and work have been viewed by the OWNER or resident project representative (RPR).
6. Any PVC slip-couplings utilized and allowed by the OWNER on pipe six (6) inches in diameter and smaller shall be 12 inches minimum length. Mechanical Joints shall be used and on all pipes greater than six (6) inches in diameter.
7. PVC Expansion Couplings shall be allowed when transitioning from PVC to RJ PVC Pipe. The expansion couplings shall be provided by the manufacturer and be RJ on one end and slip joint on the other. The fitting shall be of the same material as the pipe, and in no case shall have thinner walls than that of the pipe furnished. The fitting for gasketed joint, RJ PVC pipe shall be molded in one (1) piece.

Ductile Iron Expansion Couplings shall be a ductile iron sleeve with a restraint-joint fitting on one side and slip-joint fitting on the other side.

8. All fittings shall be of the same material and diameter as the pipe to which it is connected or of a compatible material approved by the ENGINEER.
9. Ductile Iron flanged fittings shall conform to all requirements of AWWA C115.
10. Grooved joint fittings for ductile iron pipe shall conform to all requirements of AWWA C606.

52.04. PIPE APPURTENANCES

52.04.01. MANHOLES

Manholes for gravity pipe shall be standard 4-foot diameter precast reinforced concrete and conform to the requirements of Section 32 of the Standard Specifications except as hereinafter supplemented or modified.

1. Manhole Material

Only precast reinforced concrete manholes will be allowed.

2. Manhole Steps

Polypropylene coated steel reinforcing rods are the required type of step.

3. Standard Frame and Grate

Unless otherwise called for on the Drawings, all manholes shall have a cast iron frame and lid equal to Neenah No. R-1772, East Jordan No. 1022, or equal. The lid shall be a self-sealing type with concealed pick hole and a machined groove on its underside for receiving an elastomeric, continuous gasket. The gasket shall act as a seal between the lid and frame to prevent entry of surface water. The frame and lids shall have machined bearing surfaces. The CONTRACTOR shall supply the OWNER with spare lid gaskets equal in number to 10% of the number installed, plus two (2) new and unused lid lifting tools especially designed for removing manhole lids with concealed pick holes. Manhole lids shall be marked "SANITARY".

4. Bolt Down Lid Frame and Grate

Wherever "Bolt Down Lid" is designated on the Drawings, the manhole shall have a cast iron frame and bolt down lid with gasket equal to Neenah No. R-1916-C, or equal; all bearing surfaces shall be machined; lid and frame shall weigh no less than 320 pounds.

Unless otherwise shown on the Drawings, manhole castings shall be set at finish earth grade or roadway surface; manholes in cultivated areas shall have castings set 24 inches below existing grade. Grade rings of various thickness may be required to adjust the lids to the final grading conditions and will be considered incidental to the cost of the manholes.

5. Rain Stopper/ Inflow Protection Cover

Manholes with top of rim elevations lower than surrounding ground elevation shall have an inflow protection cover, of the appropriate size, installed in addition to the

standard lid. The inflow protector cover shall be manufactured by Syneco Systems, Inc., Chanhassen, MN or equal and shall consist of the following components:

- a. ABS plastic construction;
- b. Strap handle;
- c. Bottom seal surface with gasket;
- d. Gas relief valve to relieve at pressure of 1 psi;
- e. Leak down rate limited to 10 gal/24 hrs.

6. Manhole Joints

Manhole joints shall be sealed with bituminous material for water tightness.

7. Pipe Connections

All pipe connections at manholes and other structures shall be made with cast-in-place rubber gaskets cast into the wall of the Precast manhole and secured to the pipe with an adjustable, stainless band; a mechanical seal with tapered, precast opening; or other method approved by the ENGINEER which provides for a flexible, watertight penetration.

8. Chimney Seal

Wherever "Chimney seal" is designated on the Drawings an internal flexible rubber seal shall be provided between the manhole frame and chimney or corbel section of the manholes. The rubber seals shall be as manufactured by Cretex Specialty Products, Waukesha, Wisconsin or equal and shall consist of the following components:

- a. Rubber Sleeve - The flexible rubber sleeve shall be extruded from a high grade rubber compound conforming to the applicable requirements of ASTM C923, with hardness (durometer) of 45 ± 5 .

The sleeve shall be double pleated with a minimum unexpanded vertical expansion when installed of no less than two (2) inches. The top and bottom section of the sleeve shall contain an integrally formed expansion band recess and multiple sealing fins.

Any splice used to fabricate the sleeve shall be hot vulcanized and have a strength such that the sleeve shall withstand a 180 degree bend with no visible separation.

- b. Expansion Bands - The expansion bands used to compress the sleeve against the manhole shall be 16 gauge stainless steel conforming to ASTM A240, Type 304, with a minimum width of 1-3/4 inches.

The expansion mechanism shall have the capacity to develop the pressures necessary to make a watertight seal and shall have a minimum adjustment range of two (2) diameter inches. Screws and nuts used for this mechanism shall be stainless steel conforming to ASTM F593 and 594, Type 304.

9. Lift Station/Valve Vault Lining

- a. All new and existing manholes, lift stations, valve vaults, etc., shall be lined to protect the structure and prevent the infiltration of ground water. Said structures shall be lined before they are vacuum tested and put into service. They shall be thoroughly cleaned of all dust, dirt, and debris immediately before the lining process begins. The Liner System shall be a “stress skin” panel polymer consisting of three layers with a first barrier coat of polyuria, a surfacing coat of closed-cell urethane foam, and a final barrier coat of polyuria.

The system shall have a broad range of chemical resistance and the ability to stop infiltration.

The application thickness of the three-layer system shall be no less than 500 mils. The manufacturer and applicator shall warrant all work against defects in materials and workmanship for a period of ten (10) years from the date of final acceptance of the installation. Repairs to defects in materials or workmanship shall be accomplished within a reasonable time after receipt of written notice of said defect. The applicator must have a minimum of three (3) years’ experience and be certified by the manufacturer. The product shall have been installed in wastewater structures for a minimum of seven (7) years and be verifiable.

Payment for the liner shall be incidental to the contract price.

52.04.02. SANITARY SEWER SERVICES

Service sewers shall conform to the requirements of Section 2.3.9 of the MDNR Wastewater GSD.

1. Service laterals shall be six (6) inches and be of the same material as the main, unless specified otherwise on the Drawings. All service laterals shall have a slope not less than 1% and be terminated with a cap.
2. No service laterals will be allowed to tie into the new manhole but instead will be tied to the new sewer adjacent to the manhole.
3. Set over manholes are required when connecting the new sanitary sewer main to an existing sanitary sewer line. A manhole base shall be poured around the existing sewer pipe. After the precast manhole is set on a concrete base and the pipe connections has been completed the top half of the existing sewer pipe that is exposed in the manhole shall be cut off and removed.

52.04.03. QUICK COUPLER

Intentionally Blank.

52.04.04. GATE VALVE

Gate valves shall be designed for a minimum working pressure of 250 psi. Valves shall be resilient wedge, non-rising stem type, and shall be used with the type of pipe and joint to be installed. Gate valves shall have a clear waterway equal to the full nominal diameter of the valve and shall be opened by turning counterclockwise. The operating nut shall have an arrow, cast in the metal, indicating the direction of opening. Each valve shall have the maker's initials, and pressure ratings cast on the body. Prior to shipment

from the factory, each valve shall be tested by hydraulic pressure equal to twice the water working pressure.

2 inch-12 inch gate valves shall be per Section 10.04.07.9.a with 'O' ring seals.

Gate valves shall have mechanical joints. No "push-on" joints will be allowed. All bolts for the bonnet shall be stainless steel. All bolts for the retainer glands shall be Cor Blue or an equivalent ASTM A 242 material. The valve, below the operating nut, shall be wrapped in 4 mil plastic. The plastic wrap shall cover the bonnet, the mechanical joint glands, bolts, and valve body.

52.04.05. SWING CHECK VALVE

The Swing Check Valve shall be of the full waterway body type, with a domed access cover and vent port. The shaft seals shall consist of V-type packing in a fixed gland with an adjustable follower designed to prevent over compression of the packing and to meet design parameter of the packing manufacturer. Removable, slotted shims shall be provided under the follower flanges to provide for adjustment and prevent over loading of the packing. The valve shall be factory equipped with a lever and weight assembly.

The lever shall be equipped with three holes for adjusting the bolted weight assembly. When the valve is closed, the lever and weight shall be located 30 degrees below horizontal. The valve body shall be full flow equal to nominal pipe diameter area at all points through the valve and shall be equipped with a threaded adjustable open stop. The body seat shall be O-ring sealed and field replaceable without removing the valve from the line. The end flanges shall contain integrally case mounting pads. The top access port shall be full size, allowing removal of the disc without removing the valve from the line. The access cover shall be domed in shape to provide flushing action over the disc for operating in lines containing high solids content. The disc shall be of one-piece construction and connected to the shaft with a disc arm and two pivot pins to provide pivot action to allow self-adjusting seating at all pressures.

The valve body, cover and disc shall be constructed of ASTM A536 Grade 65-45-12 ductile iron. The exterior and interior of the valve shall be coated with an NSF/ANSI 61 approved fusion bonded epoxy coating. The removable body seat shall be constructed of ASTM A276, Type 304 stainless steel. The removable resilient seat shall be precision molded Buna-N (NBR), ASTM D2000-BG. The disc arm and external levers shall be ductile iron.

Valves shall not be located in the wet well or vertically mounted. Valves shall be able to pass a sphere not less than 80% of the diameter of the valve.

52.04.06. PLUG VALVE

Plug valves shall be of the nonlubricated eccentric type with resilient faced plugs. Valve bodies shall be composed of materials meeting the requirements of ASTM A126, Class B, with added nickel and chromium ("Semi-Steel"). Bearings shall be stainless steel. Resilient plug facings shall be Neoprene for use with water, sewage, and sludge and Isobutene-Isoprene for use with compressed air (maximum temperature 250F). Stem packing (and gland) shall be accessible without disassembly of the valve and of materials compatible with the valve's service conditions. All plug valves 6" and larger shall be furnished with gear type actuators, position indicators and adjustable memory stops; plug

valves less than 6" in size shall be lever actuated with the same features. These valves have a preferred direction of shut off, and it is the responsibility of the contractor to see that they are properly installed. All exposed nuts, bolts, springs, washers, and other hardware shall be stainless steel for plug valves in buried or submerged service; otherwise, the hardware shall be zinc plated.

Valves shall not be located in the wet well or vertically mounted. Valves shall be able to pass a sphere not less than 80% of the diameter of the valve.

52.04.07. BALL CHECK VALVE

Ball check valves shall be designed to be non-clog, fully automatic, maintenance free and specifically suited for operation in sewage and storm water where solids, fibers, grit or highly viscous materials are encountered.

Ball check valves will have one moving part, the ball, which automatically rolls out of the path of flow, thus providing an unobstructed and "full flow" equal to nominal size. Upon discontinuation of flow the ball automatically rolls back to the closed position, thus providing a positive seal against back pressure or backflow.

The ball shall have an exterior coating of vulcanized nitrile rubber resistant to grease, petroleum products, animal and vegetable fats, dilute concentrations of acids and alkalies, tearing and abrasion. The body and cover shall be nodular cast iron type GGG 40/ASTM 65-45-12/SAE 4512. Ball check valves are designed to be maintenance-free and suited for installation in the horizontal or vertical position. The valve shall be so constructed that by unbolting and lifting off the cover, the ball may be removed and replaced without removing the valve from the line.

Ball check valves will be available with either a floating or sinking ball.

Valves shall not be located in the wet well or vertically mounted. Valves shall be able to pass a sphere not less than 80% of the diameter of the valve.

52.04.08. COMBINATION AIR RELEASE VALVE

Combination air release valves shall be installed at high points in the force main when directed by the ENGINEER. Valves shall have 2 inch inlet and outlet. All combination valves shall be so designed as to permit the release of a large quantity of air during the filling of the pipeline and also permit a large quantity of air to reenter the pipeline to break the vacuum and eliminate any danger of collapse should the liquid suddenly leave the pipeline. The combination pressure unit operates independently and releases small accumulations of air which may collect while the line is in operation and working under pressure. Valves shall have cast iron bodies and be furnished with national pipe threads. Floats and trim shall be of a non-corrosive metal, standard with the manufacturer. Seats shall be of a material which will provide cushion for the float sufficient to receive float shock upon closing.

All 2 inch valves shall be per Section 10.04.07.04.a. Connections shall be made to the pipeline by the use of a 2 inch corporation stop. Combination air valves shall be installed in a standard 30 inch meter well with lid. Fittings shall be used for the 2 inch copper vent line piping, bending will not be allowed. A #22 mesh stainless steel screen shall be secured over the open end of the 2 inch copper vent line piping.

Combination air release valves shall be paid for at the contract unit price for each installed as specified. This price shall include all excavation, materials, dewatering, meter well, backfill, 4 inch x 4 inch treated post (for protection of copper vent line) with the top cut at a 45° angle, installation of a Valve Marker next to wood post, a meter skin insulator, over the top of the air release valve, painting vent pipe if requested by OWNER, and other miscellaneous work as necessary including securing air release to meter well with stainless steel unistrut and stainless steel clamps. These valves shall be Combination Air Release valve shall be in a meter box.

52.04.09. VALVE BOX

Valve boxes shall be of ductile iron. Boxes shall be of the extension type with screw adjustment and flared base. The minimum thickness of metal shall be 3/16 inch. The word "SEWER" shall be cast in the cover. Boxes shall be installed over each plug valve and gate valve. The boxes shall be of such a length that will permit adjustment in length, without full extension, to the depth of cover required over the pipe at the valve location. The CONTRACTOR shall supply extension stems, as necessary, where the sewer main is installed deeper than normal due to utilities, convenience, etc. This work shall be incidental to the Contract Price.

All valve boxes for valves in the upright position (operating nut in the 0° position) shall be installed upon the valve with the use of a Gate Valve Alignment Device to stabilize and center the valve box. All costs shall be incidental to the contract price. All valve boxes for valves installed on their side (operating nut in the 90° or 270° position) and requiring a bevel gear shall be centered over the operating nut and installed upon a level surface of rock, compacted around the bevel gear and operating nut, to stabilize the valve box. The compacted rock shall be incidental to the Contract. Substantial completion will not be issued to the CONTRACTOR until it has been verified by the OWNER that all gate valves can be accessed and operated with a standard valve wrench.

52.04.10. VALVE BOX MARKER

Valve markers shall be per Section 10.04.07.15. The marker shall be two sided with identification stickers located on both sides containing OWNER's official name and telephone number. Color to be selected by OWNER. These markers shall be placed either one per valve or one per cluster of valves. The markers shall be used to mark manholes in the fields unless alternate method is approved by ENGINEER and OWNER.

52.04.11. DUCTILE IRON RESTRAINT GLANDS

Restraint for PVC and ductile iron pipe joined with standardized mechanical joint fittings shall be incorporated in the design of the follower gland for specified material. The PVC pipe restraining glands shall provide full circle contact and support of the pipe wall. Restraint shall be accomplished by a series of ring segments mechanically retained inside the gland housing and designed to grip the pipe wall in an even and uniform manner. Restraining ring segments shall be actuated by bolts featuring twist off heads. All components of the restrainer, and restraint segments shall be of high strength ductile iron, ASTM A536, Grade 65-45-12. Gland bolts shall be Cor-Blu or ASTM A242 high strength low carbon steel. Restraining devices shall be UL Listed/FM approved on PVC pipe and shall be certified by an independent testing facility as meeting or exceeding ASTM

F1674, Standard Test Method for Joint Restraint Products for Use with PVC Pipe. Joint restraints shall be used at all fittings, gate valves, and hydrants, not requiring an anchor coupling, and shall be incidental to the contract price. Restraints shall be rated at a minimum of 200 psi.

52.04.12. CASING SPACERS

Casing spacers for 6-inch sewer main and smaller shall be a polyethylene casing spacer which is injection molded from high density polyethylene. The compressive strength shall be greater than 3,100 psi and tensile strength shall be greater than 3,100 psi.

The casing spacers for sewer main larger than 6-inch shall be bolt on style with a shell made of two (2) sections of T-304 stainless steel or some other non-corrosive metal. All nuts and bolts are to be 18-8 stainless steel or equivalent non-corrosive material. The runners shall be made of ultrahigh molecular weight polymer with high abrasion resistance and a low coefficient of friction.

Casing spacers for multiple carrier pipes in one casing shall be bolt on style with a shell made of two (2) sections of T-304 stainless steel or some other non-corrosive metal. All nuts and bolts are to be 18-8 stainless steel or equivalent non-corrosive material. The runners shall be made of ultrahigh molecular weight polymer with high abrasion resistance and a low coefficient of friction. Casing spacer shall be of a style designed specifically to accommodate the specified size of the respective carrier pipes and casing.

During installation, either lock washers or lock nuts shall be used when bolting the spacers together. Casing spacers shall be installed on six (6) foot centers or three (3) to a pipe segment and shall be included in bid price for casing pipe.

52.04.13. COPPER TRACER WIRE

Copper tracer wire shall be installed with all force main. The wire shall be copper-clad steel wire coated with HDPE and shall be connected to all valves and brought up into each valve box (on the exterior of the box and doubled-over under the cover on the interior) creating a continuous wire throughout all force main and appurtenances. All splices of tracer wire shall utilize direct bury splice kits per Section 10.04.07.5.c. During installation of the connector, the CONTRACTOR shall tie the tracer wire into a knot and leave approximately 4 inches to be inserted into the connector per manufacture's specifications. The CONTRACTOR shall install tracer wire per Section 10.04.07.5.b. for force main installed by trenching and per Section 10.04.07.5.a. for force main installed by directional boring. The Contractor shall include in his bid price for force main installation all costs associated with tracer wire installation.

Substantial completion will not be issued to the CONTRACTOR until it has been verified by the OWNER that all tracer wire is continuous and can be field located with the OWNER's locating equipment.

52.04.14. METER/AIR RELEASE BOX

The CONTRACTOR shall furnish and install a meter/air release box as shown on the drawings and as approved by the ENGINEER. The meter box shall be plastic profiled-

wall, as per Specification 10.04.07.17.a. The meter box shall be supported on a minimum of 4 - 18" x 18" paving stones. The lid shall be per section 10.04.07.18.a.

BORING SEWER MAINS

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BORING SEWER MAINS

Section 55

55.01. SCOPE OF WORK

The CONTRACTOR shall furnish all equipment, machinery, labor and materials necessary to perform all operations in connection with the conventional boring and pulling or directional boring of sewer mains of the required diameter and type of material at locations that may be designated at time of construction. **Gravity pipe bores must be at grade with little or no tolerance, see below.**

The CONTRACTOR shall be responsible for notification of appropriate officials as required by Highway and Railroad permits.

Unless otherwise noted in these specifications, trenchless construction shall abide by Section 2.10 of the MDNR Wastewater GSD.

The CONTRACTOR is responsible for any charges by the railroad(s) for flagmen, foremen, engineering observers, and others; and by MoDOT and others during the course of the work; and shall include such costs in his bid price

55.02. CONSTRUCTION DETAILS

The alignment and elevation of the forward end of the boring shall be checked and if it does not meet the requirements of the permit, the auger will be pulled and a new boring made at no additional cost to the OWNER.

The CONTRACTOR shall fill over excavation of bore and recovery pits at entrance and exit of sewer main through bore hole with compacted sand or CA-6 to the bottom of the sewer main giving a sound foundation for the sewer main preventing the sewer main from shearing as the backfill settles. Payment for the sand or CA-6 shall be considered incidental to the contract price for bores.

Any cracking or damage caused by the boring operation to the traveled surfaces (regardless of the soil and/or rock type encountered) shall be repaired or replaced, at the CONTRACTOR's expense, as required by the OWNER.

55.03. MINIMUM DISTANCE FROM PAVEMENT

This section shows the maximum distance beyond road surfaces the bore payment will extend without approval of the ENGINEER unless required by permit.

State Highways	20 feet
County Highways	20 feet
Township Roadways	15 feet
Driveways	10 feet

55.04. STEEL CASING MINIMUM SPECIFICATIONS

Casing pipe used for sewer mains shall be ASTM A139 Grade B, welded pipe. The minimum wall thickness for casing pipe shall be as follows, unless otherwise noted on the Drawings:

Pipe Diameter (in.)	Wall Thickness (in.)*
6	0.28
8	0.322
10	0.365
12 – 48	0.375

*Note: Railroad crossings require greater wall thickness. The CONTRACTOR shall use the steel casing wall thickness approved by the railroad.

The casing pipe shall be bituminous tar lined inside and coated outside. Where two (2) sections of casing are welded together, a bituminous tar coating shall be applied to the welded joint.

Certain installation practices are necessary to protect the sewer main that is required to go through the casing pipe. These practices are necessary to prevent the pipe from resting on the joints, and provide for retrieval if repairs are necessary in the future. Prior to inserting the sewer main in the casing, casing spacers as specified in Section 10 and 52.04.12 shall be installed on the full length of pipe.

Restrained-joint PVC pipe shall be used inside of the casing pipe, with expansion couplings at both ends exterior to the casing (see also Section 52 of these Specifications). After installing the carrier pipe, both ends of the casing pipe shall be sealed by a method approved by the ENGINEER.

55.05. DIRECTIONAL BORE METHOD

A. GENERAL

The CONTRACTOR shall bore where called for on the Drawings. Boring under state and federal interstate highways, under railroads, and all locations called out on the Drawings shall be accomplished from pits located per the boring permits. On-Grade bores must be at grade with a horizontal alignment tolerance of +/- 3 inches and a grade tolerance of +/- 2 inches. The CONTRACTOR shall be responsible for the cost to re-bore if it is outside of the tolerances listed above.

B. PRECEDURE

The CONTRACTOR shall use water, bentonite, polymer, or bentonite/polymer mixture for the mud mixture needed for the directional boring procedure and shall include the costs of these items in their unit bid price. The CONTRACTOR shall use the mixture required by the type of soil encountered.

The CONTRACTOR shall use the backreamer needed to satisfy the conditions of the directional bore and the type of soil encountered. Spiral or coned backreamers are designed to push foreign objects such as rocks and tree roots out of the way or off to the side of the directional bore path. The surface area of the cone shaped backreamers is large so this will create a lot of drag. The wing cutter, which allows the mixed material to flow through, provides the best result in mixing.

For 8-inch or smaller pipe, a reamer larger than 1.5 times the diameter of the pipe should not be used without the permission of the ENGINEER. For 10-inch or larger pipe, a reamer of 1.3 times the diameter of the pipe or smaller is required, unless given permission by the ENGINEER.

It is recommended that the pipe follow immediately behind the backreamer or expander because the directional bore hole will start to close up instantly after the backreamer or expander is pulled through. This allows limited time, depending on the soil condition, to push the pipe in the hole.

C. DAMAGED PAVEMENT

Any cracking or damage caused by the directional boring operation to the traveled surfaces (regardless of the soil and/or rock type encountered) shall be repaired or replaced, at the CONTRACTOR's expense, as required by the OWNER, the ENGINEER, or the property owner.

D. SPECIFIED DISTANCE FROM WATERWAYS

Since waterway surfaces and streambed/streambank profiles occur in such a variety of configurations, and since CONTRACTOR's may employ a number of methods for directional boring depending on pipe installation angle, convenience, etc., it is not possible to come up with a single rule for specified directional bore distances. An estimated directional bore length has been indicated on the Drawings for each particular directional bore, and also constitutes the minimum length that will be allowed physically for the directional bore. However, the payment for lengths longer than the length indicated on the plans will only be paid with approval of the ENGINEER. In all cases, open cut excavations for bore pits shall remain at least 20 feet away from top of stream banks.

55.06. BORE AND JACK METHOD

A. GENERAL

The CONTRACTOR shall bore and jack steel casing pipe where called for on the Drawings. Boring or jacking under state and federal interstate highways, under railroads, and all locations called out on the Drawings shall be accomplished from pits located per the boring permits. The bore must be at grade with a horizontal alignment tolerance of +/- 3 inches and a grade tolerance of +/- 2 inches.

B. DAMAGED PAVEMENT

Any cracking or damage caused by the bore and jack operation to the traveled surfaces (regardless of the soil and/or rock type encountered) shall be repaired or replaced, at the

CONTRACTOR's expense, as required by the OWNER, the ENGINEER, or the property owner.

55.07. DIRECTIONAL BORING ON GRADE CASING PIPE

A. MATERIAL

Casing pipe shall be as specified on Drawings, Road Permit, and Rail Road Permits.

B. PAYMENT

This work shall be completed according to Sections 55.03, 55.04, and 55.05 above. The payment shall be per lineal foot per the bid schedule "Directional Boring Casing Pipe On-Grade" for the material, diameter, and class as called out on the drawings. Payment will only be made for bores meeting tolerances listing in section 55.05. Although the payment lengths may be less than these specified distances, depending on field conditions and actual boring lengths, no payment for borings will be allowed beyond these specified distances without approval of the ENGINEER.

55.08. DIRECTIONAL BORING ON GRADE SEWER MAIN OR SERVICE LINE

A. MATERIAL

Carrier pipe shall be as specified on Drawings.

B. PAYMENT

This work shall be completed according to Sections 55.03 and 55.05 above. The payment shall be per lineal foot per the bid schedule "Directional Boring On-Grade" for the material, diameter, and class as called out on the drawings. Payment will only be made for bores meeting tolerances listing in section 55.05. Although the payment lengths may be less than these specified distances, depending on field conditions and actual boring lengths, no payment for borings will be allowed beyond these specified distances without approval of the ENGINEER.

55.09. DIRECTIONAL BORING CASING PIPE

A. MATERIAL

Casing pipe shall be as specified on Drawings.

B. PAYMENT

This work shall be completed according to Sections 55.03, 55.04, and 55.05 above. The payment shall be per lineal foot per the bid schedule "Directional Boring Casing Pipe" for the material, diameter, and class as called out on the drawings. Payment for length beyond the lengths on the plans shall only be paid with approval of the ENGINEER.

55.10. DIRECTIONAL BORING FORCE MAIN OR FORCE SERVICE LINE

A. MATERIAL

Carrier pipe shall be as specified on Drawings.

B. PAYMENT

This work shall be completed according to Sections 55.03 and 55.05 above. The payment shall be per lineal foot per the bid schedule "Direction Boring Force Main" for the material, diameter, and class as called out on the drawings. Although the payment lengths may be less than these specified distances, depending on field conditions and actual boring lengths, no payment for borings will be allowed beyond these specified distances without approval of the ENGINEER.

55.11. BORE AND JACK CASING PIPE ON GRADE

A. MATERIAL

Casing pipe shall be as specified on Drawings.

B. PAYMENT

This work shall be completed according to Sections 55.03, 55.04, and 55.06 above. The payment shall be per lineal foot per the bid schedule "Bore and Jack Casing Pipe On-Grade" for the material, diameter, and class as called out on the drawings. Payment will only be made for bores meeting tolerances listing in section 55.06. Although the payment lengths may be less than these specified distances, depending on field conditions and actual boring lengths, no payment for borings will be allowed beyond these specified distances without approval of the ENGINEER.

55.12. BORE AND JACK CASING PIPE

A. MATERIAL

Casing pipe shall be as specified on Drawings.

B. PAYMENT

This work shall be completed according to Sections 55.03, 55.04, and 55.06 above. The payment shall be per lineal foot per the bid schedule "Bore and Jack Casing Pipe" for the material, diameter, and class as called out on the drawings. Although the payment lengths may be less than these specified distances, depending on field conditions and actual boring lengths, no payment for borings will be allowed beyond these specified distances without approval of the ENGINEER.

55.13. CARRIER PIPE IN CASING

A. MATERIAL

Carrier pipe shall be as specified on Drawings.

B. PAYMENT

Payment for the restrained-joint (RJ) PVC installed shall be based on the unit price of the bid schedule line item, “Restrained-Joint PVC – in Casing” for the appropriate size and pressure classification of RJ PVC pipe utilized. The payment length of the RJ PVC pipe shall be equal to the pay length determined for each bore and then rounded up to the next full length of pipe, measured in lineal footage, when the main extends in a straight line in at least one direction. The payment length of the RJ PVC pipe shall be equal to the length between fittings when there is a fitting adjacent to each end of the bore. If the CONTRACTOR elects to use additional RJ pipe, the difference will be paid at the normal PVC pipe price being installed adjacent to the bore. The cost of expansion couplings shall be incidental to the “Restrained-Joint PVC – in Casing” price.

55.14. CARRIER PIPE IN DIRECTIONAL BORE

Carrier pipe shall be included in the unit price for directional bores, see above sections.

Grinder Pump Station

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Grinder Pump Station

Section 66

66.01 SCOPE OF WORK

The work to be performed under this section of the Technical Provisions shall include all labor, materials, equipment, and transportation necessary to provide and install grinder pump stations and related appurtenances as shown on the Drawings and specified herein.

The CONTRACTOR's prices for the grinder pump stations and appurtenances shall be categorized according to the Bid Form. All electrical equipment from and including the Control/Alarm Box to and including the Grinder Pump and labor necessary for a complete and working system shall be included by the CONTRACTOR among the various Bid Items listed in the Bid Form. Electric to the Control/Alarm Box is others.

66.02 GENERAL

A. Spare Parts

The CONTRACTOR shall be responsible for supplying the following spare pumps/stations:

One – Environment One Model WH092 Grinder Pump Station
One – Environment One Replacement Grinder Pump

66.03 SUBMERSIBLE PUMP STATION

A. General

The CONTRACTOR shall furnish and install submersible grinder pump stations as shown on the Drawings and specified herein.

The grinder pump station shall be as manufactured by Environment One Corporation, Niskayuna, NY, or equal. The installation shall be complete with simplex grinder pump, duplex if specified, mounted in high density polyethylene (HDPE) basin, NEMA 6P electrical quick disconnect (EQD), pump removal system, stainless steel discharge assembly/shut-off valve, anti-siphon valve/check valve, each assembled in the basin, electrical alarm panel and all necessary internal wiring and controls.

The CONTRACTOR shall be responsible for coordinating the renovation with the homeowners, paying any renovation, inspection, or new service charges as established by

the power company, and obtaining any power company permits, as may be necessary.

The CONTRACTOR shall be responsible for coordinating, implementing, and operating bypass pumping facilities to the extent that they need in order to accomplish the renovations while keeping system in operation.

Distance between the alarm panel and pump station will be set in the field and will determine the cord length necessary from the manufacturer.

B. Pumps

The pump in each pump station shall be integral, vertical rotor, motor driven, close coupled, electrically powered, and solids handling. The pump shall have a single mechanical seal, stainless steel rotor. The pumps and motors shall meet requirements of National Electric Code for such units.

The motors shall be non-overloading at any point on the pump curve, from shutoff head to zero head condition.

The pumps shall be capable of handling raw, unscreened sewage. The pump suction shall be at least 4 inches in diameter. The pump discharge piping shall be 1-1/4 inch diameter stainless steel.

All major parts, such as the stator casing, oil casing, sliding bracket, volute and impeller shall be cast iron, fully epoxy coated to 8-10 mil Nominal dry thickness, wet applied. All surfaces coming into contact with sewage shall be protected by a coating resistant to sewage. All exposed bolts and nuts shall be of stainless steel.

The pump shall be provided with a mechanical shaft seal to prevent leakage between the motor and pump. The seal shall have a stationary ceramic seat and carbon rotating surface with faces precision lapped and held in position by a stainless steel spring.

The stator shall be of a specifically compounded ethylene propylene synthetic elastomer. This material shall be suitable for domestic wastewater service. Its physical properties shall include high tear and abrasion resistance, grease resistance, water and detergent resistance, temperature stability, excellent aging properties, and outstanding wear resistance. Buna-N is not acceptable as a stator material.

C. Grinder

The grinder shall be placed immediately below the pumping elements and shall be direct-driven by a single, one-piece motor shaft. The impeller shall be non-clogging design capable of handling solids, fibrous material, heavy sludge and other matter found in normal sewage applications so as to minimize clogging and jamming under all normal operating conditions including starting.

The grinder impeller (cutter wheel) assembly shall be securely fastened to the pump motor shaft by means of a threaded connection attaching the grinder impeller to the motor shaft. The grinder impeller shall be a one-piece, 4140 cutter wheel of the rotating type with inductively hardened cutter teeth. The cutter teeth shall be inductively hardened to Rockwell 50 – 60c for abrasion resistance. The shredder ring shall be of the stationary type and the material shall be white cast iron. The teeth shall be ground into the material to achieve effective grinding. The shredder ring shall have a staggered tooth pattern with only one edge engaged at a time, maximizing the cutting torque.

This assembly shall be dynamically balanced and operate without objectionable noise or vibration over the entire range of recommended operating pressures. Static and dynamic balancing operations shall not deform or weaken it.

D. Electric Motor

The electric pump motors for the pumps shall be designed to operate on 120/240 V, 1 phase, 60 cycle power. Each pump motor shall have moisture resistant Class F 155 degree Centigrade insulation. The motors shall be NEMA Design B and designed for continuous duty. The motor shall be press-fit into the casting for better heat transfer and longer winding life. Inherent protection against running overloads or locked rotor conditions for the pump motor shall be provided by the use of an automatic-reset, integral thermal overload protector incorporated into the motor. This motor protector combination shall have been specifically investigated and listed by Underwriters Laboratories, Inc., for the application.

Pump motor cable installed shall be suitable for submersible pump applications and this shall be indicated by a code or legend permanently embossed on the cable. Cable sizing shall conform to NEC specifications for pump motors and shall be of adequate size to allow motor voltage conversion without replacing the cable.

E. Tank

The tank shall be made of high-density polyethylene, with a grade selected to provide the necessary environmental stress cracking resistance. Corrugated sections are to be made of a double wall construction with the internal wall being generally smooth to promote scouring.

The tank shall include a single NEMA 6P Electrical Quick Disconnect (EQD) for all power and control functions, factory installed with tank penetrations warranted by the manufacturer to be watertight. The EQD shall be supplied with a cord useable Electrical Supply Cable (ESC) outside the station of sufficient length meeting all field conditions to connect to the alarm panel. The ESC shall be installed in the basin by the manufacturer. The EQD shall be so designed to be conducive to field wiring as required.

The tank shall also include an integral 2-inch vent to prevent sewage gases from accumulating in the tank.

F. Valves

1. Check Valve

The pump discharge shall be equipped with a factory installed, gravity operated, flapper-type integral check valve built into the stainless steel discharge piping. The check valve shall provide full pipe diameter when in open position. Moving parts will be made of a 300 Series stainless steel and fabric reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly providing a maximum degree of freedom to assure seating even at a very low back-pressure.

2. Anti-siphon Valve

The pump discharge shall be equipped with a factory-installed, gravity-operated, flapper-type integral anti-siphon valve built into the stainless steel discharge piping. Moving parts will be made of 300 Series stainless steel and fabric-reinforced synthetic elastomer to ensure corrosion resistance, dimensional stability, and fatigue strength. A nonmetallic hinge shall be an integral part of the flapper assembly, providing a maximum degree of freedom to ensure proper operation even at a very low pressure.

G. Controls

All necessary motor starting controls shall be located in the cast iron enclosure of the core unit secured by stainless steel fasteners. Locating the motor starting controls in a plastic enclosure is not acceptable.

The wastewater level sensing controls shall be housed in a separate enclosure from motor starting controls. The level sensor housing must be sealed via a radial type seal; solvents or glues are not acceptable. The level sensing control housing must be integrally attached to pump assembly so that it may be removed from the station with the pump and in such a way as to minimize the potential for the accumulation of grease and debris accumulation, etc. The level sensing housing must be a high-impact thermoplastic copolymer over-molded with a thermo plastic elastomer. The use of PVC for the level sensing housing is not acceptable.

Non-fouling wastewater level controls for controlling pump operation shall be accomplished by monitoring the pressure changes in an integral air column connected to a pressure switch. The air column shall be integrally molded from a thermoplastic elastomer suitable for use in wastewater and with excellent impact resistance. The air column shall have only a single connection between the water level being monitored and the pressure switch. Any connections are to be sealed radially with redundant O-rings. The level detection device shall have no moving parts in direct contact with the wastewater and shall be integral to the pump core assembly in a single, readily-exchanged unit. Depressing the push to run button must operate the pump even with the level sensor housing removed from

the pump.

All fasteners throughout the assembly shall be 300 Series stainless steel.

High-level sensing will be accomplished in the manner detailed above by a separate air column sensor and pressure switch of the same type. Closure of the high-level sensing device will energize an alarm circuit as well as a redundant pump-on circuit. For increased reliability, pump ON/OFF and high-level alarm functions shall not be controlled by the same switch. Float switches of any kind, including float trees, will not be accepted due to the periodic need to maintain (rinsing, cleaning) such devices and their tendency to malfunction because of incorrect wiring, tangling, grease buildup, and mechanical cord fatigue. To assure reliable operation of the pressure switches, each core shall be equipped with a factory installed equalizer diaphragm that compensates for any atmospheric pressure or temperature changes.

The grinder pump will be furnished with a 6 conductor 14 gauge, type SJOW cable, pre-wired and watertight to meet UL requirements with a factory installed NEMA 6P EQD half attached to it.

H. Alarm Panel

Each grinder pump station shall include a NEMA 4X, UL-listed alarm panel suitable for wall or pole mounting. The NEMA 4X enclosure shall be manufactured of thermoplastic polyester to ensure corrosion resistance. The enclosure shall include a hinged, lockable cover with padlock, preventing access to electrical components, and creating a secured safety front to allow access only to authorized personnel. The enclosure shall not exceed 12.5" W x 16" H x 7.5" D.

The alarm panel shall contain one 15-amp, double-pole circuit breaker for the pump core's power circuit and one 15-amp, single-pole circuit breaker for the alarm circuit. The panel shall contain a push-to-run feature, an internal run indicator, and a complete alarm circuit. All circuit boards in the alarm panel are to be protected with a conformal coating on both sides and the AC power circuit shall include an auto resetting fuse.

The alarm panel shall include the following features: external audible and visual alarm; push-to-run switch; push-to-silence switch; redundant pump start; and high level alarm capability. The alarm sequence is to be as follows when the pump and alarm breakers are on:

1. When liquid level in the sewage wet-well rises above the alarm level, the contacts on the alarm pressure switch activate, audible and visual alarms are activated, and the redundant pump starting system is energized.
2. The audible alarm may be silenced by means of the externally mounted, push-to-silence button.

3. Visual alarm remains illuminated until the sewage level in the wet-well drops below the "off" setting of the alarm pressure switch.

The visual alarm lamp shall be inside a red, oblong lens at least 3.75" L x 2.38" W x 1.5" H. Visual alarm shall be mounted to the top of the enclosure in such a manner as to maintain NEMA 4X rating. The audible alarm shall be externally mounted on the bottom of the enclosure, capable of 93 dB @ 2 feet. The audible alarm shall be capable of being deactivated by depressing a push-type switch that is encapsulated in a weatherproof silicone boot and mounted on the bottom of the enclosure (push-to-silence button).

The entire alarm panel shall be listed by Underwriters Laboratories, Inc.

I. Service

The grinder pump core shall be easily removable for inspection or service, requiring no bolts, nuts, or other fastenings to be disconnected. The unit shall have two lifting hooks complete with lift-out harness connected to its top housing to facilitate easy core removal when necessary. The level sensor assembly must be easily removed from the pump assembly for service or replacement. All mechanical and electrical connections must provide easy disconnect capability for core unit removal and installation.

The manufacturer of the pumps furnished shall have a factory authorized service center within 100 miles of the project location. The service center shall maintain a minimum small parts inventory of \$50,000 and shall have the capability to test a repaired pump under water under conditions similar to those normally encountered in actual service. The service center shall have the normal capability to dispatch service personnel to the pump station for service or repair.

A service representative will spend a minimum of two (2) hours of startup supervision and job training for the OWNER's operator after the pump stations have been completely installed, checked by the OWNER, ENGINEER, Manufacturer, and Operator and has been approved for startup and successfully started. In the event that the manufacturer's representative is called to the job site and it is found that the stations have not been completed or have a problem that renders incomplete startup and operation of all of the appurtenances, it shall be the responsibility of the CONTRACTOR to bring the factory trained service engineer back to the job site to provide the startup training. The service representative shall explain and demonstrate the operation of the pumps to a representative of the OWNER. The service representative at this time shall pass over to the OWNER's representative three (3) bound copies of the pump maintenance and operation manual.

A complete service report shall be made out and signed by the factory service representative and a representative of either the OWNER or PROJECT ENGINEER. Copies of the start-up report will be distributed as follows: One (1) copy each to the manufacturer's project file, consulting ENGINEER's project file, CONTRACTOR's project file and the OWNER's equipment file.