

SPECIFICATIONS FOR SANITARY & STORM SEWER CONSTRUCTION

S-1 SCOPE OF WORK

The Contractor shall furnish all the necessary labor, materials, equipment, tools and supplies that are necessary to install a complete sewer system, as shown on the plans and/or called for in these specifications or its addenda. It is the intent to these specifications to install a complete system or job; and the Contractor shall furnish everything necessary to do this, whether or not it may be specifically called for in these specifications or on the plans.

S-2 SANITARY SEWER PIPE

A. Standard Strength Vitrified Clay Sewer Pipe (Std. Strength VCP): All clay sewer pipe laid at depths of 0 to 12 feet shall conform to the latest revisions of ASTM Designation C700 Std. Strength VCP, and all applicable ASTM Specifications, unless extra strength pipe is specified.

B. Extra Strength Vitrified Clay Sewer Pipe (Ex. Strength VCP): Clay pipe laid at depths in excess of 12 feet shall conform to the latest revisions of ASTM Designation C700 and all applicable ASTM Specifications for extra strength VCP.

C. The PSM POLYVINYL CHLORIDE (PVC Sewer Pipe): All PVC sewer pipe shall conform to the latest revision of ASTM D3034, and shall have an SDR 35 rating. Such to be allowed for sanitary sewer of fifteen inch (15") diameter or less.

D. POLYVINYL CHLORIDE (PVC) Composite Sewer Pipe: All PVC Truss sewer pipe shall be compatible from a dimensional, performance, and use standpoint with ABS composite pipe covered by ASTM Specification D2680, and shall have a minimum stiffness (F/DY) of 200 psi. The PVC thermoplastic material shall be a rigid PVC plastic conforming to ASTM D-1784 for a minimum cell class of 12454B. The Portland Cement Perlite Concrete or other inert filler material shall be as described in Section 6.3 of ASTM D-2680. Such to be allowed for sanitary sewers of fifteen inch (15") diameter or less.

S-3 STORM SEWER PIPE

A. Reinforced Concrete Pipe: Reinforced concrete storm sewer pipe shall conform to the latest revised ASTM Designation C76 for Reinforced Concrete Tongue and Groove Pipe. The class designation shall be as shown on the plans or as specified. All applicable ASTM Specifications shall also apply to the installation of this pipe.

B. Corrugated Metal Pipe: Corrugated metal pipe shall conform to the requirements of AASHO M36 and Section 1000.1.A of South Dakota Highway Specifications. The gauge will be shown in the special provisions and on the proposal sheet. Special coating or paving will be specified in the "Special Information" and Specifications included herewith.

C. Corrugated Polyethylene Pipe: High-density polyethylene (HDPE) pipe shall meet the material and performance requirements of ASTM F2306 or the latest edition of AASHTO M294 Type S or AASHTO M252 Type S. HDPE pipe shall be joined with soil tight joints meeting the requirements of AASHTO M294 Paragraph 7.9.3 or ASTM F2306 Paragraph 6.6.3.3. Fittings may be joined using soil tight couplers. Junctions with concrete structures shall meet requirements of ASTM C923. Installation shall be per manufacturer's recommendations. The Contractor shall provide the Engineer pipe product information, installation recommendations and instructions, and additional literature, as requested, for review and approval prior to ordering pipe.

S-4 JOINT MATERIALS - SANITARY SEWERS

A. Clay Pipe: Vitrified Clay Pipe joints using materials having resilient properties shall be used unless otherwise designated. Joints shall conform to the latest revisions of ASTM Designation C425 or ASTM Designation C594.

B. Polyvinyl Chloride Sewer Pipe: PVC Sewer Pipe shall have a flexible elastomeric seal (O-ring rubber sealing joint) and conform to the latest revisions of ASTM D3212. Solvent cement joints shall not be allowed for pipe and fittings.

C. PVC Composite Sewer Pipe: PVC Truss Sewer Pipe shall have a mechanical-seal joint manufactured to be compatible with the dimensions specified for ABS materials in ASTM Specification D2680. Solvent cement joints will not be allowed, except at locations of bends and service wyes. The cement for solvent-cement joints (PVC to PVC) shall comply with ASTM Specification D2564. PVC Truss Pipe shall be compatible from a dimensional and performance standpoint with ABS Truss Pipe and fittings. The pipe, couplings, and fittings shall be sized with the necessary tolerances so that they may be joined easily and used in conjunction with ABS composite pipe, joints, and fittings. Cement for transition joints (ABS to PVC), at bends and wyes, shall comply with ASTM Specification D3138.

S-5 JOINT MATERIALS - STORM SEWERS

A. If concrete pipe tongue and groove joints are tight and true, as determined by the Engineer, they need not be grouted; but when such joints are open and/or skewed, they shall be mortared both inside and outside. The specified joints shall be jointed with cement mortar composed of one (1) part Portland Cement and two (2) parts of sand and enough water to make a workable mixture, unless otherwise stipulated on the plans or by the Special Information. All lift holes in RCP Storm Sewer shall be plugged with a concrete mortar plug made from an approved mix.

B. Corrugated metal pipe shall be jointed using either one or two pied corrugated coupling band of same diameter and gauge as the pipe unless otherwise shown .on the plans or specified.

C. Corrugated polyethylene pipe – See above section S-3 (C)

S-6 MANHOLE MATERIALS

A. Concrete used for manhole bases, pipe cradles or other monolithically poured structures shall consist of one part standard Portland Cement Type I, 2-1/2 parts clean washed sand and 3 parts crushed rock and gravel, free from foreign materials. Mortar used for laying up concrete block or brick manholes or used for plastering up outside of block manholes, in wet excavations, shall consist of Standard Portland Cement Type I, hydrated lime, and clean, sharp, well-graded sand free from foreign materials. The minimum design strength of the concrete mixture shall be 4,000 psi.

B. Precast concrete manholes shall conform to ASTM Designation C478 with all current revisions. The inside diameter will be 48 inches unless otherwise stated in the plans or Special Information. The upper section of the manhole shall be a special precast cone or slab made expressly for the purpose of providing a 24" diameter opening at the top. The cone section shall be concentric and shall not be eccentric (offset). All manholes shall be constructed without steps or ladders.

C. Precast segmental blocks shall be manufactured in accordance with ASTM Designation C139. The blocks shall be radial block to form an 8-inch wall thickness. Brick shall be clay or concrete, uniform in size and texture and meeting ASTM Specifications for Sewer Brick. Such manholes to have prior approval from the Engineer.

D. Cast Iron manhole covers shall be made of gray iron conforming to ASTM Designation A-48 for Class 20 Iron. For manholes and junction boxes, the same shall be Neenah Foundry R=1733 with self seal lid with an approved circular pick-hole (concealed type), or approved equal. For drop inlet structure, the same shall be Neenah Foundry R-6040 type Y, or approved equal. They shall be cleaned and painted with an asphaltic or coal tar paint. Covers shall fit tightly and be watertight with a self-sealing lid.

E. Reinforcing bars shall be structural grade, manufactured by the open hearth process from new billets. All bars shall be deformed.

F. Precast concrete manholes shall meet requirements of the current ASTM Specification Designation C478. Upon request from the City, the Contractor and/or Supplier shall supply the City with a test report from an independent testing laboratory showing compliance with this specification.

SM-7 SEWER TRACER WIRE

SM-7.1 Installation Requirements

Tracer wire shall be installed with sanitary sewer mains and service lines. The wire shall be installed along the lower quadrant of the pipe, but the pipe shall not be laid directly on the wire. Ground rods shall be installed adjacent to connections to the existing piping and in the locations specified on the plans. The tracer wire shall be brought to a terminal box at each manhole. The tracer wire shall be brought to a terminal box which is to be installed directly

above the end point of service line stub. Should work include installation of service lines to any structure, the Contractor shall also install the tracer wire to the structure. The tracer wire shall be spliced only if approved by the Engineer. All underground splices shall be inspected by the Engineer prior to backfilling. The tracer wire system is considered to be part of the price bid for sewer mains.

The Contractor shall be responsible for testing the tracer wire system for conductivity. Testing for conductivity shall be complete after the service lines have been tapped. If the tracer wire system does not function as intended, the Contractor shall repair the system to the satisfaction of the Engineer. Tracer wire system shall be installed in conformance with Standard Details.

SM-7.2 Tracer Wire

The components of the tracer wire system shall be suitable for direct bury applications. The conductor shall be 12 AWG, solid-strand, soft-drawn copper per ASTM B3. The conductor shall be insulated with high molecular weight polyethylene. The minimum insulation thickness shall be 0.045 inches and the color shall be green. Acceptable manufacturers of the tracer wire are Coleman Cable, Kris-Tech Wire, or an approved equal.

SM-7.3 Splice Kits/Connectors

Splices and/or connectors shall be capable of handling from two to four wires per connection and be designated as “water proof.” Splice kits/connectors shall be Scotchlok DBY by 3M, LV 9000 by SNAPLOC, or an approved equal.

SM-7.3 Terminal Boxes

The tracer wire boxes shall be placed at no more than 1,000 feet apart (along the line of the line of the Tracer Wire) or as specified on the drawings. Terminal Boxes adjacent to manhole shall be metal and be Roadway Snakepit tracing wire access box or an approved equal. Terminal Boxes not installed in street shall be metal and be Light-Duty Snakepit tracing wire access box, Tracer Wire Access Box by Drainage & Water Solutions, Inc., or an approved equal.

S-8 CATCH BASINS

A. Curb-type drop inlets shall be constructed in accordance with the standard City of Sioux Falls STORM SEWER INLET plate or as detailed on the construction drawings. Top slab shall be precast concrete with a steel channel or angle face at the curb line as detailed, and reinforcing steel as specified on the details.

B. Drop inlets and catch basins shall be constructed in accordance with City of Madison standards as detailed on the construction drawings.

S-9 ALIGNMENT AND GRADE

The Engineer will furnish all the necessary line and grade stakes, bench marks or other necessary control. It is the responsibility of the Contractor to return all grade sheets prior to completion, final acceptance, and payment for the project. It is the responsibility of the Contractor to protect these stakes, and any replacement of stakes shall be at the expense of the Contractor. The Contractor shall maintain line and grade in the trench by means of an approved laser beam system. Revolving type beacon laser systems are not acceptable. At no time shall the Contractor or his employees change the grade without approval of the Engineer or Inspector. If underground interference is encountered at the assigned grade, the Contractor shall notify the Engineer and wait for further instructions before proceeding.

S-10 UNDERGROUND INTERFERENCE

The location of underground public or private utilities may or may not be shown on the plans, as reported by the various utility companies and the City, but this does not relieve the Contractor of the responsibility of determining the accuracy or completeness of said locations. The Contractor shall determine the location of all underground ducts, conduits, pipes, cables or structures which will be affected by his excavation, and shall take steps necessary to support, protect, remove, or relocate said structures by any means suitable to the owners of the structure involved and the Engineer. In those instances where their relocation or reconstruction is impracticable, a deviation from line and grade may be ordered by the Engineer.

The Contractor shall be responsible for notifying the various utility companies when his work will expose, affect or endanger any existing utility. All cost of investigation and any necessary protection, support, removal, or relocation of said structures shall be included in the contract bid price for laying pipe. The Contractor SHALL NOT begin construction until all utility companies have been contacted and their respective underground utilities have been located/spotted.

S-11 EXCAVATION

Prior to beginning any excavation on graveled streets, the Contractor shall windrow all existing salvageable gravel and same shall be relaid, shaped, and compacted upon completion of the project. Avoid any mixing of clay or other foreign materials with the gravel. If the Contractor does not salvage the existing gravel, he shall be responsible for replacing additional gravel at his expense in an approved manner.

The Contractor shall do all excavating and trenching work as shown on the Drawings, through whatever materials may be encountered, to the lines and elevations shown on the Drawings. The Contractor shall do all bedding, filling, and backfilling necessary to bring the work to finished grade including the replacement of surface improvements.

S-12 EARTH EXCAVATION

All excavation shall be made by open cut method unless otherwise shown on the Plans. The banks of trenches shall be kept as nearly vertical as practicable and where required shall be properly sheathed and braced. Trenches shall be not less than 12 inches wider nor more than 16

inches wider than the outside diameter of the pipe laid therein, and shall be excavated true to line, so that clear space of not less than 6 inches nor more than 8 inches in width is provided on each side of the pipe. The maximum width of trench specified applies to the width at and below the level of the top of the pipe. The width of trench above that level may be as wide as necessary for sheathing and bracing and the proper installation of the work.

The bottom of trenches shall be accurately graded to provide uniform bearing and support for each section of pipe on stable material at every point along its entire length.

Under no circumstances will it be permissible to leave a pipeline excavation unprotected or unguarded when work is not actually in progress on the pipeline. If it becomes necessary for the Contractor to leave the pipeline excavation for any reason, it shall be the Contractor's responsibility to leave one of his employees at the site to watch the site so unauthorized personnel do not enter the excavation. Unless otherwise required, the pipeline excavation shall be completely backfilled at the end of each days operation, and reopened when work resumes on this portion of the line. The Contractor shall be responsible to mark the end of the pipe in such a manner that it may be easily found when the ditch is reopened.

Excavation for structures and accessories, including manholes, shall be sufficient size so as to leave at least twelve (12) inches of clear space between the outer surface of the structure and the embankment or sheathing and bracing which may be used to hold and protect them. Unless otherwise shown on the Drawings or authorized by the Engineer, the bottom of the excavation shall not be undercut below the grades established. Manhole installations shall be completed and completely backfilled the same day in which the excavation was started.

S-13 SHEETING AND BRACING

Sheeting, bracing, or pulling a trench box or shield shall be used and maintained as necessary to comply with City, County, State, and Federal regulations to protect personnel, property or the job. The cost of such shall be included in the contract bid price for laying pipe. In order to comply with the minimum trench widths at the top of pipe, as specified in the preceding paragraph, it will not be possible to pull a trench box or shield on grade at the bottom of the pipe. Therefore, the box shall be made to rest on a ledge along each side of the top of the pipe, and a narrower, deeper trench shall be cut inside the box to accommodate the bedding material, pipe and backfill material up to the top of the pipe. This installation is necessary to maintain the strength of the flexible pipe and pipe envelope and to prevent excessive deflection when the box is moved forward and the pipe trench is backfilled.

The Contractor shall provide suitable sheeting, shoring, and bracing to protect all excavations to provide safe working conditions, and in strict conformance with safety regulations. Damage or injury resulting from settlement, slides, cave-ins, water pressure or other causes shall be the responsibility of the Contractor and damage shall be repaired a this own expense.

The Contractor shall provide the necessary signs, barricades, yellow lights, watchmen, and take all necessary precautions for the protection of the work and the safety of the public. All

barricades and obstructions shall be protected at night by yellow signal lights which shall be kept lit from sunset to sunrise. Suitable warning & traffic signs in conformance with the construction & location requirements of the Manual Uniform Traffic Control Devices (MUTCD) shall be so placed as to properly advise the public for safety purposes.

The Contractor shall at all times so conduct his own work as to insure the least possible obstruction to traffic and inconvenience to the general public and the residents in the vicinity of the work, and to insure the protection of persons and property. No road or street shall be closed to the public except with the permission of the proper authority. Any police or other traffic control shall be arranged for by the Contractor and be at his expense. Fire hydrants on or adjacent to the work shall be kept accessible to fire-fighting equipment at all times. Temporary provisions shall be made by the Contractor to insure the use of sidewalks and the proper functioning of all gutters, sewer inlets, drainage ditches, and irrigation ditches, which shall not be obstructed except as approved by the Engineer.

S-14 UNDERCUTTING

Where soft, spongy, unstable, or other similar material is encountered upon which the bedding material, structure, or pipe is to be placed, this unsuitable material shall be removed to a depth ordered by the Engineer and replaced with trench stabilization material.

The trench stabilization for all sanitary sewer trenches where necessary shall be 3/4 inch to 4 inches crushed angular, well graded material. Larger material may be used if necessary and required to stabilize the bottom of the trench.

S-15 DEWATERING

Pipe jointing shall be accomplished in a relatively dry trench condition. No joints may be made under water. In case ground water is encountered the Contractor shall dewater the trench with suitable pumps and equipment. The cost of dewatering shall be absorbed in the contract bid price for laying pipe. Dewatering shall consist of furnishing all plant, labor, equipment, appliances, and materials necessary to lower the ground water table for a water free trench.

Water resulting from dewatering operations shall be disposed of in a manner approved by the Engineer. It shall not be pumped onto private property without the property owner's approval. Any damage to property, either public or private, shall be rectified to the satisfaction of the Owner and the City.

S-16 BEDDING

Bedding shall be defined as that material supporting, surrounding, and extending to the top of the pipe or conduit. Where it is shown on the Drawings and also when it becomes necessary to undercut the bottom of the utility trench to remove rock or other interfering objects at subgrade for bedding, any void below such subgrade shall be filled with compacted bedding material as approved by the Engineer.

Where it is necessary to remove soft, spongy, unstable, or other similar material which is incapable of properly supporting the structure or pipe, any void below the bottom of the structure or pipe shall be filled with compacted rock material as directed by the Engineer.

Where it is necessary for any reason to undercut below the bottom of concrete poured in place structures, the void below the bottom of the structure shall be filled with concrete at the same time and of the same quality as that of the structure itself, unless otherwise shown on the Drawings or approved by the Engineer. If the necessity for such additional bedding material has been caused by an act or failure to act on the part of the Contractor, the Contractor shall bear the expense of the additional excavation and bedding.

Installation of VCP, including bedding and backfill of the pipe, shall conform to the latest revision of ASTM C12 “Standard Recommended Practices for installing Vitrified Clay Pipe Lines”, and the specifications and details of the City of Madison included herewith. Installation of PVC pipe including bedding and backfill of the pipe, shall conform to the latest revision of ASTM D2321 “Standard Recommended Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe” and the specifications and details of the City of Madison included herewith.

The trench base shall be undercut a minimum of 4 inches or one-fourth of the outside diameter of the pipe barrel (whichever is larger) below the grade line of the pipe and uniformly backfilled with bedding material to the grade-line of pipe. After the pipe has been installed on top of the first layer of bedding material, the haunching area shall be backfilled with the same material up to “spring-line” (halfway) on the pipe (bedding material shall be used to the top of the pipe for all pipes with a diameter of 12 inches or less). The bedding material shall be “shovel-sliced” or hand tamped around and under the haunches of the pipe to insure adequate support along the bottom of the pipe. Care shall be taken to prevent dislodging and misalignment of the pipe and to provide an adequate bell hole for the pipe.

The material for sewer main bedding shall be 95% passing $\frac{3}{4}$ inch sieve and 95% retained on #4 sieve.

The material for trench stabilization shall consist of 3/4- to 4-inch crushed angular, well-graded material. Larger material may be used if necessary to stabilize the bottom of the trench. The trench stabilization material will be used as directed by the Engineer. The use of trench stabilization material will not eliminate the need for sewer main bedding material.

Granular material for Select Granular Backfill shall be “well graded subbase material” in accordance with the Standard Specifications (SDDOT Standard Specifications for Roads and Bridges). Sand may be used if approved by the Engineer.

S-17 LAYING OF PIPE

Sewer pipe shall not be laid in frozen ground or in water, and no water will be allowed to run into or through the pipe until the joints have hardened or cured. Any water that enters the

pipe shall be blocked at a downstream manhole and pumped to the surface. At no time shall it be allowed to enter the system.

Pipe shall be carefully laid to line and grade in accordance with line and grade stakes set by the Engineer so that the finished sewer will present a uniform bore. Any noticeable variations from true alignment or grade will be cause for rejection of the work.

All pipe shall be laid upgrade with spigot ends pointing in the direction of flow. The bottom of the trench shall be free of all rocks and stones and shall be hand shaped as specified and the pipe shall be in firm contact with the trench bottom for its entire length. At each joint of bell and spigot pipe, a hole shall be dug of sufficient size so that the weight of the pipe will rest on the barrel of the pipe and not on the bells, and the bell hole shall not be compacted. All pipe must be properly fitted together as no chipping of bell or spigot will be allowed. A suitable stopper shall be kept in the end of the pipe so as to prevent any dirt or water from entering during the progress of the work at all times. Any dirt, loose material, or cement mortar which may accumulate in the pipe shall be removed as the work progresses by means of a swab. The backfilling around and to a depth of one foot over the pipe shall be completed and thoroughly tamped as the pipe laying progresses as hereafter specified in bedding and backfill requirements.

The Contractor shall be responsible for inspecting the project prior to preparing a project bid to evaluate flow through sewerage system. Pumping sewage water around work area is not a requirement; however, strict compliance with dry pipe installation standards shall be required. Regardless of whether or not the Contractor incorporated pumping around into their bid or not, if strict adherence to dry pipe installation standards is not achieved, the Engineer shall have the authority to require pumping around at no additional cost to the City. There shall be no renegotiation of prices based upon this type of work.

S-18 HAND BACKFILLING

All sewer pipe laid in an open trench shall be backfilled and hand tamped or mechanically tamped to at least 12 inches above the top of the pipe. The backfill is to be placed and tamped evenly on both sides of the pipe so as not do disturb the grade or line of the pipe. The next eighteen (18) inches of backfill material shall be mechanically placed and tamped. Materials for all areas of backfilling is to be free of rock and frozen materials.

S-19 BACKFILL MATERIAL

Material obtained from the project excavations, except for in bedding areas, may be used as backfill unless otherwise shown on the Drawings or specified in these Specifications, provided that all organic material, rubbish, debris, rocks greater than six (6) inches in any dimension, and other objectionable materials are first removed. Broken portland cement concrete and bituminous type pavements obtained from the project excavations will not be permitted in the backfill.

The top three (3) inches of backfill in gravel surfaced street areas shall be compacted granular material conforming to the requirements of the South Dakota Department of

Transportation Specifications for Gravel Surfacing, unless otherwise shown on the Drawings or approved by the Engineer.

The top of the compacted backfill below improved surfaced street areas shall be held to the depth of the existing surface treatment, including base course, or twelve (12) inches below finished surface grade, whichever is the greater. The surfacing improvements shall be replaced in kind in accordance with the provisions herein. Base course material for use in surfacing improvements shall conform to the requirements of the South Dakota Department of Transportation Specification for Base Course.

The Contractor shall remove available topsoil to surface embankments and excavation backfills of trenches and around structures on the site of the work at the locations requiring topsoil. This topsoil shall be stockpiled separately and placed on the embankments and backfill after all construction across, over, or above such embankments and backfill has been completed. The minimum total depth of topsoil shall be 6 inches or of greater depth as may be specified or indicated on the plans.

Stones larger than 3 inches in diameter shall not be placed within 2 feet of the top of sanitary sewer pipe.

S-20 COMPACTION OF BACKFILL

The Contractor shall utilize an independent testing agency to inspect and test each subgrade and each fill or backfill layer as directed by the Engineer. For contract projects with city only, this shall only be required and paid for if specific bid items are included as part of contract. The Contractor shall not proceed until test results for previously completed work verify compliance with requirements.

Backfill shall be mechanically compacted by means of tamping rollers, sheepfoot roller, pneumatic tire rollers, vibrating rollers, or other mechanical tampers. All such equipment shall be of a size and type approved by the Engineer.

Permission to use specific compaction equipment shall not be construed as guaranteeing or implying that the use of such equipment will not result in damage to adjacent ground, existing improvements or improvements installed under the contract. The Contractor shall make his own determination in this regard.

Mechanically compacted backfill shall be placed in horizontal layers of thickness (not exceeding those specified below) compatible to the material being placed and the type of equipment being used. Each layer shall be evenly spread, moistened (or dried, if necessary), and then tamped or rolled until the specified relative compaction has been attained.

Compaction adjacent to all manholes, catch basins, valve boxes, curb boxes, end of services and similar structures shall be performed by the use of hand-directed mechanical tampers with lifts not exceeding that specified above.

Materials, prior to incorporation in the work, must be inspected, tested, and approved for use by the Engineer. In lieu thereof, the Engineer may permit or require the Contractor to furnish certification for certain materials. Work in which unapproved materials are used shall be performed at the Contractor's risk and are subject to inspection, test, or rejection. Copies of tests will be furnished to the Contractor's representative when requested.

Samples taken and tests made will be in accordance with the most recent standard or tentative standard methods of AASHTO, ASTM, and the "South Dakota Department of Transportation, Materials Manual-Sampling and Testing Procedures," which are current on the date of advertisement for bids. All references herein shall be referenced to the Material Manual test number – for example SD 105 – and all tests referenced in any particular test number shall be considered required and part of the named test for payment and all other purposes.

If a discrepancy exists, the order of precedence is as follows:

- (1) Notes included herein below
- (2) Department's Materials Manual
- (3) AASHTO
- (4) ASTM

Backfill in and across parking lots, driveways and roadway areas to include road shoulder areas shall be placed in lifts not to exceed eight-inches (8") in loose depth and shall uniformly compacted to a minimum of 95% maximum dry density as defined by SD 105 before successive lifts are placed. Backfill in ditches, easement areas, areas behind curb lines (boulevard areas) shall be placed in lifts not to exceed twelve-inches (12") in loose depth and shall be uniformly compacted to a minimum of 90% maximum dry density as defined by SD 105 before successive lifts are placed.

Optimum moisture content determinations for in-place material shall be the content determined in SD 104 and all backfill material shall be compacted at a moisture content of no more or less than four percentage (4%) points above or below the optimum moisture content. Copies of all tests shall be on forms specified in SD 105 and shall be promptly provided to the Engineer. Excess moisture shall be removed by drying operations.

Compaction and density test locations shall be randomly selected by the Engineer at an estimated rate of one test per 400 lineal feet of trench length per each two feet of fill bounded by the top of pipe and the top of the subgrade. If failing tests are experienced the Engineer reserves the right to require additional tests at the Contractor's expense to assure that satisfactory results are obtained. If any of the compaction and density tests indicate that the material has not been compacted to the required density, the Contractor shall recompact the material at no additional cost to the Owner. The Engineer shall have the right to require additional compaction tests to insure that the recompacted material is compacted to the required density.

The independent testing agency shall perform the above referenced field in-place density and moisture tests. Field in-place density tests may also be performed by the nuclear

method according to SD 114, provided the correction determination is accomplished and documented as outlined in SD 114 and prior written approval is provided by the Engineer.

A schedule of density tests shall be submitted to the Engineer for approval. This test frequency may be reduced at the discretion of the Engineer. Reduction in or increase in the number of tests shall not be cause for adjustment in unit prices for testing.

Lack of strict adherence to this section may result in withholding of payment, including but not limited to, the cost of testing but may also cause for further reduction in payment due to Contractor as determined by the Engineer.

S-21 TERM OF GUARANTEE

For utility construction activities, the guarantee shall cover the Contract as to workmanship and materials for a period of two (2) years from the date of final acceptance for all projects, including private projects, or Substantial Completion for City bid projects. The Contractor shall maintain all trenches and backfill from any settlement and provide and place any necessary base and/or surfacing (new or old) needed due to trench settlement for the maintenance/correction period which shall run for two (2) years after the completion and acceptance of system.

For surface construction activity, the guarantee shall cover the Contract as to workmanship and materials for a period of One (1) year from the date of final acceptance for all projects, including private projects, or Substantial Completion for City bid projects. The Contractor shall maintain any deficiencies in workmanship and materials for the maintenance/correction period which shall run for One (1) year after the completion and acceptance of the system.

The Contractor shall repair and/or replace all defective workmanship and materials, and correct all deficiencies noted in the system in a method approved by the Engineer. All such efforts to correct any defective Work, including but not limited to removal and replacement of surface construction activity Work necessary due to rectification of defective utility construction activity Work, shall be accomplished at no cost to the City.

Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this section, the correction period hereunder with respect to such Work will be extended for an additional period of one (1) year after such correction or removal and replacement has been satisfactorily completed.

The guarantee described above shall apply for all other related or referenced specification sections affected by Work.

S-22 WYE BRANCHES

“Y” branches for house connections and commercial connections shall be built into the sewers at such points as the Engineer shall designate and approve. The Contractor shall contact the property owners to inquire about the required depth and where it will be most convenient for the property owner to hook up his sewer service pipe as shown on the plans. It will be the

Contractor's responsibility to keep accurate records of the location of each wye and stubout and give to the Engineer or Inspector each day before backfilling, so that its accuracy can be checked. All wye locations shall be recorded on the grade sheets, and all grade sheet shall be turned in to the Engineer or Inspector. Stubout locations shall also be recorded and submitted to the Engineer. All wyes and stubout shall be marked with a 2"x2" piece of wood and a buried steel fence post to help relocate it and prevent breakage when excavating.

When using a plastic coupling, lubricant sealer will not be used on such stoppers, but a liquid detergent shall be used so as to permit their removal upon connection. All wyes shall be capped and sealed as it is impossible to determine if and when they will be used. All stubouts shall be capped and sealed, and the Contractor shall be responsible for the measurement(s) recorded on the grade sheet.

S-23 MANHOLE CONSTRUCTION

All manholes shall be made waterproof and sealed accordingly. The entire manhole and all portions thereof shall be made waterproof in the following manner:

- (1) Casting: Manhole casting shall be of a design approved by the Engineer and shall set in a mortar base to form a tight seal. The pick-hole and seat between the ring and cover shall be self-sealing.
- (2) Barrel Section, Base, and Grouting: All waterproof manholes shall be constructed of precast barrel sections. The joints between sections shall be of watertight construction utilizing a pre-molded rubber base type compressible gasket identified as "Ram-Nek", "Kent Seal", or an approved equal.
- (3) All manholes that are constructed shall be built with the base and bottom barrel section being precasted together in one integral concrete pour. Such will provide for no joint between the base and barrel section ensuring a watertight seal. This

section shall be constructed to meet the Specifications of the latest revision of ASTM C478.

The precast base barrel section shall also contain watertight gaskets, adaptors, or sealers to assure a leak-proof connection between the manhole and the sewer pipes entering the manhole. Such connections shall be flexible and/or pliable enough to allow for deflection from shifting or settling of the manholes, and to accommodate the pipe on grade. The connections shall also be capable of adapting to the various sizes and types of sewer pipe that may be used. A PS10 gasket as manufactured by the Press Seal Gasket Corporation, meets these requirements. Any gasket, adaptor, or sealer that meets these requirements and is approved by the Engineer may also be used. When futures are specified a short pipe length shall be installed and sealed. This section may need to be removed and replaced if another type of pipe is used for the extension.

S-24 ADJUSTING RINGS

There shall be at least two (2) 2-inch adjusting rings and a maximum of eight (8) inches of precast adjusting rings used on every manhole. The manhole frame and adjusting rings shall be set in full mortar bed at all times to the elevation set by the Engineer as shown on the grade sheet. Unless otherwise specified, the manhole cover will be set approximately six inches (6") below the finished street elevation by the sewer contractor, to be brought to the finished street elevation by the asphalt contractor prior to blacktopping.

S-25 CONNECTIONS TO EXISTING SEWERS

Wherever new sewers connect with existing sewers, the Contractor shall without extra compensation cut the necessary openings in the old manholes and make the connections thereto in a neat and workmanlike manner. The connections shall be made so as to make the joints around the entering sewers watertight and an approved smooth channeled flow line shall be constructed.

Connections to existing sewers at locations other than manholes shall utilize an approved non-shear Fernco type for sanitary sewer and shall be an acceptable industry standard acceptable to the Engineer for all sewer connections.

S-26 STUBS FROM MANHOLES FOR FUTURE EXTENSIONS

Stubs for future from a manhole shall be laid to the grade staked and/or specified. These shall be plugged with a suitable watertight stopper. The futures and the stoppers installed in the manhole are considered incidental to the manhole construction, the cost of which shall be included in the price bid for manhole construction.

S-27 CROSSINGS ABOVE WATER LINES

If the water line is less than 18 inches above the sewer, or is below the sewer, the sewer pipe shall be fully encased in concrete for a distance of ten (10) feet each side of the water line, unless otherwise specified. The thickness of the concrete including that at the pipe joints shall not be less than six (6) inches. This work is considered incidental to the sewer main construction, the cost of which shall be included in the price bid for lineal foot of sewer pipe.

S-28 TESTING AND INSPECTION

A. General: The Engineer shall have access at all times to all parts of the job, and the Contractor must furnish such personnel, facilities, equipment, tools, and materials as are necessary to make whatever tests and inspection that are deemed necessary.

B. Pipe Material Testing: The Engineer may require a test of specimens not to exceed 5 percent of the quantity of pipe to be furnished in order to prove the acceptability of the pipe. The manufacturer shall provide an approved testing stand near the site of the plant.

C. Pipe Inspection: Prior to being lowered into the trench, each pipe shall be carefully inspected by the Contractor and those not meeting the specified requirements shall be removed from the site immediately. Rejections may be made for any of the reasons as stated in the specifications for each specific type of pipe. Pipe having minor flaws not serious enough to cause rejection shall be installed so as to bring such flaws in the top half of the sewer. Pipe shall be protected during handling against impact, shocks, and free fall.

D. Television Inspection: The Contractor will perform an inspection of the completed sewer line prior to acceptance through the use of a television camera. The expense of the initial television inspection and one additional reinspection will be borne entirely by the Contractor. The City will perform an inspection of the completed sewer line within the two-year warranty period through the use of a television camera. If defective workmanship of material or construction is noted, the deficiency shall be corrected by the Contractor at no expense to the City. The Contractor will perform additional television inspections to review if the repairs were made properly and in accordance with the specifications. The expense of all television inspections except for the aforementioned City two-year warranty inspection shall be borne entirely by the Contractor. The costs for television inspections shall be incidental pipe installation costs unless otherwise specified.

The television inspections are typically conducted by an independent qualified televising subcontractor. Such a subcontractor is not required; however, inadequacies in televising and/or records of such inspection provided to City are unacceptable. A City representative authorized by the Engineer shall witness said televising. The decision of said acceptability shall be entirely and solely at the Engineer's discretion.

The Contractor shall be responsible for all repair and other related costs, including concrete or asphalt resurfacing, if the street has been surfaced. The Contractor shall be required to repair all areas of infiltration and other deficiencies.

E. Pipe and Manhole Leakage Field Testing – General: All manholes and piping shall be tested and inspected for leakage by the Contractor. In addition to the testing and inspection for leakage in the manhole, the Contractor shall perform manhole vacuum tests when the ground water table elevation is lower than 2 feet above the top of the pipe. Exfiltration testing with water will only be allowed where specifically specified.

Piping shall be tested using one of two methods: infiltration test or pipe exfiltration test (low pressure air test). The pipe infiltration test shall be used when the ground water table elevation is greater than 2 feet above the top of the pipe as determined by the Engineer. The pipe exfiltration test (water test or low pressure air test) shall be used when the ground water table elevation is less than 2 feet above the top of the pipe as determined by the Engineer. Exfiltration testing of the pipe with water will only be allowed where specifically specified.

After each section of sanitary sewer between manholes has been completely installed and backfilled, the line and manholes shall be inspected by the Contractor for leakage. All visual leakage at individual joints or other parts of the sewer and/or leakage in excess of that specified shall be repaired by the Contractor at the Contractor's expense before the sewer is accepted. The

repair of leaks may require the removal and replacement of manhole sections and pipe sections. The gasket shall be the sole element depended upon to make the joint leak proof. The use of grout to repair leaks will not be allowed. The actual method of correction shall be approved by the Engineer prior to performing the repair.

When existing sanitary sewers which have service connections are being reconstructed or replaced (example: street reconstruction projects), the leakage test requirements may be waived or other testing methods substituted, subject to the approval of the City Engineer.

The Contractor shall notify the Engineer 24 hours prior to performing the test to enable the Engineer to be present during the testing operations. All data will be recorded and evaluated by the Engineer. All lined manholes and pipe shall be tested prior to welding the joints.

F. Infiltration Test: Upon completion of the sanitary sewer construction and before any house services are connected in, leakage tests shall be made. This test shall be performed by the Contractor using a V-notched weir in the downstream manhole of a line segment to measure the upstream sewer leakage. The test shall be maintained for not less than 24 hours before the measurement is performed. The test shall be performed one line segment at a time (a line segment shall be defined as the line from one manhole to the next adjacent manhole). The V-notched weir shall have volumetric calibrations (gallons/24 hours) and shall be easy to read.

The Engineer may waive the use of the V-notched weir if the Engineer determines that the leakage flow is obvious or nonexistent through visual inspection. The maximum allowable infiltration or exfiltration for any new sanitary sewer section, including all manholes, shall be 50 gallons per inch of diameter per mile of pipe per day. All visible leakage at individual locations (including the amounts less than the 50 gallons per inch of diameter per mile of pipe per day) as determined by the Engineer shall still be the Contractors responsibility to repair. Payment for the infiltration test will be incidental to the pipe and manhole installation. The decision of the Engineer shall be final.

G. Pipe Exfiltration (Water) Test: The low pressure air test shall be used for the exfiltration test unless otherwise specified. The pipe exfiltration (water) test shall only be allowed where specified. The pipe exfiltration (water) test shall be performed by sectionalizing the test so that interior pressure in pipe does not exceed 5 feet of water pressure. The test will be performed by the Contractor as follows:

1. Place watertight bulkhead in inlet of the upstream and downstream manholes of sewer to be tested.
2. Fill section of sewer and upstream manhole with water until the elevation of water in the upstream manhole is 2 feet higher than the top of the pipe in the line being tested or 2 feet above the existing ground water in the trench—whichever is the higher.
3. Allow the water to stabilize for one-half hour, then fill the manhole with water to the original level and begin the test.

4. The amount of water lost in the manhole during one hour will be measured and used to determine the exfiltration. The maximum allowable drop in vertical water height in the manhole shall be 1/4 inch for all diameter manholes. If the water level in the manhole drops below the allowable drop amount, the Contractor shall repair the leak and retest.

H. Pipe Exfiltration (Low Pressure Air) Test: The pipe exfiltration (low pressure air) test shall be performed in accordance with ASTM F1417 standards. The following procedure is summarized from ASTM F1417 and shall be followed in conjunction with ASTM F1417 unless modified by the Engineer. Repair of leaks may require the removal and replacement of manhole sections. The use of grout to repair leaks will not be allowed.

Procedure

1. Clean the section of sewer line to be tested by flushing or other means prior to conducting the low-pressure air test. This cleaning serves to eliminate debris and produce the most consistent results.
2. Isolate the section of sewer line to be tested by inflatable stoppers or other suitable test plugs.
3. Plug or cap the ends of all branches, laterals, tees, wyes, and stubs to be included in the test to prevent air leakage. All plugs and caps shall be securely braced to prevent blow-out. One of the plugs or caps should have an inlet tap, or other provision for connecting a hose to a portable air control source.
4. Connect the air hose to the inlet tap and portable air control source. The air equipment shall consist of necessary valves and pressure gauges to control an oil-free air source and the rate at which air flows into the test section to enable monitoring of the air pressure within the test section.
5. Add air slowly to the test section until the pressure inside the pipe reaches 4.0 psig.
6. After the pressure of 4.0 psig is obtained, regulate the air supply so that the pressure is maintained between 3.5 to 4.0 psig for at least 2 minutes depending on air/ground temperature conditions. The air temperature should stabilize in equilibrium with the temperature of the pipe walls. The pressure will normally drop slightly until equilibrium is obtained; however, a minimum of 3.5 psig is required.
7. Determine the rate of air loss by the time-pressure drop method.
8. Time-Pressure Drop Method—Air is slowly introduced into the section of pipe to be tested, until the air pressure is raised to approximately 4.0 psi and the test pipe section is stabilized as in 6 above. Disconnect the air supply and decrease the pressure to 3.5 psi before starting the test. Determine the time required for the pressure to drop from 3.5 psi to 2.5 psi, and compare this interval to the required time to decide if the rate of

air loss is within the allowable. Minimum holding times required by pipe diameter are shown in Table 3.17.10 and are also listed in ASTM 1417.

9. Upon completion of the test, open the bleeder valve and allow all air to escape. Plugs

should not be removed until all air pressure in the test section has been reduced to atmospheric pressure.

Table No. 3.17.10 below indicates the minimum test period durations, length of test section for minimum test durations, and the formula to calculate the testing time when the test section length exceeds the length for minimum test time (in accordance with ASTM F1417). Repair of leaks may require the removal and replacement of pipe sections. The use of grout to repair leaks will not be allowed.

The Engineer may reduce the testing time to one-half the testing time if the pressure drop is less than 0.5 psi for the first one-half the test period listed in Table 3.17.10.

Table No. 3.17.10

Nominal Pipe Diameter, in.	Minimum Time, min:s	Length for Minimum Time, ft.	Time for Longer Length, s
4	3:46	597	0.380 L
6	5:40	398	0.854 L
8	7:34	298	1.520 L
10	9:26	239	2.374 L
12	11:20	199	3.418 L
15	14:10	159	5.342 L
18	17:00	133	7.692 L
21	19:50	114	10.470 L
24	22:40	99	13.674 L
27	25:30	88	17.306 L
30	28:20	80	21.366 L
33	31:10	72	25.852 L
36	34:00	66	30.768 L

I. Manhole Exfiltration Test: The manhole vacuum test shall be used for testing manholes for leakage defects. The manhole water exfiltration test shall only be allowed where specified.

To perform this test, the inlet and outlet of the manhole shall be plugged and the manhole filled with water to a depth equal to that used for the sanitary line water test, or in the case when the air test was run on the line, a minimum depth of 2 feet above the top of the sewer line or 2 feet above the existing ground water—whichever is the higher. Allow the water to stabilize for one-half hour and refill the manhole to the original elevation. Mark the initial depth of the water,

and after one hour record the drop in the water level in the manhole. The maximum allowable drop in vertical water height in the manhole shall be 1/4 inch for all diameter sizes of manholes. If the water level in the manhole drops below the allowable drop amount, the Contractor shall repair the leak and retest.

J. Manhole Vacuum Test: The manhole vacuum test shall be performed in accordance with ASTM C1244. The following procedure is summarized from ASTM C1244 and shall be followed in conjunction with ASTM C1244 unless modified by the Engineer. The vacuum test shall include testing the top of the manhole, excluding the adjusting rings and manhole frame and cover. Testing will be allowed after backfilling has occurred or as specified in the Special Provisions. Manhole vacuum tester assembly and vacuum pumps shall be as manufactured by Cherne Industries, Inc. or approved equal. Repair of leaks may require the removal and replacement of manhole sections. The use of grout to repair leaks will not be allowed.

Procedure

1. All lift holes shall be plugged.
2. All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.
3. The test head shall be placed at the top of the manhole in accordance with the manufacturer's recommendations.
4. A vacuum of 10 inches of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop to 9 inches of mercury.
5. The manhole shall pass if the time for the vacuum reading to drop from 10 inches of mercury to 9 inches of mercury meets or exceeds the values indicated in Table 3.17.12.
6. If the manhole fails the initial test, necessary repairs shall be made by an approved method. The manhole shall then be retested until a satisfactory test is obtained.

**Table 3.17.12
Minimum Test Times for
Various Manhole Diameters in Seconds**

Depth, (ft)	Diameter, in.		
	48	60	72
	Time, in 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

S-29 CLEANING THE SEWER LINES

The Contractor shall be responsible for all work necessary to make the sewer acceptable for usage. This shall include removing all mud, silt, rocks, or blockages that might hinder the flow and make said sewer unacceptable for final acceptance and usage. This shall include all work necessary in the manholes and all cleanup work required prior to final acceptance. Final acceptance will be granted by the City Engineer’s Office only, and this decision shall be final.

The City Sewer Department will not be responsible for cleaning the line prior to televising the sewer. In the event that the line is not acceptable for televising, the Contractor will be notified. It will be his responsibility to make arrangements to clean the sewer and make it acceptable for the television work.

S-30 DEFLECTION

After the pipe has been laid, backfilled and in place for 30 days, it shall be checked for deflection in the following manner. Testing shall be done by the Contractor under the direction and observation of the Engineer. Maximum allowable pipe deflection shall be 5%. The deflection shall be checked using a “go, no go” mandrel.

Testing shall be conducted on a manhole to manhole basis. Passage of the mandrel through the pipe without excessive resistance will indicate a successful test.

Should the result of any test fail to meet the criteria for deflection testing, the Contractor shall, at his own expense, locate and repair the rejected section and retest until it is within specified allowances.

S-31 PROTECTION OF EXCAVATION

The Contractor shall provide suitable sheeting, shoring, and bracing to protect all excavations to provide safe working conditions, and in strict conformance with safety regulations. Damage or injury resulting from settlement, slides, cave-ins, water pressure, or other causes shall be the responsibility of the Contractor and damage shall be repaired at his own expense.

The Contractor shall provide adequate signs, barricades, yellow lights, and watchmen and take all necessary precautions for the protection of the work and the safety of the public. All barricades and obstructions shall be protected at night by yellow signal lights which shall be kept lit from sunset to sunrise. Barricades shall be of substantial construction and shall be painted white or whitewashed to increase their visibility at night. Suitable signs shall be placed as to show in advance where construction, barricades, or detours exist.

The Contractor shall at all times so conduct this work as to insure the least possible obstruction to traffic and inconvenience to the general public and the residents in the vicinity of the work, and to insure the protection of persons and property. No road or street shall be closed to the public except with the permission of the proper authority. Any police or other traffic control shall be arranged for by the Contractor and be at his expense. Fire hydrants on or adjacent to the work shall be kept accessible to fire-fighting equipment at all times. Temporary provision shall be made by the Contractor to insure the use of sidewalks and the proper functioning of all gutter, sewer inlets, drainage ditches, which shall not be obstructed except as approved by the Engineer.

S-32 SURFACE RESTORATION AND CLEANUP

Unless stated specifically to the contrary in the Special Information, the Contractor shall (1) replace all surface materials, (2) dispose of excess material in a manner and location approved by the Engineer, (3) level gutters, repair fences, sod, topsoil, and other items disturbed, to a condition equal to that before the work began; furnishing all labor, materials and equipment necessary to do this work. Traveled streets shall be kept open and maintained by the Contractor after backfilling and before surfacing or final inspection.

S-33 CONSTRUCTION SITE EROSION AND SEDIMENT CONTROL MEASURES

Every effort shall be made by the Contractor and Subcontractor to prevent and correct problems associated with erosion and runoff processes which could occur during and after project construction. The efforts should be consistent with applicable local ordinances and the EPA Nonpoint Source Pollution Control Guidance.

Wherever appropriate, the Contractor's efforts shall reflect the following engineering principles:

1. When appropriate, land grading and excavating should be kept at a minimum to reduce the possibility of creating runoff and erosion problems which require extensive control measures.
2. Whenever possible, topsoil should be removed and stockpiled before grading begins.
3. Land exposure should be minimized in terms of area and time.
4. Exposed areas subject to erosion should be covered as quickly as possible by means of mulching or vegetation.
5. Natural vegetation should be retained whenever feasible.
6. Appropriate structural or agronomic practices to control runoff and sedimentation should be provided during and after construction.
7. Early completion of stabilized drainage system (temporary and permanent systems) will substantially reduce erosion potential.
8. Roadways and parking lots should be paved or otherwise stabilized as soon as feasible.
9. Clearing and grading should not be started until a firm construction schedule is known and can be effectively coordinated with the grading and clearing activity.

S-34 USE AND REPAIR OF STREET

The Contractor shall carry on the work in such a manner as to interfere as little as possible with the use of the street for public travel.

Wherever any paved gutters, pavements, graveled highways or street crossings or other improvements are interfered with or removed, they must be replaced by the Contractor and left in as good condition as previously. The Contractor shall also remove all surplus material leaving the streets clean and in good order.

No more than three hundred feet (300') of trench will be opened at any one time in advance of the complete construction of the sewer mains, and the backfilling and restoring of the street shall follow up the building of the sewer mains at a distance not to exceed two hundred feet (200'), and in any event not more than one intersecting street shall be obstructed at any time on any one line of sewer main.

All street repairs and cleaning shall be promptly done as the work progresses. The Contractor shall not obstruct any street gutters but shall provide for the passage of surface water along the same at all times.

S-35 ASPHALT REMOVAL & REPLACEMENT

Where streets are asphalt surfaced, the Contractor shall cut the asphalt surfacing full depth by an approved method to a width of twelve inches (12") wider than the trench excavation, unless otherwise specified.

When asphalt surfacing has a concrete base, the asphalt shall be cut in the previously described manner and the concrete base removed with a pneumatic or mechanical type hammer or by similar means.

Unless otherwise specified, the Contractor shall place a six-inch (6") gravel base under the concrete base, replace the concrete base with a minimum of six inches (6") of 5-bag concrete and then place a minimum of two inches (2") of asphalt surfacing meeting City Specifications on top of the concrete base, or as otherwise specified in the Special Information.

Unless otherwise specified, all excavations in asphalt surfaces without concrete base, there shall be a minimum of twelve-inches (12") of gravel base and a minimum of four-inches (4") of asphalt mat. The new mat shall be the same thickness or greater than the depth of the existing asphalt.

All asphalt surfacing shall be placed and rolled in accordance with standard City of Madison Bituminous Paving Specifications.

The cost of removing, replacing, and cutting asphalt surfaces and concrete and gravel base shall be included in the unit price bid for pipe, unless otherwise specified.

All street surfacing cuts, asphalt or concrete, shall be in a straight line parallel to the existing curb and gutter or perpendicular to the centerline of the street. No jagged, skewed or irregular cuts will be allowed. All asphalt cuts shall be in an approved manner, and not ripped-out with the bucket. Such work lifts the remaining mat away from the base material and shall be cause for widening the street cut and increasing the amount of surfacing replaced at the Contractor's expense.

S-36 CONCRETE PAVEMENT REMOVAL & REPLACEMENT

Unless otherwise specified, the surface of all concrete pavements shall be sawed with a concrete saw to a depth of a minimum of 1-1/2" before concrete is removed. The width of pavement removed shall be twelve inches (12") wider than the trench excavation to provide a shoulder on each side, unless otherwise specified.

The Contractor shall place a six-inch (6") gravel base unless otherwise specified and replace the concrete pavement to the same thickness as the original pavement, with a minimum thickness

of six inches (6"). The concrete shall be six-bag (6) mix meeting City Specifications and shall be finished the same as the existing pavement.

The cost of pavement removal, replacement, and sawing of the concrete shall be included in the unit price bid for pipe unless otherwise provided for in the proposal or specified in the Special Information.

S-37 PRIVATE CONSTRUCTION

All private construction, "i.e., construction work contracted and paid for by the developer", shall be installed according to, and shall meet all requirements of the Standard City Specifications. When completed, the Contractor shall meet with the Consultant Engineer and Engineer representing the City of Madison for the final inspection and acceptance by the City.

S-38 MEASUREMENT AND PAYMENT

All measurements and payments will be based on complete work performed in strict accordance with the Drawings and Specifications and respective prices and payment shall constitute full compensation for all work completed including incidentals. No separate payment will be made for excavation, trenching, removal of water, bedding, encasement, testing, and backfilling for items of work covered under this section of the Specifications and all such costs pertinent to these items shall be included in the applicable unit prices therefore unless otherwise specified.

S-38.1 Gravity Sewer Pipe

The sewer pipe shall be measured in lineal feet along the centerline of the pipe, from the end of the pipe or inside wall of manhole, junction box, or drop inlet. Deduction will not be made for fittings for each of the various sizes of sewer pipe satisfactorily installed. Payment for sewer pipe shall be made at the Contract unit price per lineal foot for "Sewer Pipe" as stipulated in the Bid for the various sizes, which payment shall be full compensation for furnishing all labor, tools, equipment, and materials required to construct the sewer line, including excavation, trenching, bedding, specified backfill, laying and jointing pipe, backfilling, compaction, removal and replacement of fences and culverts, protection of utilities which may be encountered by the work, disposal of excess excavation, clean-up, and other incidentals required to complete the construction of sewer lines in accordance with the Drawings and Specifications.

S-38.2 Waterproof Manholes

Manholes shall be measured by the number satisfactorily furnished and installed complete in place. Payment shall be made at the Contract unit price for each manhole stipulated in the Bid which payment shall be full compensation for furnishing all labor, tools, equipment, and materials required to construct the manholes, including excavation, removal of water, bedding, backfilling, compaction, concrete, frame and assembly, stubouts, clean-up, and other incidentals required to complete the work.

S-38.3 Sewer Pipe Fittings

No separate measurement for payment shall be made for the sewer pipe fittings, wyes, plugs, caps, stubouts, etc. The cost of sewer pipe specials and fittings shall be included in the cost of sewer pipe for which payment is specified.

S-38.4 Sewer Services

Sewer services shall be measured by the number actually constructed as shown on the Drawings. Payment of this item shall be made at the respective Contract unit price for each type of "Sewer Service" as stipulated in the Bid, which price and payment shall be full compensation for all labor, tools, equipment and materials, including pipe, wyes, and fittings for furnishing and installation of items including excavation, laying and jointing, connections to existing service lines, backfilling, compaction, and other incidentals required to complete the work. There will be no deduction for measurement of "Sewer Pipe" through the wyes.

S-38.5 Drop Manhole Connection

Drop Manhole Connections shall be measured by the number actually constructed as shown on the Drawings. Payment of this item shall be made at the respective Contract unit price for the work required as stipulated in the Bid, which price and payment shall be full compensation for all labor, tools, equipment, and materials necessary to satisfactorily complete the work item.