SECTION 1100 – GRADING

1101 SCOPE. This section covers the performance of all work required for grading the project in coordination with all previous work performed at the locations shown on the contract drawings.

1102 MATERIALS AND DEFINITIONS.

A. Grading. Grading shall be defined as meaning the performance of all excavation, embankment and backfill in connection with the construction of all improvements.

B. Excavation. Excavation is defined as the removal of materials from the construction area to the lines and grades as shown on the contract drawings.

Unless otherwise provided for in the Special Provisions and included in the proposal, all excavation shall be unclassified excavation and the Contractor shall satisfactorily remove and dispose of all materials encountered regardless of their nature.

C. Embankment. Embankment - Fill or Backfill, is defined as the placing and compacting of material in the construction area to the lines and grades as shown on the contract drawings.

Materials suitable for earth embankment shall be free of organic materials, waste material, trash and debris, contain less than ten (10) percent by volume of rock and gravel, and contain no particles having a dimension greater than three (3”) inches.

Materials suitable for rock embankment shall be free of organic materials, waste material, trash and debris, and contain ten (10) percent or greater by volume of rock or gravel containing particles ranging in size from a minimum dimension of three (3") inches to a maximum of twenty-four (24") inches.

Material not suitable for use as embankment material shall include, but shall not be limited to, frozen material, organic material, topsoil, rubbish, brick, asphaltic concrete, and other debris and soil not containing the characteristics and moisture content to obtain the required compaction. Rock and broken concrete shall not be included in embankment material unless rock embankment is specified in the Special Provisions and the materials meet the size requirements indicated in this section.

D. Topsoil. Topsoil shall be soil which is fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than 1 1/2" in any dimension, and other extraneous or toxic matter harmful to plant growth. Topsoil may be obtained from the project site by segregating appropriate material from other material during excavation and trenching operations, or from off-site locations at no additional cost to the Owner.

E. FLOWABLE FILL. Provide low-strength, air-entrained flowable fill (flowable mortar) mix that has adequate flow characteristics to fill all voids and complies with the following compressive strength and unit weight requirements.

3-day Compressive Strength (minimum)	20 psi
28-day Compressive Strength (maximum)	100 psi
Unit Weight (maximum)	120 pcf

Fine aggregate, cement, fly ash, water and additives used in the mix shall conform to applicable sections of the current KDOT Standard Specifications.

F. Structures. Structures, as used herein, refers to bridges, basins, drainage structures, headwalls, retaining walls, and similar construction.

Material for structure backfill shall be composed of earth only and shall contain no organic materials, broken concrete, stones, trash, or debris of any kind.

1103 CONSTRUCTION - GENERAL. During grading the work shall be performed in a manner and sequence that will provide drainage at all times. Soft spots or areas that develop during grading operations shall be removed, the area then backfilled with suitable material and compacted to obtain the required density. No additional payment will be made to the Contractor for this work.

1104 EXCAVATION - GENERAL Excavation shall be performed to the lines and grades indicated on the contract drawings. All suitable material removed by excavation shall be used as far as practicable in the formation of embankments or elsewhere as indicated or specified, or as directed by the Engineer. It shall be the responsibility of the Contractor to handle excavation in a manner such that suitable materials will be available when required. No additional compensation will be allowed for any special sequence of excavating, placing of materials, or any re-handling of materials.

Follow all OSHA safety regulations for sloping the sides of excavations and trenches, using shoring and bracing as required.

The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the pipe to be installed therein is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result. Discharge of water from dewatering operations shall conform to local and state stormwater pollution prevention regulations.

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

Excavated materials in excess of the amount needed to complete the grading shall be considered as waste material, which shall be removed from the site by and at the expense of the Contractor.

Any additional fill material required which is not available from excavation within the construction limits shall be supplied by the Contractor at no expense to the Owner unless provided for in the proposal and Special Provisions. All such material brought to the site and incorporated in the work shall be subject to the approval of the Engineer.

During excavation and grading operations if materials are encountered which are determined as being unsuitable or unstable by the Engineer they shall be removed to the depth required to reach stable material. The area involved shall then be backfilled with suitable material as determined by the Engineer and compacted to obtain the required density. Suitable material may include suitable soils or aggregate materials such as KDOT AB-3 material.

All roadway excavation in rock or shale shall be undercut as indicated on the drawings or specified in the Special Provisions. If undercut is not included in the drawings or Special Provisions, remove material and backfill with suitable soil or granular material as directed by the Engineer.

1105 EXCAVATION – TRENCHING. The Contractor shall not open more trench in advance of pipe laying than is necessary to expedite the work. One block or four hundred (400) feet (whichever is the shorter) shall be the maximum length of open trench on any line under construction unless otherwise approved by the Engineer. The Contractor shall backfill all open trench by the end of the day's work, except that which is necessary for

inspection or immediate continuation of the following day's work. All open areas shall be fenced.

The alignment, depth, width and grade of all trenches shall be in accordance with the drawings. Boulders and large stones shall be removed to provide a minimum clearance of six (6) inches below and on each side of all pipes.

1106 EMBANKMENT - FILL. Embankments shall be formed with suitable materials, as herein defined, procured from excavations made on the project site, or from Contractor furnished borrow pits as required to complete the grading work. Embankment construction shall not be performed when material contains frost, is frozen, or a blanket of snow prevents proper compaction.

The existing surface upon which embankment material is to be placed shall have all unstable and unsuitable material removed to the depths shown, or as directed by the Engineer, before starting the embankment work.

Earth embankment shall be placed in successive horizontal layers distributed uniformly over the full width of the embankment area. Each layer of material shall not exceed eight (8") inches in thickness (loose measurement) and shall be compacted as specified in paragraph 1108 before the next layer is placed thereon. As the compaction of each layer progresses, continuous blading will be required to level the surface and to ensure uniform compaction.

Successive horizontal layers of rock embankment not exceeding two (2') feet in depth shall be made by placing larger stones uniformly over the embankment area. Small stone fragments, sand, earth, or gravel shall be placed between the larger stones to fill all voids. Each layer shall be thoroughly compacted before the next layer is placed.

Large rocks shall be withheld from the top two (2) feet or more of the embankment and only earth used in this layer unless otherwise indicated or specified.

1107 EMBANKMENT- BACKFILL.

A. GENERAL. Backfill shall not be placed when material contains frost, is frozen, or a blanket of snow prevents proper compaction. Backfill shall not contain waste material, organic material, or debris of any kind. The method of placement and compaction, and the type of equipment used shall be at the discretion of the Contractor subject to being appropriate for the material and obtaining the specified densities for the location.

The top portion of the backfill within right-of-way areas shall be finished with at least six (6”) inches of topsoil.

B. TRENCHES. Trench backfill shall be flowable fill for 1) all trenches crossing existing or proposed streets shall be backfilled with flowable fill from two (2) feet behind the back of curb on each side of the street, and 2) all portions of trenches running parallel to and within two (2) feet of the back of curb. All other trench backfill shall be either flowable fill or compacted earth as indicated on the drawings and standard details, or as specified in the Special Provisions.

Earth backfill material to be placed above pipe embedment shall be free of brush, roots more than two (2) inches in diameter, debris, cinders, or other corrosive material, but may contain rubble and detritus from rock excavation, stones, and boulders in certain portions of the trench depth. No backfill material containing rocks, or rock excavation detritus material, shall be placed within two (2) feet of final surface. No stone larger than eight (8) inches in its greatest dimension shall be placed within three (3) feet of the top of pipe. Large stones may be placed in the remainder of the trench backfill only if well separated and arranged so that no backfill settlement will result due to voids.

Compact masses of stiff clay or other consolidated material more than one (1) cubic foot in volume, shall not be permitted to fall from a height of more than five (5’) feet into the trench.

C. FLOWABLE FILL. Flowable fill (flowable mortar) shall be placed so all voids in the excavation or around the structure are filled. Filling operations shall proceed simultaneously on both sides of pipe or conduit so that the two fills are kept at approximately the same elevation at all times. Place flowable fill around structures in lifts to prevent the buildup of excess hydrostatic pressure. Weather limitations for flowable fill shall be the same as for concrete.

D. STRUCTURES. Backfill around and outside of structures shall be deposited in layers not to exceed eight (8) inches in uncompacted thickness. Compaction of structure backfill by rolling will be permitted provided the desired compaction is obtained and damage to the structure is prevented. Compaction of structure backfill by inundation with water will not be permitted. No tamped, rolled, or otherwise mechanically compacted backfill shall be deposited or compacted in water.

1108 COMPACTION

A. Moisture Control Requirements. The moisture content of the soil at the time of compaction shall be as indicated on the drawings or in the Special Provisions. If no moisture content requirements are provided, moisture content shall be as necessary to obtain the density specified for the particular location unless it is determined by the Engineer that the soil is unstable at that moisture content.

When the moisture content of the soil is not satisfactory to the Engineer, water shall be added or the material aerated, whichever is needed to adjust the soil to the proper moisture content. Moisture content shall be distributed uniformly and water for correction of moisture content shall be added sufficiently in advance that proper moisture distribution and compaction will be obtained. In no case, shall water be added without the consent of the Engineer.

All work involved in either adding moisture to, or removing moisture from soils shall be considered incidental to the completion of the grading operation.

B. Compaction Control Requirements. Earth embankment/fill and backfill materials shall be placed in horizontal layers not exceeding eight (8”) inches unless otherwise specified or approved by the Engineer and compacted as specified below before the next layer is placed. Effective spreading equipment shall be used on each lift to obtain uniform thickness prior to compaction.

1. Subgrade for Embankments: Compact to a minimum of 95% of standard proctor maximum density as determined by ASTM D698.
2. Embankments/Fills: Compact to a minimum of 95% of the standard proctor maximum density for the material used as determined by ASTM D698.
3. Backfill: Unless otherwise specified, compact to a minimum of 95% of the standard proctor maximum density for the material used as determined by ASTM D698.
4. All fill or backfill material placed behind the curb and gutter or beneath and either side of sidewalks within the right-of-way shall be compacted such that no further consolidation is evident after additional rolling or tamping.
5. Structure Backfill: Compact to a minimum of 90% of standard proctor maximum density as determined by ASTM D698. Backfill around and outside of structures that will ultimately lie under proposed pavements shall be compacted to the requirements of SECTION 1200 "Subgrade Preparation."

1109 FINAL GRADING. After embankments and backfills are completed, all areas on the site of the work, which are to be graded, shall be brought to

grade at the indicated elevations, slopes, and contours, including shoulder, berm, and sidewalk spaces. The graded surface shall be made free of rock, concrete, and brick, or fragments thereof, or rubbish. Use of graders or other power equipment will be permitted for final grading and dressing of slopes, provided the result is uniform and conforming to the lines and grades shown on the plans. Grades on areas to receive topsoil shall be established and maintained as a part of the grading operations. The Contractor shall repair any damaged surface and shall not use any equipment that will leave a marred surface.

Topsoil shall be placed to a minimum depth of six (6) inches in all areas indicated or specified to be seeded or sodded. Immediately prior to dumping and spreading topsoil, the surface shall be loosened by scarifying to a depth of two (2") inches to permit bonding of the topsoil to the underlying surface. Placement of all topsoil should be done in a manner so that roadway surfaces, sidewalks, manholes, valve boxes, and other utility structures or facilities are not covered by material being placed.

1110 CLEANUP. Cleanup shall follow the work progressively and final cleanup shall follow immediately behind the finishing. The Contractor shall remove from the site of the work all debris, equipment, tools, discarded materials and other construction items. The entire right-of-way or easement shall be left in a finished and neat condition. Cleanup shall be considered a subsidiary obligation of the grading work.

In the event the Contractor does not promptly comply with the terms of such instructions, the city may have the defective work corrected or the rejected work removed and replaced. All direct and indirect costs of such removal and replacement, including compensation for additional professional services, shall be paid by the Contractor. The Contractor will also bear the expenses of repairing work of others destroyed or damaged by the correction, removal or replacement of defective work.

1111 SETTLEMENT. The Contractor shall be responsible for all settlement of backfill, fills, and embankments, which may occur within one year after final acceptance of the contract under which the work was performed. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after notice from the Engineer.