19-1 TRENCH EXCAVATION

Trench excavation shall include the removal of all materials or obstructions and the control of water as necessary to construct the Work as shown or specified in the Contract. Unless otherwise shown or specified in the Contract, excavation shall be by open cut or as directed by the City.

Attention is directed to Section 10-5, "Control of Water in the Work", and Section 14, "Restoration of Surfaces", of these Specifications, for additional requirements. Surface water shall not be allowed to enter any pipe trench and shall not be permitted to enter the existing downstream pipe system.

19-1.01 Exploratory Excavation

An encroachment permit shall be obtained from the City prior to any exploratory excavation within roadway rights-of-way or other public easements. Prior to the end of each Working Day, exploratory excavations made outside the paved surface during that Working Day shall be backfilled with sand or native excavated materials as directed by City and mechanically compacted to prevent subsequent settlement. Excavations made within the paved surface shall be permanently restored per City Standard Drawing ST-6A.

19-1.02 Trench Width

Unless otherwise specified or shown on the Contract Plans the minimum trench width, at the top of the pipe, shall be as shown in the City Standard Drawings.

Minimum trench width, at the top of the pipe, for Sewer Pipe, Storm Drain Pipe and Water Distribution System, shall conform to the City Standard Drawings SD-6.1 through SD-6.2 unless otherwise specified or shown on the Contract Plans.

19-1.02A Sewer Pipe

Trench excavation requirements for sanitary sewer systems shall be constructed in accordance with these Standard Construction Specifications, unless the standard specifications of the specific utility company is more stringent. Within the City Limits of Elk Grove, the primary sewer utility company is, but not limited to, the Sacramento Area Sewer District (SASD).

19-1.02B Storm Drain Pipe

If trench widths at the top of the pipe are exceeded by any amount, the Contractor shall provide stronger pipe and or improved bedding and backfill conditions, as approved by the Engineer to meet the changed load requirements. The stronger pipe or improved bedding and or backfill will be provided at the Contractor's expense.

19-1.02C Water Distribution Systems Pipe

Trench excavation requirements for water distribution systems shall be constructed in accordance with these Standard Construction Specifications, unless the standard specifications of the specific utility company is more stringent. Within the City Limits of Elk Grove, the primary water supply companies include, but are not limited to, Elk Grove Water District, and Sacramento County Water Agency.

19-1.03 Pavement Cutting

When the trench is in an existing paved area, the pavement shall be saw cut on neat lines parallel and equidistant from the trench centerline. The width of the saw cut shall not be any greater than is required to properly install the pipe and not damage the edges of the pavement left in place, or as directed by the City. Pavement between the lines shall be broken and removed as directed by the City immediately ahead of the trenching operations. The existing pavement shall be removed and repaired in conformance with. Standard Drawing ST-1A.

Pavement shall not be cut until the respective utility companies have marked the location of their underground facilities and the City has given final approval of the trench alignment.

19-1.04 Maximum Length of Open Trench

Unless otherwise specified in these Specifications the Special Provisions, or directed by the Engineer, at the end of each Working Day, there shall be a maximum of three hundred feet (300') of trench allowed to remain open in unimproved areas, excluding manhole excavations, for each operation. The remainder of the trench shall be backfilled and compacted, and when in active streets, opened to traffic as soon as possible. The maximum length of trench open for cast-in-place concrete pipe shall be as specified in Section 36-3, "Trench Excavation", of these Specifications.

At the completion of each work shift, the ends of the pipe shall be sealed to prevent debris (such as liquids, earthen materials, trash, or animals) from entering.

19-1.05 Control of Groundwater

If groundwater is encountered in the trench, the Contractor shall design a method to remove the groundwater from the trench in order to allow for the proper installation of the planned designed pipe. The means and methods of groundwater removal from the trench shall be such that existing underground improvements are not affected by removal of water through the pipe zone materials causing potential settlement of previously placed backfill materials. All adjacent improvements shall be protected during trench dewatering operations.

19-1.06 Shoring and Bracing

The Contractor shall furnish and install sufficient shoring and bracing to ensure the safety of personnel and public, the protection of the Work, and the protection of adjacent improvements. The Contractor must comply with all of the requirements of Section 6-20, "Excavation and Trench Safety", of these Specifications.

Sheeting shall not extend below the bottom of the pipe barrel. Unless otherwise specified in the Special Provisions or required by the City, all sheeting, timbering, lagging, and bracing shall be removed during backfilling, and in such a manner to prevent any movement of the ground or damage to the pipe or to other structures. When the City requires that sheet piling, lagging, and bracing be left in place, such materials shall be cut off where designated and the upper part withdrawn. If steel piling is used, it may be removed simultaneously with placing and compacting of backfill.

When using movable trench supports, care shall be exercised to prevent disturbing the

pipe location, jointing, or embedment. Removal of any trench protection below the top of the pipe and within two and one-half (2-1/2) pipe diameters of each side of the pipe will be prohibited after the pipe embedment has been placed and compacted. Movable trench supports shall only be used in either wide trench construction where supports extend below the top of the pipe on a shelf above the pipe with the pipe installed in a narrow, vertical wall sub-ditch. Any voids left in the trench wall or embedment materials by support removal shall be carefully filled with bedding material and compacted. Removal of bracing between sheeting shall only be done where backfilling proceeds and bracing is removed in a manner that does not relax trench support.

19-1.07 Special Foundation Treatment

Whenever the bottom of the trench is soft, saturated, or rocky, or, in the opinion of the City, otherwise unsuitable as a foundation for pipe bedding, the unsuitable material shall be removed to a minimum depth of six inches (6") and replaced with one-inch (1") clean crushed rock as specified in Section 50-16 "Cleaned Crushed Rock" of these specifications.

When the trench bottom is cobbled or of any other material which might, in the opinion of the City allow loss of sand backfill, the bedding and backfill material shall be one-inch (1") clean crushed rock as specified in Section 50-16, "Clean Crushed Rock", of these Specifications.

Sand backfill, when permitted by the City for use in rocky trench conditions, shall conform to the requirements in Section 50-13.01, "River Sand", of these Specifications. Such backfill material shall be compacted to a minimum relative compaction of ninety percent (90%).

In addition to the bedding materials specified above, the City may direct the Contractor to furnish and place geotextile fabric below the bedding materials. The geotextile material shall be a high modulus woven fabric, and shall be inert to commonly encountered chemicals, rot-proof and resistant to ultraviolet light exposures, insects, and rodents. The geotextile fabric shall have a minimum grab tensile strength of two hundred pounds (200 lbs.) in any direction as measured in accordance with ASTM D 1682, a Mullen burst strength of at least four hundred pounds (400 lbs.) per square inch per ASTM D 3786, and an Equivalent Opening Size no larger than U.S. Standard Sieve Number 50 as determined by U.S. Corps of Engineers Specification CW-02215. Geotextile fabric shall be Mirafi 600X, or equal. Each roll of fabric used shall be labeled in accordance with ASTM D 4873. Geotextile fabric shall be handled and placed in accordance with the manufacturer's recommendations. Furnishing and placing of geotextile fabric will be paid for as extra work as provided in Section 9, "Changes and Claims", of these Specifications.

If material more than twelve inches (12") below the typical trench bottom is ordered removed by the City, the excavation below that point and the imported material required to backfill the trench to that elevation will be paid for as extra work as provided in Section 9, "Changes and Claims", of these Specifications unless otherwise specified in the Special Provisions. Before excavation of the pipe trench in fill areas or roadway embankments, the fill area or embankment shall be completed to a height above the pipe invert grade line of not less than twice the internal pipe diameter or to final fill or embankment subgrade, whichever is lower, but in no case less than twelve inches (12") above the top of the pipe. Such embankment shall be compacted to a minimum relative compaction of ninety three percent (93%) for a distance on each side of the pipe equal to at least two (2) pipe

diameters. The remainder of the embankment shall be compacted to the minimum relative compaction specified elsewhere in these Specifications for the type of construction being done, or as specified in the Special Provisions or on the Plans. Special foundation treatment for cast-in-place concrete pipe shall be as specified in Section 36-4, "Cast-In-Place Concrete Pipe (CIPCP) - Special Foundation Treatment", of these Specifications.

19-1.08 Excavation Method

Methods used in excavation shall not cause damage to surrounding property or damage remaining pavement and other existing improvements that are to remain. Outriggers for excavation equipment, and other heavy equipment, shall be fitted with street pads to prevent pavement damage.

Damage caused by the Contractors operations shall be repaired at the Contractors expense. The Contractor shall obtain written approval from the Engineer prior to repairing the damage.

19-1.09 Payment

Full compensation for trench excavation, including all equipment, labor, materials, control of water, shoring and bracing, and other safety measures required, is included in the prices paid per linear foot of the respective sizes, grades, and types of pipes listed in the Contract, and no additional compensation will be paid.

19-2 PIPE BEDDING AND BACKFILLING OF TRENCHES

19-2.01 Pipe Bedding

Pipe bedding materials shall meet the requirements of these Standard Construction Specifications, Special Provisions, Standard Drawings and the approved project plans. Pipe bedding shall be consistent with trench details shown on City Standard Drawings SD – 6.0, SD-6.1 and SD-6.2 unless otherwise specified by a specific utility company.

19-2.01.A Sewer

Unless stated otherwise, all bedding requirements for sanitary sewer systems shall be constructed in accordance with the standard specifications of the specific utility company. Within the City Limits of Elk Grove, the primary sewer utility company is, but not limited to, the Sacramento Area Sewer District (SASD)

19-2.01.B Storm Drain

Unless otherwise specified in the Special Provisions, initial backfill for storm drain construction shall conform to this Section 19 and Standard Drawing . SD-6.0, SD-6.1 and SD-6.2.

The initial backfill material shall consist of three-quarter inch ("¾") clean crushed rock per Section 50-16, "Clean Crushed Rock" of these specifications.

For reinforced concrete storm drain pipes greater than forty-eight inches (48") in inside diameter, the initial backfill material shall consist of one-inch (1") clean crushed rock per Section 50-16, "Clean Crushed Rock", of these specifications.

For field conditions requiring Control Density Fill as backfill, the material shall conform to Section 50-15.01, "Control Density Fill (CDF)" Backfill", of these Specifications.

For field conditions requiring portland cement concrete backfill, the material shall conform to Section 50-5.01, "Portland Cement Concrete - Composition", Class "C", of these Specifications.

Prior to using portland cement concrete, Controlled Density Fill (CDF), or Controlled Low Strength Material (CLSM), the Contractor shall submit a plan to the Engineer, for approval, on how the Contractor will prevent the pipe from floating, changing line, grade or displacement. The method of anchoring the pipe shall be sufficient to ensure a continuous even grade in the flow line of the pipe. Anchors shall be no less than every quarter point of a single pipe length. The method of anchoring shall not damage the pipe. Any damage or displacement to the pipe will be replaced at the Contractor's expense.

1. During placement of portland cement concrete, Controlled Density Fill, or Controlled Low-Strength Material, the material shall not fall more than eight feet (8') without using pipes, or tubes to prevent segregation.

19-2.01.C Water Distribution Systems

Unless stated otherwise, all bedding requirements for water distribution systems shall be constructed in accordance with the standard specifications of the specific utility company. Within the City Limits of Elk Grove, the primary water supply companies include, but are not limited to, Elk Grove Water District, and Sacramento County Water Agency.

19-2.02 Initial Backfill

Initial backfill materials shall meet the requirements of the Standard Construction Specifications, Standard Drawings, and the approved project plans. Initial backfill and compaction shall be consistent with trench details shown on Standard Drawings SD – 6.0, SD - 6.1 and SD – 6.2 and in accordance with these specifications.

For compaction of the haunch area with clean crush rock, the Contractor shall place initial backfill material to the spring line of the pipe in eight-inch (8") loose lifts so as not to disturb or damage the pipe and shall be brought up evenly on both sides. The initial lift shall be thoroughly compacted by shovel slicing to provide proper support under the pipe haunches. Each additional eight-inch (8") loose lift shall be compacted mechanically. The mechanical compaction shall be completed by using a reversible vibratory plate compactor with a maximum width of eighteen-inches (18"), minimum centrifugal force of 6,500 pound-force (lbf). The compaction effort shall ensure the haunch area is sufficiently compacted to support the pipe as designed. The Contractor methods of compaction shall not damage the pipe, nor change the line, grade nor disturb or displace the pipe.

Damage to the pipe shall be replaced at Contractor's expense.

Backfill shall not proceed past the spring line per Standard Drawing SD-6.0 until approved by the Engineer.

19-2.02.A Storm Drain

Unless stated otherwise, all initial backfill requirements for sanitary sewer systems shall be constructed in accordance with the standard specifications of the specific utility

company. Within the City Limits of Elk Grove, the primary sewer utility company is, but not limited to, the Sacramento Area Sewer District (SASD)

Prior to placing intermediate backfill material, the Contractor shall separate the initial backfill and intermediate backfill with Geotextile Fabric conforming to Standard Drawing SD-6.0, SD-6.1, and SD-6.2, unless the material used for intermediate backfill is identical material used for the initial backfill material.

19-2.02.B Sewer

Unless otherwise specified in the Special Provisions, initial backfill for storm drain construction shall conform to this Section 19 and Standard Drawing . SD-6.0, SD-6.1 and SD-6.2.

The initial backfill material shall consist of three-quarter inch (“¾”) clean crushed rock per Section 50-16, “Clean Crushed Rock” of these specifications.

For reinforced concrete storm drain pipes greater than forty-eight inches (48”) in inside diameter, the initial backfill material shall consist of one-inch (1”) clean crushed rock per Section 50-16, “Clean Crushed Rock”, of these specifications.

For field conditions requiring Control Density Fill as backfill, the material shall conform to Section 50-15.01, "Control Density Fill (CDF)” Backfill", of these Specifications.

For field conditions requiring portland cement concrete backfill, the material shall conform to Section 50-5.01, "Portland Cement Concrete - Composition”, Class "C”, of these Specifications.

Prior to using portland cement concrete, Controlled Density Fill (CDF), or Controlled Low Strength Material (CLSM), the Contractor shall submit a plan to the Engineer, for approval, on how the Contractor will prevent the pipe from floating, changing line, grade or displacement. The method of anchoring the pipe shall be sufficient to ensure a continuous even grade in the flow line of the pipe. Anchors shall be no less than every quarter point of a single pipe length. The method of anchoring shall not damage the pipe. Any damage or displacement to the pipe will be replaced at the Contractor’s expense.

During placement of portland cement concrete, Controlled Density Fill, or Controlled Low-Strength Material, the material shall not fall more than eight feet (8’) without using pipes, or tubes to prevent segregation.

19-2.02.C Water Distribution Systems

Unless stated otherwise, initial backfill requirements for water distribution systems shall be constructed in accordance with the standard specifications of the specific utility company. Within the City Limits of Elk Grove, the primary water supply companies include, but are not limited to, Elk Grove Water District, and Sacramento County Water Agency.

Prior to placing intermediate backfill material, the Contractor shall separate the initial backfill and intermediate backfill with Geotextile Fabric conforming to Standard Drawing SD-6.0, SD-6.1 and SD-6.2, unless the material used for intermediate backfill is identical material used for the initial backfill.

19-2.03 Intermediate Backfill

Intermediate backfill materials shall consist of material placed between the initial backfill and bottom of subgrade in paved areas or to the top of the trench in unpaved areas, unless otherwise shown on the Plans or specified in the Contract.

Intermediate backfill materials shall meet the requirements of the City Standard Construction Specifications, City Standard Drawings, and the approved project plans.

The intermediate backfill material may be native material excavated at the work site if the intermediate backfill depth between the top of the initial backfill and subgrade is greater than or equal to eighteen inches (18"). Native material must be free of organic or other unsuitable materials as determined by the City that may cause voids or depressions to develop during or after placement of the intermediate backfill. Rocks, stones and solid earth chunks exceeding three inches (3") in greatest dimension shall be removed from the intermediate backfill material. The intermediate backfill material for intermediate backfill depths less than eighteen inches (18") measured from the top of the initial backfill to the bottom of subgrade shall be Type "A" ¾" Class II Aggregate Base (AB) or Type "D" Controlled Density Fill (CDF) material conforming to the requirements in Section 50 of these Specifications and Standard Drawings SD - 6.0, SD-6.1 and SD – 6.2. Aggregate base shall be placed in eight inch (8") maximum loose lifts. Compaction requirements for aggregate base shall be the same as required for compaction of job excavated native material. An alternative use of Type "D" CDF material as defined in Section 50-15 of these specifications must be approved in writing by the Engineer. Type "D" material will not be allowed over other agency water pipes or sewer pipes.

Unless otherwise shown or specified in the Contract, compaction of all intermediate backfill material shall be by mechanical pneumatic or vibratory compaction equipment. Hydraulic ponding and hydraulic jetting methods are not permitted.

1. Compaction

   The first lift of the intermediate backfill material shall be no more than eight inches (8") in loose thickness and shall be compacted to achieve a minimum of ninety (90%) percent of the ASTM D1557 maximum dry density at a moisture content between zero (0) and three percent (3%) above the optimum moisture content. This lift shall be tested for relative compaction prior to continuation of backfill procedures. All subsequent backfill shall be placed in lifts no greater than eight inches (8") in loose thickness (or less depending on ability of compaction equipment) and compacted to achieve a minimum of ninety three percent (93%) of the ASTM D1557 maximum dry density at a moisture content between zero (0) and three (3) percent (3%) above the optimum moisture content. The intermediate backfill material within a two foot (2') wide zone surrounding vertical structures shall be mechanically compacted by smaller hand operated or walk behind compactors in addition to the larger trench compaction equipment. Hydraulic jetting will not be permitted by the City of Elk Grove.

   For new and existing street areas where over-compaction of expansive soils is a concern, if native material, used in the upper three feet (3') of trenches, has an Expansion Index (EI) greater than seventy (70) (based on 1997 UBC Test Method 29-2), then the contractor/developer shall submit for approval, alternative methods to either reduce the expansion potential of the native material or replace with

suitable non-expansive material. An alternative to conventional intermediate backfill materials would be CDF.

2. Moisture Content

The moisture content of the intermediate backfill during compaction shall be between zero (0) and three percent (3%) above the optimum moisture content as established by ASTM D1557 unless otherwise specified by the geotechnical report for the specific project and approved by the Enginer. The intermediate backfill material shall be uniformly moisture conditioned as needed prior to placement and compaction.

Construction Quality Assurance

1. Field Density Tests

Nuclear moisture content and density testing shall conform to ASTM D2922 and ASTM D3017. Test frequency, at minimum, shall include at least one test per 100 linear feet of trench length and every two feet (2') vertically starting two feet (2') above the pipe. Density tests shall be performed at a frequency of at least one test for every two feet (2') of backfill vertically for vertical structures (i.e. manholes, valve risers, etc.). Backfill above lateral services shall be tested at least every two feet (2') vertically. Calibration shall be performed for each nuclear gauge on a weekly basis to confirm the accuracy of nuclear density gauge moisture readings. The frequency and location of testing may be revised as determined by the Engineer.

2. Modified Proctor Compaction Curve

Modified Proctor compaction curves (ASTM D1557) shall be performed as needed depending on changes in material types or a minimum once for every 2,000 cubic yards of material placed whichever comes first.

3. Profile Plots of Test Locations

All compaction tests performed on trench backfill placed in utility trench mainlines, services, and around manholes shall be plotted and individually numbered on a set of record drawings for submittal to the Engineer immediately upon completion of the testing. Test reports and technician Daily Field Reports shall be submitted electronically to the Engineer within five (5) working days of testing. All trench backfill test reports shall be submitted to the Engineer at a minimum of ten (10) working days in advance of subgrade preparation.

Unless otherwise specified in the Special Provisions, the Contractor has the option to use imported granular material for trench backfill in place of native material excavated at the work site. The imported granular material shall be uniformly graded Class 2 aggregate base conforming to the requirements in Section 50-7, "Aggregate Bases", of these Specifications. The imported granular material shall be placed in lifts not to exceed six inches (6") after compaction. Compaction requirements for imported granular material shall be the same as required for compaction of job excavated native material. Unless otherwise specified in the Special Provisions, the optional use of imported granular material for trench backfill will be at the Contractor's expense.

19-2.04 Cut Off Collars

If Clean Crushed Rock is selected for initial backfill on drain pipe, a path is created that can allow water flow within the initial backfill material. Trench plugs or Cut Off Collars of CDF material shall be installed within the initial backfill zone. Cut off collars, where required, shall be as shown on City Standard Drawing SD-6.2 and at least eight inche (8") thick (as measured in the direction of the pipeline) and extend at least one foot (1') laterally beyond and below the bedding and initial backfill into the surrounding soils in all directions. The required pipe sleeves shall be placed a minimum of two feet (2') away from all service connections on the main line. The collars shall be generally placed near the mid-point of the pipeline between manholes. However, final placement shall be at the direction of the Engineer.

Cut off collars shall also be installed around all services that extend beyond the curb or back of sidewalk at the outside edge of a roadway, including joint utility crossings. The collars may either be installed on the horizontal portion of the main service lateral prior to the elbow or on the vertical portion of the service prior to any plumbing fittings installed by the Contractor. The collar shall be placed behind the back of curb and sidewalk where present. The horizontal collar has the added benefit of being easier to construct and reduces the potential of the pipe shearing by extending horizontally through a rigid structure.

19-2.05 Payment

Full compensation for furnishing, placing, and compacting pipe bedding and trench backfill materials is included in the prices paid per linear foot of the respective sizes, grades, and types of pipes listed in the Contract, and no additional compensation will be paid.