DIVISION 2

TRENCH EXCAVATION AND BACKFILL

Section 2.01 GENERAL:

This section covers the requirements for trenching and backfilling for underground pipelines. Unless otherwise shown or ordered, pipe shall be laid in an open trench. All incidental clearing, preliminary grading, structure removal, and benching shall be considered a part of the trenching operation.

Section 2.02 BARRICADES:

Barriers shall be placed at each end of all excavations, and at such places as may be necessary along excavations, to warn all pedestrians and vehicular traffic of such excavations. Lights shall also be placed along excavations from one hour before sunset each day to one hour after sunrise of the next day, until such excavations are entirely refilled, compacted, and surfaced or final graded. All excavations shall be barricaded in such a manner as to prevent persons from walking into, falling into, or otherwise entering those excavations.

Section 2.03 BLASTING:

Blasting will not be allowed except by permission from the Public Works Representative/Engineer. The Developer/Contractor shall comply with all laws, regulations, ordinances, and safety codes relative to the handling, storage, and use of explosives. The Developer/Contractor shall be fully responsible for all damage to life and property attributable to its blasting operations. Excessive blasting or overshooting will not be permitted. The Developer/Contractor shall remove any material outside the authorized cross section, which may be shattered or loosened by blasting.

Section 2.04 SHEETING, BRACING AND SHORING OF EXCAVATIONS:

Excavations shall be sheeted, braced, and shored as required to support the walls of the excavations. These measures shall be taken to protect the workers, the work in progress, existing utilities, structures, and improvements, from damage due to sliding and settling of trench walls. All such sheeting, bracing, and shoring shall comply with the regulations of the Utah State Industrial Commission, and accident prevention and safety provisions of the Contract.

The Developer/Contractor shall be fully responsible for the adequacy of methods and materials used in trench sheeting, bracing, shoring, and other systems provided to protect workers. Injury to or death of workers resulting from inadequate trench safety measures shall be the full and complete responsibility of the Developer/Contractor. All damages resulting from lack of adequate sheeting, bracing and shoring shall be the responsibility of the Developer/Contractor, and the Developer/Contractor shall affect all necessary repairs or reconstruction at its own expense resulting from such damage.

Sheeting or shoring that does not extend below the centerline of the pipe may be removed at the discretion and responsibility of the Developer/Contractor after the pipe embedment has been placed and compacted to a level twelve inches (12") above the top of the pipe. Following removal of the sheeting or bracing, the trench shall be immediately backfilled and compacted or consolidated.

Section 2.05 CONTROL OF GROUNDWATER:

All trenches shall be kept free from water during excavation, fine grading, pipe laying and jointing, and pipe embedment operations. Where the trench bottom is mucky or otherwise unstable because of the presence of groundwater, and in all cases where the static groundwater is above the bottom of any trench or bell hole excavation, such groundwater shall be lowered to the extent necessary to keep the trench free from water and the trench bottom stable when the work within the trench is in progress. The discharge from excavation dewatering shall be conducted to natural drainage channels, gutters, drains, or storm sewers. No sanitary sewer shall be used for disposal of trench water. Surface water shall be prevented from entering trenches.

Section 2.06 TRENCH EXCAVATION:

Excavation for pipelines shall be located as shown on the Drawings or as staked in the field. Trenches shall be excavated to the depths and widths required to accommodate the construction of the pipelines, as follows:

Sub-section A. Normal Excavation:

Except in ledge-rock, cobbles, stones, or water-saturated earth, mechanical excavation of trenches shall not extend below an elevation four inches (4") below the bottom of the pipe after placement in its final position. All additional excavation necessary for preparation of the trench bottom shall be made manually.

Sub-section B. Authorized Over-Excavation:

Where ledge-rock, cobble rock, stones or other material render the trench material unsuitable for pipe bedding, as determined by the Public Works Representative/Engineer, bedding material shall be imported and placed. The trench shall be excavated to a minimum of four-inches (4") below the bottom of the pipe after placement in its final position.

Where unstable material is encountered in the excavation, foundation material may be required, as determined by the Public Works Representative/Engineer. In such cases, a minimum of eight inches (8") below the bottom of the pipe after placement in its final position shall be removed. Over-excavation not ordered, specified, or shown shall be considered to be unauthorized excavation.

Sub-section C. Unauthorized Over-Excavation:

Any excavation carried below the elevation required to install the pipe as specified in these Specifications, or directed by the Public Works Representative/Engineer, shall be considered to be unauthorized. Such excavation shall be backfilled in accordance with Section 2.07, all at the Developer/Contractor's expense.

Sub-section D. Trench Width:

The trench shall be excavated such that the pipe is always centered in the trench. The minimum clear trench width at the horizontal diameter of the pipe must not be less than the outside diameter of the pipe plus twelve inches (12").

Trench width for pipeline structures, valves, or other accessories shall be sufficient to leave at least twelve inches (12") clear between their outer surfaces and the trench. Backfill with earth under structures or valves will not be permitted. Any unauthorized excess excavation below the elevation indicated for foundation of any structures shall be backfilled in accordance with Section 2.07, at the Developer/Contractor's expense.

Sub-section E. Trenches in Embankments:

Before laying pipes that are to be in fill or embankment areas, the embankment shall first be placed and compacted to the specified density to a depth of not less than two feet (2') above the top of the proposed pipe. After placing and compacting the embankment, the trench for the pipe or conduit shall be excavated through the fill and fine graded and the pipe installed as specified. The Public Works Representative/Engineer may perform random testing to verify relative densities. In the event that a test fails, the Developer/Contractor shall rework the section as described above and shall bear all of the cost of re-testing until the section passes.

Sub-section F. Placement of Excavated Material:

All excess material shall be hauled away from the construction site and disposed of in an area obtained by the Developer/Contractor and approved by the Public Works Representative/Engineer. The Developer/Contractor shall be responsible for all rights-of-way, easements, and access associated with the

disposal of excess excavated material. It shall further be responsible to obtain permission from the property owner or person controlling the property where the Developer/Contractor plans to dispose of excavated material. No compensation will be made to the Developer/Contractor for disposal of excess excavated material.

Non-excess excavated material shall be piled in a manner that will not endanger the work and will avoid obstructing sidewalks and driveways. Gutters and irrigation ditches shall be kept clear or other satisfactory provisions shall be made for street drainage and continuity of irrigation.

Grading of the area surrounding the trenches, including excavated materials, shall be performed as necessary to prevent surface water from flowing into trenches, or other excavations. Control of groundwater shall be as specified in section 2.05, Control of Groundwater.

Sub-section G. Fine Grading the Trench Bottom:

The bottom of the trench shall be accurately graded and prepared to provide uniform bearing and support on undisturbed soil or compacted granular bedding at every point along the entire length of the pipe. Bell holes shall be hand excavated after the trench bottom has been fine graded. Bell holes shall be only large enough to permit making the joints and to assure that any portion of the joint or bell does not support the pipe.

Section 2.07 TRENCH BACKFILL

Trench backfill for piping consists of four zones: foundation, bedding, initial backfill, and final backfill. "Pipe embedment" is a commonly used term that refers to the region including the bedding and initial backfill zones, or any region within one foot (1') of any pipe, pipeline structure, or accessory. The foundation is defined as the region between eight inches (8") and four inches (4") below the bottom of the pipe. The bedding is defined as the region between four inches (4") below the bottom of the pipe and the bottom of the pipe. The initial backfill is defined as the region between the bottom of the pipe and twelve inches (12") above the top of the pipe. The final backfill is defined as the region above twelve inches (12") above the pipe.

All fill materials shall be compacted as specified in this section.

The Public Works Representative/Engineer shall determine the suitability of excavated materials for use as foundation, bedding, initial backfill, and final backfill. When the excavated materials are not satisfactory for foundation, bedding, or backfill, the Developer/Contractor shall provide imported granular material.

Sub-section A. Imported Granular Material:

Imported granular material for foundation, bedding, and backfill shall be cleaned crushed rock or gravel, free from sod, vegetation, and other organic or deleterious material. Slag will not be allowed in the pipe embedment. Imported granular material shall conform to the following gradation specifications:

1. Foundation Material. One hundred percent (100%) less than two-inch (2") and maximum of five percent (5%) less than one-half-inch (1/2").

2. Embedment Material. Ductile-iron pipe - One hundred percent (100%) less than two-inch (2") and maximum of five percent (5%) passing a No. 200 sieve.

PVC or polyethylene pipe - One hundred percent (100%) less than one-inch (1") and maximum five percent (5%) passing a No. 200 sieve.

3. Final Backfill Material. One hundred percent (100%) less than twelve-inch (12") and maximum of fifteen percent (15%) passing a No. 200 sieve.

Sub-section B. Foundation Placement:

When over-excavation is authorized by the Public Works Representative/Engineer, foundation material shall be placed in the foundation zone and below. The foundation material shall be placed so that the trench can be properly fine graded as specified. The foundation material shall be deposited over the entire trench width and compacted in layers. The layers shall have a maximum uncompacted thickness of six-inches (6").

The material shall then be fine graded in accordance with the specification for Fine grading herein.

Sub-section C. Pipe Embedment:

Embedment material for other than PVC pipe may be excavated materials consisting of loose earth, sand, or gravel having no material larger than two-inches (2") in any dimension. For PVC pipe, the material must be no greater than-one inch (1") in any dimension. If the excavated materials are not satisfactory, the specified imported granular material shall be used for pipe embedment.

1. Bedding. The bedding material shall be deposited over the entire trench width to a compacted thickness of no less than four inches (4"). The material shall have a maximum uncompacted thickness of six inches (6").

2. Initial Backfill. After the pipe is in place, initial backfill material shall be placed at any point below the mid-point of the pipe simultaneously and uniformly on both sides of the pipe in un-compacted layers not to exceed ten-inches (10") or one-half the diameter of the pipe, whichever is less. Initial backfill material shall be placed with care to prevent displacement of or damage to the pipe during the embedment process. Initial backfill material shall be scattered alongside the pipe and not dropped into the trench in compact masses.

That section of the pipe zone from the mid-point of the pipe to twelve inches (12") above the top of the pipe shall then be filled with initial backfill materials and compacted.

Sub-section D. Final Backfill:

Final backfill shall be from twelve inches (12") above the top of the pipe to the level shown on the Drawings. Excavated materials consisting of fines, sand, and gravel shall be used for final backfill. No oil cake, bituminous pavement, concrete, rock, or other lumpy material shall be used in the final backfill unless these materials are scattered and do not exceed six inches (6") in any dimension. Perishable or spongy material shall not be used in final backfilling.

Sub-section E. Compaction:

Backfill shall be compacted by means of sheepsfoot rollers, pneumatic tire rollers, vibrating rollers, or mechanical tampers.

Under pavements or other surface improvements the in-place density shall be a minimum of ninety-six percent (96%) of laboratory standard the maximum dry density as determined by AASHTO T-99. In shoulders and other areas the in-place density shall be a minimum of ninety percent (90%) of the maximum dry density as determined by AASHTO T-99.

Fill material shall be placed at a moisture content and un-compacted lift thickness such that after compaction the required relative densities will be produced. In no event will the material be placed in lifts

that, prior to compaction, exceed six inches (6") for foundation and embedment and twelve inches (12") for final backfill.

Prior to compaction each layer shall be evenly spread, moistened, and worked by disk harrowing or other equivalent means.

If the required relative density is not attained, test sections will be required to determine any adjustments in compaction equipment, thickness of layers, moisture content and compactive effort necessary to attain the specified minimum relative density.

Approval of equipment, thickness of layers, moisture content, and compactive effort shall not be deemed to relieve the Developer/Contractor of the responsibility for attaining the specified minimum relative densities. The Developer/Contractor, in planning its work, shall allow sufficient time to perform the work connected with test sections and to permit the Public Works Representative/Engineer to make tests for relative densities.

Sub-section F. Consolidation

Consolidation of backfill shall be accomplished by those methods in which water is used as the essential agent to produce the desired condition of density and stability. Water shall be applied by jetting unless flooding is specifically authorized by the Public Works Representative/Engineer. Authorization by the Public Works Representative/Engineer to use any consolidation method does not relieve the contractor of his responsibility to meet the specified density requirements. Water for consolidation shall be furnished by the contractor at his expense.

In the jetting procedure the jets shall be inserted at not more than four-foot intervals (staggered throughout the length of the back filled area) and shall be slowly forced down to the bottom of the trench or top of previously jetted lift and held until the trench back fill is completely saturated with water. Depth of jetted lift shall not exceed 5 feet unless otherwise approved by the Public Works Representative/Engineer.

The minimum size of hose equipment shall be as to provide a minimum pressure of 35 pounds per square inch at the discharge. The jet shall be a rigid iron pipe with a minimum diameter of one inch.

After the water-settled trench has set for several days, any depression in the trench shall be filled, mounded over, and wheel rolled to compact the material thus placed.

All precautions necessary shall be taken by the contractor to prevent damage and movement (including floating) of the pipeline, structures, and existing adjacent improvements and utilities. The use of consolidation methods will be allowed only when they not result in damage to adjacent ground. The contractor shall make his own determination in this regard, and shall assume all risks and liability for settlement or lateral movement of adjacent ground, improvements, or utilities, either on the surface of the ground or underground.

Section 2.08 TRENCH CROSSINGS AND EASEMENTS:

At road crossings or where existing driveways occur on a road, the Developer/Contractor shall make provisions for trench crossings either by means of backfill, tunnels, or temporary bridges.

Any disturbance to property caused by the Developer/Contractor's activity within easements shall be restored to the satisfaction of the owner of the property. If necessary, shrubs, fences, mailboxes or other objects shall be removed carefully. If work must occur on a lawn, the lawn shall be cut to a width of two feet (2') wider than the intended work area (one foot (1') on each side). The lawn sod shall be stacked separately from and shall not be mixed with other excavated material.

After the sod is removed, if excavation is necessary, the topsoil shall be removed to a depth of twelve inches (12"), or the actual depth of the topsoil, whichever is less. The topsoil shall be stored separately from and shall not be mixed with other excavated material.

Following completion of the backfilling and the compaction of the trench, the Developer/Contractor shall replace topsoil, lawn sod, shrubs, fences, mailboxes and other items that may have been removed from within the easement area and shall clean up and remove any rocks, dirt or any other debris that remain from the construction work. Excess excavated material shall be offered to the City at no cost before other disposal options are sought.

Section 2.09 RESTORATION OF CONSTRUCTION SITE:

During the progress of the Work, the Developer/Contractor shall clean up all construction debris, excess excavation, and excess materials, and shall restore all fences, irrigation structures, ditches, culverts, and similar items. The Developer/Contractor shall stockpile the excavated trench material so as to do the least damage to adjacent grassed areas, or fences, regardless of whether these are on private property or public rights-of-way. All excavated materials shall be removed from grassed and planted areas and these surfaces shall be left in a conditions equivalent to their original surface and free from all rocks, gravel, boulders, or other foreign materials. Excess excavated material shall be offered to the City at no cost before disposal options are sought.

Section 2.10 DEVELOPER/CONTRACTOR'S RESPONSIBILITY:

The Developer/Contractor will be responsible to see that the backfilling and compaction are properly and adequately done. Settlement of trenches within a period of two- (2) years after final acceptance of the project shall be considered incontrovertible evidence of inadequate compaction, and the Developer/Contractor shall be responsible for correcting the condition in accordance with the provisions of these Specifications. This includes the replacement of sidewalk, curb and gutter, and other surface improvements.