SECTION 300 SITE WORK AND EARTHWORK

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310.00 GENERAL

All site work and excavation shall comply with the requirements of the STANDARDS AND SPECIFICATIONS and any special criteria established by the City. The Director(s), at a pre-design/pre-construction meeting, may establish special criteria. Site work shall be completed as detailed on the accepted engineering plans. Site work shall consist of demolition and removal of structures and obstructions; clearing and grubbing; overlot grading; subgrade preparation; removal of topsoil; site preparation; excavation and embankment; excavation, trenching, bedding and backfill of pipelines and service lines; excess excavation; borrow; and restoration and cleanup.

311.00 Local Laws, Ordinances and Codes

The Contractor shall comply with all current federal, state, county, and local laws, and codes pertaining to earthwork. The Contractor must obtain all necessary permits as required in Section 100, General Conditions, of these STANDARDS AND SPECIFICATIONS and/or any permits required by this Section prior to commencement of the work. The Contractor shall notify the Director(s) twenty-four (24) hours before the start of the work or when work is to be resumed following a delay.

312.00 Protection of Public Improvements

The Contractor shall be held responsible for the protection of public improvements as stated in Section 141.00, Protection of Public and Utility Interests, of these STANDARDS AND SPECIFICATIONS. It will be the Contractor's responsibility to replace all public improvements so damaged at his own expense. Street cuts are restricted according to Section 143.00 of these STANDARDS AND SPECIFICATIONS.

312.01 Operation of Existing Valves

The Contractor of record shall not operate any valve or other control device on any existing system for any purpose.

312.02 Interruption of Services

Before starting site work, the Contractor shall plan and coordinate for the disconnection or interruption of all services such as water, sewer, cable T.V., telephone, gas, electric power and traffic. Disconnection and/or interruptions shall be made in accordance with the regulations of the utility that controls the supply of the service. Whenever the flow of traffic is affected, a Traffic Control Plan shall be provided in accordance with Section 141.07, Traffic Control, Barricades, and Warning Signs, of these STANDARDS AND SPECIFICATIONS.

The Utility Department shall provide a representative to be on site to observe and approve the Contractor's disconnection or interruption of the water and sewer services. One (1) week prior to the interruption of service, the Contractor will notify the City of his plan and schedule. Forty-eight (48) hours prior to the interruption of service, the Contractor will notify all users in writing with a hand delivered notification whose service will be interrupted in order for them to make provisions for necessary water storage. No line in service will be shut down for more than a four (4) hour period at one time. Prior approval by the City is required for all shutdowns.

312.03 Equipment Operated on Streets

Only pneumatic-tired equipment shall be permitted to operate over paved surfaces. Other types of equipment can be used at the sole discretion of the city. The Contractor shall be responsible for any damage to the street surface resulting from his operation.

320.00 DEMOLITIONS AND REMOVAL OF STRUCTURES AND OBSTRUCTIONS

All salvable material shall be clearly marked by the City and will be removed, without unnecessary damage, in sections or pieces that may be readily transported and will be stored in locations approved by the Director(s). These materials may include, but shall not be limited to, manhole frames and covers, inlet grates, fence material, handrails, culverts, guardrail, walkway, roadway and parking appurtenances (traffic signals and attached hardware, including mast arms and span wire) and irrigation systems and appurtenances. The Contractor shall be required to replace any materials lost from improper storage methods or damaged by negligence.

Where portions of structures are to be removed, the remaining parts shall be prepared to fit new construction. The work will be done in accordance with plan details and in such a manner that materials to be left in place will be protected from damage. The Contractor at his expense shall repair all damage to portions of structures that are to remain in place. Depressions resulting from the removal of structures, footings, and other obstructions, shall be filled and compacted with clean fill materials so as to eliminate hazards of cave-in, accumulation and ponding of water.

Where culverts or sewers are to be left in place and plugged, the ends shall be filled with Type III concrete. Culvert and sewer ends are to be sufficiently filled to prevent future settlement of embankments.

321.00 Bridges, Culverts and Other Drainage Structures

Bridges, culverts, and other drainage structures in use by traffic shall not be removed until the Director(s) in accordance with Section 141.08, General Conditions, of these STANDARDS AND SPECIFICATIONS, has approved a Traffic Control Plan.

Unless otherwise directed, the substructures of existing structures will be removed down to one (1) foot below natural stream bottom or ground surface. Where such portions of existing structures lie wholly or in part within the limits of a new structure, they will be removed as necessary to accommodate the construction of the proposed structure. Steel, pre-cast concrete and wood bridges

shall be carefully dismantled without unnecessary damage. Steel members to be salvaged will be match-marked with waterproof paint.

322.00 Pavements, Sidewalks, Curbs, Etc.

All concrete or asphalt that is to remain shall have a straight, true line with a vertical face. Concrete or asphalt may be cut with a cutting wheel or saw. If the Contractor cannot maintain a straight, true break line, the Director(s) will order sawing. The sawing shall be done carefully, and the Contractor, at his expense will repair all damages to the concrete or asphalt to remain in place. The minimum depth of saw cuts in concrete will be two (2) inches.

The Contractor shall be responsible for the cost of removal and replacement of all over break as determined by the Director(s).

323.00 Disposal

The Contractor shall make all necessary arrangements for obtaining suitable disposal locations, and the cost involved will be included in the work.

330.00 SITE PREPARATION

The Contractor shall complete all work necessary to satisfactorily prepare the site as shown on the accepted drawings and as specified herein. Site preparation includes clearing, grubbing, grading, tree and shrub removal, native grass stripping and removing and disposing of all debris within the limits of the project and such other areas as may be indicated on the plans or required by the work, except such objects as are designated to remain or are to be removed in accordance with other sections of these STANDARDS AND SPECIFICATIONS. This work shall also include the preservation from injury or defacement of all vegetation and objects designated to remain.

331.00 Clearing

The City shall establish construction lines and designate all trees, shrubs, plants and other things that are to remain. The Contractor shall preserve all things designated to remain. Paint required for cut or scarred surfaces of trees or shrubs selected to remain will be an approved asphalt base paint, prepared especially for tree surgery.

Branches on trees or shrubs shall be removed as directed. Branches of trees extending over the roadbed must be trimmed to give a clear working area above the roadbed surface. All trimming shall be done in accordance with Section 1000 of these Standards and Specifications.

Hedges will be pulled or grubbed in such a manner as to assure complete and permanent removal. Sod not required to be removed, must be thoroughly disked before construction of embankment.

All surface objects and trees, stumps, roots and other protruding obstructions not designated to remain will be cleared and/or grubbed as required, except nonperishable solid objects which will be a minimum of two (2) feet below subgrade.

Except in areas to be excavated, stump holes and other holes from which obstructions are removed must be backfilled with suitable material and compacted in accordance with these STANDARDS AND SPECIFICATIONS.

The Contractor will scalp areas where excavation or embankment is to be made. Scalping will include the removal of material such as brush, roots, sod, grass, residue of agricultural crops, sawdust, and other vegetable matter from the surface of the ground.

Clearing shall be performed in a careful and orderly manner with due consideration and protection of adjoining property, the public and workmen. Any damage to streets, parking lots, utilities, plants, trees, buildings or structures on private property, or to bench marks and construction staking due to the negligence of the Contractor, shall be repaired and restored to its original condition by the Contractor at his expense. Those areas which are to be saved will be clearly staked or fenced off by the Contractor per the City's instructions and it will be the Contractor's responsibility to ensure that these areas are not damaged during the construction process. Following completion of construction, should any of these trees, shrubs or sod require replacement, it shall be done at the Contractor's expense.

332.00 Grading

A Grading and Stormwater Quality Permit shall be required as specified in Section 151.00 of these STANDARDS AND SPECIFICATIONS.

A. If grading is in excess of 1 acre, additional requirements must be adhered to in accordance with the City of Brighton's Standards.

Upon completion of the work, the Contractor shall provide the following information:

A. An "as-graded" plan showing original ground surface elevations, as constructed ground surface elevations, lot drainage patterns, locations and elevations of all surface and subsurface drainage facilities.
B. A soil grading report prepared by the soils engineer including locations and elevations of field density tests, summaries of field and laboratory tests and any other substantiating data and comments on any changes made during grading and their effect on the recommendations made in the soils engineering report.
C. A geological report prepared by the engineering geologist including a final description of the geology of the site including any new information disclosed during the grading, and the effect of it on recommendations incorporated in the accepted grading plan.

All areas disturbed during grading operations shall have the final graded area hydro seeded or re-vegetated with native grasses in accordance with the requirements of the City of Brighton. Seeding must be completed within sixty- (60) days of the grading completion and no longer than one hundred eighty (180) days of the commencement of grading operations at the site.

The Contractor shall insure that the dust proofing requirements of Section 141.06, General Requirements, of these STANDARDS AND SPECIFICATIONS are strictly adhered to for the duration of the project.

Grading of filled and unfilled areas shall be to the lines and grades indicated on the accepted plans. Grading shall be performed in conjunction with all of the necessary clearing, grubbing, stripping, filling, and compacting operations to the satisfaction of the City.

Grading shall be done by approved means. Areas adjacent to structures and other areas inaccessible to heavy grading equipment shall be graded by manual methods.

Final grading shall be performed in such a manner as to provide proper drainage. In no case shall drainage from the project site be so altered or controlled as to result in damage, or the potential for damage, to adjacent property or to any portion of the work executed under the project from erosion or flooding.

333.00 Topsoil

The Contractor shall salvage within the project limits, or acquire when needed, loose friable loam reasonably free of admixtures of subsoil, refuse, stumps, roots, rocks, brush, weeds, heavy clay, toxic substances or other material which would be detrimental to the proper development of vegetative growth.

Topsoil shall not be placed until the areas to be covered have been properly prepared and grading operations in the area have been completed. Topsoil shall be placed and spread at locations and to the thickness shown on the plans and shall be keyed to the underlying material.

340.00 EARTHWORK

This work shall consist of excavation, disposal, shaping or compaction of all material encountered within the limits of the project, including but not limited to excavation of ditches and channels, surface boulders, muck, rock, concrete foundations, slabs, stripping, etc. Excavation will be performed to the line and grade and typical cross sections indicated on accepted plans or as required by the Director(s).

Excavation, dewatering, sheeting, and bracing shall be carried out in such a manner as to eliminate any possibility of undermining or disturbing the foundation of any existing structures or any work previously completed.

This Section does not include any work that is related to trenching, backfilling and compacting (refer to Section 350.00 of these STANDARDS AND SPECIFICATIONS).

Should the project warrant, the Director(s) might require the Contractor to provide an earth-moving diagram and haul routes.

340.01 Definitions

Backfill Material - Any suitable material or borrow. Free running material shall be drained from material before placement.

Bedding material - material that is installed under pipelines (other than sanitary sewer and water lines), riprap, low flow channel or any other place considered necessary by the Director(s). The thickness of this material will be as shown on the accepted plans and will normally be six (6) inches under structures and three (3) inches under the bell of any pipe. Bedding material shall meet the gradation of CDOT "No.67 Coarse Aggregate" as specified in Section 703.02 in the latest edition of the CDOT "Standard Specifications for Road and Bridge Construction".

Borrow - backfill or embankment material that must be acquired from designated borrow areas to make up the deficient areas that cannot be completed from excavation within work limits. All sources of borrow material must be approved by the Director(s).

Embankment fill - earthwork consisting of embankments, including preparation of the area upon which they are to be placed, dikes within or outside right-of-way, placing and compacting of approved material within areas where unsuitable materials have been removed, and placing and compacting of embankment materials in holes, pits and other depressions to lines and grades shown on the accepted plans. Only suitable materials shall be used in construction of embankments and backfills.

Proof rolling - the application of test loads over a sub-grade surface by means of a heavy pneumatic-tired vehicle to locate weak areas in sub grade. See Section 344.00 for specifications.

Stabilization material - material that is to be placed in areas of over excavation of unsuitable material, or in areas of high water table to stabilize the unsuitable material. Stabilization material shall meet the gradation of "No. 4 Coarse Aggregate" as specified in Section 703.02 of the CDOT "Standard Specifications for Road and Bridge Construction".

Structure backfill - earthen material that is installed around and over any structure as illustrated on the accepted plans. Imported structure backfill (Class I) shall meet the general gradation of "Class 1 Structure Backfill Material" as specified in Section 703.08 of the CDOT "Standard Specifications for Road and Bridge Construction". On site Class 2 structure backfill shall also meet the requirements of Section 703.08 of the CDOT Specifications for Road and Bridge Construction.

Structure excavation - excavation of any and all materials over an area extending three (3) feet out from the outer most bottom edge of a proposed structure, up to existing grade or top of proposed grade (whichever comes first) at a one to one (1:1) slope.

Suitable material - any earthen material consisting of on-site or similar non-organic sands, gravels, clays, silts and mixtures thereof with a maximum size of six (6) inches. Bedrock that breaks down to specified soil types and sizes during excavation hauling and placement may be considered as suitable material.

Unclassified excavation - any and all earthen materials encountered, including rocks and boulders, during construction.

Unsuitable material - any earthen material containing vegetable or organic silt, topsoil, frozen materials, trees, stumps, certain man made deposits, or industrial waste, sludge or landfill, or other undesirable materials.

340.02 Grading Tolerances

All earthwork shall be carried out in such a manner that final grades, after excavation, compaction of backfill, placement of rip rap, and construction of channel lining, etc. shall conform to those illustrated by design cross sections. The final earthwork shall be considered acceptable, providing all final grade elevations function as intended.

341.00 Excavation

All excavated areas will be graded in a manner that will permit adequate drainage, will not disturb material outside the limits of slopes and will be within the tolerances noted in Section 340.02 of these STANDARDS AND SPECIFICATIONS. When practical, all suitable material removed from the excavation will be used in the formation of embankments, for backfilling, and for other purposes. Materials that are considered unsuitable material (including rock) or surplus by the Director(s) shall be disposed of by the Contractor at his expense, in accordance with Section 323.00 of these STANDARDS AND SPECIFICATIONS.

All water pumped or drained from the work shall be disposed of according to Section 800.XX

341.01 Excess Excavation

If in the opinion of the Director(s), the material at or below the depth to which excavation for structures would normally be carried is unsuitable for the required installation, it shall be removed to such widths and depths as directed by the Director(s) and shall be replaced with stabilization material.

Where the bottom of the excavation, by error of the Contractor, have been taken to a depth greater than the depth specified, shown on the accepted plans or directed by the Director(s), said condition shall be corrected by refilling to the proper grade with structure backfill. Should this backfill for over excavation occur in areas of high groundwater, and then the backfill material shall be stabilization material. The Director(s) shall approve all measures taken to rectify conditions caused by over excavation, and the cost resulting from such measures shall be borne by the Contractor.

If, through failure or neglect of the Contractor to conduct the excavation work in a proper manner, the surface of the subgrade is in an unsuitable condition for proceeding with construction, the Contractor shall, at his own expense, remove the unstable material and replace it with recycled concrete, structure backfill, or other approved material so that the condition of the subgrade meets with the approval of the Director(s) before any work is placed thereon. Failure of the Contractor to

control surface or groundwater adequately, premature excavation at the work site, or other manifestations of the Contractor's neglect or improper conduct of work, as determined by the Director(s), shall be grounds for requiring removal and replacement of unsuitable subgrade without additional compensation.

341.02 Excavation Near Existing Structures and Utilities

The Contractor's attention is directed to the fact that underground utilities may exist within or immediately adjacent to the areas of proposed construction. Where possible, these utilities are indicated on the accepted plans; however, all of the services may not have been shown on the accepted plans, and the completeness and accuracy of the information presented is unverified and without guarantee. This information is supplied for the purpose of providing the Contractor with an indication as to the approximate locations of utilities at the work areas so that he will be made aware of probable obstructions and the extent to which these may affect construction.

All utility lines shall be located on the ground with location equipment in advance of the work at all times. All such locations shall be plainly marked by coded paint symbols on pavement or by marked stakes in the ground. All utility markings are valid for the time prescribed by their locators. The Contractor, at no extra cost, shall provide all such work.

342.00 Protection of Existing Structures and Utilities

All existing poles, pipes, wire, fences, curbs, property line markers, and other structures that, in the opinion of the Director(s), must be preserved in place without being temporarily or permanently relocated, shall be carefully supported and protected from damage by the Contractor. In case of damage, the Contractor shall notify the property owner so that proper steps may be taken to repair any and all damage done. When the property owners do not wish to make the repairs themselves, the Contractor shall repair all damage; or if not promptly done by him, the City may have the repairs made at the expense of the Contractor.

All utility services shall be supported by suitable means so that services do not fail during construction or when tamping and settling occur.

342.01 Relocation and Replacement of Existing Structures and Utilities

If, in the course of construction, the Contractor encounters utility services and/or structures of any kind not indicated on the plans, or otherwise provided for, which encroach upon or are encountered near and substantially parallel to the edge of the excavation and which, in the opinion of the Director(s), will impede progress to such an extent that satisfactory construction cannot proceed, they shall be relocated or removed, later to be restored or replaced as follows:

A. Whenever the Contractor encounters any of the conditions as described above and is so ordered in writing, he shall do the whole of or such portions of the work as directed; change the location of, remove and later restore, or replace such structures; assist the Owner thereof in so doing. For such work the contractor shall be issued a change order for extra work.

B. In removing existing pipes, or structures or utilities as described above, the Contractor shall use care to avoid damage to materials, and the Director(s) shall include for payment only those new materials which, in his judgment, are necessary to replace those unavoidably damaged.

When fences interfere with the Contractor's operations, he may remove and, unless otherwise specified, later restore them to a condition at least as good as that in which they were found immediately before the work was begun, all without additional compensation. The restoration of fences shall be done as promptly as possible and not left until the end of the construction period.

343.00 Storage of Excavated Material

Excavated material shall be placed so as to minimize the inconvenience to occupants traveling on streets and driveways or adjoining properties. Excavated material shall not be deposited on private property unless written consent of the property owner(s) has been filed with the Director(s)

It is expressly understood that no excavated materials shall be removed from the site of the work or disposed of by the Contractor except as directed or approved by the Director(s), or as noted below.

Suitable excavated material shall be used as backfill, fill for embankments, or other parts of the work in accordance with the appropriate sections of these STANDARDS AND SPECIFICATIONS.

Disposal of surplus material shall be in accordance with Section 323.00 of these STANDARDS AND SPECIFICATIONS.

344.00 Proof Rolling

Proof rolling may be required to determine whether certain areas of subgrade meet compaction requirements. Where required by the Director(s), proof rolling shall be carried out as designated with a water truck loaded to a minimum of 36,000 lb. No separate payment shall be made for proof rolling operations.

Areas of subgrade exposed and not previously disturbed but found to be weak and/or to fail the test shall, at the direction of the Director(s), be excavated, scarified, wetted if necessary, and recompacted with suitable backfill material to the requirements for density and moisture. The Contractor shall be compensated for this work either at applicable unit bid prices or by change order.

Areas of subgrade already worked but upon proof rolling are found to be weak and/or fail the test shall be ripped, scarified, wetted if necessary, and recompacted to requirements for density and moisture at the Contractor's expense.

345.00 Fill

345.01 Embankment

Earth fill shall be constructed in accordance with this Section, including placing and compacting of all embankment material, and all related work as required to ensure proper bond of materials with previously placed embankment.

No material shall be placed in any section of embankment until the foundation for that section has been cleared, stripped, and dewatered and compacted in accordance with these STANDARDS AND SPECIFICATIONS.

The suitability of each part of the foundation for placing embankment material thereon and of all materials for use in the embankment construction will be as determined by the Director(s) or the projects' Soils Engineer. All materials shall be placed and compacted in layers of the specified thickness

After subgrade has satisfactorily been prepared, the fill material shall be placed and compacted thereon and built-up in successive layers until the required elevation is reached. Fill shall be placed within the lines and grades shown on the accepted plans or as directed by the Director(s). No fill shall be placed on frozen surfaces, nor shall the fill material contain snow, ice, or other frozen materials.

Fill for embankment shall be a homogenous mixture of suitable material. The characteristics of the material shall be in accordance with that of suitable material as defined in Section 340.01 of these STANDARDS AND SPECIFICATIONS.

The filling operation shall begin in the deepest part of the area to be filled and fill shall be brought up in essentially level lifts. Fill shall be placed in layers by an approved method. The entire surface of the work shall be maintained free from ruts and in a condition that will permit construction equipment to travel over any section readily.

The lifts may be discontinued, providing that the slopes of the bonding surfaces of adjoining portions of embankment shall not be steeper than 10:1 (horizontal to vertical). Previously placed material shall be moistened in such a manner and to such depths as will ensure a satisfactory bonding surface with a new material.

The Contractor shall maintain the embankment in a manner satisfactory to the Director(s) until the City has given final acceptance of all work.

No compacting shall be done when the material is too wet, causing yielding. If the compacted surface of the fill layer is determined to be too smooth to provide an adequate bond with the succeeding layer, the surface shall be loosened by harrowing or by some other approved method before placement of the succeeding layer.

Excavated materials which the Contractor desires to use for embankment may be used provided they are at the proper moisture content. No additional payment will be made for adding moisture to materials.

The moisture content of the embankment prior to, and during, compaction shall be distributed uniformly throughout each layer of material. The placement moisture content for all materials shall be as noted below.

The Contractor will be responsible for insuring that compaction tests will be made when the Contractor has determined that he has properly compacted the embankment. Testing shall be completed in accordance with Section 354.00 of these STANDARDS AND SPECIFICATIONS.

All embankment fill shall be compacted to the percent of relative compaction shown in Table 345.00-1 and will be equal to or greater than the minimum values shown for the various types of soil. The moisture content will be maintained within ± two percent (2%) of optimum moisture for A-1 through A-5 materials and optimum to 2% above for A-6 and A-7-6 materials during compaction. Each project shall have a soils report and specifications designed for that project, site specific.

TABLE 345.00-1

Soil Classification (AASHTO M 145)	AASHTO T 99 Min. Standard Proctor Relative Compaction (Percent)	AASHTO T 180 Min. Modified Proctor Relative Compaction (Percent)
A - 1	100	95
A – 3	100	95
A - 2 - 4	100	95
A - 2 - 5	100	N/A
All Others	95	N/A

If at any time the Director(s) judge(s) that the degree of compaction being obtained is insufficient, he may halt operations and order that compaction tests be taken at his direction. Areas found deficient in degree of compaction shall be recompacted and regraded, if necessary. Failed compaction tests, when ordered by the Director(s), shall be paid for by the Contractor.

345.02 Structure Backfill

Structure backfill material shall be used to backfill behind reinforced concrete structures as illustrated on the accepted plans. Structure backfill shall comply with material as described in Section 340.01 of these STANDARDS AND SPECIFICATIONS. In addition, this material shall have a liquid limit not exceeding 35 and a plasticity index of not over 15 when determined in conformity with AASHTO T 89 and T 90.

Areas adjacent to structures and other areas inaccessible to mobile compaction equipment shall be compacted with suitable power-drive hand tampers or other acceptable devices. Compaction by the latter method shall be done in six- (6) inch layers, unless otherwise directed by the Director(s).

Backfilling shall consist of placing materials in uniform layers brought up on all sides of the structure.

Backfill material shall not be deposited against the back of concrete abutments, concrete retaining walls, or the outside of cast-in-place concrete structures until the concrete has developed a strength of not less than 2,500 psi in compression. Backfill placed within two (2) feet of any structure shall be covered up evenly on all sides to avoid unequal lateral pressures.

Compaction equipment or methods that produce horizontal or vertical earth pressures which may cause excessive displacement or may damage structures, shall not be used.

Unless otherwise indicated on the accepted plans or directed by the Director(s), the Contractor, prior to backfilling, shall remove all sheeting and bracing used in structure excavation.

THE EXCESSIVE USE OF WATER DURING BACKFILLING OPERATIONS WILL NOT BE PERMITTED.

No compacting shall be done when material is too wet to be compacted properly; at such times the compacting work shall be suspended until the previously placed and new materials have dried out sufficiently to permit proper compacting, or such other precautions shall be taken as may be necessary to obtain proper compacting. The moisture content of the embankment prior to, and during, compaction shall be distributed uniformly throughout each layer of material. The moisture content will be maintained within $\pm$ two percent (2%) of optimum moisture for A-1 through A-5 materials and optimum to two percent (2%) for A-6 and A-7-6 materials during compaction

In the event that sufficient satisfactory backfill material is not available on the site, the Director(s) shall direct the Contractor to import Class 1 structure backfill as defined in Section 340.01 of these STANDARDS AND SPECIFICATIONS.
Where pipe is connected to a structure being backfilled, the bedding and backfilling procedure shall conform to the requirements of Section 352.00 and 353.00 of these STANDARDS AND SPECIFICATIONS.

The Contractor shall apply the proper compactive effort and moisture control throughout the backfilling process. The Contractor shall be responsible for ensuring that compaction tests are made of the fill when the Contractor has determined that he has properly compacted the structural backfill. Testing shall be completed in accordance with Section 354.00 of these STANDARDS AND SPECIFICATIONS.

Structure backfill shall be compacted in conformance with Table 345.00-1.

If at any time the Director(s) determines that the degree of compaction being obtained is insufficient, he may halt operations and order that compaction tests be taken at his direction. Areas found deficient in degree of compaction shall be recompacted and regraded. Failed compaction tests, when ordered by the Director(s), shall be paid for by the Contractor.

345.02 Roadway Excavations, Backfill and Compaction

Roadway excavation shall be in accordance with unclassified excavation as defined in Section 340.01 of these STANDARDS AND SPECIFICATIONS. The material and execution for the

roadway backfill shall conform to Section 345.00 of these STANDARDS AND SPECIFICATIONS.

All roadway backfill shall be compacted to at least ninety-five percent (95%) of maximum density at optimum moisture content in accordance with ASTM Specification Designation D-698-70 (Standard Proctor). Water shall be applied uniformly during compaction to control moisture content. The moisture content will be maintained within ± two percent (2%) of optimum moisture for A-1 through A-5 materials and optimum to two percent (2%) above for A-6 and A-7-6 materials during compaction.

Prior to placement and compaction of roadway fill, all existing rubble and organic material shall be removed down to suitable existing material. The existing material shall then be scarified and roadway fill placed in accordance with Section 345.00 of these STANDARDS AND SPECIFICATIONS.

346.00 Moisture Control

Moisture in fill materials shall be equal to that found in the natural unexcavated condition insofar as is practicable. If the Director(s) determines that the fill material to be used is extremely wet, the Contractor shall spread the material on the areas to be filled and the fill shall be permitted to dry to allowable moisture content. Harrowing where necessary shall assist the drying process.

If, in the opinion of the Director(s), additional moisture is required, water shall be applied by some sprinkling device in such a way as to provide uniform distribution over the area to be treated with accurate control of the rate and quantity of water applied. If excessive amounts of water are added or if rain should cause excessive wetness, the area shall be allowed to dry as described above.

The moisture content of the fill shall be as near to optimum moisture content as possible, to create the least compactive effort to obtain maximum density.

347.00 Borrow

It will be the Contractor's responsibility to stockpile suitable backfill material, both for embankment fill and structure backfill, in anticipation for use in other areas of the project. Only at the time that he estimates that he has sufficient suitable backfill material stockpiled to complete the project, should he proceed to haul excavated material from the site. If the Contractor should fail to preserve, on-site, sufficient suitable material, and should haul off and dispose of suitable material, he shall be responsible for recovering said suitable material to the site for use, at his sole cost.

Should there be an insufficient quantity of material available on site for completion of the necessary embankment and structure backfill operations, the Contractor shall furnish approved backfill material as defined in Section 340.01 of these STANDARDS AND SPECIFICATIONS.

350.00 TRENCHING, BACKFILLING AND COMPACTING

This work shall consist of furnishing all labor, materials, tools and equipment for trenching, bedding, backfill and compaction for all underground utilities as specified herein and shown on the accepted plans. The excavation shall be made to lines and grades shown on the accepted plans and as established by the Director(s). Except where shown otherwise on the accepted plans and except where the Director(s) gives written permission to do otherwise, all trench excavation shall be made by open cut to the minimum depth of 6 inches below the bottom of the pipe. All excavation shall be unclassified.

When excavating in concrete or asphalt areas, the limits of the trench shall be string lined and the surface cut in a vertical plane by sawing, cutting wheel or other Director-approved method. Vertical edges shall be cut to a vertical plane to a point one (1) foot outside the limits of excavation prior to placing the resurfacing material.

Surface materials such as concrete and asphalt shall be disposed of independently of the underlying soil; base course and gravels are to be salvaged to stockpile, protected from contamination and reused for suitable material for backfill. The Contractor, in accordance with Sections 324.00 and 333.00 of these STANDARDS AND SPECIFICATIONS must dispose of all unsuitable materials unacceptable for use as backfill.

All excavated material which meets the requirements for backfill materials shall be stockpiled in a manner which will not endanger the performance of the work, the workmen, and should be at a sufficient distance from the banks to avoid overloading, obstruct sidewalks, driveways, or streets, and provide the least possible interference with traffic.

In existing developments excavation will not be permitted to advance more than forty (40) feet ahead of pipe laying and sixty (60) feet in advance of the backfill operations, unless approved by Director(s). No trench will be left open overnight without written permission of the Director(s).

The contractor shall provide and maintain adequate equipment to properly remove and dispose of all surface or ground water entering the trench. A Construction Dewatering permit must be obtained from the Colorado Department of Public Health and Environment (CDPHE). Water shall be disposed of in a suitable manner without damage to adjacent property or without being a nuisance to public health and convenience. The use of any sanitary sewer to dispose of trench water will not be permitted. The trench shall be dry at all times during pipe installation and so maintained until the joining operation is complete.

350.01 Special Conditions

Subsurface investigation - Prior to the connection of any planned utility line to an existing line, the Contractor shall expose the existing utility at the points of connection in order to verify the elevations and materials of construction. The Director(s) shall be notified a minimum of two (2) working days before such an investigation is performed. The Contractor shall also expose utilities as they cross each other to allow for verification of elevation and materials of construction. The Director(s) will evaluate this information and provide comments.

Telephone, Fiber Optic, Cable TV, and all other "Wire Utility" lines - Where underground "wire utility" lines are encountered which were not shown on the accepted plans, they shall be relocated as

directed by the Utility Company and in accordance with its specifications. The Contractor shall coordinate this work with all other phases of construction to avoid further conflicts.

Gas and electric lines - Where underground gas and electric lines are encountered which were not shown on the accepted plans, they shall be relocated as directed by the Utility Company, and in accordance with its specifications. The Contractor shall coordinate this work with all other phases of construction to avoid further conflicts.

351.00 Trench Excavation for Pipelines and Service Lines

351.01 Trench Width

Existing asphalt or concrete surfacing shall be cut vertically, in a straight line, and removed from the jobsite prior to starting the trench excavation; this material shall not be used in any fill or backfill unless approved in writing by Utilities Director.

The trench shall be excavated so that a minimum of 6 inches of clearance is maintained on each side of the pipe for proper placement and densification of the bedding and pipe zone or backfill material. The maximum trench width, measured at the top of the pipe, shall be the outside diameter plus 18 inches regardless of the type of pipe, type of soil, depth of excavation, or the method of densifying the bedding and backfill.

351.02 Trench Support

Trenches shall be adequately supported and the safety of workers provided for as required by the most recent Occupational Safety and Health Administration (OSHA) "Safety and Health Regulations for Construction". These regulations are described in Subpart P, Part 1926 of the Code of Federal Regulations. Sheeting and shoring shall be utilized where required to prevent any excessive widening or sloughing of the trench which may be detrimental to human safety, to the pipe being placed, to trees, or to any existing structure. Where excavations are made under severe conditions, it may be required that the contractor use an approved piling instead of sheeting and shoring.

351.03 Removal of Water

The Contractor shall provide and maintain at all times ample means and devices with which to remove promptly and properly dispose of all water entering the trench excavation. Water shall be disposed of in a suitable manner without damage to adjacent property or without being a nuisance to public health and convenience.

Dewatering shall be accomplished by well points, sumping or any other acceptable methods that will insure a dewatered trench. All dewatering methods will be subject to the approval of the Director(s).

351.04 Pipe Bedding and Pipe Zone Material

351.04.1 Installation of Bedding and Pipe

After completing the trench excavation and proper preparation of the foundation, 6 inches of bedding material shall be placed on the trench bottom for support under the pipe. Bell holes shall be dug deep enough to provide a minimum of 2 inches of clearance between the bell and the bedding material. Pipe shall be installed to ensure full support of the pipe barrel over its entire length. After the pipe is adjusted for line and grade and the joint is made, the pipe zone material shall be carefully placed and tamped under the haunches of the pipe and in the previously dug bell holes.

Tamping is herein defined as the act of placing approved pipe zone material under the haunches of the pipe while paying particular attention to voids, bell holes, and sling holes. The purpose of tamping is to ensure uniform support for the pipe.

The limits of bedding and pipe zone material shall be from 6 inches below the bottom of the pipe to 6 inches above the top of pipe. Approved backfill may then be installed to the ground line.

The compaction of pipe bedding is not required when using squeegee sand. The only requirement is sufficient tamping to achieve uniform support under the pipe.

351.04.02 Type of Bedding and Pipe Zone Material

The bedding and pipe zone material shall be clean, free draining, well graded sand or squeegee sand that is in accordance with the following limits when tested by means of laboratory sieves:

Well Graded Sand (For use with 24-inch or larger diameter conduits)	
Sieve Size	Total Percent (Passing by Weight)
3/8-inch	100
No. 4	70 to 100
No 8	36 to 93
No. 16	20 to 80
No. 30	8 to 65
No 50	2 to 30
No 100	1 to 10
No. 200	0 to 3
Squeegee Sand (For use with 20-inch or smaller diameter mains)	
3/8 inch	100
No. 200	0 to 3

Approved bedding and pipe zone material shall be stockpiled on the jobsite. City of Brighton reserves the right to require the use of specified bedding and pipe zone materials at any time.

352.00 Backfill for Pipelines and Service Lines

352.01 Pipes

The pipe zone shall be backfilled to the limits shown on the Standard Drawings. Well graded sand shall be compacted by jetting and vibrating to 70% relative density as determined by ASTM D 1566, ASTM D 4253, and ASTM D 4254. Squeegee sand backfill shall be compacted by tamping and rodding to 70% relative density as determined by ASTM D 1556, ASTM D 4253, and ASTM D 4254. Cohesive material shall be compacted to 95% of maximum dry density for cohesive soils as determined by ASTM D 698 within 2% of optimum moisture content for meeting ASTM D 698 requirements for compaction.

The trench excavation may provide suitable backfill material above the pipe zone. Wet, soft, or frozen material, asphalt chunks, or other deleterious substances shall not be used for backfill. If the excavated material is deemed unsuitable for backfill by City of Brighton, then a suitable material shall be utilized and the rejected material disposed of properly.

Backfilling shall be conducted in a continuous manner to prevent damage to the pipe and its coating and kept as close to the pipe laying operation as possible. Backfilling procedures shall be in accordance with the additional requirements, if any, of appropriate agencies or private ROW agreements.

352.02 Structures

Backfill and fill within 3 feet adjacent to any structure and for the full height of the walls shall be selected nonswelling material. It shall be relatively impervious, well graded, and free from stones larger than 3 inches. Material may be job excavated; however, selectivity will be required.

Stockpiled material other than topsoil from the excavation shall be used for backfilling unless an impervious structural backfill is specified. The backfill material shall be free from rubbish, clods, and frozen lumps of soil. Backfill around the structures shall be consolidated by mechanical tamping. The material shall be placed in 6 inch loose lifts within a range of 2% above to 2% below the optimum moisture content and compacted to 95% of maximum dry density for cohesive soils as determined by ASTM D 698 or to 70% relative density as determined by ASTM D 4253 and D4254.

Impervious structural backfill, where shown or specified, shall consist of material having 100% finer than 3 inches in diameter and a minimum of 20% passing a No. 200 U.S. Standard sieve. The material shall be placed in 6 inch loose lifts within a range of 2% below the optimum moisture content and compacted to 95% of maximum dry density as determined by ASTM D 698.

352.03 Composite Meter Pits

Backfill and fill within 1 foot around a composite meter pit and to the bottom of the top 1 foot ring shall be squeegee sand. The sand shall be carefully placed and mechanically compacted to ensure the meter pit does not deform more than 1 inch out of round at any point of its depth. Compaction using the wheels of construction equipment is not permitted.

354.00 Compaction Testing

The compaction of the bedding and all types of backfill shall be tested at a rate of at least one (1) test per 200 cubic yards of fill material or portions thereof and at least one (1) test per 200 lineal feetat various depths and locations as indicated by the Director(s) .. The Director(s) may require additional testing around structures, manholes, valve boxes, etc. The Contractor shall also have tests provided to the City for water and/or sewer service lines as directed by the City Inspector.

Initial test results shall be submitted to the Director(s) within twenty-four (24) hours of the test or on the next working day.

Private engineering or geotechnical firms shall perform compaction testing at the Contractor's expense. A qualified technician who works under the direct supervision of a Registered Professional Engineer shall perform this testing. Final soils compaction reports shall be prepared and signed by a Registered Professional Engineer who is registered in the State of Colorado, and who is qualified to prepare such reports. Reports shall be submitted to the Director(s) within one (1) week of the test.

360.00 RESTORATION AND CLEANUP

At all times during construction, the Contractor shall maintain the site, partially finished structures, material stockpiles and other like areas in a reasonable state of order and cleanliness.

The surface grade and condition of all un-surfaced areas shall be restored to the grade and condition immediately prior to construction. The Contractor shall restore or replace all sod, trees, shrubbery, sprinkler systems, fences, and any other items, to a condition equal to that before the work began and to the satisfaction of the Director(s). See Section 1030.00 Seeding Specifications regarding appropriate mix for specific areas.

All roadway surfacing, curbing, sidewalks, and gutters shall be restored or replaced to a condition equal to or better than before the work began and to the satisfaction of the Director(s). All roadway surfacing between the vertical surface cuts on each side of the excavation shall be removed and replaced with base course material and/or hot mix bituminous or concrete surfacing.

Pavement repair shall be completed as described in Section 143.00, Pavement Cuts, of these STANDARDS AND SPECIFICATIONS.

Before final acceptance, the project area, material pits, and ground occupied by the Contractor in connection with the work shall be cleaned of all rubbish, excess materials, temporary structures, and equipment, and all parts of the work shall be left in acceptable conditions to the satisfaction of the Director(s).

In the event of the Contractor's failure to perform the above work, the City at the expense of the Contractor may perform the work.