

PART III

EARTHWORK STANDARD SPECIFICATIONS

Chapter 1 – General

- 1.01 Authority. These Specifications are promulgated by the City of Cripple Creek. The interpretation, enforcement, and revision of these Specifications are hereby delegated to the Superintendent of the Water and Sewer Department.
- 1.02 Effective Date of Specification. These Specifications shall be in effect fifteen (15) calendar days after adoption by the city council and shall supersede all former standard specifications for earthwork within the City of Cripple Creek
- 1.03 Revisions, Amendments or Additions. These Specifications may be revised, amended or added to. Such revisions, amendments and additions shall be binding and in full force and effect when adopted in the manner set forth in Section 1.02.
- 1.04 Department Control. These Specifications will apply to the installation of water and wastewater facilities under the control of the City of Cripple Creek Water and Sewer Department.
- 1.05 Organization and Interpretation of Specifications. These Specifications are composed of written Standards of Engineering Practice, Material Specifications and Standard Drawings. The interpretation of any section or of differences between sections, when appropriate, shall be made by the Superintendent of the Water and Sewer Department and his/her interpretation shall be binding and controlling in its application.
- 1.06 Definitions. As used in these Specifications, or in any of the drawings where these Specifications govern, unless the context shall otherwise require, the following words defined shall have the meanings herein ascribed:
- a. Department or Water and Sewer Department. The department of the City of Cripple Creek that is responsible for the operation and maintenance of the water supply and wastewater collection systems.
 - b. Superintendent. The Superintendent of the Water and Sewer Department or his/her representative.

- c. Engineer. The Engineer or consultant of the Water and Sewer Department, acting either directly or through properly authorized agents, such agents acting within the scope of the particular duties entrusted to them.
- d. Collection or Distribution System. Sanitary sewer and potable water mains, together with all appurtenant and necessary valves, hydrants, taps, meters, service pipes, manholes and associated materials, property and equipment collecting sanitary sewer from or distributing potable water to individual customers.
- e. Pipe or Main. That portion of the water supply system which transmits and distributes water of the City from treatment or storage facilities to users and/or the sanitary sewage collection system which collects wastewater from the user extending to the wastewater treatment plant, excluding service lines.
- f. Service Line. The sanitary sewer or water line extending from the premises up to and including the connection to the collection or distribution main as appropriate.
- g. Contractor. In the context of these Specifications a person or persons, co-partnership or corporation employed by an applicant for the purpose of installing sanitary sewage collection or water system extensions or replacements.
- h. Inspector. The authorized representative of the Water and Sewer Department assigned to the project.
- i. Standard Drawing. Water and Sewer Department Standard Drawings are a part of these Specifications.

1.07 Abbreviations. All references to documents or specifications shall be the latest edition or revision thereof:

- a. ASTM American Society for Testing and Materials
- b. AWWA American Water Works Association
- c. ANSI American National Standards Institute
- d. NSF National Sanitation Foundation
- e. OSHA Occupational Safety and Health Act
- f. USGS United States Geological Survey
- g. CIP Cast Iron Pipe
- h. DIP Ductile Iron Pipe
- i. PVC Polyvinyl Chloride-Plastic Pipe
- j. psi Pounds per Square Inch
- k. PPM Parts per Million
- l. PRV Pressure Reducing Valve

EARTHWORK STANDARD SPECIFICATIONS

Chapter 2 – Trenching, Backfilling and Compacting

2.01 General Provisions

- a. Unless otherwise indicated on the drawings, all excavations shall be made by open cut. Provisions for installation of potable water and/or sanitary sewer pipeline and appurtenances in other than open cut conditions shall be specifically detailed in the drawings and contract documents for the project.
- b. The Contractor and/or Developer shall be responsible for obtaining all permits necessary to accomplish the work. This includes all permits by any local general purpose governing agency relative to excavation and construction within public right-of-way, permits required by state highway agencies, permits required by railroad and other utility agencies and permits required by the State of Colorado, Water Quality Control Division including necessary site approvals, if appropriate.
- c. All work to be accomplished shall be done under the review and inspection of City representatives. Notification to the city shall be made by the contractor and/or Developer indicating proposed schedules and times of work. Work accomplished without notification and review of the City's representatives may not be acceptable to the City. It shall be the responsibility of the Owner/Developer to adequately demonstrate to the City that all facilities have been constructed in accordance with the rules and regulations of the City.
- d. All rules and regulations of the City shall be applicable to all construction and operation of potable water and/or sanitary sewerage facilities within the boundaries of the City and those that are proposed for acceptance by annexation to the City. These rules and regulations shall be supplemented by all rules and regulations of the State of Colorado, Water Quality Control Division, in so far as they do not conflict with these rules and regulations. Any conflict shall be governed by an interpretation and ruling by the superintendent, whose decision shall be final.
- e. Earthwork shall include all clearing, grubbing, grading, excavation, fill, backfill, excess excavation, bedding material, borrow material, and surface restoration as may be required to complete the work.

2.02 Job Conditions.

a. Protection of Existing Facilities

(1) Surface Improvements

The Contractor shall protect from damage or restore to their original condition all surface improvements, encountered during trenching or construction. Said improvements shall include but not be limited to the following: surfacing; sidewalks; curbs; valley gutters; trees and shrubs; other surface vegetation; driveways; mailboxes; utilities; signs; or other improvements.

(2) Underground Utilities and Obstructions.

The Contractor shall protect from damage any underground pipes, utilities or structures encountered during construction. Restore any damaged underground obstruction to their original condition at no cost to the City unless evidence of other arrangements satisfactory to all parties is presented to the City.

Before commencing work, obtain information concerning location, type and extent of concealed existing utilities on the site and adjacent properties. Consult records and personnel of local utility companies, municipal utility department and telephone company. File Notice of Excavation with these agencies prior to commencing work.

(3) Underground obstructions known to exist, except service lines are to be shown on the drawings or otherwise referred to in the specification. The locations shown may prove to be inaccurate and other obstructions not shown may be encountered. In any case, it shall be the responsibility of the Contractor to protect or restore all underground obstructions encountered.

b. Sheeting, Shoring, and Bracing. Except where trench banks are cut back on a stable slope, provide and maintain all sheeting necessary to protect adjoining grades and structures from caving, sliding, erosion or other damage and suitable forms of protection against bodily injury all in accordance with applicable codes and governing authorities. Comply with the most recent standards adopted by the Occupational Safety and Health Administration (OSHA). Do not remove any sheeting unless the pipe strength is sufficient to support the trench loads based on trench width measure to the back of sheeting. Remove sheeting and shoring as excavations are backfilled in a manner to protect the construction or other structures, utilities or property. Do not remove any sheeting after backfilling.

- c. Blasting. In general, blasting will be allowed in order to expedite the work if a permit by the local authority having jurisdiction is granted and a copy presented to the Department. All explosives and appurtenances shall be transported, handled, stored and used in accordance with the laws of the local, state and federal governments, as applicable.

All blasting shall be controlled so as not to injure any existing structure of facility. The protection of life and property and all liability for blasting shall be placed solely on the person or persons conducting the blasting operation. The hours of blasting shall be fixed by the Inspector in accordance with the permit of the local authority. Owners or occupants of nearby structures or facilities must be notified by the Contractor at least 72 hours in advance of blasting, in writing. The notice shall state the date, the time of blasting and who is responsible for the blasting. The Department shall be notified a minimum of 48 hours in advance of any blasting.

Blasting shall be controlled to avoid making any excavation unduly large or irregular and so as not to shatter the rock on the bottom or sides of any excavation or surface upon or against which concrete is to be placed. If, in the opinion of the Department, blasting is liable to damage rock foundations or supports, concrete, other utilities or structures, all blasting shall be terminated and excavation shall be continued by jackhammering, barring, wedging or other methods.

- d. Drainage. Maintain the excavations and site free from water throughout the work. Remove any water encountered in the trench to the extent necessary to provide firm subgrade, to permit joints to be made dry at the final grade and to prevent entrance of water into the pipeline. Accomplish the foregoing by the use of sumps and gravel blankets, well points, drain lines or other means approved by the City.
- e. Interruption of Service. Coordinate interruptions of utility services with the city or utility owner as appropriate. Make connections to the existing system requiring the interruption of service during the time designated by the City or utility owner.

Obtain permission to cut and replace existing service lines to facilitate trenching. Notify affected users a minimum of two hours in advance of, and restore service within four hours after any interruption. Repair all lines at not cost to the City unless otherwise provided for.

- f. Detours and Other Traffic Controls. When construction operations are located within streets make provisions at cross streets and walks for free passage of vehicles and pedestrians by bridging or other approved methods. Do not block streets or walks without prior approval.

Maintenance of access through the construction site by the traveling public shall be maintained by the contractor unless a street closure is approved in writing by the City or other governing authority. Access to all abutting residences and properties shall be maintained to the maximum extent possible. It shall be the responsibility of the Contractor and/or Developer to coordinate access to all adjacent private properties with the respective owners.

To protect persons from injury and to avoid property damage, adequate barricades, construction signs, safety flasher lights and guards as required shall be placed and maintained during the progress of the construction work and until it is safe for traffic to use the roadway. All material piles, equipment and pipe that may serve as obstructions to traffic shall be enclosed by fences or barricades and shall be protected by proper lights when the visibility is poor. All safety and traffic rules and regulations of local authorities shall be observed. All barricading and detours shall be coordinated as appropriate with the City of Cripple Creek, Teller County and/or the Colorado Department of Highways and shall be in accordance with their regulations. Controls shall be in accordance with the "Manual on Uniform Traffic Control Devices," latest edition.

Should the Department be contacted regarding a failure to properly barricade a construction area and the responsible Contractor cannot be contacted, the Department shall set the necessary barricade at the Contractor's expense.

The Contractor shall carry on the work in a manner that will cause the least interruption in traffic and may close to through travel, not more than two (2) consecutive blocks, including the cross street intersected when so approved by the City. Where traffic must cross open trenches, the Contractor shall provide suitable bridges at street intersections and driveways. The Contractor shall post, where directed by the Department, suitable signs indicating that a street or a portion of a street is closed and necessary detour signs for the proper maintenance of traffic.

- g. Sequencing. Pipeline installation shall follow trench excavation within 50 lineal feet. Trench backfill shall follow pipe installation within 50 lineal feet. Approved cleanup shall follow trench excavation with 200 linear feet.

2.03 Guarantee

- a. The Contractor and/or Developer shall guarantee all materials and workmanship for a period of one year from the date of initial acceptance by the City. Initial acceptance shall be made by the City's official written confirmation of acceptance.
- b. The guarantee shall include the maintenance of acceptable trench backfill for a period of one year from initial acceptance. Acceptable trench backfill shall include maintenance of an acceptable surface configuration matching surrounding grade or conforming to the finished street cross section. Removal and replacement of finished street surfacing due to excessive settlement shall be the responsibility of the Contractor and/or Developer within the one-year warranty period.

2.04 Products

- a. Embedment Materials. All water and sanitary sewer mains are to receive one of the following embedment materials extending from the bottom of the excavation to 12 inches over the pipeline.
 - (1) Concrete. The pipeline embedment with concrete shall utilize concrete having a 28-day compressive strength of a minimum of 3000 psi and other characteristics as set forth in these Specifications.
 - (2) Granular Material. Well-graded, crushed stone or gravel meeting the requirements of ASTM C33, Gradation 67 (3/4" to No. 4).
 - (3) Fine Granular Material. Natural or manufactured sand meeting the following requirements:

Well-Graded Sand

Sieve Size	Total Percent Passing by Weight
3/8 inch	100
No. 4	95 – 100
No. 8	80 – 100
No. 16	50 - 85
No. 30	25 – 60
No. 100	2 – 10

(4) Squeege Sand.

Sieve Size	Total Percent Passing by Weight
3/8 inch	100
No. 200	0 – 5

(5) Selected Backfill. Selected oil free from rock, clods or stones greater than 1-1/2" in any dimension as approved by the City's representative. Granular material, fine granular material or squeege sand may be substituted for selected backfill.

b. Backfill Materials

(1) Suitable Material. Soil obtained from the excavation that is free of frozen material, stumps, roots, brush, other organic matter, debris and other items. In addition, suitable material shall meet the following requirements.

(2) Upper Portion of Trench. Material placed within one (1) foot of pavement subgrade or finished surface in unimproved areas shall be free from rocks, greater than 6 inches in nominal diameter.

(3) Other Portions of Trench. Material within 6 inches below and 12 inches above the pipe shall contain particles of a size to conform to the embedment class required but in no case shall it contain rocks greater than 1-1/2 inches in any dimension. From a point 12 inches above the pipeline to within one (1) foot of the pavement subgrade or finished surface in unimproved areas, maximum size of any rock in the trench backfill shall be 18 inches nominal diameter.

(4) Public Highways. Provide and install material in conformance with the Colorado Department of Highways requirements where they do not conflict with other provisions of these regulations. Should a conflict exist, submit a request for clarification to the City in writing prior to proceeding with work.

2.05 Preparation of Trenching.

a. Construction Staking. All work shall be constructed in accordance with lines and grades shown on the drawings and as established by the Engineer-of-Record and/or City. These lines and grades may be modified by the Engineer-of-Record only after re-approval by the City.

Water facilities shall be staked in accordance with Part I, Chapter 2, Sections 20.9, 2.10 and 2.11. Sanitary sewer facilities shall be staked as follows.

Line and grade stakes shall be set for each manhole or other appurtenance and at each 25-foot station along the pipeline. When laser beam equipment is being utilized for alignment of the pipeline, construction stakes shall be set at each manhole and 25 feet, 50 feet and 75 feet and each 100 feet thereafter proceeding upstream from the manhole. The Contractor shall check the elevation at each grade stake and at intervals between stakes from a string line placed between the grade stakes. Should a variance from the design elevation be found, the pipeline shall be removed to a point where vertical and horizontal alignment is satisfactory and reconstructed in accordance with these specifications.

All facilities, equipment and assistance shall be furnished by the contractor and/or Developer to facilitate checking alignment and grade of the pipe by the City's representative and workmen involved in the construction.

- b. Pavement Removal. Before trenching begins, remove any pavement, curbs, gutters, sidewalks and other surface improvements necessary to install the pipeline and appurtenances.

Remove bituminous pavement to clean, straight lines at locations necessary to accommodate the work. Width of removal for pipelines shall be kept to a minimum as dictated by trenching operations but shall extend 6 inches to 12 inches beyond limits of trench excavation. Make pavement cuts with spade-bitted air hammer, saw or other approved method so to provide a straight and square edge. Should a cut edge become damaged during the course of construction, the edge will be re-cut prior to placement of surfacing material.

Remove concrete surfacing materials to neatly sawed edges with sawcuts made to a minimum depth of 1-1/2 inches or as otherwise required to neatly remove surfacing materials.

Make sawcuts in straight lines and at right angles to the alignment of sidewalks or curb and gutter. If the sawcut should fall within 30 inches of an existing construction joint, expansion joint or edge, the concrete shall be removed to the joint or edge.

- c. Clearing. Remove all stumps, roots, brush, other vegetation and debris from areas that will be disturbed by the construction operations.
- d. Sod Removal. In lawn areas, cut and roll back sod before trenching. Store sod for reinstallation after completion of backfilling operations.

- e. Topsoiling. Strip existing topsoil from areas to be disturbed by construction operations. Stockpile in areas designated by the Engineer-of-Record. Keep topsoil segregated from non-organic trench excavation materials and debris.

2.06 Excavation – Open Cut

- a. Caution is Excavation. The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground utilities and structures, both known and unknown, may be determined, and he/she shall be held responsible for the repair of such structures when broken or otherwise damaged because of carelessness on his/her part.
- b. Exploratory Excavation. Whenever, in the opinion of the Department, it is necessary to explore and excavate to determine the location of underground utilities and structures that may interfere with construction, the Contractor shall make the exploration and excavations for such purposes.
- c. Limitation of Disturbed Area. The area disturbed by construction activities shall be confined within the construction limits as shown on the plans. The length of trench to be opened at any one time shall be limited in accordance with the requirements of Part III, Section 3.02.g of these specifications.
- d. Drainage and Protection. The sides of the trench shall be sloped or braced and the trench drained so that workmen can work safely and efficiently. All work must be done in a dry trench and no water will be permitted to be discharged down the pipe previously laid. The discharge from pumping shall be laid to an approved natural drainage channel or other location to prevent drainage into the sanitary sewer facilities and damage to public or private property.

All pipe trenches or structure excavation shall be kept free from water during pipe laying and other related work. The method of dewatering shall provide for a completely dry foundation at the final lines and grades of the excavation.

Dewatering shall be accomplished by the use of well points, sump pumps, rock or gravel drains placed below subgrade foundations or subsurface pipe drains. All water shall be disposed of in a suitable manner without being a menace to public health or causing public inconvenience. No water shall be drained into other work being completed or under construction.

The dewatering operation shall continue until such time as it is safe to allow the water table to rise in the excavations. Pipe trenches shall contain enough backfill to prevent pipe flotation. When pipe is installed in a casing or tunnel longer than thirty (30) pipe diameters, the pipe inside and casing of tunnel shall be secured so flotation does not occur when the pipe is empty.

Water shall not be allowed to rise until any concrete has set and the forms have been removed. Water shall not be allowed to rise unequally against unsupported structural walls.

Pile material suitable for backfilling in an orderly manner a sufficient distance from banks of the trench to avoid overloading and prevent slides or cave-ins.

Remove and waste excavated materials not suitable or not required for backfilling from the site. All surplus excavation shall be removed from the job site and disposed of properly. If the surplus excavation is disposed of on private property, written permission shall be obtained from the owner of the property and a copy given to the Department Inspector.

- e. Excavation to Grade. Accurately grade trench bottoms to provide uniform bearing and support for each section of pipe on undisturbed soil at every point along its entire length. Provide a smooth uniform surface in the pipe subgrade where bedding material will be placed. If the subgrade material is over-excavated more than 2 inches, backfill shall be accomplished with compacted granular material in accordance with the bedding requirements.
- f. Limiting Trench Widths. Excavate trenches to provide adequate working space and pipe clearance for proper pipe installation, jointing and embedment. Provide a minimum clearance of 6 inches on each side of the pipe for a pipe 12 inches in diameter or less and 8 inches for pipe between 14 inches and 30 inches in diameter. The maximum allowable width of trench at one (1) foot above the top of the pipe shall not be greater than the outside diameter of the pipe plus 24 inches for all sizes.
- g. Bell Holes. Dig bell holes and depressions for joints after the trench bottom has been brought to final grade. Bell holes and depressions shall be only of such length, depth and width as required for properly making the particular type of joint. The use of earth mounds for bedding the pipe and adjusting for grade shall not be allowed.
- h. Preparation of Pipe Bearing Areas. Shape the pipe subgrade or bedding material to provide a continuous uniform bearing support at all points along its length except at required bell holes.
- i. Pipe Clearance in Rock. Where rock excavation is necessary, over excavate the trench bottom a minimum of 6 inches below the bottom of the pipe for pipe 24 inches in diameter or less and 9 inches for pipe larger than 24 inches. Backfill over depths with granular material specified.

- j. Excavation for Structures. Except as otherwise dictated by construction conditions, the excavation shall be of such dimensions as to allow for the proper installation and removal of concrete forms, or precast structures, and to permit the construction of the necessary pipe connections. Care shall be taken to insure that the excavation does not extend below established grades. If excavation is made below such grades, the resulting excess excavation shall be filled in with approved material deposited in horizontal layers not more than 6 inches in thickness, after being compacted, as directed by the Department.
- k. Unstable Pipe Subgrade. If the bottom of the excavation at subgrade is found to be soft or unstable or to include ashes, cinders, refuse, vegetation or other organic material, or large pieces or fragments of inorganic material that, in the opinion of the inspector, cannot satisfactorily support the pipe or structure, the contractor shall further excavate and remove such unsuitable material to the width and depth specified by the Inspector. Before the pipe or structure is installed, the subgrade shall be made as specified by the Department.

Where the bottom of the trench at subgrade is found to consist of material that is unstable to such a degree that, in the opinion of the Department, it cannot be removed and replaced with an approved material which will support the pipe or structure properly, the Contractor shall be required to construct a special foundation or support for the pipe or structure, consisting of pilings, timbers, or other materials, as specified by the Department.

2.07 Pipe Embedment

- a. Placement of Embedment Material. Embedment material shall be placed in the trench on prepared subgrade in accordance with the requirements of these specifications. The embedment material shall be brought to a density beneath the proposed pipeline as required herein. The embedment material shall be shaped to conform to a cylindrical surface with a radius equal to the radius of the outside of the pipe with a width sufficient to allow 60% of the width of the pipe barrel to be uniformly supported by the bedding. Bedding material shall then be placed in two lifts, each being compacted to the densities specified herein to a depth of 1 foot above the top of the pipe.

- b. Embedment Classes. (See Drawing 1 of Part II – applicable for all pipelines.)

Class A – Concrete Cradle of Arch.

(1) Concrete Cradle

The pipe shall be bedded in a monolithic cradle of plain or reinforced concrete as specified on drawings, having a minimum thickness of one-fourth the inside pipe diameter or a minimum of 4 inches under the barrel and extending up the sides for a height equal to one-fourth the outside diameter. The cradle shall have width at least equal to the outside diameter of the pipe barrel plus 8 inches. Backfill above the crown of the pipe shall be compacted carefully.

(2) Concrete Arch

The pipe shall be embedded in carefully compacted granular material having a minimum thickness of one-fourth the outside diameter between barrel and bottom of trench excavation and extending halfway up the sides of the pipe. The top half of the pipe shall be covered with reinforced concrete arch having a minimum thickness of one-fourth the inside diameter of the crown and having a minimum width equal to the outside pipe diameter plus 8 inches.

Class B – Granular Bedding.

Granular material for fine granular material selected based on trench conditions encountered. Place as described in Section 2.07.a and compact in accordance with trench backfill requirements. If select backfill is not readily available for the upper portion of the bedding requirement, granular material may be substituted.

Class C

Select backfill material placed as described in Section 2.07.a and compacted.

Class D – Impermissible bedding condition.

2.08 Trench Backfilling and Compacting

- a. Place backfilled material above embedment materials in a manner to prevent damage or misalignment of the pipeline. Place in lifts of a thickness necessary to acquire the specified backfill density or in conformance with other regulatory requirements. Backfilled material shall conform to the requirements of Part III-Section 2.04.b of these specifications.

- b. Backfill Density Requirements. Unless otherwise specified or required by local governing authority, all backfill should be placed in a manner to achieve the density specified below.

(1) State Highway

100 % of maximum in paved and shoulder areas
95% of maximum in all other areas

(2) Paved roadways, sidewalks and other areas to receive pavement

95% of maximum density for entire trench depth

(3) Gravel roadways

95% of maximum density for entire trench depth

(4) Sodded or lawn areas over a dedicated easement of right-of-way

90% of maximum density

(5) Zone 6" below to 12" above pipe

95% of maximum density for all pipelines

Where another governing agency having jurisdiction over work within a road right-of-way has specifications requiring a greater backfill density, the requirements of the more stringent specification shall apply.

- c. Method of Compaction. In general, backfill shall be mechanically compacted by means of tamping rollers, sheep foot rollers, pneumatic tire rollers, vibrating rollers and other mechanical tampers.

Compaction by jetting shall not be permitted unless material is of suitable granular material as determined by the City. In no case will compaction by jetting be permitted in state highways or paved or gravel roadways.

- 2.09 Backfill for Structures. Backfill and fill within 3 feet adjacent to all structures and for full height of the walls shall be selected non-swelling material. It shall be relatively impervious, well graded, and free from stones larger than 3 inches. Material may be job excavated, but selectivity will be required.

No backfilling will be allowed in freezing weather except by permission of the Department. No additional backfill will be allowed over any frozen material already in the trench.

All water required for backfill and compaction operations can be furnished from a designated fire hydrant near the project. The Contractor will be charged in accordance with the current cost for construction water. However, the Contractor will be responsible for furnishing all required personnel, valving, hose and other equipment needed to deliver the water to the desired location on the project. The Department will designate the fire hydrant to be used and must be notified when water is required.

2.10 Field Quality Control

- a. Density Testing and Control. Density testing as may be required by the City's representatives shall be the responsibility of the Contractor and/or Developer. Results of such density testing shall be reported directly to the City by the testing agency. All reports shall be submitted with the seal and signature of a registered professional engineer experienced in the testing of soil material.
- b. Soil Compaction Tests. Conduct in accordance with the requirements of ASTM C698-70 or AASHTO T99, "Standard Method of Test for Moisture Density Relations of Soils Using a 5.5 lb. Rammer and a 12 inch Drop." Use method A, B, C or D as appropriate on soil condition and judgment of the testing laboratory. Samples tested shall be representative of materials to be placed (or altered). Obtain optimum moisture density curve for each type of material or combination of materials encountered or utilized. Use test results as a basis for compaction control. Testing includes Atterberg Limits, grain size determination and specific gravity.

Density Control

Conduct tests for density control during compaction operations in accordance with the requirements of:

ASTM D2922 – Tests for Density of Soil and Soil – Aggregate In-Place by Nuclear Methods

ASTM D1556 – Tests for Density of Soil and Soil-Aggregate In-Place by the Sand Cone Method

OR

ASTM C2167 – Test for Density of Soil In-Place by the Rubber-Balloon Method

- c. Test Frequency. The City representative shall determine the location of all density testing to be accomplished. As a minimum, three tests at three (3) different levels for every 1,000 lineal feet of trench shall be performed. The tests shall be taken approximately one foot above the pipe, mid-trench depth and within the top one foot of the trench. The Contractor and /or Developer shall excavate backfilled material to the depths directed by the City representative to accommodate the testing and backfill test holes in accordance with these regulations.

- 2.11 Surface Restoration. Fine grade all areas disturbed by the construction operations after completion of backfilling and compacting. Areas that are to receive pavements, surfacing, topsoil or landscaping shall be graded as required to allow installation of the specific surface treatment. Grade all other areas to match the existing ground line.

Replace suitable topsoil to the depth of stripping over all areas disturbed by the construction that do not receive other surface treatment. Do not compact topsoil during stripping, stockpiling or placing.

The Contractor shall restore all pavement, sidewalks, curbing, gutters or other surface structure removed or disturbed as part of the work to a condition meeting the standards of the governing agency, and shall furnish all incidental labor and materials. No permanent pavement shall be restored until, in the opinion of the Department or agency having control, the condition of backfill is such as to properly support the pavement.

If any pavement, street, shrubbery, sod, rock, fences, poles or other property and surface structures have been damaged, removed or disturbed by the Contractor, whether deliberately or through failure to carry out the requirements of the controlling agency or the specific directions of the Department, or through failure to employ usual and reasonable safeguards, such property and surface structures shall be replaced or repaired, to the satisfaction of the owner, at the expense of the Contractor.

- 2.12 Surface Improvement Repair and Restoration. Replace and repair any surface improvements damaged or removed. Meet the requirements specified for the particular type of improvements to be repaired or replaced. All surface improvements shall meet the requirements of the local governing agency and/or the requirements shown on the contract drawings as approved by the City.

2.13 Cleanup. Upon completion of the work, all rubbish, unused materials, concrete forms and other like materials shall be removed from the jobsite. All excess excavation shall be disposed of as specified and the areas shall be left in a state of order and cleanliness.