THE CITY OF THORNTON
9500 CIVIC CENTER DRIVE
THORNTON, COLORADO 80229-4326

Project Manual
For
Construction of

THORNTON ACTIVE ADULT CENTER
NORTHWEST LANDSCAPE IMPROVEMENTS

PROJECT NO. 17-68B

100% CONSTRUCTION DOCUMENTS
SEPTEMBER 22, 2023

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SECTION 01 5639

TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This section consists of retention and protection of trees during the construction of the project.

1.2 REFERENCE STANDARDS AND GUIDELINES

A. Contractor shall comply with applicable requirements and recommendations of the most current versions of the following standards and guidelines. Where these conflict with other specified requirements, the more restrictive requirements shall govern.
   1. ANSI Z133.1-2006: American National Standard for Tree Care Operations.
   2. ANSI A300: Tree, Shrub, and Other Woody Plant Management – Standard Practices.
   3. Guide for Plant Appraisal – Current Edition: Authored by the Council of Tree and Landscape Appraisers; published by the International Society of Arboriculture.

1.3 GENERAL REQUIREMENTS

A. Appropriate tree pruning and/or removal permits must be secured prior to beginning work.

B. Owner will conduct daily observation of Contractor's field crews the during the critical phases of the project, for example: demolition of existing concrete, root pruning, construction of retaining walls, and construction of new curb or sidewalk in tree protection areas. Owner may require a consulting arborist be hired to oversee the project. Contractor to notify Owner at least two (2) weeks prior to when such observations will be needed.

C. If it appears that the completion of the construction may cause damage to the branches of any tree, the Contractor shall contact the Owner's Office. The Owner will make a determination as to whether such damage is imminent.

D. To prevent or minimize soil compaction, designated routes for equipment and foot traffic by work crews shall be determined prior to commencing construction activities, and shall be indicated in the tree protection plan to be submitted by Contractor to the Owner. These routes shall be marked at the site, prior to commencement of construction, with tree protection fencing and signage as specified in Articles 3.6 and 3.7 of this section. A Tree Protection Plan shall be submitted to the Owner for approval.

E. Motorized equipment and trailers, including tractors, bobcats, bulldozers, rubber tired excavators, tracked excavators, trucks, cars, and carts shall not be allowed access within tree protection areas. Should access be necessary within designated tree protection areas, the existing grade shall be covered with twelve inches (12") of wood mulch with overlapping three quarter inch (3/4") thick plywood on top to help distribute the weight of equipment and to minimize soil compaction and rutting. Plywood and/or mulch are not acceptable bridging materials for driving over exposed tree roots. Exposed tree roots shall not be driven over. The Owner shall be notified and shall approve of the access and driving surface prior to its use.

F. Materials and supplies shall not be stockpiled or stored within the tree protection area. Should temporary storage be necessary within designated tree protection areas, the existing grade shall be covered with twelve inches (12") of wood mulch with overlapping three quarter inch (3/4") thick plywood on top to help distribute the weight of equipment and to minimize soil compaction and rutting. Plywood and/or mulch are not acceptable bridging materials for driving over exposed tree roots.

G. Under no circumstances shall any objects or materials be leaned against or supported by a tree's trunk, branches, or exposed roots. The attachment or installation to trees of any sign, cable, wire, nail, swing,

or any other material that is not needed to help support the natural structure of the tree is prohibited. Standard arboricultural techniques such as bracing or cabling that are performed by professional arborists are acceptable upon approval by the Owner.

1.4 DEFINITIONS

A. Critical Root Zone: Shall be defined as the tree protection area encompassing one and one half (1.5) minimum to two (2) times the distance between the trunk and drip line.

B. Trunk Size:

Trunk Size	Where Measured
< 4”	6” above grade
4” – 8”	12” above grade
> 8”	54” above grade

Note: All measurements should be rounded up to the nearest inch.

C. Drip Line: The outermost edge of the tree’s canopy or branch spread. The area within a tree’s drip line is all the ground under the total branch spread.

D. High Value Shrub: Any specimen shrub with an appraised value of one-hundred dollars ($100.00) or more.

E. Project Consulting Arborist: An independent consultant with a degree in a horticulture, arboriculture, and/or ISA Certified Arborist, and at least five years field experience in tree preservation or on-site monitoring of public works or construction projects involving tree retention and protection. The Consultant should be an active member in the American Society of Consulting Arborists and/or International Society of Arboriculture.

F. Tree Protection Area: The tree protection area should consist of the ground encompassing from one and one half (1.5) minimum to two (2) times the distance between the trunk and drip line, or one linear foot away from the trunk base for every inch diameter of the trunk, whichever is greater (see definition of drip line, above). Areas of ground covered by pavement, buildings, or other permanent structures where the presence of roots is minimal or negligible are excluded. The area under or within the tree’s drip line is also referred to as the “Critical Root Zone” (see definition of critical root zone, above).
   1. With groups of trees or where an array effect is present, there may be discontinuous (non-overlapping) perimeters of tree protection areas, which result in difficult to maintain or ineffective tree protection fencing. In these cases, even though tree protection areas do not overlap, they should be treated as though they do if the distance between the perimeters of such areas is less than thirty (30)-feet. In effect, this will artificially enlarge the area of tree protection, but will result in a more clearly defined, manageable area.

1.5 SUBMITTALS

A. See Section 01 3000 – Administrative Requirements, for submittal procedures.

B. Tree Protection Plan: Submit tree protection plan for approval by the Owner.

C. Proposed methods and schedule for effectuating tree and other plant protection shall be submitted for approval. Contractor shall submit construction schedule which includes a time frame for work near existing plants. Approval of such shall be obtained from the Owner prior to commencement of construction near tree protection areas.

D. Proposed methods, materials, and schedule for root pruning, branch pruning, and other tree maintenance shall be submitted for approval.
   1. The Owner shall mark the location of root pruning lines in the field prior to the operation.
   2. If possible, root pruning should occur between autumnal leaf fall and spring foliation.
   3. Root pruning during the growing season shall require approval of the Owner.

E. Maintenance Schedule: Submit maintenance schedule to Owner for approval.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 CONSTRUCTION REQUIREMENTS

A. This section provides standards and guidelines for the retention and protection of trees and high-value shrubs for any proposed construction project.

3.2 DEMOLITION OF EXISTING CONCRETE

A. Caution should be used during removal of existing street, curb, gutter, sidewalk, drain inlets, and other concrete and asphalt demolition, to minimize injury to tree root systems. The following procedures should be used when removing existing concrete.

B. Breaking of the existing concrete and asphalt for removal should be done in a manner that will minimize ground disturbance and vibration.

C. Curbs and sidewalks within designated tree protection areas and critical root zones shall be removed by hand. When removing existing sidewalks and curbs, care should be taken to avoid injury to roots located under, over, or adjacent to paved surfaces.

D. Roots and root-trunk flares growing over curbs should not be injured during breaking of curbs and removal of debris. Wood and bark tissues shall not be injured by striking tissues with equipment.

E. During the removal of concrete, all root systems and soil areas exposed shall not be disturbed.

F. Motorized equipment and trailers, including but not limited to tractors, skid steers, bulldozers, rubber tired excavators, tracked excavators, trucks, cars, and carts are to be limited to access on the existing paved street only. Access is not allowed behind the curb within tree protection areas.

G. Should access be necessary within designated tree protection areas, the existing grade shall be covered with double, overlapping sheets of 3/4-inch thick plywood and twelve inches (12”) of wood mulch to help distribute the weight of equipment and to minimize soil compaction and rutting.
   1. Plywood and/or mulch are not acceptable bridging materials for driving over exposed tree roots. Exposed tree roots shall not be driven over.
   2. The Owner or Project Consulting Arborist shall be notified and shall approve of the access and driving surface prior to its use.

3.3 CONSTRUCTION OF SIDEWALKS, CURBS, CONCRETE, ASPHALT PAVING, AND DRAINAGE INLETS

A. The following procedures shall be used when constructing sidewalks, curbs, concrete, asphalt paving, and drainage inlets.
   1. Keep all materials and equipment within the street bounded by existing curbs.
   2. Protect exposed roots from contamination by stabilization materials and concrete.
   3. Locate concrete washout areas away from roots and tree protection areas.
   4. When excavating for the construction of inlets, excavated soil shall be deposited in trucks and hauled off or deposited temporarily on three quarter inch (3/4”) thick plywood outside the critical root zone. Excavated and fill soil shall not be deposited, even temporarily, on unprotected natural grade.
   5. After proper pruning, as needed, cover exposed roots within thirty (30) minutes to minimize desiccation. Roots may be covered with soil, mulch, or moistened burlap (7 ounce or equivalent), and shall be kept moist during the period until the final grade is established.

6. Where possible, construction should be relocated to prevent damage to existing roots. Where relocation of walks is not possible, walks should be constructed in a manner with the least amount of impact/damage to roots including but not limited to raised, narrowed, curbed, ramped, bridged, cantilevered, use of pylons, root break out zones, root channeling, structural cells to prevent cutting and removing major roots (e.g. roots greater than two inches in diameter).
7. Place a sheet of 6-mil or thicker plastic over the grade within affected portions of tree protection areas prior to placing concrete sidewalks, curbs, inlets, ramps, and driveway approaches. The plastic will assist in providing a non-leaching barrier between the concrete, soil and roots.
8. Construct new sidewalks on, or above, the existing grade instead of excavating into root zones. The new grade shall not interfere with sheet-flow drainage.
9. Grading within the critical root zone shall consist of the ground encompassing from one and one half (1.5) minimum to two (2) times the distance between the trunk and drip line, or one linear foot away from the trunk base for every inch diameter of the trunk, whichever is greater. Grading within the critical root zone shall be performed by hand. Any fill material that needs to be placed in the critical root zone shall be limited to a maximum of one inch (1") of fill material over the critical root zone area. Fill should consist of sandy loam topsoil. Clay soils shall not be used as fill. When using fill soil, the existing surface to receive fill should be scarified by hand to a maximum depth of one inch (1") from the finished grade prior to placing fill material, to ensure proper incorporation of fill material. Any filling operation should not occur during water saturated soil conditions.
10. Existing soil may be used as a form for back of curb and gutter, with or without the use of a thin masonite-type form, although a Masonite form is preferred. This will minimize excavation in the critical root zone and prevent undue injury to the roots. This method is unnecessary in areas outside the critical root zone. Place a layer of "Typar BioBarrier" between the curb and tree roots to help inhibit root growth that may exploit small cracks in the curb. Where appropriate, use curbs with discontinuous footings to maintain natural grade near the base of trees adjacent to the curbing, and to minimize injury to roots and root flares.
11. Provide for easy concrete removal and replacement where an obvious raised root may cause sidewalk cracking in the future. This can be accomplished by installing an expansion joint on either side of the root or by scoring (as shown on the documents) the concrete on either side of the root to allow that particular section to be broken out and replaced. Compaction rating for the replacement walkway should not exceed eighty percent (80%) Proctor density. Tree roots will continue to slowly add girth every year; therefore, the base material needs to be malleable (e.g. suitable subgrade aggregates, crushed granite, or compacted sand) to prevent a fulcrum or pressure point which can crack or heave the walkway.
12. Where appropriate, and under the direction of the Owner, root restricting barriers can be installed with a minimal amount of disturbance away from sidewalks, curbs and streets. Materials include:
    a. Eight (8) Mesh Copper (0.028-inch or greater) wire screen.
    b. "Typar BioBarrier" as manufactured by Fiberweb, Inc. www.biobarrier.com. Contact Dave Zill, (651)330-2920.
    c. Or acceptable substitution.

13. In areas where roots have to be removed for construction of drain inlets, roots shall be severed prior to excavation to eliminate unnecessary tearing of roots by equipment, refer to Article 3.5 - Root Pruning.
    a. Excavate soil by hand at the construction cut limit to a depth of thirty (30) inches or to the depth of the required root cut, whichever is less.
    b. Prune roots as specified.
    c. Protect exposed roots as specified.

14. Concrete or chemicals spilled within tree protection areas should be completely removed. Contamination soil shall be completely removed at the time of the spill and removed by hand and/or air spade tool without disturbance to root systems. Appropriate soil should be added as necessary to restore the grade. Contact the Owner immediately in the event of a spill within a tree protection area.

3.4 IRRIGATION OR UTILITY INSTALLATION

A. Protection of Trees and High Value Shrubs: Contractor shall protect all trees and high-value shrubs from injury due to irrigation related work. All injuries to trees and high-value shrubs shall be mitigated to the

satisfaction of the Owner, and, if appropriate in accordance with guidelines established in the "Guide for Plant Appraisal". All costs of such mitigating shall be charged to and paid by the Contractor. See Article 3.9 – Injuries to Existing Plants – Damage Penalties of this section for definition of high value trees and shrubs.

1. All irrigation lines shall be indicated on construction plans and pre-approved by the Owner. No irrigation lines shall be located within ten feet (10') of any existing tree trunk, without prior approval of Owner.

B. Existing Trees: The Owner shall be notified prior to any trenching or excavation known or suspected to disturb more than ten percent (10%) of the critical root zone.

C. Where it is necessary to excavate within the critical root zone of existing trees, the Contractor shall use all possible care to avoid injury to trees and tree roots. Where more than ten percent (10%) of the critical root zone area is to be disturbed the Contractor shall notify the Owner to review the conditions. Final approval must be provided by Owner prior to excavation work. In areas where tunneling or boring are to occur all exposed roots shall be covered with moistened burlap to prevent drying of roots.

D. When trenching or excavation within the critical root zone is to occur care shall be taken not to disturb roots contained within the structural root plate of the tree. The structural root plate shall be determined based on the following guidelines:

Tree Diameter (in inches)	**Structural Root Plate (in feet)**
< 5	3
5	3.75
10	6
15	7.5
20	9
25	10
> 30	12

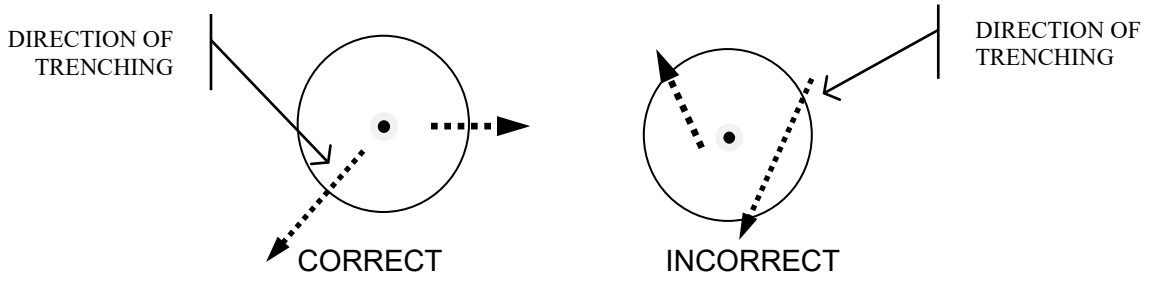
If trenching or excavation is to occur the following procedures shall apply:

1. If excavation, trenching or utility installation only occurs on one side of the tree or within a six inch (6") linear distance from the trunk base for every one inch (1") of trunk diameter, horizontal directional boring (auger tunneling), shall be used for irrigation or utility line installations.
2. If excavation, trenching or utility installation will occur on two or more sides of a tree (e.g. N,S,E, or W) or is within one foot (1') linear distance from the trunk base for every one inch (1") of trunk diameter, then horizontal directional boring (auger tunneling) shall be used.

E. All trenching or other work within the drip line of any tree shall be done by hand or other methods approved by the Owner, which will prevent breakage or other injury to branches and roots.

F. Wherever a trenching machine exposes roots extending through the trench wall, those roots shall be hand pruned immediately, refer to Article 3.5 - Root Pruning. All trenches within critical root zones shall be closed within twelve (12)-hours; if this is not possible, the trench walls shall be covered with burlap and kept moistened. Prior to backfilling, the Contractor shall contact the Owner to inspect the condition and treatment of roots injured by trenching.

G. Trenching within critical Root Zone shall be done perpendicular to the radial center of the tree and not through the critical root zone.



3.5 ROOT PRUNING

A. Tree roots shall not be pruned or cut unless their removal is unavoidable or absolutely necessary. The Owner shall be notified prior to any operation known or suspected to involve cutting of more than:
   1. The Owner shall be notified immediately in the event that roots in excess of one-half the diameter of the tree, as measured per Paragraph 3.4.D, are cut, torn, ripped, or otherwise injured.

B. Upon approval by the Owner, prior to any excavation, removal of sidewalk, or other activity that will result in removal of soil and tree roots, all tree roots within a designated area will be pruned to a depth of fourteen inches (14”). Pruning shall occur with a Dosko Root Pruner, or equivalent, in accessible areas, and by hand in areas inaccessible to the root pruning machine. All other root pruning shall be done by hand with approved tools.

C. Removal of roots greater than one-half the diameter of the tree, as measured per Paragraph 3.4.D, or parts of roots that are injured or diseased should be performed as follows:
   1. Preserve the root bark ridge (similar in structure and function to a branch bark ridge). Directional root pruning technique shall be used during hand excavation around tree roots. Roots are similar to branches in their response to pruning practices. With directional root pruning, objectionable and severely injured roots are properly cut to a lateral root one third (1/3) the size of the root being cut, if possible, that is growing downward or in a favorable direction.
   2. All roots needing to be pruned or removed shall be cut cleanly with sharp hand tools, with oversight by the Owner. No wound dressings shall be used.
   3. Recommended root pruning tools:
      a. Scissor-type lopper.
      b. Scissor-type pruner.
      c. Large and small hand saws.
      d. Wound scriber.

D. Root Pruning Near Sidewalks:
   1. Root pruning should be done carefully, by hand, to achieve the objective of reducing future sidewalk problems as well as preserving the trees. Removing anchoring roots or causing injuries in anchoring roots and root flares can cause future decay and potential hazards. Indiscriminate cutting of vigorous roots results in their regeneration so that several more new roots may grow from the cut end, back under the sidewalk, thereby reducing the time between sidewalk repairs. Roots can be managed in the ground without significant harm to trees, if care is taken to avoid injuries that lead to root and trunk decay.
   2. Directional root pruning is recommended because it considers the tree’s response to root pruning and decay. With directional root pruning, roots are cut to a lateral one third (1/3) the size of the root being cut, if possible, that is growing downward or in a more favorable direction. The pruned root ends will be less likely to regenerate, since a large lateral can assume the new terminal role of the root.
   3. Proper removal of selected roots or parts of roots can direct roots away from sidewalks in the future. Procedures for root pruning directly next to sidewalks are as follows:
      a. Hand-dig a trench six (6)- to eight (8)-inches in depth at the edge of the planting strip and sidewalk.
      b. Remove all roots less than 2-inches in diameter in this trench back to a desirable lateral root, preserving the root bark ridge. If careful excavation does not reveal a desirable lateral root

within twelve inches (12”) of the exposed root in question, then the exposed root shall be pruned properly so that a minimal amount of root is removed.

c. Small root bundles, the source of future sidewalk problems, should also be removed at this time.

E. All roots one-half the diameter of the tree caliper as measured per Paragraph 3.4.D shall be examined by the Owner in terms of their role in anchoring the tree.

1. All roots that contribute significantly to anchorage should be preserved. Remove all other roots in this size range to sound, downward growing lateral roots that are at least one third (1/3) the size of the root being removed.
2. All roots larger than one-half the diameter of the tree caliper as measured per Paragraph 3.4.D diameter are to be preserved unless their removal is absolutely necessary and approved by the Owner. Preservation of large roots may require:
   a. Reducing the sidewalk width near the root flare and/or
   b. Curving or relocating walk around root/root flare.
   c. Ramping or bridging the sidewalk over the roots to allow for root growth.
   d. Use of cantilever/pylon technology.
   e. Establish root break out zones.
   f. Root channeling.
   g. Structural cells.

F. Tree Guying Subsequent to Root Pruning: Upon review of on-site root pruning and constructing grading limits, the Owner shall determine if existing trees subject to root pruning should be guyed or otherwise stabilized. Contractor shall retain a qualified tree service company to complete tree guying and stabilization in accordance with Tree Care Industry Association standards. .

3.6 TREE PROTECTION FENCING

A. Tree protection fencing should be installed 1-foot behind the existing curb in areas where the street surface will be removed and replaced. Tree protection areas shall be designated on construction documents, and fencing locations should be staked for approval by the Owner.

B. Tree protection fences should be constructed of one of the following:

1. Galvanized Chain-link – Six feet (6’) in height. Posts should be installed no less than ten feet (10’) on center, at a depth of thirty six inches (36”) minimum. Installation of post shall not result in injury to tree surface roots; root flares or branches.
2. Colored (orange), molded plastic construction fencing-four forty eight inches (48”) in height.

C. Fencing should be installed to completely surround the limits of tree protection areas, and should extend at least ten feet (10’) beyond the designated construction limits.

D. Tree protection fencing shall be installed prior to any site activity and shall remain until its removal is authorized by the Owner.

3.7 PROJECT SITE MONITORING

A. As determined by the Owner for projects of sufficient size to warrant such, a Project Consulting Arborist shall be retained to enforce and monitor the Tree Retention and Protection objectives.

1. The project site should be monitored a minimum of two (2) times weekly (more frequently at the start of the project) until all procedures and specifications are understood and properly executed by all parties.
2. Specific monitoring schedules should be developed at preconstruction meetings and modified as deemed necessary by the appropriate parties.
3. Schedules shall be relayed to the Owner along with reports of site visits.

3.8 INJURIES TO EXISTING PLANTS - DAMAGE PENALTIES

A. Contractor to coordinate with City Forester on trees to be removed and tree loss to be mitigated.

B. Tree and High-Value Shrub Appraisal: All trees and high-value shrubs will be evaluated and appraised by the Owner, and a list of all tree values for the project will be on file in the Contractor's office.
   1. Any tree or other plant requiring retention or protection that is not on the list shall be appraised by the Owner as necessary to comply with this damage penalty.

C. Documentation for appraisals will consist of:
   1. Measurement of plant size.
   2. Identification by common and botanical names.
   3. Current condition (overall health, injuries, overt hazard status, etc.).
   4. Location factors as described in the most current addition of "Guide for Plant Appraisal". Photographs may be taken of certain trees and shrubs to document debilitating condition factors.

D. The threshold level for plants to be appraised shall be one-hundred dollars ($100.00); only those trees and shrubs estimated to have a monetary value greater than one-hundred dollars ($100.00) shall be appraised.

E. Trees and other plants designated as requiring retention or protection shall be identified and located on construction plans. Loss of, or partial injury to, any of these plants due to Contractor neglect or improper construction activities will result in a penalty of up to three times the appraised value of the tree as determined by the Owner.

F. Trees determined as requiring "general protection" or "special protection" in the construction areas and in other key locations should be clearly identified by the Owner. Loss or partial injury to any of these trees due to Contractor neglect or improper construction activities will result in a penalty of up to three times the appraised value of the trees as determined by the Owner. Injury to a portion of these trees will be assessed by the Owner and a corresponding portion of the damages will be assessed to the Contractor.

G. A fine of one-thousand dollars ($1,000.00) will be levied against the Contractor for each incident of construction damage (including construction traffic) within designated tree protection areas. Any fine shall be independent of any applicable damages for the appraised value of the tree or tree part.

H. Trees or roots visibly and unnecessarily injured, in the opinion of the Owner will cause the City to withhold from the Contractor an assessed amount conforming to the requirements stipulated above, for a period of one full year. After that period the impact of the injury to any tree will be assessed by the Owner.

END OF SECTION

SECTION 01 5713

TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 RELATED WORK

A. Additional information concerning temporary erosion and sedimentation control may be found in the City of Thornton construction standards. In case of conflict between the drawings, jurisdictional criteria and the information specified herein, the more stringent requirements shall govern.

B. Additional information concerning temporary erosion and sedimentation control may be found in the Storm Water Management Plan (SWMP) by Martin/Martin, Inc.

C. Additional information concerning temporary erosion and sedimentation control may be found in the Urban Drainage Criteria Manual, Volume 3 published by the Urban Drainage Flood Control District.

1.02 SUMMARY

A. Work Included. Furnish, install, maintain, and remove temporary erosion and sedimentation controls as shown on the drawings or specified herein, or as required to complete the work. Provide documentation as required by City of Thornton and/or LEED requirements as applicable.

B. Permits and Fees: Obtain and pay for all permits and fees required for the work of this section, including erosion and sediment control and water quality permits required by the authority having jurisdiction and the Colorado Department of Public Health and Environment, Water Quality Control Division.

C. Erosion Control: The Erosion and Sedimentation Control Drawings included in the Contract Documents is the minimum requirement to be implemented. Provide additional control as necessary to meet applicable local State and Federal criteria, as applicable, City of Thornton and engineer requirements.

1.03 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Unclassified Excavation: Removal of all material of whatever character required for the work encountered above subgrade elevations and to lines and dimensions indicated, including boulders.

C. Fill: Fill is all material placed to raise the grade of the site or to backfill excavation, upon which the Soils Engineer has made sufficient tests and observations to enable him to issue a written statement that, in his opinion, the fill has been placed and compacted in accordance with the requirements of these specifications.

D. BMP: Best Management Practice. Erosion and sediment control devices, which may consist of silt fence, crates, filter fabric, riprap, etc.

E. SWMP: Storm Water Management Plan. Identifies BMPs, which are erosion and sediment control measures for the project.

F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

G. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

H. Utilities: Include on-site underground pipes, conduits, ducts, and cables, as well as underground services to buildings.

1.04 SUBMITTALS

A. See Section 01 3000 – Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's published descriptive literature and complete specifications for manufactured products specified herein and utilized on the project.
   1. Geotextiles.
   2. Erosion Control Fabric.

1.05 QUALITY ASSURANCE:

A. Regulatory Requirements: Comply with applicable local, State and Federal ordinances, rules and regulations concerning sedimentation control and storm water runoff.

B. Preconstruction Conference: Conduct conference at Project site as directed by Owner's Representative prior to start of construction. Contractor to comply with requirements, which may also be included in Division 1 Section "Project Management and Coordination."

1.06 PROJECT/SITE CONDITIONS

A. Existing Conditions: Verify all existing conditions affecting the work of this section prior to submitting bids or proposals. Additional compensation will not be allowed for revisions or modification of work resulting from failure to verify existing conditions.

1.07 WARRANTY

A. Temporary Erosion and Sediment Control measures shall be maintained until permanent measures are in place. All damaged, disturbed or devices filled with sediment, which may occur within the specified project warranty period, shall be corrected at no cost to the Owner. Any devices damaged by erosion or sediment shall be restored to their original condition by the Contractor, at no cost to the Owner.

PART 2 PRODUCTS

2.01 MATERIALS

A. Erosion and Sedimentation Control Materials: Provide one or more of the following materials, as shown on the plans or as applicable for site conditions:
   1. Sand bags.
   2. Silt fences.
   3. Rock riprap.
   4. Temporary seeding.
   5. Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh.
   6. Biodegradable twisted jute or spun-coir mesh, 0.92 lb/sy minimum, with 50 to 65 percent open area.
   7. Drainage geotextile.
   8. Impervious fill.
   9. Other materials proposed for use on-site.

PART 3 EXECUTION

3.01 PREPARATION

A. General:
   1. Determine the existing ground elevations, drainage patterns, and changes to such patterns during excavation in order to satisfactorily plan and provide materials for adequate erosion and sediment control devices.

3.02 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and rights-of-way according to requirements of authorities having jurisdiction.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

D. Secure grading permit from agency having jurisdiction prior to commencing grading operations.

3.03 EXAMINATION

A. Verification of Conditions: Examine areas and conditions under which the work of this section will be performed. Do not proceed with the work until unsatisfactory conditions have been corrected. Commencement of work implies acceptance of all areas and conditions.

3.04 INSTALLATION

A. Erosion and Sedimentation Control Devices. Erosion and sedimentation control measures to be taken during construction include, but are not necessarily limited to the following:
   1. Apply soil stabilization within 14 days to all disturbed areas that are to be dormant for a period longer than 30 calendar days after reaching grade. Stabilize soil with mulch anchored per criteria of authorities having jurisdiction. Temporarily revegetate areas that will remain in an interim condition for more than three (3) months.
   2. Roads and parking areas indicated to be paved may be covered with an appropriate aggregate base course in lieu of mulch. Temporary mulching or aggregate base course is not required if final pavement construction will take place within 30 days after grading to final contours.
   3. Soils that will be stockpiled for more than 30 days must be mulched and seeded within 14 days after stockpile construction.
   4. Prevent sediment from leaving the project site by installing a silt fence or other BMPs as indicated on the plans. Protect existing storm inlets adjacent to the site by an approved gravel filter.
   5. Locate stone stabilization pads at all points of vehicular ingress and egress to the construction site.
   6. Provide temporary erosion controls consisting of berms at the top of slopes and interceptor ditches at ends of berms and at those locations which will eliminate or minimize erosion during construction, along with temporary seeding, temporary diversion, chutes, and down pipes and lining of water courses.
   7. Temporary sedimentation controls shall consist of silt dams, traps, silt fence, barriers, and appurtenances at the top of spoil and borrow area slopes and where runoff water exits the site.
   8. Maintain the available silt holding capacity of silt dams, fence traps and barriers until no longer needed. The sediment capacity of sediment retainage areas shall be at a minimum, the capacity shown on the plans in conformance with Urban Drainage Criteria Manual, Volume 3. Prior to removal, obtain concurrence of the Owner and Engineer.
   9. Remove accumulated sediment and debris from a BMP when the sediment level reaches one-half the height of the BMP, or at any time the sediment or debris adversely impacts the functioning of the BMP.
   10. The erosion/sediment control plan shows the minimum required for the project. If it becomes apparent that additional controls are necessary, additional controls shall be installed.

B. Chemicals and Pollutants:
   1. Store construction materials and chemicals that could contribute pollutants to the runoff within an enclosure, container, or dike located around the perimeter of the storage area, to prevent discharge of these materials into runoff from the construction site.
   2. Locate areas used for collection and temporary storage of solid and liquid waste away from the storm drainage system. Provide covering or fencing as required to prevent windblown materials; construct perimeter dike to contain liquid runoff. These measures may not be necessary if materials are immediately placed in covered waste containers.
   3. Perform equipment maintenance in designated areas using measures such as drip pans to control petroleum products spillage.
   4. Immediately clean up and properly dispose of spills of construction related materials such as paints, solvents, or other chemicals.

C. Final Stabilization and Long-Term Management:
   1. Final stabilization shall be achieved through permanent vegetation and landscaping after construction.
   2. With approval of City of Thornton temporary erosion and sediment control measures may be removed within 30 days after final site stabilization is achieved or after temporary measures are no longer needed.

D. Inspection and Maintenance: Inspect erosion and sediment control measures weekly during construction. In addition, inspect all facilities immediately after any significant runoff or snowmelt which results in runoff. Repair or otherwise mitigate any damage to the erosion and sediment control facilities at no additional cost to the Owner.

3.05 CLEANING

A. Removal of Controls: Remove controls upon completion of that portion of the work for which controls were furnished. Leave the site and work area in a clean condition.

END OF SECTION

SECTION 31 1000

SITE CLEARING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes the following:
   1. Protecting existing trees, shrubs, groundcovers, plants, grass, and other vegetation to remain or as designated by Owner in pre-construction conference.
   2. Removing existing trees, shrubs, groundcovers, plants, grass, and other vegetation.
   3. Clearing and grubbing.
   4. Stripping and stockpiling topsoil.
   5. Removing above- and below-grade site improvements.
   6. Disconnecting, capping or sealing, and removing site utilities.
   7. Removing existing fill.

1.02 DEFINITIONS

A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other non-soil materials.

B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.03 MATERIAL OWNERSHIP

A. Except for stripped topsoil or other materials indicated to be stockpiled or to remain on Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.04 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

B. Record drawings, identifying and accurately locating capped utilities and other subsurface structural, electrical, and mechanical conditions. Information required may also be included in Division 1 Section "Project Record Documents."

1.05 QUALITY ASSURANCE

A. Preconstruction Conference: Conduct conference at Project site as directed by Owner’s Representative prior to start of construction. Contractor to comply with requirements, which may also be included in Division 1 Section "Project Management and Coordination."

1.06 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing indicated removal and alteration work on property adjoining Owner’s property will be obtained by Owner before award of Contract. Authority and permits for performing indicated removal and alteration work on adjacent rights-of-way shall be obtained by Contractor.
   1. Do not proceed with work on adjoining property until directed in writing by Owner’s Representative.

C. Protect improvements on adjacent and Owner’s property.

D. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

E. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

F. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.

G. Restore damaged improvements to their original condition, as acceptable to parties having jurisdiction.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earth Moving," (PART 2 – PRODUCTS).

PART 3 EXECUTION

3.01 PREPARATION

A. Protect and maintain benchmarks, survey control points, monuments, property line pins and other reference points from disturbance during construction. If disturbed or destroyed, restore or replace at no cost to Owner.

B. Provide erosion control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust from leaving project site.

C. Locate and clearly flag trees and vegetation to remain or to be relocated.

D. Protect existing site improvements to remain from damage during construction.
   1. Restore or replace damaged improvements to their original condition, as acceptable to Owner.

3.02 TREE PROTECTION

A. Erect and maintain temporary fencing around drip line of individual trees or around perimeter drip line of groups of trees to remain before starting site clearing. Remove fence when construction is complete.
   1. Do not store construction materials, debris, or excavated material within fenced area.
   2. Do not permit vehicles, equipment, or foot traffic within fenced area.
   3. Maintain fenced area free of weeds and trash.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
   1. Cover exposed roots with burlap and water regularly.
   2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
   3. Coat cut faces of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
   4. Cover exposed roots with wet burlap to prevent roots from drying and backfill with soil as soon as possible.

D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Owner’s Representative.
   1. Employ a qualified arborist, licensed in jurisdiction where Project is located, to submit details of proposed repairs and to repair damage to trees and shrubs.
   2. Replace trees that cannot be repaired and restored to full-growth status, as determined by the qualified arborist.

3.03 UTILITIES

A. Contractor will locate, identify, arrange for disconnect and seal or cap off utilities indicated to be removed before site clearing.
   1. Verify that utilities indicated as abandoned have been disconnected and capped before proceeding with site clearing.
   2. Arrange with utility companies having jurisdiction to shut off indicated utilities.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify Owner's Representative not less than two days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner's Representative's written permission.

C. Excavate for and remove underground utilities indicated to be removed.

D. Removal of underground utilities may also be included in Division 2 Sections covering site utilities. Removal of underground utilities may also be included in Division 15 Mechanical or Division 16 Electrical Sections.

E. After removal of underground utilities, as indicated, properly cap and/or plug existing lines to remain in accordance with authorities having jurisdiction.

3.04 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
   3. Grind stumps and completely remove roots, obstructions, and debris extending to a depth of 18 inches (450 mm) below exposed subgrade.
   4. Use only hand methods for grubbing within drip line of remaining trees.
   5. Chip removed tree branches and coordinate with the City of Thornton for stockpiling and/or disposal off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earth moving is indicated.
   1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches and compact each layer to a density equal to adjacent original ground.

3.05 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered or as determined by Geotechnical Engineer in a manner to prevent intermingling with underlying subsoil or other waste materials.
   1. Remove subsoil and non-soil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Limit height of topsoil stockpiles to 72 inches unless authorized by Owner's Representative.
   2. Do not stockpile topsoil within drip line of remaining trees.
   3. Dispose of excess topsoil as specified for waste material disposal.
   4. Stockpile surplus topsoil to allow for respreading a thicker layer of topsoil.

3.06 SITE IMPROVEMENTS

A. Remove existing above and below grade improvements as indicated and as necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated on plans.
   1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
   2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

C. C. Remove existing fill. Refer to Geotechnical Investigation and/or drawings for information regarding suitability for re-use and estimates of location/extent of existing fill.

3.07 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
   1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

END OF SECTION

SECTION 31 2000

EARTH MOVING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Additional information concerning earth moving may be found in the City of Thornton construction standards. In case of conflict between the drawings, jurisdictional criteria and the information specified herein, the more stringent requirements shall govern.

1.02 SUMMARY

A. This Section includes the following:
   1. Preparing and grading subgrades for slabs-on-grade, walks, pavements, lawns and grasses, and exterior plants.
   2. Overexcavation of existing unsatisfactory on-site soil materials and replacement with structural fill.
   3. Drainage course for slabs-on-grade.
   4. Subbase and base course for asphalt or concrete paving.
   5. Subsurface drainage backfill for walls and trenches.

B. This specification is based on recommendations from the Geotechnical Study performed by Terracon for the Thornton Active Adult Center overall project on March 29, 2019.

C. Where the City of Thornton may not engage a geotechnical engineer to perform additional investigations or perform construction inspections for the Sensory Walk Project, a qualified City of Thornton representative may choose to perform inspections or evaluate appropriate soil compaction or subgrade preparation.

D. Permits and Fees: Obtain and pay for all permits and fees required for the work of this section, including erosion and sediment control and water quality permits required by the City and the Colorado Department of Public Health and Environment, Water Quality Control Division.

1.03 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.
   1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe. Follow City of Thornton Standard Details for depth of backfill, depending on pipe material.
   2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill approved by the Owner or Geotechnical Engineer.

E. Excavation: Removal of all material of whatever character required for the work encountered above subgrade elevations and to lines and dimensions indicated, including boulders. See Section 3.4 for definition of unclassified and classified excavation.

F. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed or approved by Owners Representative and the testing and inspections agency to correct unsatisfactory conditions. Authorized additional excavation and replacement material will be paid for according to Contract Provisions for changes in the Work.

G. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.

H. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Owners Representative. Unauthorized excavation including disposition of overexcavated materials and other work resulting from slides, cave-ins, swelling, upheaval, or remedial work, as well as remedial work directed by Owners Representative, shall be without additional compensation.

I. Fill: Fill is all material placed to raise the grade of the site or to backfill excavation, upon which the Owner or Geotechnical Engineer has made sufficient tests and observations to enable them to issue a written statement that, in his opinion, the fill has been placed and compacted in accordance with the requirements of these specifications.

J. Structural Fill: Select granular material for use below floor slabs and to 5-feet-0-inches beyond building lines. On-site material may be used if approved by the Owner or Geotechnical Engineer.

K. Underslab Gravel: Imported Class 6 road base per Colorado Department of Transportation Standard Specifications for Road and Bridge Construction (current addition) or material approved by the Owner or Geotechnical Engineer.

L. Rock Excavation: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. (0.76 cu. m) for Bulk Excavation or 3/4 cu. yd. (0.57 cu. m) for footing, trench, and pit excavation which in the Owner or Geotechnical Engineer's opinion cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
   1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch-wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,090 lbf and stick-crowd force of not less than 18,650 lbf; measured according to SAE J-1179.
   2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 48,510-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.

M. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

N. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

O. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

P. Utilities: Include on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.04 SUBMITTALS

A. See Section 01 3000 – Administrative Requirements, for submittal procedures.

B. Material Test Reports: Provided by the Owner from a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
   1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.
   2. Laboratory compaction curve according to ASTM D 698 for each on-site or borrow soil material proposed for fill and backfill.

C. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth moving operations. Submit before earth moving begins.

1.05 QUALITY ASSURANCE

A. Comply with applicable codes, ordinances, regulations, references and standards in effect at bid date:
   1. Uniform Building Code (UBC) or International Building Code (IBC) per jurisdiction criteria.
   2. American Society for Testing and Materials (test methods as specified hereafter)(ASTM).
   3. State and local codes.

B. In case of conflict between the above codes, regulations, references and standards and these specifications, the more stringent requirements shall govern.

C. Testing Agency: The Owner will employ a qualified independent Geotechnical testing agency or provide their own internal testing and inspections. Contractor shall furnish testing agency access to work, facilities

and incidental labor required for testing. Notify the testing and inspection agency not less than 48 hours in advance of all work requiring testing.

D. Reference Standards:

Compaction Standard: Standard Proctor Density ASTM D698.

E. Preconstruction Conference: Conduct conference at Project site as directed by the Owner's Representative prior to start of construction. Contractor to comply with requirements, which may also be included in Division 1 Section "Project Management and Coordination."

1.06 PROJECT CONDITIONS

A. A. Existing Utilities: Locations, sizes and depths or invert elevations of existing utilities as shown on the drawings are based on information provided by others, and believed to be correct, but may not be absolutely so. Such information is therefore presented only as approximations and should be verified prior to construction. Protect from damage any sewer, water, gas, electric, phone or other pipe lines or conduits uncovered during the work until they have been examined by the Owner's Representative. If such lines are found to be abandoned and not in use, remove affected sections without extra cost. If such lines are found to be in use, carefully protect and carry on work around them. If Owner' Representative deems it advisable to move such lines, Owner will pay cost of moving. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Owner's Representative and then only after arranging to provide temporary utility services according to requirements indicated.
   1. Contact utility-locator service for area where project is located before excavating.
   2. Notify Owner's Representative not less than two (2) days in advance of proposed utility interruptions.
   3. Do not proceed with utility interruptions without Owner's Representative's written permission.

B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

C. Remove all existing fill deemed by the Owner or Geotechnical Engineer to be unsatisfactorily placed.

D. Existing Contours and Elevations: Contours and spot elevations of existing ground elevations at the site, and approximate elevations of finish grade cuts, fills, and excavations for the Work are shown on Drawings. Contours and elevations for existing ground lines are based on information provided by others, and are believed to be correct, but may not be absolutely so. Existing contours and elevations should therefore be considered approximate and should be verified at the site prior to construction.

E. Verification of Existing Conditions: Visit the site prior to submission of bids. Verify existing conditions, elevations, and contours. In the event of discrepancies between existing conditions and those indicated on the Contract Documents or survey, contact the Owner's Representative for clarification.

F. Existing Benchmarks: Carefully preserve and maintain existing benchmarks, monuments, property line pins, and other reference points. If disturbed or destroyed, restore or replace by a Professional Land Surveyor at no additional cost to the Owner.

G. Frost Protection: When freezing temperatures may be expected, do not excavate to the full depth indicated unless the footing or slabs are to be poured immediately after the excavation has been completed. If placing of concrete is delayed, protect the bottoms of excavations from frost until concrete is placed.

1.07 WARRANTY

Settlement in backfill, fill or in structures built over backfill or fill, which may occur within the specified project warranty period, shall be corrected at no cost to the Owner. Any structures damaged by settlement shall be restored to their original condition by the Contractor, at no cost to the Owner.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Shall meet approval of the Owner or Geotechnical Engineer and shall be free of rock or gravel larger than 3 inches (75 mm) in any dimension, debris, waste, frozen materials, vegetation, and

other deleterious matter. Clean, on-site, natural soils, or imported materials, as approved by the Owner or Geotechnical Engineer.

C. Unsatisfactory Soils: Soil Classification Groups GP, SP, MH, OL, MH, OH, and PT according to ASTM D 2487, or a combination of these groups, as identified by the Geotechnical Engineer.
   1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Backfill and Fill: Satisfactory on-site materials as approved by the Owner or Geotechnical Engineer for their intended use and location within the project site.

E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand in conformance with the gradation and quality requirements of Class 6 aggregate base course as listed in Section 703 of the CDOT specifications.

F. Engineered Fill: Engineered fill shall meet the following material property requirements:

PART 3 Fill Type[1]	USCS Classification	Acceptable Location for Placement
On-Site Clay Soils	CL, CH	On-site clay soils are suitable for reuse as compacted fill below-slab and pavement areas, crawlspace subgrade areas, wall backfill and within utility trenches.
On-Site Sand Soils mixed with clay soils[3]	SC, SM	On-site sand soils mixed with clay soils are considered suitable for reuse as compacted fill below slab and pavement areas, crawlspace subgrade areas, wall backfill and within utility trenches.
Imported Soils	Varies	Imported soils meeting the gradation and quality characteristics outlined herein can be considered acceptable for use as engineered fill beneath slabs and pavements

1. Controlled, compacted fill shall consist of approved materials that are free of organic matter and debris. Frozen material should not be used, and fill should not be placed on a frozen subgrade. A sample of each material type should be submitted to the Owner or geotechnical engineer for evaluation.

2. Care shall be taken during the fill placement process to avoid zones of dis-similar fill. Improvements constructed over varying fill types are at a higher risk of differential movement compared to improvements over a uniform fill zone.

3. On-site sand soils may be mixed with on-site clay soils to meet the gradation requirements outlined below for imported soils.

4. Granular soils shall not be used in the overexcavation zone below the building, slabs or pavement areas, or as wall backfill or in utility trenches.

G. Imported Fill: Imported soils for engineered fill shall meet the following material property requirements:

Gradation	Percent Finer by Weight (ASTM C136)
3 inches	100
No. 4 Sieve	50 – 100
No. 200 Sieve	>50

Liquid Limit ..... 30 (max
Plastic Index ..... 15 (max)
Maximum Expansive Potential (%) 0.5*

* Measured on a sample compacted to approximately 95% of the ASTM D698 maximum dry density at optimum water content. The sample is confined under 500 psf surcharge and submerged.

1. Bedding Course: As specified in Division 31Section “Trenching and Backfilling.”
2. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
3. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.02 GEOTEXTILES

B. Subsurface Drainage and Separation Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288. Utilize Mirafi 140N or as recommended by the Owner or Geotechnical Engineer.

PART 3. EXECUTION

3.01 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

B. Preparation of subgrade for earth moving operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."

C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Temporary Erosion and Sediment Control," during earth moving operations. Provide erosion control measures to prevent erosion or displacement of soils and discharge of soil bearing water runoff or airborne dust to adjacent properties and rights-of-way.

D. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

E. Cold Weather Work: Prevent frost from entering bearing stratus upon which construction will take place or in areas where fill will be placed in that season.

3.02 DEWATERING

A. Prevent surface water and subsurface ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.
3. Obtain and comply with all provisions of the Colorado Department of Public Health and Environment, Water Quality Control Division, Construction Dewatering Permit.

C. Protection of Persons and Property:
1. Provide all necessary measures to protect workmen and passersby. Barricade open excavations occurring as part of the Work, as required by municipal or other authorities having jurisdiction.
2. Protect adjacent streets, roadways, and properties throughout the entire operation. Protect newly graded areas from destruction by weather or runoff. Protect structures, utilities, sidewalks, pavements, and other improvements from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.

3.03 EXPLOSIVES

A. Explosives: Do not use explosives.

3.04 EXCAVATION, GENERAL

A. Unclassified Excavation: All excavation (other than rock excavation and earth excavation {see section 3.04.B below) is considered as unclassified and is defined as removal of all material encountered, regardless of soil type. Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include soil materials, and obstructions. Unclassified excavation is considered normal excavation and no extra costs will be allowed.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
   2. Remove material of every nature or description encountered in obtaining required lines and grades. Excavate and/or place and compact fill to provide for building pad elevation(s) required by drawings.
   3. Excavate wide enough at foundations and retaining walls to permit erection and removal of forms, application of dampproofing or waterproofing.
   4. Pitch grading around excavations to prevent water from running into excavated areas.
   5. Pre-rip hardpan and soft bedrock with single-tooth ripper or other suitable equipment to facilitate excavation with conventional earth-moving equipment.
   6. Bearing soils disturbed by excavating equipment must be recompacted to 95 percent of maximum Standard Proctor Density (ASTM D698) prior to placing concrete. Follow Owner or Geotech recommendations for soils disturbed during boring activities for drilled piers.
   7. Exposed areas which will receive fill once properly cleaned, shall be scarified to a minimum depth of 8-inches, conditioned to near optimum moisture content as noted in the project Geotechnical Report, and compacted.

B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth excavation and rock excavation. Do not excavate rock until it has been classified and cross sectioned by Owner's Representative.
   1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
      a. Intermittent drilling; ram hammering; or ripping of material not classified as rock excavation is earth excavation.

C. Stability:
   1. Slope sides of excavations in compliance with OSHA requirements and local codes or ordinances. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
   2. Continuously monitor cut slopes for distress. Take all necessary precautions to safeguard workers, structures, and utilities.
   3. Provide all necessary shoring, sheeting, or bracing of sides of excavations required to prevent caving, erosion, and gullying. Provide underpinning of existing structures or other improvements adjacent to excavations which are subject to damage.

D. Unanticipated Conditions: Notify the Owner's Representative immediately upon finding evidence of previous structures or filled materials which penetrate below designated excavation levels, groundwater or water-bearing strata, or other conditions which are not shown or which cannot be reasonably assumed from existing surveys and geotechnical reports. Secure the Owner's Representative instruction before proceeding with further work in such areas.

E. Rock Excavation: Includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction. Rock excavation in unconfined areas is defined as removal and disposal of material which in the Owner or Geotechnical Engineer's opinion, cannot be excavated without continuous and systematic drilling and blasting, or continuous use of a suitable ripper or other special equipment.
   1. Unanticipated Rock Excavation: Rock excavation that is not indicated on existing surveys or which cannot be reasonably assumed from geotechnical studies of the site and which could not have been anticipated without extensive investigations. Unanticipated rock excavation shall be subject to change order procedures or previously agreed upon unit prices.

3.05 EXCAVATION FOR WALKS AND PAVEMENTS

A. Over-excavate surfaces under walks and pavements a minimum 3 feet below indicated lines, cross sections, elevations, and subgrades. Over-excavation limits shall extend minimum 2 feet beyond walks and pavements, and curb and gutter.

B. Minimize moisture increases in the backfill materials and control moisture density to levels recommended in the project Geotechnical Report during placement and compaction of backfill materials.

3.06 EXCAVATION FOR UTILITY TRENCHES

A. Refer to Division 31 Section “Trenching and Backfilling,” for excavating and backfilling of utilities.

3.07 SUBGRADE INSPECTION

A. Notify the Owner when excavations have reached required subgrade.

B. If Owner’s Representative and Geotechnical Consultant determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Owner’s Representative, without additional compensation.

3.08 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Geotechnical Engineer. If approved by Owner or Geotechnical Engineer, structural fill placed at 100 percent ASTM D698, 2 percent below to 1 percent above optimum moisture may be used.
   1. Fill unauthorized excavations under other construction or utility pipe as directed by Owner’s Representative.

3.09 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials in approved locations without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
   1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.
   6. Removing temporary shoring and bracing, and sheeting.
   7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
   8. Acceptance of subgrade by Owner or Geotechnical Engineer, if requested by the Owner.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.11 UTILITY TRENCH BACKFILL

A. Refer to Division 31 Section “Trenching and Backfilling,” for excavating and backfilling of utilities.

3.12 SOIL FILL

A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.
   1. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
   2. In areas of fill, scarify natural soil following removal of unsatisfactory material, to a depth of 8-inches.

B. Place and compact fill material in layers to required elevations per the geotechnical report and as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill or structural fill as approved by the Owner or Geotechnical Engineer.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.13 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to optimum or to 3 percent over optimum moisture content for clay soils, or within 2 percent of optimum moisture content for granular soils. Refer to geotechnical study for additional recommendations.
1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content beyond the tolerances described above and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
1. Under exterior flatwork, slabs, steps, and pavements, scarify and recompact top 8 inches of existing subgrade and each layer of backfill or fill soil material at **95** percent.
2. Underfootings and interior floor slabs, excavate to approved natural soils, in fill condition, compact to 95 percent.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
4. Compact foundation wall backfill to 95 percent.
5. Compact scarified subgrade soils to 95 percent.
6. Compact retaining wall backfill to 95 percent.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
1. Lawn or Unpaved Areas: Plus or minus 0.10 feet.
2. Walks: Plus or minus ¼ - inch.
3. Pavements: Plus or minus ½ - inch.
4. Grading inside Building Lines: Finish subgrade to a tolerance of ½-inch when tested with a 10-foot straightedge.

3.16 BASE COURSES

A. Place base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place base course under pavements and walks as follows:
1. Install separation geotextile, if requested by the Owner or Geotechnical Engineer, on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over compacted sub-grade under hot-mix asphalt pavement.
3. Shape base course to required crown elevations and cross-slope grades.
4. Place base course 6 inches or less in compacted thickness in a single layer.

5. Place base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
6. Compact base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

C. Pavement Shoulders: Place shoulders along edges of base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.17 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing, or will perform such services themselves.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Owner's Representative.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Perform field moisture tests in accordance with ASTM D3017. Tests will be performed at the following locations and frequencies at a minimum:
1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 2000 sq. ft. or less of paved area or building slab, but in no case fewer than 3 tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.18 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
1. Scarify or remove and replace soil material to depth as directed by Owner's Representative; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

SECTION 32 0190

OPERATION AND MAINTENANCE OF PLANTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Contract Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, and Civil permit specifications package, apply to this Section.

1.2 SUMMARY

A. This Section includes requirements for furnishing of all supervision, labor, materials, equipment and transportation required to maintain the landscape areas called for under this contract for the time period specified. The work includes but is not limited to: weed control, re-seeding, re-sodding, mowing, weed control, watering of plant material and pruning, irrigation system repair and maintenance, maintenance of erosion control measures (BMP's) including storm water features and coordination with City staff.

1.3 INSPECTION AND ACCEPTANCE

A. Formal Inspections: The project will be inspected during the Maintenance and Guarantee Period at the following points:
   1. Initial Acceptance
   2. Quarterly Inspections
   3. Final Acceptance

B. Additional inspections and observations to monitor maintenance and landscape conditions will be done throughout the Maintenance and Guarantee Period by the Owner.

C. Substantial Completion Inspection:
   1. Arrange for Owner's presence 48 hours in advance of walk-through.
   2. All landscape items shall be completely installed prior to scheduling of walk-through.
   3. Generate a list of items to be corrected within 3 weeks of inspection and prior to Initial Acceptance.
   4. Furnish all materials and perform all work required to correct all inadequacies due to deviations from Contract Documents.

D. Initial Acceptance Inspection:
   1. After Substantial Completion has been issued and at the completion of all construction operations under this Contract, and prior to the beginning of the post-construction warranty period, and inspection will be performed (or Initial Acceptance walk-through). The City will, upon 7 days advance notice, make inspection of the work to determine acceptability. The City will prepare a "punch list" of items improperly installed, inadequately sized or otherwise deficient. The "punch list' deficiencies shall be corrected not more than 3 weeks after the inspection.
   2. Debris and litter shall be cleaned up and all walkways and curbs shall be cleaned of soil and debris left from planting operations. At the time of this inspection, the Contractor shall have all planted and landscape areas complete and irrigation system operational. All fencing and protection shall be in place. The inspection will not occur until these conditions are met.
   3. Prior to the date of the walk-through, before the Initial Acceptance, the Contractor shall convey to the City the job record set of all changes made to all plans during the construction period, labeling said prints "As-Built". Turnover items noted in other specification sections shall be delivered prior to this inspection.
   4. The improvements will be initially accepted by the City when all items are satisfactorily completed in accordance with the terms of the approved Construction Drawings and applicable City Standards and Specifications. If, after the inspection, the City if of the opinion that all work has been

performed as per the contract documents, the City will give the Contractor written notice of Initial Acceptance signifying commencement of the guarantee period.

5. Replacement or repair of materials prior to Initial Acceptance does not waive normal warranty. At the time of this inspection, areas disturbed by Project construction and Improvements installation shall have been suitably restored. The City shall have received and approved all product certifications and quantities.
6. The City will maintain all work items and areas following Initial Acceptance. The Contractor shall be responsible for one-time irrigation winterization and subsequent spring start-up and winter watering of plant material as needed, with a minimum of four winter watering.
7. The City will allow use of the site between Initial Acceptance and Final Acceptance.
8. If corrective work for completion of the Punch List items is not completed within the timeframe stated in the General Conditions, then another walk-through will be required and a new "punch list" of deficiencies, as well as an equivalent extension of the guarantee period, will be required at no additional cost to the City.

E. Final Acceptance, one (1) year from date of Initial Acceptance: On or before 45 days prior to the expiration of the guarantee period, the City and Contractor shall conduct a final inspection of the Work. The Contractor shall give at least 48 hours notice to the City to request this inspection. The City will prepare a list of defects discovered during such final inspection ("punch list") and submit the punch list to the Contractor. Additional defects discovered subsequent to the final inspection of the Work but prior to the date of Final Acceptance (as hereafter defined) shall also be submitted to the Contractor for repair at the cost and expense of the Contractor. When "punch list items" and other defects are corrected and all phases of the project have been deemed by the City to have been dutifully completed, the City shall issue the Final Acceptance of the project.

1.4 SUBMITTALS

A. See Division 01 Section "Closeout Submittals" for submittal requirements.

B. Maintenance Reports: Submit detailed maintenance quarterly reports and schedules for the Maintenance and Guarantee Period for review and approval by the Owner, City of Thornton Forester, and City of Thornton Horticulturalist.

C. Material List: Submit a detailed list of materials, to be used for seeding, fertilization, pesticides, weed control, plant health and mulching.

D. Equipment List: submit a detailed list of equipment and chemical controls to be used for weed control, seeding and mulching operations. Include brand and model number of all equipment to be used for soil preparation and seeding activities.

E. Work Examples: submit list of three projects completed in the last two years of similar complexity to this project with name and location of project, Owner's name and telephone number, name of project landscape architect and telephone number. Include certifications held by contractor and subcontractor employees who will oversee the work during the maintenance period.

1.5 CONTRACTUAL REQUIREMENTS

A. Maintenance and Warranty Period: The maintenance period shall be up to Initial Acceptance, and Warranty period shall commence from the date of work startup of the contract work in accordance with these Specifications and continue for the period of one (1) year from Date of Initial Acceptance.

B. Limits of Work Area: All improvements and maintenance within the project work area are included unless otherwise indicated on the Contract Drawings or directed by the Owner. Areas outside defined areas, as illustrated on the Contract Drawings, will be maintained by the City.

C. Licenses, Taxes, and Insurance:

1. Licenses: Contractor agrees to obtain and pay for all licenses required by the City, State and Federal governments that are necessary for legally conducting business. Contractor shall maintain all licenses and permits required for maintenance activities (e.g. pesticide application).
2. Taxes: Contractor shall pay all applicable taxes, including sales taxes on materials supplied.
3. Insurance: Contractor shall maintain all insurance policies in accordance with the General Conditions of the contract through the entire term of the maintenance and guarantee period.

PART 2 - PRODUCTS

2.1 Pesticides:

A. For cultivated landscape areas: As approved by Owner.

END OF SECTION

SECTION 32 1313

CONCRETE PAVING

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes constructing exterior concrete paving on prepared subgrade or base course in accordance with these specifications. This work shall be in conformity with the lines, grades, thicknesses and typical cross-sections shown on the plans for the following:
   1. Driveway aprons.
   2. Curbs and gutters.
   3. Sidewalks, steps, ramps.
   4. Base material for unit paver.
   5. Dumpster and loading dock pads.
   6. As detailed on the plans.

1.02 REFERENCES

A. City of Thornton Standard Specifications for Design and Construction, latest edition.

B. Colorado Department of Transportation Standard Specifications for Road and Bridge Construction, current edition.

1.03 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, expansive hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume.

B. CDOT: State of Colorado Department of Transportation.

C. CDOT Specifications: Colorado Department of Transportation Standard Specifications for Road and Bridge Construction, current edition.

D. ADA Handbook: Americans with Disabilities Act Standards for Accessible Design, U.S. Department of Justice.

E. ANSI A117.1: Standard for Accessible and Usable Buildings and Facilities, American National Standard Institute.

F. Refer to ACI 301: (American Concrete Institute – Standard Specifications for Structural Concrete), for additional definitions.

1.04 SUBMITTALS

A. See Section 01 3000 – Administrative Requirements, for submittal requirements.

B. Product Data: For each type of manufactured material and product indicated.

C. Design Mixes: For each concrete pavement mix, and includes alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

D. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:
   1. Aggregates.
   2. Cement.
   3. Admixtures.

E. Material Certificates: Signed by manufacturers certifying that each of the following materials used in the project complies with requirements:
   1. Cementitious materials and aggregates.
   2. Steel reinforcement and reinforcement accessories.

3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or adhesive.
8. Joint fillers.

F. Field quality-control test reports.

G. Pavement Joint Layout Plan: Submit plan to show joint locations and typical dimensions for review and approval by engineer.

H. Traffic Control Plan: For work in the public right-of-way.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed pavement work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94/C 94 M requirements for production facilities and equipment.
1. Manufacturer must be certified according to the National Ready Mix Concrete Association's (NRMCA) Plant Certification Program.

C. Testing Agency Qualifications: An independent agency qualified according to ASTM C1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.

D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.

E. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by the requirements of the Contract Documents.

F. Concrete Testing Service: The Owner will engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

G. Preconstruction Conference: Conduct conference at project site as directed by Owner’s Representative prior to start of construction. Contractor to comply with requirements, which may also be included in Division 1 Section “Project Management and Coordination.”

H. Regulatory Requirements:

I. Comply with City of Thornton standards for sidewalks, curbs, ramps, gutters, and driveway approaches or aprons, including standard dimensions, profiles, thicknesses, reinforcing, and compressive strength. In the event of conflict between the Contract Documents and the standards, the more stringent requirements will apply.
1. Comply with applicable requirements of ADA Handbook, ANSI A117.1, and local and State codes and ordinances regarding walks, steps, ramps and curb ramps.

1.06 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Coordination and Scheduling: Coordinate with other trades and arrange scheduling to avoid damage to other work including grading, site utilities and piping, asphalt paving, landscaping and irrigation systems.

C. Field Measurements: Verify dimensions and existing conditions shown on the drawings by taking field measurements prior to start of work. Report discrepancies to the Owner’s Representative for clarification and make minor adjustments in layout as required by field conditions and as approved by the Owner’s Representative, at no additional cost to the Owner.

D. Environmental Requirements: Perform work only under suitable weather conditions. Comply with the environmental requirements of Section 3.6 for concrete placement.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
   1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
   2. Products: Subject to compliance with requirements, provide one of the products specified.
   3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
   4. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.02 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
   1. Use flexible or curved forms for curves of a radius 100 feet or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.03 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Fabric: CDOT Section 709 and ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

B. Reinforcement Bars: CDOT Section 709 and ASTM A 615/A 615M, Grade 60, deformed. Cut bars true to length with ends square and free of burrs.

C. Joint Dowel Bars: Plain steel bars, CDOT Section 709 and ASTM A 615/A 615M, Grade 60. Cut bars true to length with ends square and free of burrs.

D. Tie Bars: CDOT Section 709 and ASTM A 615/A 615M, Grade 60, deformed.

E. Supports for Reinforcement: Chairs, spacers, and other devices for spacing, supporting, and fastening reinforcement bars, welded wire fabric, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
   1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.04 COLORED ADMIXTURE

Colored Admixture: L.M. Scofield Co. “Chromix” or Rockwood Industries “Davis Colors”, color as selected by Owner’s Representative. Use for colored concrete where indicated on the drawings.

2.05 EXPANSION JOINT FILLER

A. Sealed Joints: Preformed, compressible fiber or cork filler material complying with ASTM D1751 or D1752, Type II, guaranteed compatible with expansion joint sealant materials, ½-inches thick unless otherwise indicated. Provide high-impact polystyrene removable “void cap” to create ½-inches deep reveal for installation of sealant.

B. Self-Sealing Joints: Preformed, compressible asphalt fiber joint filler complying with ASTM D994, ½-inches thick unless otherwise indicated. Do not use asphalt fiber filler in joints to receive elastomeric joint sealants.

2.06 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:
   1. Portland Cement: CDOT Section 701 and ASTM C 150, Type I II I/II, gray.
      a. Fly Ash: ASTM C 618, Class F.
      b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

B. Normal-Weight Aggregates: CDOT Section 703 and ASTM C 33, coarse aggregate, uniformly graded. Provide aggregates from a single source.
   1. Maximum Coarse-Aggregate Size: 3/4 inch nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
   3. Do not use fine or coarse aggregates containing substances that cause spalling.

C. Water: CDOT Section 712 and ASTM C 94/C 94M potable.

2.07 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures.

B. Air-Entraining Admixture: CDOT Section 711 and ASTM C 260.

C. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
   1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
   2. Retarding Admixture: ASTM C 494/C 494M, Type B.
   3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
   4. Water-Reducing and Accelerating Admixture: ASTM C494, Type E.
   5. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
   6. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
   7. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.08 FIBER REINFORCEMENT

A. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in concrete pavement, complying with ASTM C 1116, Type III, 1/2 to 1-1/2 inches long.

2.09 CURING MATERIALS: CDOT SECTION 711

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq.yd. (305 g/sq.m) dry.

B. Moisture-Retaining Cover: ASTM C 171, waterproof paper, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type I, Class B.
   1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.

F. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type II, Class B.
   1. Provide material that has a maximum volatile organic compound (VOC) rating of 350 g/L.

2.10 RELATED MATERIALS

A. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.
   1. Manufacturers:
      a. Bayer Corporation.
      b. b. ChemMasters.
      c. Conspec Marketing & Manufacturing Co., Inc.
      d. Davis Colors.

e. Elementis Pigments, Inc.
f. Hoover Color Corporation.
g. Lambert Corporation.
h. Scofield, L. M. Company.
i. Solomon Colors.

2. Color: As indicated by the Landscape Architect.

B. Pigmented Mineral Dry-Shake Hardener: Factory-packaged dry combination of portland cement, graded quartz aggregate, color pigments, and plasticizing admixture. Use color pigments that are finely ground, nonfading mineral oxides interground with cement.

1. Products:
a. Conspec Marketing & Manufacturing Co., Inc.; Conshake 600 Colortone.
b. Dayton Superior Corporation; Quartz Tuff.
c. Euclid Chemical Company (The); Surflex.
d. Lambert Corporation; Colorhard.
e. L&M Construction Chemicals, Inc.; Quartz Plate FF.
f. MBT Protection and Repair, ChemRex Inc.; Mastercron.
g. Metalcrete Industries; Floor Quartz.
h. Scofield, L. M. Company; Lithochrome Color Hardener.
i. Symons Corporation; Hard Top.

2. Color: As indicated by the Landscape Architect.

2.11 CONCRETE MIXTURES

A. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the trial batch method.
2. Do not use Owner's field quality-control testing agency as the independent testing agency.

B. Proportion mixes to provide concrete with the following properties:

1. Compressive Strength (28 Days): 4,500 psi.
2. Modulus of Rupture (28 day): Minimum 600 psi.
3. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
4. Slump Limit: 4 inches.
5. Minimum 564 lb. Cement per cubic yard. (CDOT Class P)

C. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 5.0 to 8.0 percent.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture and/or plasticizing and retarding admixture in concrete, as required, for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement according to ACI 301 requirements for concrete exposed to deicing chemicals as follows:

1. Fly Ash: 20 - 30 percent Class F Fly Ash CDOT Section 601.02, Class P Concrete.

G. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd.

H. Color Pigment: Add color pigment to concrete mixture according to manufacturer’s written instructions.

2.12 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116. Furnish batch certificates for each batch discharged and used in the Work.

2.13 LEED REQUIREMENTS

A. Materials/products shall contain the maximum amount of recycled content allowed that retains material integrity.

B. Preference shall be given to materials that are manufactured, harvested, extracted, mined, quarried, etc. within a 500 mile radius of the project site.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Follow recommendations of the project Geotechnical Report. Overexcavate a minimum of 3-ft below the pavement section. Condition to 0 to +3% of the optimum moisture content, and compact to 95% of standard Proctor maximum dry density.

C. Proof-roll prepared subbase surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.
   1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
   2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons.
   3. Subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction according to requirements in Division 2 Section "Earth Moving."

D. Subgrade shall be tested by Geotechnical Engineer and pass required tests prior to concrete pavement placement.

E. Proceed with concrete pavement operations only after non-conforming conditions have been corrected and subgrade is ready to receive pavement.

3.02 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.03 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form release agent to ensure separation from concrete without damage.

3.04 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating reinforcement and with recommendations in CRSI's "Placing Reinforcing Bars" for placing and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

E. Install fabricated bar mats in lengths as long as practicable. Handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities, or replace units as required before placement. Set mats for a minimum 12-inch overlap of adjacent mats.

3.05 JOINTS

A. General: Construct/install construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.
   1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.
   2. Contractor to provide plan of joint placement for the Engineers approval.
   3. The distance between joints shall not exceed in feet, twice the pavement thickness in inches. (i.e.: 6-inches PCC pavement to utilize maximum 12-foot joint spacing.)

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour, unless pavement terminates at expansion joints.
   1. Contractor may utilize preformed galvanized steel or plastic keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
   2. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.
   3. Provide tie bars at sides of pavement strips where indicated.
   4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

C. Expansion Joints: Form expansion joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
   1. Locate expansion joints in pavement where indicated on plans.
   2. Extend joint fillers full width and depth of joint.
   3. Terminate joint filler no less than 1/2 inch or no more than 1 inch below finished surface for joint sealant.
   4. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
   5. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with groover tool to the indicated radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.
   2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
   3. Tied Contraction Joints: Install deformed bars and support assemblies at joints where indicated.

3.06 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

D. Comply with ACI 301 and ACI 304R requirements and recommendations for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery to the project site.

F. Do not add water to fresh concrete after testing.

G. Do not add water to concrete surface during finishing operations.

H. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

I. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping. Use equipment and procedures to consolidate concrete according to recommendations in ACI 309R.
   1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

J. Screed pavement surfaces with a straightedge and strike off.

K. Commence initial floating using bull floats or darbies to form an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading dry-shake surface treatments.

L. Curbs and Gutters: Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified with expansion joints at intervals of approximately 100 feet and tooled contraction joints at 10-foot intervals When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements.

M. Walks: Minimum 7-inches thick, with expansion joints at intervals of approximately 100 feet and tooled contraction joints at intervals equal to width of walks or maximum 5-foot intervals. Tool edges to rounded profile and finish as noted herein or shown on the drawings. Contractor may utilize sawed contraction joints. Pitch walks 3/16-inches per foot for drainage unless otherwise indicated.

N. Ramps: Construct ramps similar to walks. Comply with applicable ADA Handbook, ANSI A117.1, and local and State codes, ordinances, and details including maximum allowable slope not to exceed 1 foot vertical in 12 foot horizontal, with maximum rise not to exceed 30-inches between level landings.

O. Steps: Minimum 6-inches thick at intersection of treads and risers, reinforced as indicated. Slope treads ¼-inches to nosing, and tool nosings to uniform ½-inches radius. Finish as specified below.

P. Paving: Minimum 6-inches thick unless otherwise indicated. Provide expansion joints as indicated on the drawings, and contraction joints at a minimum 12-feet -0-inches EWW. Provide fibermesh reinforcing. Place concrete paving over compacted subgrade as specified in Division 2 Section “Earth Moving”. Provide minimum 1% slope for drainage unless otherwise indicated.

Q. Driveway Approaches: Minimum 6-inches thick, unless otherwise indicated or required by local public works standards or building codes. Construct to radius of flare indicated, and taper or warp into alignment with adjacent curbs, gutters, and walks. Place approaches over compacted subgrade as specified in Division 2 section “Earth Moving.” Refer to drawing and details for any reinforcing requirements.

Slip-Form Pavers: When automatic machine placement is used for pavement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce pavement to required thickness, lines, grades, finish, and jointing as required for formed pavement.

Compact subbase and prepare subgrade of sufficient width to prevent displacement of paver machine during operations.

R. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.

S. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
   1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
   2. Do not use frozen materials or materials containing ice or snow.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

T. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:
   1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
   2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
   3. Fog-spray forms, reinforcement steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

U. Wet-Weather Placement: Do not begin to place concrete while rain, sleet, or snow is falling unless adequate protection is provided and, when required, acceptance of protection is obtained.

3.07 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

C. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots, and fill low spots. Refloat surface immediately to uniform granular texture.
   1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.
   2. Medium-to-Course-Textured Broom Finish: For use on roadways and streets only. Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

D. Pigmented Mineral Dry-Shake Hardener Finish: After initial floating, apply dry-shake materials to pavement surface according to manufacturer's written instructions and as follows:
   1. Uniformly spread dry-shake hardener at a rate of 100 lb/100 sq. ft. unless greater amount is recommended by manufacturer to match pavement color required.
   2. Uniformly distribute approximately two-thirds of dry-shake hardener over pavement surface with mechanical spreader, allow to absorb moisture, and embed by power floating. Follow power floating with a second dry-shake hardener application, uniformly distributing remainder of material at right angles to first application to ensure uniform color, and embed by power floating.
   3. After final floating, apply a hand-trowel finish followed by a broom finish to concrete.
   4. Cure concrete with curing compound recommended by dry-shake hardener manufacturer. Apply curing compound immediately after final finishing.

3.08 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection and follow the recommendations of ACI 305R for hot-weather protection during curing.

C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

D. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.09 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:
1. Elevation: 1/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch.
4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
6. Alignment of Tie-Bar End Relative to Line Perpendicular to Pavement Edge: 1/2 inch.
7. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
8. Joint Spacing: 3 inches.
9. Contraction Joint Depth: Plus 1/4 inch, no minus.
10. Joint Width: Plus 1/8 inch, no minus.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain at least 1 composite sample for each 50 cu. yd. or fraction thereof of each concrete mix placed each day.
    a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each type of concrete mix. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231, pressure method; one test for each composite strength test, but not less than one test for each day's pour of each type of concrete mix.
4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each set of composite strength specimens.
5. Compression Test Specimens: ASTM C 31/C 31M; one set of four standard cylinders for each compressive-strength test, unless otherwise indicated. Cylinders shall be molded and stored for laboratory-cured test specimens unless field-cured test specimens are required.
6. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd., but less than 25 cu. yd., provide at least two tests for every 100 cu.yd., (one set for each 50 cu. yd.). One specimen shall be tested at 7 days and two specimens at 28 days; one specimen shall be retained in reserve for later testing if required.
7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, current operations shall be evaluated and corrective procedures shall be provided for protecting and curing in-place concrete.

C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi .

D. Test results shall be reported in writing to Owner's Representative, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, concrete type and class, location of concrete batch in pavement, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Owner's Representative, but will not be used as the sole basis for approval or rejection.

F. Additional Tests: Testing agency shall make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Owner's Representative. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.11 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.

B. Drill test cores where directed by Owner's Representative when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 32 1373

CONCRETE PAVING JOINT SEALANTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Additional information concerning concrete paving may be found City of Thornton construction standards. In case of conflict between the drawings, jurisdictional criteria and the information specified herein, the more stringent requirements shall govern.

1.02 SUMMARY

A. This Section includes the following:
   1. Expansion and contraction joints within cement concrete pavement.
   2. Joints between cement concrete and buildings and structures.
   3. Surface preparation including primers.
   4. Joint backup material.

1.03 REFERENCES

A. City of Thornton Standard Specifications for Design and Construction, latest edition.

B. Colorado Department of Transportation Standard Specifications for Road and Bridge Construction, current edition.

1.04 SUBMITTALS

A. See Section 01 3000 – Administrative Requirements, for submittal procedures.

B. Product Data: For each joint-sealant product indicated.

C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

D. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
   1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
   2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.05 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Work under this section shall be subject to all applicable provisions of federal, state, and local rules and regulations.

B. Applicator: Company specializing in application of sealants with five years minimum experience and be acceptable to manufacturer. Manufacturer’s field representative shall visit site and make suggestions.

C. Adhesion Tests: Prior to any sealant application, perform adhesion tests as directed by sealant manufacturer’s technical representative.

D. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.07 PROJECT CONDITIONS

A. Install sealant materials in strict accordance with all safety and weather conditions recommended by manufacturer, product literature, or Material Safety Data Sheets. Do not proceed with installation of sealants under adverse weather conditions, or when temperatures are below or above manufacturer's recommended limitations for installation. Proceed only when forecasted weather conditions are favorable for proper cure and development of high-early bond strength. Wherever joint width is affected by ambient temperature variations, install elastomeric sealants only when temperatures are in lower third of manufacturer's recommended installation temperature range.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.

2.02 COLD-APPLIED JOINT SEALANTS

A. Approved Sealants:

For each application, provide the grade of sealant (non-sag, self-leveling, no-track knife grade preformed, etc.) as recommended by the manufacturer for the particular condition of installation (location, joint shape, ambient temperature, and similar conditions), to achieve the best possible overall performance. Grades specified herein are for normal condition of installation.

1. Silicone Sealant: ASTM C-920-79, Type S, Class 25, Grade NS.
2. Two-Component (plus color) polyurethane low-modulus, non-sag sealant: ASTM C920-79, Type M, Class 25, Grade NS.
3. Two-Component (plus color) polyurethane self-leveling sealant: ASTM C920-79, Type M, Class 25, Grade P.

2.03 JOINT SEALANTS

A. Single-component formulation complying with ASTM D 6690 of D1190.
   1. Refer to CDOT Standard Specification, Section 705.01 and 705.09 for joint and crack sealant material requirements.
   2. Refer to CDOT Standard Specification, Section 412.18 for joint and crack sealant installation requirements.

2.04 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rods for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

D. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.

2.05 PRIMERS

A. Primers: Product recommended by join-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from manufacturers recommendation.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 JOINT DESIGN

A. Sealant depth is measured at the center (thin) section of sealant bead.

B. Install sealants to depths and widths as recommended by sealant manufacturer and as shown on the drawings. Also, conform to the following general limitations if not in conflict with sealant manufacturer’s recommendations.
   1. For sidewalks, pavements and similar joints subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75 percent of joint width, but neither more than 5/8 inch deep nor less than 3/8 inch deep.
   2. For normal moving joints not subject to traffic, fill joints to a depth equal to 50 percent of joint width, but neither more than 5/8 inch deep nor less than 1/4 inch deep.
   3. Depth of sealant must not exceed width of joint.
   4. Sealant joints shall not be less than 1/4 inch in width and 1/4 inch in depth.
   5. Sealant joints shall not exceed 2 inches in width in a single application.

3.04 SURFACE PREPARATION

A. Preparation work shall result in clean surfaces in all areas where sealant is to be adhered. Such surfaces shall be free of any old sealant, contaminants, and impurities, which are deleterious to bonding or adhesion of primers or sealant.

B. Clean ferrous metals of all rust, mill scale, and coatings by wire brush or grinding. Any equipment used to remove rust shall be free of oil contaminants.

C. Wire brush masonry joint surfaces, then blow clean with oil free compressed air.

D. Apply primer per manufacturer’s recommendations. Allow primer to dry prior to applying sealant.

E. Do not caulk joints until they are clean, dry, and free of dust, loose mortar, old sealant, foreign matter or other bond inhibiting materials, and in compliance with requirements of manufacturer of materials, details shown on drawings, and specific requirements of other sections of specifications.

3.05 JOINT BACKING

A. Use joint backing to control depth of joint to specified thickness.

B. Select joint backing size to allow for 25 percent compression of backing when inserted into joint.

C. Where shown on drawings where depth of joint will not permit use of joint backing, or wherever recommended by sealant manufacturer, install bond-breaker tape to prevent three (3) sided adhesion.

D. Do not leave voids or gaps between ends of joint backing units.

3.06 APPLICATION/INSTALLATION OF JOINT SEALANT

A. Apply sealants neatly, in a good and workmanlike manner, which meets following minimum requirements or standards. Specific instructions of manufacturer must also be followed.

B. Apply sealant using a gun with proper size nozzles. Use sufficient pressure to fill all voids and joints solid to backup material, with complete wetting of all joint bond surfaces.

C. Applied sealant shall form a full, smooth, uniform bead, free of ridges, wrinkles, sags, air pockets and embedded impurities.

D. After joint has been completely filled with sealant, neatly tool joint sealant to eliminate air pockets, or voids, and to provide a smooth, slightly concave, neat appearing finish, with sealant surface slightly below adjoining surfaces. Wetting of finished surface will not be allowed.

E. Where horizontal joints are located between a horizontal surface and vertical surface, fill joint to form a slight cove, so joint will not trap moisture and dirt.

F. Protect adjacent surfaces and systems from sealant material. Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

G. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

H. Tooling of Non-Sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
   1. Remove excess sealants from surfaces adjacent to joint.
   2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

I. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.

J. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.07 CLEANING

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.08 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes, so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

3.09 JOB SITE CLEAN-UP

A. Sealant applicator must remove all excess materials from job site.

B. Leave all surrounding areas where joint sealant has been applied free of excess sealant, debris, and foreign substances.

END OF SECTION

SECTION 32 1540

CRUSHED STONE SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Contract Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes requirements for demolition, earthwork, grading, furnishing, and placement of crushed stone paving.
   1. Furnish and place crushed stone paving, bonded with fine aggregate, constructed on a prepared underlying base course in accordance with these specifications and in conformity with the dimensions, typical cross section, and the lines and grades shown on the Contract Drawings. The locations where crushed stone paving will be used are shown on the Contract Drawings.

1.3 REFERENCES

A. ASTM C117 – Test Method for Materials Finer than No. 200 (75-um) Sieve in Mineral Aggregates by Washing.

B. ASTM C136 – Method for Sieve Analysis of Fine and Coarse Aggregates.

C. ASTM D4318 – Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.

1.4 SUBMITTALS

A. Material Analysis: Contractor shall provide copies of the following test data required by ASTM:
   1. ASTM C136 - Sieve Analysis.
   2. ASTM C127 - Specific Gravity and Absorption.
   3. ASTM C131 - L.A. Abrasion.

B. Samples: Provide a one (1) gallon sample of material for approval.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.

B. Bulk Materials:
   1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas, plant materials or within critical root zones.
   2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
   3. Accompany each delivery of bulk materials with appropriate certificates.

C. Rejection of material.
   1. Evidence of inadequate protection or improper handling or storage shall be cause for rejection.
   2. Any product or material exhibiting signs of damage due to nonconformity to specifications or due to delivery, storage or handling shall be rejected by the Owner. Contractor shall be responsible for

hauling off-site and disposing of according to general conditions and codes of the governing jurisdiction.

1.6 PROJECT CONDITIONS

A. Environmental requirements: Work shall occur only when weather and soil conditions permit in accordance with locally accepted practice.

B. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with proposed crushed stone paving areas by field measurements before proceeding with work.

C. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others.

D. Existing Conditions:
1. Utilities: Determine location of existing and proposed underground utilities. Perform work in a manner to avoid damage. Hand excavate, as required.
2. Excavation: Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.

E. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained.

1.7 MAINTENANCE SERVICE

A. General: Maintain Work in accordance with Division 01.
1. Maintenance Period: Begin maintenance immediately after Work is completed. Maintain areas until the end of Initial Acceptance.

1.8 WARRANTY

A. See Division 01 Section “Closeout Submittals”.

PART 2 - PRODUCTS

2.1 CRUSHED STONE PAVING

A. Type: Crushed granite stone or gravel. Shall be unused material free of shale, lay, friable materials, organics and debris.
1. Size Range: 3/8 inch maximum

Sieve Size	Percent Passing
2 inch	100
3/8 inch	100
No. 4	85
No. 8	63
No. 16	50
No. 30	39
No. 50	29
No. 100	18

2. Color: Uniform grey.

3. Pre mixed, stabilized crusher fines material to be from Golf and Sport Solutions. Product name “Gray Stabilizer Cart Path”, 3/8” screened Gray Crusher Fines with Stabilizer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where the Work of this Section will be performed for compliance with requirements and conditions affecting installation and performance.
   1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within the work area.
   2. Verify that final grades are completed in accordance with the drawings.

B. Proceed with installation only after unsatisfactory conditions have been corrected and approved by Owner.

3.2 QUALITY CONTROL

A. Mock-up: Provide field constructed sample installation of crushed stone paving, and prepared subgrade.
   1. Mock-up to be ten foot (10') x ten foot (10') and located where directed by Owner. Mock-up shall include proposed edge and banding, and surface stabilization if specified.
   2. Owner shall review mock up within forty eight (48) hours of notification by the contractor.
   3. Make necessary adjustments as directed by Owner.
   4. Obtain approval from Owner before proceeding with the Work.
   5. Retain and protect mock-up during construction as a standard for judging completed crushed stone paving work. Do not remove or destroy mock-up until work is completed.
   6. Accepted and properly maintained sample installations may remain in completed work if approved in writing by Owner.
   7. All work shall match accepted field mock-up.

3.3 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, turf areas, existing landscape areas, and trees from damage.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of

C. Install edging of type and in locations shown on drawings. Obtain acceptance of layout by Owner before excavating or installing. Make minor adjustments as required.

3.4 PLACEMENT OF CRUSHED STONE PAVING

A. Cut earthwork to width of trail/area to receive crusher fines paving to approximate depth section as specified on the Contract Drawings. Remove, haul and dispose of excess material off site, or use on-site with approval of Owner.

B. Complete excavation required in sub-grade before fine grading and final compaction of sub-grade is performed. Extend sub-grade compaction one foot (1') beyond proposed edge of crushed stone paving or as indicated on drawings.
   1. Where earth moving is required the sub-grade shall be compacted to ninety five percent (95%) standard proctor within two percent (2%) of the optimum moisture.
   2. Keep areas being graded or compacted shaped and drained during construction. Ruts greater than or equal to 1 inch deep in sub-grade shall be graded out and reshaped as required, and re-compacted before crushed stone paving placement.
   3. If the trail is part of a cross slope it should drain in the direction of the slope no greater than two percent (2%). Ensure that no low spots exist so that ponding does not occur.

C. Prior to placement of Crushed Stone Paving material, the sub-grade shall be proof rolled. Where soft spots are detected, scarify subgrade beneath Crushed Stone Paving to a minimum of six-inch (6") depth. Moisture treat and compact to a minimum ninety five percent (95%) proctor density as determined by

ASTM D698 or AASHTO T-99. Take moisture density tests every two hundred fifty (250) lineal feet of trail or proof roll. Treat and compact sub-grade, leaving it 5-inches below final grade for placement of Crushed Stone Paving. Compact material and retest by proof rolling to achieve approval of Owner.

D. Install crushed stone paving only after excavation and construction work which might injure it have been completed, and after edging has been completely installed on the compacted sub-grade. Install crushed stone paving, over compacted base course in areas indicated on plan.

E. Spread crushed stone evenly to fifty percent (50%) of specified depth. Avoid segregation of aggregate and contamination with lower courses or sub-grade.

F. Compact to ninety five percent (95%) of maximum density as determined by ASTM D1557.
   1. Maintain surface course moisture content within plus/minus three percent (± 3%) of optimum. Add water to quarry fines paving as required to achieve optimum moisture content and a uniform, compacted surface conforming to the finish grades indicated.
   2. Compact areas inaccessible to rolling by mechanical tamping.

G. Protect crushed stone paving from soil or other contaminates during and following installation.

H. Spread and compact additional crushed stone paving to achieve the required minimum compacted thickness. Compact per 3.3.F above.

3.5 PLACEMENT OF STABILIZED CRUSHED STONE PAVING

A. Complete items 3.3.A through 3.4 H above using specified crusher fines material.

B. Do not allow traffic on stabilized crushed stone paving for two days.

3.6 MAINTENANCE AND REPAIRS:

A. Crusher Fines Paving:
   1. Areas that do not compact, become eroded or are degraded in visual quality and/or performance as determined by the Owner are to be removed and/or repaired. Obtain approval of repair methods from Owner prior to affecting repairs.

3.7 CLEANUP AND PROTECTION

A. All areas shall be clean at the end of each workday.

B. The contractor shall maintain protection during installation, curing, and maintenance periods.
   1. Erect temporary fencing or barricades and warning signs as required protecting newly installed Crushed Stone Paving areas from traffic, other trades, and trespassers. Maintain fencing and barricades throughout initial maintenance period and remove with approval of Owner.

C. Project completion: All debris, soil, trash, and excavated and/or stripped material resulting from Crushed Stone Paving operations and unsuitable for or in excess of requirements for completing work of this Section shall be disposed of off-site.

D. Maintain protection during installation and maintenance periods. See Division 1 – General Requirements. Treat, repair or replace damaged work as required.

3.8 QUALITY ASSURANCE

A. Refer to Division 1 Section “Quality Requirements”.

END OF SECTION

SECTION 32 3300

SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes benches, bicycle racks, tables, and trash receptacles.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 BENCH (L3.1 and L3.2 Plans, L4.6 Site Details)

A. Products: Subject to compliance with requirements, provide the following:

1. 6’ Bench by DuMor, Inc. Model #68-296 W/SKATE STOPES, surface mounted (or approved substitute), 6’ long bench with back, arms, skate guard. Color Argento.

2.2 TRASH RECEPTACLE (L3.1 and L3.2 Plans, L4.6 Site Details)

A. Products: Subject to compliance with requirements, provide the following:

1. Trash Receptacle by DuMor, Inc. Model 432-55-FTO (or approved substitute). 55 Gallon. Color Argento.

2.3 SHADE SAIL (L3.1 and L3.2 Plans, L4.7 Site Details)

A. Products: Subject to compliance with requirements, provide the following:

1. 4 Post Shade Sail and 3 Post Shade Sail by USA Shade (or approved substitute). Colors for posts and fabric to be confirmed by City of Thornton.

2.4 FABRICATION

A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.

B. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.

C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout

entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

D. Preservative-Treated Wood Components: Complete fabrication of treated items before treatment if possible. If cut after treatment, apply field treatment complying with AWPA M4 to cut surfaces.

E. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.

F. Factory Assembly: Assemble components in the factory to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.5 ALUMINUM FINISHES

A. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

2.6 STEEL AND GALVANIZED-STEEL FINISHES

A. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

B. PVC Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

2.7 IRON FINISHES

A. Baked-Enamel, Powder-Coat Finish: Manufacturer's standard, baked, polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

2.8 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run directional finishes with long dimension of each piece.

2. Directional Satin Finish: No 4.

3. Dull Satin Finish: No. 6.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.

END OF SECTION

SECTION 32 8400

IRRIGATION SYSTEMS

PART 1 - GENERAL

1.01 WORK INCLUDED

Work of this Section generally includes provisions for the installation of an underground landscape irrigation system including the following:

A. Static pressure verification and coordination of irrigation system installation with landscape material installation.

B. Trenching, stockpiling excavation materials, refilling and compacting trenches.

C. Complete irrigation system including but not limited to piping, backflow preventer assemblies, valves, fittings, heads, controllers and wiring, and final adjustments to insure complete coverage.

D. Water connections.

E. Replacement of unsatisfactory materials.

F. Clean-up, Consultant Reviews, and Project Acceptance

G. Tests.

H. Fall Winterization and Spring Start-up & Adjustments.

1.02 RELATED SECTIONS

A. Examine all sections related to project work.

1.03 REFERENCES

A. Perform Work in accordance with requirements of Conditions of the Contract and Division 01 - General requirements as well as provisions of all applicable laws, codes, ordinances, rules, and regulations.

B. Conform to requirements of reference information listed below except where more stringent requirements are shown or specified in Contract Documents.
   1. American Society for Testing and Materials (ASTM) - Specifications and Test Methods specifically referenced in this Section.

2. Underwriters Laboratories (UL) - UL Wires and Cables.

1.04 QUALITY ASSURANCE

A. Installer Qualifications - Installer shall have had considerable experience and demonstrate ability in the installation of irrigation system(s) of specific type(s) in a neat orderly, and responsible manner in accordance with recognized standards of workmanship. To demonstrate ability and experience necessary for this Project, and financial stability, submit if requested by consultant, prior to contract award the following:
   1. List of 3 projects completed in the last 2 years of similar complexity to this Project. Description of projects shall include:
      a. Name of project.
      b. Location.
      c. Owner.
      d. Brief description of work and project budget.

B. Special Requirements:
   1. Work involving substantial plumbing for installation of copper piping, backflow preventer(s), and related work shall be executed by licensed and bonded plumber(s). Secure a permit at least 48 hours prior to start of installation.
   2. Tolerances - Specified depths of mains and laterals and pitch of pipes are minimums. Settlement of trenches is cause for removal of finish grade treatment, refilling, compaction, and repair of finish grade treatment.
   3. Coordination with Other Contractors - Protect, maintain, and coordinate Work with Work under other Section.
   4. Damage To Other Improvements - Contractor shall replace or repair damage to grading, soil preparation, seeding, sodding, or planting done under other Sections during Work associated with installation of irrigation system at no additional cost to Owner.

C. Pre-Construction Conference - Contractor shall schedule and conduct a conference to review in detail quality control and construction requirements for equipment, materials, and systems used to perform the Work. Conference shall be scheduled not less than 10 days prior to commencement of Work. All parties required to be in attendance shall be notified no later than 7 days prior to date of conference. Contractor shall notify qualified representatives of each party concerned with that portion of Work to attend conference, including but not limited to Architect, Consultant, Contractor's Superintendent, and Installer.
   1. Minutes of conference shall be recorded and distributed by Contractor to all parties in attendance within five days of conference.

1.05 SUBMITTALS

Prepare and make submittals in accordance with conditions of the Contract.

A. Materials List - Submit One electronic copy of a complete materials list indicating manufacturer, model number, and description of all materials and equipment to be used. Show appropriate dimensions and adequate detail to accurately portray intent of construction.

B. Record Drawings (As-Builts):
   1. At onset of irrigation installation secure AutoCAD files of original irrigation design from Owner. At the end of every day, revise as-built prints for work accomplished that day in red ink. As-built field prints shall be brought up-to-date at the close of the working day every Friday by a qualified draftsperson. A print of record plan(s) shall be available at Project Site. Indicate zoning changes on weekly as-built drawings. Indicate non-pressure piping changes on as-built. Upon completion of Project, but prior to scheduling of substantial acceptance walk-through, submit for review a final set of as-built mylars and an AutoCAD disk copy. Dimensions, from two permanent points of reference (building corners, sidewalk, road intersections or permanent structures), location of following items:
      a. Connection to pump assembly.
      b. Routing of sprinkler pressure lines (dimension maximum 100 feet along routing).
      c. Sprinkler control valves.
      d. Quick coupling valves.
      e. Manual drains and stop and waste valves.
      f. Drip line blow-out stubs.
      g. Control wire routing if not with pressure mainline.
      h. Gate valves.
      i. Control wire and communication cable splices
      j. Locations of all sleeving including size, quantity and depth of sleeve
   2. Owner’s Representative will not certify any pay request submitted by the Contractor if the as-built drawings are not current, and processing of pay request will not occur until as-builts are up-dated.

C. Operation Instructions - Submit written operating instructions (One paper & one electronic) including winterization procedures and start-up, with cut sheets of products, and coordinate controller/watering operation instruction with Owner maintenance personnel.
   1. Controller Charts:
      a. Do not prepare charts until consultant has reviewed record (as-built) drawings.
      b. Provide one controller chart for each automatic controller installed.
         - Chart may be reproduction of record drawing, if scale permits fitting of controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility.
         - Chart shall be blueline print of actual "as-built" system, showing area covered by that controller.
      c. Identify area of coverage of each remote-control valve, using a distinctly different pastel color drawing over entire area of coverage.
      d. Following review of charts by consultant, they shall be hermetically sealed between two layers of 20-mm thick plastic sheet
      e. Charts shall be completed and reviewed prior to final review of irrigation system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, unload, store, and handle materials, packaging, bundling, products in dry, weatherproof, condition in manner to prevent damage, breakage, deterioration, intrusion, ignition, and vandalism. Deliver in original unopened packaging containers prominently displaying manufacturer's name, volume, quantity, contents, instructions, and conformance to local, state, and federal law. Remove and replace cracked, broken, or contaminated items or elements prematurely exposed to moisture, inclement weather, snow, ice, temperature extremes, fire, or jobsite damage.

B. Handling of PVC Pipe - Exercise care in handling, loading and storing, of PVC pipe. All PVC pipe shall be transported in a vehicle that allows length of pipe to lie flat so as not to subject it to undue bending or concentrated external loads. All sections of pipe that have been dented or damaged shall be discarded, and if installed, shall be replaced with new piping.

1.07 JOBSITE CONDITIONS:

A. Protection of Property:
   1. Preserve and protect all trees, plants, monuments, structures, and paved areas from damage due to Work of this Section. In the event damage does occur, all damage to inanimate items shall be completely repaired or replaced to satisfaction of Owner, and all injury to living plants shall be repaired by Owner. All costs of such repairs shall be charged to and paid by Contractor.
   2. Protect buildings, walks, walls, and other property from damage. Flare and barricade open ditches. Damage caused to asphalt, concrete, or other building material surfaces shall be repaired or replaced at no cost to Owner. Restore disturbed areas to original condition.

B. Existing Trees:
   1. All trenching or other Work under limb spread of any and all evergreens or low branching deciduous material shall be done by hand or by other methods so as to prevent damage to limbs or branches.
   2. Where it is necessary to excavate adjacent to existing trees use all possible care to avoid injury to trees and tree roots. Excavation, in areas where 2 inch and larger roots occur, shall be done by hand. Roots 2 inches or larger in diameter, except directly in the path of pipe of conduit, shall be tunneled under and shall be heavily wrapped with burlap to prevent scarring or excessive drying. Where a trenching machine is operated close to trees having roots smaller than 2 inches in diameter, wall of trench adjacent to tree shall be hand trimmed, making clean cuts through roots. Trenches adjacent to trees shall be closed within 24 hours, and when this is not possible, side of trench adjacent to tree shall be kept shaded with moistened burlap or canvas.

C. Protection and Repair of Underground Lines:
   1. Request proper utility company to stake exact location (including depth) of all underground electric, gas, or telephone lines. Take whatever precautions are necessary to protect these underground lines from damage. If damage does

occur, Utility Owner shall repair all damage. Contractor shall pay all costs of such repairs unless other arrangements have been made.

2. Request Owner, in writing, to locate all private utilities (i.e., electrical service to outside lighting) before proceeding with excavation. If, after such request and necessary staking, private utilities that were not staked are encountered and damaged by Installer, Owner shall repair them at no cost to Installer. If Contractor damages staked or located utilities, they shall be repaired by Utility Owner at Contractor's expense unless other arrangements have been made.

D. Replacement of Paving and Curbs - Where trenches and lines cross existing roadways, paths, curbing, etc., damage to these shall be kept to a minimum and shall be restored to original condition.

1.08 WARRANTY/GUARANTY

A. Manufacturer shall warrant materials against defects for a period of one year from date of Initial Acceptance. Installer(s) shall guaranty workmanship for similar period.

B. Settling of backfilled trenches that may occur during guaranty period shall be repaired at no expense to Owner, including complete restoration of damaged property.

C. Owner will maintain turf and planting areas during warranty period, so as not to hamper proper operation of irrigation system.

1.09 MAINTENANCE:

A. Furnish the following maintenance items to Owner prior to final Acceptance:
   1. Two Sets of special tools required for removing, disassembling, and adjusting each type of sprinkler head and valve supplied on this Project.

B. Winterization - winterizing complete system at conclusion of sprinkling season (in which system received final acceptance) within 3 days notification by the Owner. System shall be voided of water using compressed air or similar method. Reopen, operate, and adjust system malfunctions accordingly during April of following season within 3 days of notification by Owner.

1.10 EXTRA STOCK

A. In addition to installed system furnish the following items to Owner:
   1. 5 Pop-up spray heads with nozzles of each type used.
   2. 2 Rotor heads of each type used.
   3. 1 Single Station Decoders
   4. Hand Held Remote, receiver, chargers, pigtails, carry case

PART 2 - PRODUCTS

2.01 MATERIALS:

A. General Piping:
1. Pressure Supply Lines (downstream of backflow prevention units) - Class 200 PVC BE (1" - 2 1/2") and Class 200 PVC RT (3" and larger).
2. Non-pressure Lines - Class 200 PVC BE.
3. PVC Sleeving - Class 160 PVC.

B. Copper Pipe and Fittings:
1. Fittings - Wrought copper, solder joint type.
2. Joints - Soldered with solder, 45% silver, 15% copper, 16% zinc, and 24% cadmium and solidus at 1125~F and liquids at 1145~F.

C. Brass Pipe and Fittings:
1. Brass Pipe - 85% red brass, ANSI Schedule 40 screwed pipe.
2. Fittings - Medium brass, screwed 125-pound class.

D. Ductile Iron Pipe and Fittings:
1. Fittings – Mechanical joint as supplied by the pipe manufacturer and rated for working pressures of 350 psi.
2. Gaskets – Furnish in accordance with ANSI C111 and AWWA A21.11.

E. Plastic Pipe and Fittings:
1. Identification Markings:
   a. Identify all pipe with following indelible markings:
   b. Manufacturer's name.
   c. Nominal pipe size.
   d. Schedule of class.
   e. Pressure rating.
   f. NSF (National Sanitation Foundation) seal of approval.
   g. Date of extrusion.
2. Solvent Weld Pipe - Manufactured from virgin polyvinyl chloride (PVC) compound in accordance with ASTM D2241 and ASTM D1784; cell classification 12454-B, Type 1, Grade 1.
   a. Fittings - Standard Wright, Schedule 40, injection molder PVC; complying with ASTM D1784 and D2466, cell classification 12454-B.
   b. Threads - Injection molded type (where required).
   c. Tees and ells - Side gated.
   d. Threaded Nipples - ASTM D2464, Schedule 80 with molded threads.
   e. Teflon Tape – All PVC male threaded fittings and nipples, excluding marlex fittings, shall receive wrapping of Teflon tape applied to threaded surfaces per pipe manufacturer’s recommendations.
   f. Joint Cement and Primer - Type as recommended by manufacturer of pipe and fittings.

3. Gasketed End Pipe - Manufactured from virgin Polyvinyl Chloride compound in accordance with ASTM D2241 and ASTM D1784; cell classification 1254-B, Type 1, Grade 1.
    a. Fittings and Services Tees (3" and larger) - Ductile iron, grade 70-55-05 in accordance with ASTM A-536. Fittings shall have deep bell push-on joints with gaskets meeting ASTM F-477.
    b. Gaskets - Factory installed in pipe and fittings, having a metal or plastic support within gasket or a plastic retainer ring for gasket.
    c. Lubricant - As recommended by manufacturer of pipe fittings.
4. Flexible Plastic Pipe - Manufactured from virgin polyethylene in accordance with ASTM D2239, with a hydrostatic design stress of 630 psi and designated as PE 2306.
        a. Fittings – Insert type manufactured in accordance with ASTM D2609; PVC Type 1 cell classification 12454-B.
        b. Clamps - All stainless-steel worm gear screw clamps. Use 2 clamps per joint on 1-1/2 inch and 2-inch fittings.
5. Pressure Supply Piping Locating Tape: Mark line Tape, 3" wide detectable tape, NP purple in color with the words "CAUTION: RECYCLED/ RECLAIMED WATERLINE BELOW" printed every 36 inches. Place 6" below finish grade.

F. Gate Valves:
1. Gate Valves for 3/4 inch through 2-1/2 Inch Pipe - Brass construction; solid wedge, IPS threads, and non-rising stem with wheel operating handle.
2. Gate Valves for 3 Inch and Larger Pipe - Iron body, brass or bronze mounted AWWA gate valves with a clear waterway equal to full nominal diameter of valve; rubber gasket or mechanical joint-type only. Valves shall be able to withstand a continuous working pressure of 200 psi and be equipped with a square operating nut and resilient wedge. Provide pipe restraints on gate valves 3 inches or larger as detailed.

G. Quick Coupling Valves - Brass two-piece body designed for working pressure of 150 PSI; operable with quick coupler. Equip quick coupler with locking NP purple plastic cover.

H. Valve Boxes:
1. Gate Valves, Quick Coupling Valves, Drain Valves, Drip Line Blow-out Stubs, and Wire Splice or Stub Box - Carson Brooks #910-10, box w/ Purple Bolt Down Cover, as detailed.
2. 1 inch through 2-inch Control Valves, Pressure Regulating Valves and Communication Cable Splice box - Carson Brooks #1730-15 box w/ Purple Bolt Down Cover, as detailed.

I. Electrical Control Wiring:
1. Low Voltage -2 Wire:
    a. Electrical Control Wire - UFUL approved No. 14/14 (2-wire Paige #170116RB or as per manufactures requirements) direct burial copper wire to operate system as designed.
    c. Control Wire connections and splices shall be made with 3M DBR-6 direct bury splice.
    d. Loop five (5) feet minimum of 2-wire cable into all valve boxes.

J. Automatic Controller (2-Wire) - Existing controller- Coordinate with Parks Maintenance on the controller operations and Decoders.
   1. Single and Multi-station Decoders (2-Wire) - Size and type shown on Drawings; mounted as detailed.
   2. Install decoders and wire per manufacture recommendations and requirements.
   3. Grounding for all decoders and 2-wire cable, to be per manufactures recommendations and requirements. Minimum one grounding assembly per every 500' of wire and/or every 10th decoder and at all ends of the wire runs.

K. Electric Control Valves - Size and type shown on Drawings having purple manual flow adjustment and purple solenoids and manual bleed nut, 2-wire decoder.

L. Sprinkler Heads - As indicated on Drawings. Fabricated riser units in accordance with details on Drawings - with fittings and nipples of equal diameter as riser inlet in sprinkler body. Install Purple cap covers on all spray heads and NP purple reclaimed identification caps on all rotor heads.

M. Reclaimed Water Signage:
   1. Sign shall state: "CAUTION: RECLAIMED WATER – DO NOT DRINK," and display the international "do not drink" symbol.
   2. Signs shall be installed and prominently displayed at; all points of ingress, restroom facilities, around all reclaimed lakes and water features, and a maximum spacing of 500 feet within the project.
   3. Signs shall be visible and legible from all directions.

PART 3 - EXECUTION

3.01 SITE CONDITIONS, LANDSCAPE PLAN REVIEW AND COORDINATION

A. Contractor will be held responsible for coordination between landscape and irrigation system installation. Landscape material locations shown on the Landscape Plan shall take precedence over the irrigation system equipment locations. If irrigation equipment is installed in conflict with the landscape material locations shown on the Landscape Plan, the Contractor will be required to relocate the irrigation equipment, as necessary, at Contractor's expense.

B. Contractor is responsible to notify Consultant of any field conditions that vary from the conditions shown on the Landscape Construction Documents. If Contractor fails to notify Consultant of these conditions, Contractor will be held responsible for all costs associated with system adjustments required due to the change in field conditions.

3.02 STATIC PRESSURE VERIFICATION

Contractor shall field verify the static pressure at the project site, prior to commencing work or ordering irrigation materials, and submit findings, in writing, to consultant. If Contractor fails to verify static water pressure prior to commencing work or ordering irrigation materials, Contractor shall assume responsibility for all costs required to make system operational and the costs required to replace any damaged landscape material. Damage shall include all required material costs, design costs and plant replacement costs.

3.03 INSPECTION

A. Examine areas and conditions under which Work of this Section is to be performed. Do not proceed with Work until unsatisfactory conditions have been corrected.

B. Grading operations, with the exception of final grading, shall be completed and approved by Owner before staking or installation of any irrigation system begins.

C. Underground Utilities shall be installed prior to installation of irrigation system. If irrigation installation takes place prior to utility installation, Contractor shall notify Owner of this condition in writing prior to commencement of irrigation installation.

3.04 PREPARATION:

A. Staking shall Occur as Follows:
   1. Mark, with powdered lime, routing of pressure supply line and flag heads for first few zones. Contact Consultant 48 hours in advance and request review of staking. Proposed locations of all trees shall be field staked by Contractor and approved by Owner/Landscape Architect prior to Consultant review of irrigation staking. Consultant will advise installer as to the amount of staking to be prepared. Consultant will review staking and direct changes if required. Review does not relieve installer from coverage problems due to improper placement of heads after staking.
   2. Contractor shall contact Consultant if field spacing varies by +/- 10% of the spacing shown on the irrigation plans. If Contractor fails to notify Consultant of variances exceeding 10%, Contractor assumes full responsibility for the costs associated with any required system modifications deemed necessary by the Consultant or Owner.
   3. If Project has significant topography, freeform planting beds, or other amenities, which could require alteration of irrigation equipment layout as deemed necessary by consultant, do not install irrigation equipment in these areas until consultant has reviewed equipment staking.

B. Install sleeving under asphalt paving and concrete walks, prior to concreting and paving operations, to accommodate piping and wiring. Compact backfill around sleeves to 95% Modified Proctor Density within 2% of optimum moisture content in accordance with STM D1557.

C. Trenching - Trench excavation shall follow, as much as possible, layout shown on Drawing. Dig trenches straight and support pipe continuously on bottom of trench. Trench bottom shall be clean and smooth with all rock and organic debris removed.
   1. Clearances:
      a. Piping 3 Inches and Larger - Make trenches of sufficient width (14 inches minimum) to properly assemble and position pipe in trench. Minimum clearance of piping 3 inches or larger shall be 5 inches horizontally on both sides of the trench.
      b. Piping Smaller than 3 Inches - Trenches shall have a minimum width of 7 inches.
      c. Line Clearance - Provide not less than 6 inches of clearance between each line and not less than 12 inches of clearance between lines of other trades.
   2. Pipe and Wire Depth:
      a. Pressure Supply Piping - 24 inches from top of pipe.
      b. PVC Sleeving – To match depth of sleeved material.
      c. Non-pressure Piping (rotor) - 18 inches from top of pipe.
      d. Non-pressure Piping (pop-up) - 12 inches from top of pipe.
      e. Control Wiring/Communication Cable - Side of pressure main or at 18-inch depth if installed in a separate trench with no mainline piping.
   3. Boring will be permitted only where pipe must pass under obstruction(s) which cannot be removed. In backfilling bore, final density of backfill shall match that of surrounding soil. It is acceptable to use sleeves of suitable diameter installed first by jacking or boring, and pipe laid through sleeves. Observe same precautions as though pipe were installed in open trench.
   4. Vibratory Plow - Non-pressure piping may be installed through use of vibratory plow method if consultant determines soil conditions are satisfactory for this method of installation. Vibratory plowing does not relieve installer of minimum pipe depths.

3.05 INSTALLATION

A. Locate other equipment as near as possible to locations designated. Consultant shall review deviations prior to installation.

B. PVC Piping - Snake pipe in trench as much as possible to allow for expansion and contraction. Do not install pipe when air temperature is below 40 degrees F. Place manual drain valves at low points and dead ends of pressure supply piping to insure complete drainage of system. When pipe installation is not in progress, or at end of each day, close pipe ends with tight plug or cap. Perform Work in accordance with good practices prevailing in piping trades.
   1. Solvent Weld PVC Pipe - Lay pipe and make all plastic-to-plastic joints in accordance with manufacturer's recommendations.
   2. Gasketed End Pipes:
      a. Lay pipe and make pipe to fitting or pipe to pipe joint, following OR70 recommendations (Johns-Manville Guide for Installation of Ring-Tite Pipe), or pipe manufacturer's recommendations.
      b. Construct concrete thrust blocks behind all gasketed fittings, tees, bends, reducers, line valves, and caps in accordance with pipe manufacturer's recommendations. Contact Consultant prior to placing thrust blocks, for observation of thrust block excavation and initial placement. Thrust block bearing

surface shall be calculated based on tables below. All bearing surfaces shall be undisturbed soil:

3. THRUST BLOCK SIZING GUIDE:

Thrust developed per 100 PSI pressure (lbs. force) for various fitting configurations.

Pipe Size	Fitting 90° Elbow	Fitting 45° Elbow	Valves, Tees Dead Ends
3	1,000	600	800
4	1,800	1,100	1,300
6	4,000	2,300	2,900
8	7,200	4,100	5,100
10	11,200	6,300	7,900
12	16,000	9,100	11,300

Approximate bearing strength of typical soils.

Soil Type	lbs/ft 2
Mulch, Peat, etc.	0
Soft Clay	500
Sand	1,000
Sand and Gravel	1,500
Sand and Gravel with Clay	2,000
Sand and Gravel Cemented with Clay	4,000
Hard Pan	5,000

Example Calculation: 6-inch 90-degree elbow in sand and gravel soil

Bearing Surface Area (square feet) = 4,000 lbs /1,500 lbs/ ft ^{2}
= 2.67 square feet bearing surface area on undisturbed soil

4. Flexible Plastic (Polyethylene) Pipe - Lay pipe and assemble fittings following manufacturer's recommendations.

C. Control Wiring:

1. Low Voltage Wiring:
   a. The wire paths shall be twisted pair, solid-core, color-coded red/blue pairs with each conductor in a polyethylene jacket suitable for direct burial. The two-wire paths shall be Hunter Industries Model IDWIRE1 for 14 AWG(1.5mm) conductors, or Model IDWIRE2 for 12 AWG(2mm) conductors for extended range (over 10,000 ft./3km, up to 15,000 ft./4.5km).
   The two-wire paths may be spliced, or “teed”, permitting extensions of the path in multiple directions. In general, the distance from the controller to the end of any one end of a “tee” or wire run shall not exceed the maximum for the gauge of wire, even if the total of all wire exceeds that number. For example, a path comprised of IDWIRE1 (rated for 10,000ft./3km) could extend 5000 ft./1.5km to a “tee” splice, and each arm of the tee could extend an additional 5000 ft./1.5km. The total wire connected would equal 15,000 ft./4.5km, but the distance from the controller, to the end of each run, would be 10,000ft./3km or less, meeting the

specification. All wire splices must be made in a valve box with DBR-6 or equal direct-burial waterproof connectors.

D. Automatic Controller: Use Existing Two-Wire controller “C”.

E. Electric Control Valves - Install cross-handle four inches below finished grade were shown on Drawings as detailed. When grouped together, allow minimum of 12 inches between valve box sides. Install each remote-control valve in a separate valve box. Install valve box flush with grade or when present flush with surfacing material (rock mulch). When parallel to roadway, sidewalk or other permanent element or structure, control valve and box to be installed perpendicular to element or structure, spaced equally.
   1. All connections in the two-wire paths (outside the controller enclosure) shall be made with 3M DBR-6 waterproof, strain-relieving direct burial connectors, or exact equals. Decoder output to solenoid connections shall be made with 3M DBY waterproof, strain-relieving connectors, or exact equals. No substitution of wire or wire connector specifications is permissible. All connections, tees, and splices shall be positioned in valve boxes for future location and service. The installer shall provide adequate earth ground (not to exceed 10 Ohms, or in compliance with practices as defined in American Society of Irrigation Consultants Earth Grounding Guideline 100-2002, available at www.asic.org) and connect it to one of the decoder grounds leads every 1000 ft.(330m), or every 12th decoder module, whichever is shorter. Minimum ground hardware shall be a 4” x 36” (100 x 915mm) copper plate with at least 10AWG/2.5mm dia. copper wire. In high lightning areas, grounding may be increased to every 500 ft./150m or 10 decoders. Ground connections from decoder ground lead to grounding hardware shall be made by joining the 12AWG (2mm dia.) decoder ground wire with a 10AWG (2.5mm dia.) solid copper lead in an approved wire nut of appropriate size, inserted in a DBR-6 waterproof direct burial connector, or with an approved wire clamp. Ground hardware shall extend at right angles from the two-wire red/blue path, and ground hardware shall be located at least 6ft./2m away from the two-wire path.

F. Quick Coupling Valves – Coordinate locations with Parks maintenance - Install quick couplers on swing-joint assemblies as indicated on construction details; plumb and flush to grade. Angled nipple relative to pressure supply line shall be no more than 45 degrees and no less than 10 degrees.

G. Drain Valves - Coordinate locations with Parks maintenance - Install one manual drain valve on pressure supply line directly downstream of backflow preventer as detailed. Provide a three cubic foot drainage sump for drain valve as detailed.

H. Valve Boxes:
   1. Install one valve box for each type of valve installed as detailed. Valve box extensions are not acceptable except for master valves and flow sensors. Install gravel sump after compaction of all trenches. Place final portion of gravel inside valve box after valve box is backfilled and compacted.
   2. Brand controller letter and station number on lid of each valve box. Letter and number size shall be no smaller than 1 inch and no greater in size than 1 1/2 inches. Depth of branding shall be no more than 1/8 inch into valve box lid.

I. Gate Valves - Install where shown on Drawings as detailed.

J. Sprinkler Heads - Install sprinkler heads where designated on Drawings or where staked. Set to finish as detailed. Spacing of heads shall not exceed the maximum indicated on Drawing unless re-staked as directed by consultant. In no case shall the spacing exceed maximum recommended by manufacturer. Install heads on swing joints or riser assemblies as detailed. Adjust part circle heads for proper coverage. Adjust heads to correct height after sod is installed. Plant placement shall not interfere with intended sprinkler head coverage, piping, or other equipment. Consultant may request nozzle changes or adjustments without additional cost to the Owner.

K. Backfilling - Do not begin backfilling operations until required system tests have been completed. Backfill shall not be done in freezing weather except with review by consultant. Leave trenches slightly mounded to allow for settlement after backfilling is completed. Trenches shall be finish graded prior to walk-through of system by consultant.
   1. Materials - Excavated material is generally considered satisfactory for backfill purposes. Backfill material shall be free of rubbish, vegetable matter, frozen materials, and stones larger than 1 inch in maximum dimension. Do not mix subsoil with topsoil. Material not suitable for backfill shall be hauled away. Contractor shall be responsible for providing suitable backfill if excavated material is unacceptable or not sufficient to meet backfill, compaction, and final grade requirements.
   2. Do not leave trenches open for a period of more than 48 hours. Open excavations shall be protected in accordance with OSHA regulations.
   3. Compact backfill to 90% maximum density, determined in accordance with ASTM D155-7 utilizing the following methods:
      a. Mechanical tamping.
      b. Puddling or ponding. Puddling or ponding and/or jetting is prohibited within 20’-0" of building or foundation walls.

L. Piping Under Paving:
   1. Provide for a minimum cover of 18 inches between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete or concrete paving.
   2. Piping located under areas where asphalt or concrete paving will be installed shall be bedded with sand (a layer 6" below pipe and 6" above pipe).
   3. Compact backfill material in 6" lifts at 90% maximum density determined in accordance with ASTM D155-7 using manual or mechanical tamping devices.
   4. Set in place, cap, and pressure test all piping under paving, in presence of Owner prior to backfilling and paving operations.
   5. Piping under existing walks or concrete pavement shall be done by jacking, boring, or hydraulic driving, but where cutting or breaking of walks and/or concrete is necessary, it shall be done and replaced at not cost to Owner. Obtain permission to cut or break walks and/or concrete from Owner.

M. Water Supply and Point of Connection - Water supply shall be extended as shown from water supply lines.

3.06 FIELD QUALITY CONTROL:

A. Flushing - After piping, risers, and valves are in place and connected, but prior to installation of sprinkler heads, quick coupler assemblies, and hose valves, thoroughly flush piping system under full head of water pressure from dead end fittings. Maintain flushing for 5 minutes through furthermost valves. Cap risers after flushing.

B. Pressure Testing - Conduct test in presence of consultant. Arrange for presence of consultant 48 hours in advance of testing. Supply force pump and all other test equipment. Compressed air shall not be used for pressure testing system.
   1. After backfilling, and installation of all control valves, fill pressure supply line with water, and pressurize to 40 PSI over the designated static pressure or 120 PSI, whichever is greater, for a period of 2 hours.
   2. Leakage, Pressure Loss - Test is acceptable if no loss of pressure is evident during the test period.
   3. Leaks - Detect and repair leaks.
   4. Retest system until test pressure can be maintained for duration of test.
   5. Before final acceptance, pressure supply line shall remain under pressure for a period of 48 hours.
   6. Pressure test shall be scheduled and passed prior to scheduling of Substantial Completion Walk-through.

3.07 WALK-THROUGH FOR SUBSTANTIAL COMPLETION:
   1. Arrange for Consultant's presence 48 hours in advance of walk-through.
   2. Entire system shall be completely installed and operational prior to scheduling of walk-through.
   3. Operate each zone in its entirety for consultant at time of walk-through and additionally, open all valve boxes if directed.
   4. Generate a list of items to be corrected prior to Final Completion.
   5. Furnish all materials and perform all work required to correct all inadequacies of coverage due to deviations from Contract Documents.
   6. During walk-through, expose all drip emitters under operations for observation by consultant to demonstrate that they are performing and installed as designed, prior to placing of all mulch material. Schedule separate walk-through if necessary.
   7. Supply Consultant with prints of irrigation as-builts prior to scheduling substantial completion walk-through.

3.08 WALK-THROUGH FOR INITIAL ACCEPTANCE:
   1. Arrange for Consultant’s presence 48 hours in advance of walk-through.
   2. Show evidence to consultant that Owner has received all accessories, charts, record drawings, and equipment as required before Initial Acceptance walk-through is scheduled.
   3. Operate each zone, in its entirety for consultant at time of walk-through to insure correction of all incomplete items.
   4. Items deemed not acceptable by consultant shall be reworked to complete satisfaction of consultant.

5. If after request to consultant for walk-through for Initial Acceptance of irrigation system, Consultant finds items during walk-through which have not been properly adjusted, reworked, or replaced as indicated on list of incomplete items from previous walk-through, Contractor shall be charged for all subsequent walk-throughs. Funds will be withheld from final payment and/or retainage to Contractor, in amount equal to additional time and expenses required by consultant to conduct and document further walk-throughs as deemed necessary to ensure compliance with Contract Documents.

3.09 ADJUSTING – TO BE DONE PRIOR TO WALK-THROUGH FOR SUBSTANTIAL COMPLETION.

A. Upon completion of installation, fine-tune entire system by adjusting patterns and break-up pins, and setting pressure reducing valves at proper and similar pressure to provide optimum and efficient coverage. Flush and adjust all sprinkler heads for optimum performance and to prevent overspray onto walks, roadways, and buildings as much as possible. Heads of same type shall be operating at same pressure +/- 10%.

B. If it is determined that irrigation adjustments will provide proper coverage, and improved water distribution as determined by consultant, contractor shall make such adjustments prior to Initial Acceptance, as directed, at no additional cost to Owner. Adjustments may also include changes in nozzle sizes, degrees of arc, and control valve throttling.

C. All sprinkler heads shall be set perpendicular to finish grade unless otherwise noted on Construction Plans or directed by consultant.

D. Areas which do not conform to designated operation requirements due to unauthorized changes or poor installation practices shall be immediately corrected at no additional cost to the Owner.

3.10 CLEANING

Maintain continuous cleaning operation throughout duration of work. Dispose of, off-site at no additional cost to Owner, all trash or debris generated by installation of irrigation system.

END OF SECTION 02815

SECTION 32 9113

SOIL PREPARATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 General Requirements apply to this Section.

1.2 SUMMARY

A. The Work of this Section includes preparation of soil for the purpose of amending the soil for irrigation sod and shrub bed areas.

1. Soil preparation consists of ripping, fertilizing, soil conditioning and fine grading the topsoil. Soil preparation as specified herein MUST precede all seeding, sodding, and planting.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1. Include recommendations for application and use.

2. Include test data, from within 3 months of site use, substantiating that products comply with requirements.

3. Include sieve analyses for aggregate materials.

4. Material Certificates: For each type of soil amendment and fertilizer before delivery to the site, according to the following:

a. Manufacturer's qualified testing agency's certified analysis of standard products.

5. Load tickets, verifying source, quality and quantity of material delivered to site.

B. Samples: For each bulk-supplied material, Contractor shall submit for approval at least 14 days prior to site delivery, 1-gallon volume of each in sealed containers labeled with content, laboratory analysis, source, and date obtained. Dated within thirty days of date of submittal. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

C. Quality Control Submittals:

1. Certificates: State, Federal and other inspection certificates shall accompany invoice for materials showing source or origin. Submit to Owners Representative prior to acceptance of material.

2. Material Analysis: Provide soil conditioner analysis performed no more than three months prior to delivery to site.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Fertilizer: Deliver inorganic or chemical fertilizer to site in original unopened containers bearing manufacturer’s guaranteed chemical analysis, chemical name, trade name, trademark and conformance to state law, bearing name and warranty of producer.

B. Notify Owners Representative of delivery schedule in advance so material can be inspected upon arrival at project site. Immediately remove unacceptable material from project site.

1.5 PROJECT/SITE CONDITIONS

A. General: Do not perform work when climate and existing site conditions will not provide satisfactory results.

B. Vehicular site access shall be limited to the area(s) indicated on the drawings or as defined by the Owners Representative.

C. Damage to lawns, natural areas, pavements, irrigation systems, underground utilities, and other improvements shall be repaired by the contractor at no additional cost to the Client.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.

1. Laboratories: Subject to compliance with requirements:

a. Colorado Analytical, Brighton, Colorado 303.659.2313.

2. Multiple Laboratories: At Contractor's option, work may be divided among qualified testing laboratories specializing in physical testing, chemical testing, and fertility testing.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency approved by the Owners Representative to perform preconstruction soil analyses on existing imported soil.

B. Imported Soil Analyses: For each unamended imported soil source, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.

1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

1.8 SOIL-SAMPLING REQUIREMENTS

A. General: Extract soil samples according to requirements in this article.

B. Sample Collection and Labeling: Have samples taken and labeled by Contractor in presence of Owner under the direction of the testing agency.

1. Number and Location of Samples: Minimum of 4 representative soil samples from varied locations in the Thornton Active Adult Center location.

2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils."

3. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.9 TESTING REQUIREMENTS

A. General: Perform tests on soil samples according to requirements in this article.

B. Physical Testing:

1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":

a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.

b. Hydrometer Method: Report percentages of sand, silt, and clay.

2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."

3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."

4. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction according to ASTM D 698 (Standard Proctor).

C. Chemical Testing:

1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3-Chemical Methods."

2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1- Physical and Mineralogical Methods."

3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.

4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

D. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of SSSA NAPT NCR-13, including the following:

1. Percentage of organic matter.

2. CEC, calcium percent of CEC, and magnesium percent of CEC.

3. Soil reaction (acidity/alkalinity pH value).

4. Buffered acidity or alkalinity.

5. Nitrogen ppm.

6. Phosphorous ppm.

7. Potassium ppm.

8. Manganese ppm.

9. Manganese-availability ppm.

10. Zinc ppm.

11. Zinc availability ppm.

12. Copper ppm.

13. Sodium ppm and sodium absorption ratio.

14. Soluble-salts ppm.

15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.

16. Other deleterious materials, including their characteristics and content of each.

E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."

F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients. Contractor to compare the recommendations to the City of Thornton minimum amendments and choose whichever is greater.

1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.

2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

3. Do not move or handle materials when they are wet or frozen.

4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Install soil amendments as required in Section 31 0000 - Earthwork

B. Topsoil and Topsoil Mix: See Section 32 9120 - Topsoil.

C. Soil Conditioner for All Planted Areas:

1. Composted material shall consist of aged organic matter, free of weed or other noxious plant seeds, screened to 3/8” minus and free from lumps, stones, roots, sticks, weed stolen, seeds, high salt content and other foreign contaminants harmful to plant life, and having the following characteristics based on a nutrient test performed no longer than 3 months prior to its incorporation into the project:

a. Organic matter: minimum 25% and maximum 35% organic matter, measured on dry weight basis

b. EC electrical conductivity (soluble salts) 2.0 – 5.0 (sod) mmhos/cc @ 1:5 (compost water weight ratio)

c. pH range: 6.0 to 7.0 (7.0 is neutral)

d. Carbon to nitrogen ratio: 10:1 to 12:1, 12-16 may be acceptable

2. Mountain peat, aspen humus, gypsum and sand will not be accepted.

3. Acceptable product: Class I compost, such as Ecogro or Bio-comp, as produced by A1 Organics, Eaton, CO, or approved equal.

4. If a site is unable to be tilled as determined by the Owners Representative, then the following products shall be used as a soil conditioner:

a. Organic slow release fertilizer (6-1-1), acceptable product: “Biosol” or approved equal.

2.2 SOIL CONDITIONER APPLICATION RATES

A. General: soil conditioner is to be applied to all planted areas, including the total square footage of planting beds.

B. Irrigated Native Seed:

1. 6 cubic yards of a Class I compost per 1000 SF, “Biocomp” non-manure based compost as specified by A-1 Organics, Eaton, Colorado, or approved equal. Compost shall be distributed across the soil surface in a uniform 2” and incorporated into the top 8 inches of soil with a rototiller capable of tilling to 8 inches in depth.

C. Shrub Areas:

1. 6 cubic yards of a Class I compost per 1000 SF, “Biocomp” non-manure based compost as specified by A-1 Organics, Eaton, Colorado, or approved equal. Compost shall be distributed across the soil surface in a uniform 2” and incorporated into the top 8 inches of soil with a rototiller capable of tilling to 8 inches in depth.

2.3 FERTILIZER

A General:

1. Fertilizer shall conform to applicable State fertilizer laws. It shall be uniform in composition, dry, and free flowing, and shall be delivered to the site in the original, unopened containers, each bearing the manufacturer’s guaranteed analysis. Fertilizer that has become caked or damaged will not be accepted.

B Planted Areas:

1. Granular fertilizer 18-46-0 at the rate of 3 lb/1000 sf with the following composition by weight: Nitrogen, eighteen percent (18%) and phosphoric acid (P205), forty-six percent (46%). These elements may be organic, inorganic, or a combination of the two, and shall be measured according to the methods of the Association of Official Chemists

2. When grass is dry, using fertilizer that will provide actual nitrogen of at least 1 lb/1000 SF, 20-10-5 plus iron and 8% sulfur fertilizer (50% sulfur coated urea).

2.4 HERBICIDE

A. Post Emergent Herbicide: Roundup (Glyphosate) or approved equal as manufactured by Monsanto Company or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. General: Verify that existing site conditions are as specified and indicated on drawings before beginning work under this Section.

1. Grades: Inspect to verify rough grading is within +/- 0.1-foot of grades indicated and specified.

2. Damaged Earth: Inspect to verify that soil rendered unfit to support planting due to concrete, water, mortar, limewater or any other contaminant dumped on it has been removed and replaced with clean soil from a source approved by the Owners Representative.

B. Unsatisfactory Conditions: Report in writing to General Contractor with copy to Owners Representative.

C. Acceptance: Beginning of installation means acceptance of existing conditions by installer.

3.2 PREPARATION

A. Areas of Newly Placed Topsoil:

1. Protection:

a. Locate sewer, water, irrigation, gas, electric, phone and other pipelines or conduits and equipment prior to commencing work.

b. Contractor shall be responsible for proper repair to landscape, utilities, walls, pavements and other site improvements damaged by operations under this section.

B. Weed Control: Perform herbicide treatment over the entire area to be planted. Allow sufficient time to successfully complete the entire herbicide treatment process before proceeding with planting.

1. Herbicide treatment must be completed during the growing season.

2. Water surface 1/2" per week for two weeks prior to application if natural precipitation does not supply this amount to encourage weed seed germination.

3. Treat site with “Roundup” herbicide in accordance with manufacturer’s recommendations.

a. Two days after application water surface 1/2" per week if natural precipitation does not supply this amount to encourage weed seed germination.

b. Ten (10) days after the first “Roundup” application, review surface for evidence of plant growth.

c. Repeat steps 2, 3, 4, and 5, for a total of three (3) applications, until there is no evidence of plant growth after a 10-day period.

d. Obtain Owners Representative approval of surface conditions fourteen (14) days after last herbicide application.

e. Herbicide treatments beyond the 3 applications shall be considered additional to the contract and will be performed at the directed of the Owners Representative, after cost has been approved. Additional herbicide treatments required for imported topsoil shall be borne solely by the Contractor.

f. Remove plant debris from treated area.

g. Contact Owners Representative 48 hours in advance to review the site after each herbicide treatment. Do not proceed with additional planting until the results are approved and accepted by the Owners Representative.

4. Surface Grade: Establish grades as indicated on drawings, and as required in Division 31 Section “Earth Moving”.

5. Remove weeds, debris, clods and rocks larger than one 1-inch. Remove and dispose of accumulated materials at direction of Owners Representative.

6. Erosion Control: Take measures and furnish equipment and labor necessary to control the flow, drainage and accumulation of water, and prevent soil erosion, blowing soil and accumulation of wind-deposited material on the site throughout duration of work. Insure that all excess water will run off the grades or will percolate within 12 hours.

7. Soil Testing: Soil amendments shall meet the minimum amounts as specified in Article 3.3, “Installation”, below. Unless determined by the Owners Representative the Contractor shall be responsible for performing horticultural soil tests on a minimum of 4 current soil samples for each source of topsoil to be used in the project. Soil test will be used to determine the type and amount of soil organic amendment and fertilizer to be applied prior to seeding, sodding and planting. Locations for testing shall be approved by the Owners Representative.

8. Timing: Perform soil preparation just prior to planting operations and in accordance with final planting schedule. Coordinate with irrigation system installation to avoid damage.

C. Areas of Compacted Topsoil: Areas within the work limits or as defined on Drawings or by the Owners Representative that have vegetation that is sparse, stunted, anemic, weedy or was used as a construction staging, parking area and/or subjected to heavy use will require ripping to prepare the soil for revegetation. Scarify compacted soil to a 12-inch depth minimum to loosen topsoil.

D. Scarify all other areas to a minimum depth of 8 inches to loosen topsoil.

3.3 INSTALLATION

A. Install soil amendments as required in Section 310000 - Earthwork

B. Soil Preparation in Turf Grass Areas and Shrub Bed Areas:

1. Apply amendments at the following rates:

a. Soil conditioner: 6 cubic yards of organic compost per 1000 square feet.

b. Fertilizer: 18-46-0 at 3 pounds per 1000 square feet.

2. After applying soil conditioner and fertilizer, thoroughly till area to depth of 8-inches minimum by plowing, rototilling, harrowing, or disking until soil is well pulverized and thoroughly mixed.

C. Fine Grading in all Landscape Areas:

1. Complete fine grading for all areas prior to seeding or planting. Allow for natural settlement.

2. For ground surface areas surrounding buildings to be landscaped, maintain required positive drainage away from buildings.

3. Establish finish grades to within plus or minus 0.10-foot of grades indicated, in order to prevent “bird-baths” or ponding.

4. Finish grade shall be below edge of pavement prior to sodding, seeding or planting.

a. Sodded Areas: Allow 1-1/2-inches for sod.

b. Shrub Beds: Allow 4-inch for mulch.

5. Noxious weeds or parts thereof shall not be present in the surface grade prior to seeding.

6. Compaction of Surface Grade Prior to Landscape Installation: Firm, but not hard, 85% standard Proctor density within 2% optimum moisture.

7. Hand Raking:

a. Turfgrass Lawn Areas: Prior to acceptance of grades, hand rake to smooth, even surface, free of debris, clods, rocks and organic matter greater than 1-inch.

8. Restore planting areas to specified condition if eroded or otherwise disturbed after fine grading and prior to planting.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Contractor is responsible for specified tests.

C. Perform the following tests:

1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D 698. Space tests at no less than one for each 1000 sq. ft.

D. Soil will be considered defective if it does not pass tests.

E. Prepare test reports.

F. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

G. Inspection: Provide notice to the Owners Representative requesting inspection at least 7 days prior to anticipated date of completion.

H. Deficiencies: The Owners Representative will specify deficiencies to Contractor who shall make satisfactory adjustments and shall again notify Owners Representative for final inspection.

3.5 CLEANING

A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

B. Remove debris and excess materials from site. Clean out drainage inlet structures. Clean paved and finished surfaces soiled as a result of work under this Section, in accordance with Section 208 of the General Specifications or as directed by the Owners Representative.

3.6 PROTECTION

A. Provide and install barriers as required and as directed by Owners Representative to protect completed areas against damage from pedestrian and vehicular traffic until acceptance by Client. Contractor is responsible for all damage including vandalism, etc until Initial Acceptance.

B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Vehicle traffic.
4. Foot traffic.
5. Erection of sheds or structures.
6. Impoundment of water.
7. Excavation or other digging unless otherwise indicated.

C. If planting soil or subgrade is overcompacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Owners Representative and replace contaminated planting soil with new planting soil.

END OF SECTION

SECTION 32 9119.13

TOPSOIL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Contract Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to this Section.

B. Refer to Specification 32 9113 Soil Preparation for compost requirements of all planted areas.

1.2 SUMMARY

A. This Section includes requirements for furnishing, stockpiling, and placing topsoil on a previously prepared subgrade.

1.3 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.

B. Finish Grade: Elevation of finished surface of planting soil.

C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.

D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

E. Planting Area: Areas to be planted.

F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 SUBMITTALS

A. See Division 01 Section “Closeout Submittals” for submittal requirements.

B. Soil Analysis Report: As indicated in Article 1.5 “Quality Control”, below.

1.5 QUALITY CONTROL

A. Existing On-Site Topsoil:

1. Submit soil analysis report for stockpiled on-site topsoil from the State University Agricultural Extension Service or other approved soil testing laboratory. Report shall cover soil textural classification (percentages of sand, silt, and clay), pH, percentage organic matter, and soluble salts (electric conductivity in millimos/centimeter), and shall include additive recommendations.
2. A minimum of five (5) sample locations per acre are required, with individual tests completed for each sample.
3. A map of the site illustrating the locations of each sample location is to be submitted to Owner for approval prior to collecting samples.
4. Follow instructions from soil testing laboratory when collecting samples.
5. Testing will be at the expense of the Contractor.
6. Submit a one (1) quart sample along with analysis results.

B. Imported Topsoil:
1. Submit source location for topsoil to be imported to site for approval by Owner.
2. Submit soil analysis report for topsoil imported to site, from the State University Agricultural Extension Service or other approved soil testing laboratory. Report shall cover soil textural classification (percentages of sand, silt, and clay), pH, percentage organic matter, and soluble salts (electric conductivity in millimos/centimeter), and shall include additive recommendations.
   a. One 1-quart sample per five hundred (500) cubic yards of imported soil is required, with individual tests completed for each sample.
   b. Follow instructions from soil testing laboratory when collecting samples.
3. Testing will be at the expense of the Contractor.
4. Submit a one (1) quart sample along with analysis results.

C. Manufactured Topsoil:
1. Submit source of manufactured topsoil to be imported to site for approval by Owner.
2. Submit soil analysis report for stockpiled on-site topsoil from the State University Agricultural Extension Service or other approved soil testing laboratory. Report shall cover soil textural classification (percentages of sand, silt, and clay), pH, percentage organic matter, and soluble salts (electric conductivity in millimos/centimeter).
   a. Test is to be completed within sixty (60) days preceding delivery to site. Report shall cover soil textural classification (percentages of sand, silt, and clay), pH, percentage organic matter, and soluble salts (electric conductivity in millimos/centimeter).
   b. Submit a one (1) quart sample along with analysis results.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver or place topsoil in a frozen, wet, or muddy condition.

B. Protect stored and placed topsoil from vehicular traffic, equipment storage, material storage, or from contaminants or pollution sources. Topsoil that is compacted or tainted during construction is to be removed from site and disposed of at a licensed landfill at no additional cost to the City.

PART 2 - PRODUCTS

2.1 ON-SITE TOPSOIL

A. Topsoil previously stripped and stockpiled prior to earthwork operations. See Division 31 Section “Earth Moving” in Civil permit specifications package.

B. It shall be obtained from the top six-inches (6”) of well drained areas.

2.2 IMPORTED TOPSOIL

A. General: Topsoil sample and analysis to be approved by City of Thornton

B. Textural classification: sandy loam, loam, or sandy clay loam.

C. Topsoil Mix: 80% specified topsoil, 20% specified compost, as measured by volume; bulk mix prior to site delivery.

D. At least ten (10) days prior to topsoil delivery, notify Owner of the source(s) from which topsoil is to be furnished. Topsoil shall be furnished by the Contractor and shall be a natural, friable soil representative of productive soils and shall meet the following conditions.

E. Fertile, friable, loamy soil, reasonably free from subsoil, refuse, roots, heavy or stiff clay, stones larger than one-inch (1”), coarse sand, noxious seeds, sticks, brush, litter, and other deleterious substances; suitable for the germination of seeds and the support of vegetative growth.

F. pH value: pH less than 8.5

G. Soluble salts: less than 5.0 mmhos/cc, with organic matter of 2% - 5%.

H. Additives: As determined by soil fertility tests.

I. Percent Organic Content: Amend soil per specifications.
   1. Turf grass shall be three percent (3%) maximum after amending or conditioning.

J. Soluble Salts: Electric conductivity (EC) shall be less than two (2.0) mmhos/cm for turfgrass areas, dryland areas, and planting beds.

K. “Amended Topsoil” as manufactured by A1 Organics, 16350 WCR 76, Eaton, CO 80615 Ph: (970) 454-3492, (800) 776-1644 Fax: (970) 454-3232 www.a1organics.com, or substitution as approved by Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where the Work of this Section will be performed for compliance with requirements and conditions affecting installation and performance.
   1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within the work area.
   2. Verify that final grades are completed in accordance with the Contract Drawings.

B. Proceed with installation only after unsatisfactory conditions have been corrected and approved by Owner.

3.2 PLACING TOPSOIL

A. Scarify compacted subgrade to a six-inch (6”) depth to bond topsoil to subsoil. Place topsoil to a minimum depth of six-inches (6”) after settlement. Topsoil shall be free from weeds, sod, and material larger than 1-inch (1”), toxic substances, litter or other deleterious material. Spread evenly and grade to elevations and slopes shown on Contract Drawings. Hand rake areas inaccessible to machine grading.

B. Utilize salvaged topsoil as the top layer to the extent available. If sufficient on-site material is not available, the Contractor shall furnish and install imported topsoil in the manner described above. Topsoil shall mixed thoroughly with the salvaged topsoil prior to placement.

C. Utilize manufactured topsoil as the top layer, placing over scarified subgrade to a depth of six-inches (6”).

3.3 PROTECTION AND REPAIR

A. Protect completed areas where topsoil has been spread from traffic which will compact the soil volume. Any areas that, as determined by Owner, become compacted due to Contractor's construction traffic shall be reconstructed to specified requirements and approved by Owner.

END OF SECTION

SECTION 32 9219

NATIVE SEEDING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 General Requirements, and Civil permit specifications package, apply to this Section.

1.2 SUMMARY

A. The Work of this Section includes installation of native grass seed and specified mulch, straw matting if applicable

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

D. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

E. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.

F. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.

G. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

H. Weeds: Including but not limited to Goathead, Bindweed, Twitch, Dandelion, Jimsonweed, Knapweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Weed, Bent Grass, Wild Garlic, Perennial Sorrel, and Broom Grass.

1.4 REFERENCES

A. Comply with U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act and be equal to or better in quality than the standards for Certified Seed.

B. Colorado Department of Transportation (CDOT) – Standards Specifications for Road and Bridge Construction.

1.5 SUBMITTALS

A. See Section 01 3300 – Submittal Procedures for submittal requirements.

B. Product Data: For each type of product indicated.
   1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.

C. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

D. Qualification Data: For qualified landscape Installer.

E. Product Certificates: For soil amendments and fertilizers, from manufacturer.

F. Load tickets for each type of soil amendments are required.

G. Material Test Reports: For existing in-place surface soil.
   1. Soil analysis for each topsoil to be used.
   2. Analysis for manufactured topsoil.
   3. Analysis for each soil amendment.
   4. Analysis for each amended planting soil.

H. Analysis and standards: Wherever applicable, for non-packaged materials, provide two copies of analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists.

I. Planting schedule: Submit in writing two copies of proposed planting schedule, indicating dates for topsoil placing, site preparation, herbicide treatments, soil preparation, sodding, seeding, and coordination with plant procurement, planting soil preparation, plant delivery and planting. Schedule all Work during specified planting seasons. Once accepted, revise dates only as approved in writing, after documentation of reasons for delays.

J. Maintenance Instructions: Recommended procedures for maintenance of dryland grasses during a calendar year. Submit before expiration of required initial maintenance periods.

K. Contract Closeout Submittals:
   1. Operating and Maintenance Data: At completion of work, submit 1 digital copy and 2 hard copies to the Owners Representative in accordance with Division 01 Section “Contract Closeout”. Include directions for irrigation, aeration, mowing, fertilizing, and spraying as required for continued and proper maintenance through full growing season and dormant period.
   2. Warranty for Native Seed Areas: At completion of work, furnish written warranty to Owners Representative based upon specified requirements.

L. The Owners Representative reserves the right to reject the seed at any time prior to acceptance and that fails to meet specification requirements. Promptly remove rejected seed from the site.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf and dryland grass establishment.
   1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
   2. Experience: Five years' experience in turf installation in addition to requirements in Division 01 Section "Quality Requirements."
   3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
   4. Personnel Certifications: Installers shall have certification the following categories from the Professional Landcare Network:
      a. Certified Landscape Technician - Exterior, with installation maintenance irrigation specialty area(s), designated CLT-Exterior.
   5. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
   6. Pesticide Applicator: State licensed, commercial.

B. Soil-Testing Laboratory Qualifications: An independent laboratory or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Soil Analysis: See Sections 32 9113 - Soil Preparation and 31 0000 – Earthwork.

D. Preinstallation Conference: Conduct conference at Project site to coordinate the process with other trades, to coordinate equipment movement within planting areas and to avoid soil compaction, to review proposed methods of installation, performance criteria, and maintenance procedures. Review underground utility location maps and plans. This meeting shall be coordinated by the Contractor, and comply with requirements in Division 1.

E. Standards: All materials and methods used during this portion of the work shall meet or exceed applicable federal, state, county, and local laws and regulations. All seed shall be free from insects and disease. Species shall be true to their scientific name as specified.

F. Materials: The Contractor shall submit to the Owners Representative for approval a complete list of all materials to be used during this portion of the work prior to delivery of any materials to the site. Include complete data on source, amount and quality. This submittal shall in no way be construed as permitting substitution for specific items described on the plans or in these specifications unless approved in writing by the Owners Representative.

G. Plant species substitutions shall be submitted to and approved by the Owners Representative prior to construction.

H. All native grass species shall be supplied as pure live seed. Submit to the Owners Representative lab germination test results for all grass species. Submit an affidavit that describes estimated purity for all forb species that are not typically tested.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Seed and other Packaged Materials: Deliver seed and packaged materials in original unopened containers bearing weight, analysis and name of supplier. Store in a manner to prevent the materials from becoming wet and deteriorating.

B. Fertilizer: Deliver organic or chemical fertilizer to site in original unopened container bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark and conformance to state law, and bearing name and warranty of producer.

C. Bulk Materials:
   1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
   2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
   3. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.
   4. Seed: Deliver seed materials in original unopened containers, showing bearing weight, analysis and name of supplier. Store in a manner to prevent the materials from wetting and deterioration.
   5. Fertilizer: Deliver inorganic or chemical fertilizer to site in original unopened container bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark and conformance to state law, and bearing name and warranty of producer.

D. Material will be inspected upon arrival at project site. The Owners Representative will reject any opened or unacceptable materials as described above.

E. Immediately remove unacceptable material from job site.

1.8 PROJECT/SITE CONDITIONS

A. Work scheduling: Proceed with and complete landscape work as rapidly as portions of the site become available, working within the specified planting season and approved schedule.

B. Planting Restrictions: Planting is preferred in spring but may be performed during one of the following periods. Variance from the schedule shall be permitted only with written approval from the Engineer. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion**.**

C. Vehicular accessibility on site shall be as directed by the Owners Representative. Repair damage to prepared topsoil and existing surfaces, caused by vehicular access and movement during work under this section, to original condition at no additional cost to the client.

D. Do not drill or sow seed during windy, rainy weather or when ground is frozen or otherwise unable to be tilled.

E. Seeding Season: Seeding shall occur as specified below. The following are typical Colorado schedules. Modify the following for appropriate region. Verify with local producers and contractors prior to finalizing.

Seed Type	**Irrigated Areas Only**	**Non-irrigated Areas**
Dryland Grasses	April 15-Sept.1	April 1-May 15 Oct 15-Nov 15

F. Existing conditions:
1. Existing Plants: Install seed only after all other landscape and irrigation items have been installed and accepted by the Owners Representative.
2. Utilities: Determine location of underground utilities. Perform work in a manner to avoid possible damage. Hand excavate, as required.
3. Excavation: Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned. When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, noxious materials or obstructions, notify Owners Representative before planting.
4. If weeds are present on site, treat with herbicide prior to preparing soil for installing seed as specified below.

G. Coordination:
1. Coordinate with construction of utilities on site. Do not begin placing topsoil or amendment until underground work is completed in the area.
2. Coordinate with seeding and landscape Contractor(s) approved schedule. Limit construction access to areas where topsoil has been placed if placement is completed more than 3 days prior to commencement of landscaping in the area. Limit fine grading to areas that can be prepared for planting within 24 hours after fine grading.
3. Coordinate with Contractors work requiring access to site over seeded areas.
4. Coordinate with installation of underground irrigation system.

1.9 WARRANTY

A. Warranty for Native Seed Areas: Warrant areas in seed to be in a healthy, vigorous growing condition, and for consistency and completion of coverage for a period of 2 years from date of Initial Acceptance as a full stand of grass. After seed germination, re-seed any spots where seed has not germinated within the total seeded area. Continue this procedure until a successful stand of grass is growing and accepted by the Owners Representative.
1. During the original warranty period, reseed at once with comparable blend/mix, those areas that have failed to achieve a stand of grass or which in the Owners Representative's opinion are unhealthy.
2. Reseeding will not be allowed in any season considerable unfavorable for seeding by the Owners Representative.
3. Reseed in a manner to achieve quality as originally specified.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil: See Section 32 9120 - Topsoil.

B. Soil Preparation: See Section 32 9113 - Soil Preparation.

C. General:
1. The selected seed mix must be approved by the Owners Representative prior to its incorporation into the project.
2. All seed shall be furnished in bags or containers clearly labeled to show the name and address of the supplier, the seed name, the lot number, net weight, origin, the percent of weed seed content, the guaranteed percentage of purity and germination, pounds of pure live seed (PLS) of each seed species, and the total pounds of PLS in the container. All brands shall be free from Colorado prohibited noxious weed seeds as Russian or Canadian Thistle, European Bindweed, Johnson Grass, and Leafy Spurge. The Contractor shall furnish to the Owners Representative a signed statement certifying that the seed is from a lot that has been tested by a recognized laboratory for seed testing

within six months prior to the date of delivery. Seed that has become wet, moldy or damaged in transit or in storage will not be acceptable.

3. Computation for quantity of seed required on the project is based on Pure Live Seed (PLS).
4. The formula used for determining the quantity of PLS shall be:

   Pounds of Seed x (Purity x Germination) = Pounds of PLS.

5. If seed available on the market does not meet the minimum purity and germination specified, the Contractor must compensate for a lesser percentage of purity or germination by furnishing sufficient additional seed to equal the specified product. Product comparison shall be made on the basis of PLS in pounds, stated on each seed bag

D. Seed Mixes:
   1. Native Prairie Mix Provided by Pawnee Buttes Seed Inc, or approved equal. (800) 782-5947 or (970) 356-7002.

      (29%) Blue Grama
      (25%) Buffalograss
      (5%) Green Needlegrass
      (20%) Sideoats Grama
      (20%) Western Wheatgrass
      (1%) Sand Dropseed

      a. After amendment (Compost and Biosol products per Thornton Installation & Maintenance Standards), seed minimum 30 lbs PLS/Acre or 3 lbs PLS/1000 sf.
      b. Minimum seeding rate for non-irrigated areas is 18 lbs PLS/acre or 3 lbs PLS/1000sf. Seeding rate for irrigated areas is 30 lbs PLS/acre or 3 lbs PLS/1000sf. Double the rate for all broadcast seeding.

E. Soil Amendment: See Section 32 9113 – Soil Preparation

F. Mulch:
   1. All seeded areas shall be hydromulched, applied with tackifier at rates recommended by the manufacturer. Hydraulic mulching shall not be performed in the presence of free surface water. In areas not able to be hydromulched, cover all seeded area with 100% biodegradable straw blanket with biodegradable blanket pins.

G. Fertilizer: None required unless otherwise specified by soils test.

H. Water: Contractor to utilize the irrigation system and or quick coupler(s) when available. If irrigation or quick coupler(s) are not available then the contractor is responsible for watering. Water shall be free of substances that may be harmful to seed growth. Hoses and other watering equipment necessary to water the seed to be furnished by Contractor.

2.2 HERBICIDES

A. General: Herbicide, registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted herbicides unless authorized in writing by Owners Representative and authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Non-Selective): Journey herbicide, as manufactured by BASF, 800-545-9525, or equal as approved by Owners Representative. Use only with approval by Owners Representative and in strict compliance with manufacturer's instructions.

C. Post-Emergent Herbicide. "Round-up" by Monsanto, or approved equal.

2.3 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended wood staples, 6inches long.

B. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd., with 50 to 65 percent open area. Include manufacturer's recommended wood staples, 6 inches long.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
   1. Verify that finish grades are consistent with the slopes and grades indicated on the Drawings. Verify grades are in conformance with Division 31 Section "Earth Moving".
   2. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
   3. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
   4. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
   5. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected and approved by the Owners Representative.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Engineer and replace with new planting soil.

D. Acceptance: Beginning of installation means acceptance of existing conditions by the Contractor.

3.2 PROTECTION

A. Protect existing utilities, paving and other facilities from damage caused by seeding operations, Contractor shall repair any damage at no additional cost to the Client.

B. Restrict vehicular and pedestrian traffic from seeded areas until grass is established. Erect signs and barriers as required or directed by the Owners Representative at no additional cost to the Client.

C. Locate, protect and maintain the irrigation system during seeding operations. Repair irrigation system components damaged during seeding operations shall be replaced or repaired to current City irrigation standards at Contractor's expense.

D. Erosion Control: Take measures and furnish equipment and labor necessary to control and prevent soil erosion, blowing soil and accumulation of wind-deposited materials on the site throughout the duration of work.

3.3 PREPARATION

A. Work notification: Notify the Owners Representative at least 7 working days prior to start of seeding operations.

B. Utilize equipment having low unit pressure ground contact within planting areas.

C. Limit preparation to areas that can be seeded within 24 hours of preparation.

D. After weed eradication (plowing, chiseling, disking and herbicide application as may be appropriate), the seedbed shall be ripped and worked to 8" by plow, disc, chisel and/or harrow. The seed bed shall be free of debris, including weeds, plant matter, rocks, clods and other impervious material over 1" in diameter. Seed bed shall be smooth and free of large clumps, fluffy yet firm, moist but not wet. When walking across the bed, a shoe imprint in the soil should not be deeper than 1". Before incorporation of amendment, COT will inspect the seedbed.

E. Preparing the seed bed should be timed with appropriate planting dates to conserve soil moisture and prevent wind and water erosion. Seeding of irrigated grasses can occur any time during the growing season. For best results, irrigated warm season grasses should be seeded in May and no later than July. Dryland seeding of non-irrigated warm and cool season grasses should occur between December and May. If seeding must occur outside this timeframe, an alternative maintenance plan must be created.

F. The Contractor shall prepare the soil of all areas to be seeded in accordance with the requirements of Division 32 Section "Soil Preparation". When completed, the soil shall be firmed by float dragging, followed by steel raking, to provide for the proper seeded surface. The seed bed shall be totally free from rock or clay clods over 1-inch in diameter.

G. Fine Grading: See Division 31 Section "Earth Moving" and Division 32 Section "Soil Preparation". Maintain positive drainage, prevent ponding and direct run-off into catch basins, drainage structures, etc., and provide well-contoured surface prior to proceeding. A firm weed-free seed bed is required. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations. Obtain Owners Representative's approval of finished grade prior to proceeding with seeding operations.
   1. Protect adjacent and adjoining areas from hydromulching overspray.
   2. Protect grade stakes set by others until directed to remove them.

H. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

I. Verify that all areas are graded to drain at a minimum of 2% or as indicated on the drawings. Verify that subsurface drainage system and drain inlets if any, are operative.

J. Verify that irrigation system is operable and provides adequate coverage prior to planting.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

A. Review erosion control measures with Owners Representative prior to installation.

B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.

C. Fill cells of erosion-control mat with planting soil and compact before planting.

D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.

3.5 INSTALLATION

A. Before installation, COT will approve incorporation of amendment into seed bed.

B. Weather Limitations: Proceed with seeding only when existing and forecasted weather conditions permit seeding to be performed when beneficial and optimum results may be obtained. Do not seed during excessively wet or frozen conditions. Apply products during favorable weather conditions according to manufacturer's written instruction and warranty requirements. COT to approve weather conditions prior to seeding.

C. Seed within 24 hours after preparation of seed bed. Seeding at other times may only be done if approved by the Owners Representative.

D. Areas outside Contract Limits disturbed as a result of construction operations shall be seeded at Contractor's expense.

E. Seed shall be uniformly applied at the specified rate, (half in one direction and the other half at right angles to the first application). The direction of the final application shall always be at right angle to the slope or running in the direction of the contour. Seed shall be installed at a depth between 1/4-inch and 1/2-inch. Accomplish seeding by a rangeland grass drill with double disk openers and depth bands.

F. Areas that are too small or steep for mechanical seeding may be hand seeded at double the specified seeding rate. Seed shall be uniformly applied at the specified rate utilizing a broadcast spreader and then hand rake in to a depth of no more than 1/2-inch, then roll seed bed to ensure proper contact to the soil.

G. Hydraulic seeding can only be used in areas not accessible for machine methods; seed and mulch to not be applied in the same operation.

H. Dormant Seeding: Upon approval of the Owners Representative, dormant seeding may be accomplished between October 15 and March 31. No seeding shall be done when the ground is frozen, muddy, covered with snow, or otherwise in a condition unsuitable for seeding. Dormant seeding will not relieve the Contractor from the warranty or the acceptance requirements specified elsewhere in this section.

I. If irrigated, water seeded area frequently and lightly within 12 hours of seeding. Water enough to keep the soil moist but not so heavily as to cause soil washing and loss of the grass seed.

3.6 MULCHING.

A. Hydromulch Application: All seeded areas shall be hydro-mulched with virgin wood fiber (not produced from paper or recycled materials) in a separate application after drilling. Mix water, 2000 lbs/Ac of mat fiber mulch and 100 lbs/Ac of tackifier, or at manufacturer's recommended rates, whichever is greater. Contractor shall provide verification of application rates in the form of ship tickets.

B. In areas not able to be hydromulched, cover all seeded area with 100% biodegradable straw blankets with biodegradable blanket pins. With prior approval, a weed and seed free wood straw mulch at 2 tons per acre can be applied to reduce seed loss and soil erosion.

C. Mulching shall not be installed when surface water is present resulting from rains, melting snow irrigation or other causes.

D. Areas not properly mulched, or any damage that may occur during construction is the responsibility of the Contractor and shall be repaired and re-mulched in an acceptable manner at the Contractor's expense. Mulching removed by wind, rain or other causes prior to acceptance shall be re-established by the Contractor at their own expense.

E. The seeded area shall be mulched within 8 hours of seeding. Areas not mulched within 24 hours after seeding must be re-prepped and re-seeded with the specified seed mix at the Contractor's expense.

F. Contractor shall remove all hydromulch from and surface area not specified for seeding, including but not limited to plant materials, fences, paved areas, signs, mulch beds, irrigation components and all other objects as directed by the Owners Representative.

3.7 EROSION CONTROL BLANKET

A. Install erosion control blanket on slopes exceeding 4:1, and in swales or other areas of concentrated runoff. As shown on the drawings or as directed by the Owners Representative, install in accordance with manufacturer's instructions.

3.8 PROTECTION

A. Protect existing utilities, paving and other facilities from damage caused by seeding operations, Contractor shall repair any damage at no additional cost to the Client

B. Restrict vehicular and pedestrian traffic from seeded areas until grass is established. Erect signs and barriers as required or directed by the Owners Representative at no additional cost to the Client.

C. Locate, protect and maintain the irrigation system during seeding operations. Repair irrigation system components damaged during seeding operations shall be replaced or repaired to current City irrigation standards at Contractor's expense.

D. Erosion Control: Take measures and furnish equipment and labor necessary to control and prevent soil erosion, blowing soil and accumulation of wind-deposited materials on the site throughout the duration of work.

3.9 SATISFACTORY DRYLAND GRASSES

A. Dryland grass seed installations shall be minimally established to meet the following criteria by Initial Acceptance as determined by Owners Representative:

1. Germination during the growing season is expected within 3-6 weeks. Spot re-grading, reseeding and mulching shall immediately be required for areas of little or no germination and to repair areas damaged by erosion, wind, vandalism, fire or other causes.
2. Within three months, total vegetation cover of specified seed in all zones seeded shall exceed 70% (by aerial cover). Dryland grass shall be free of weeds, foreign grasses, disease and harmful insects.
3. By the end of the first full growing season after seeding, total vegetation cover shall exceed 90% (by aerial cover) .
4. At any time during the contract period no more than 10% (by aerial cover) of the seeded area should be dominated by aggressive exotic species such as, but not limited to, red clover (*Trifolium* spp.), white or yellow sweet clover (*Melilotus* spp.), Canada thistle (*Cirsium arvense*), tall fescue (*Festuca elatior*), bindweed*(Convolvulus arvensis*) etc.
5. A healthy stand of dryland seeded grass may take 3-5 years to become fully established.
6. The establishment period for irrigated seed to be one year from Initial Acceptance.
7. Until Final Acceptance seeded areas that fail after having been replaced previously, shall be replaced until it meets establishment as required above. Replacement materials shall be identical to those originally specified. Provide seed tags to the Owners Representative for verification.
8. Remedial action: If seeded areas greater than 10 square feet fail to meet the terms of the guarantee shown above, the Landscape Contractor will develop and submit to the Owners Representative a remedial action plan that takes into consideration the site goals and specific deficiencies causing the remedial action. Contractor will implement the remedial action plan and submit a report that describes the remedial action taken.
9. Any materials found to be dead, missing, unhealthy, in poor condition, or that has lost their natural shape shall be replaced immediately.
10. The Owner shall be the sole judge as to the condition of the material. Replacement or repair of materials prior to Initial Acceptance does not waive the normal warranty.
11. Seeded areas will not be accepted in parts. Each time any portion or section of the entire seeded area requires replacement or remedial action, the maintenance period shall extend until all seeded areas meet the minimum establishment requirements stated above.
12. All expense incurred including repairs from vandalism for the replacement and or establishment of the seed areas are the responsibility of the Contractor.
13. If seeded in the fall, review for establishment shall be no later than June 15 of the following year.

3.10 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from all excess materials, debris and equipment from site. Repair any damage resulting from seeding operations.

B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

C. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION 32 9219

SECTION 32 9300

TREES, PLANTS, AND GROUNDCOVERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Contract Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, and Civil permit specification package, apply to this Section.

1.2 SUMMARY

A. This Section includes requirements for furnishing, installing, and maintaining live woody plant material, and winter watering.

1.3 DEFINITIONS

A. ANSI: American National Standards Institute. Z60.1 is the national standard for nursery stock.

B. Backfill: The earth used to replace or the act of replacing earth in an excavation.

C. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than the minimum root spread according to ANSI Z60.1 for type and size of plant required.

E. Caliper: Trunk diameter is measured six-inches (6”) from the ground; if the caliper is greater than four-inches (4”), the measurement is taken at twelve-inches (12”) from the ground.

F. Cane: A cane shall be considered a primary stem which starts from the ground or at a point close to the ground at a point not higher than one-fourth (1/4) the height of the plant, and which reaches the minimum height stated in the plant size specification.

G. Central leader: Also referred to as leader or the dominant leader. A continuation of the main trunk located more or less in the center of the crown, beginning at the lowest main scaffold branch and extending to the top of the tree.

H. Circling root(s): One or more roots whose diameter is greater than ten percent (10%) of the trunk caliper circling more than one-third of the trunk. Circling roots are unacceptable.

I. Clear Trunk: The portion of the trunk below the main crown which may include shortened temporary branches.

J. Co-dominant: Two or more vigorous, upright branches or stems of relatively equal diameter that originate from a common point, usually where the leader was lost or removed. Co-dominant stems are unacceptable.

K. Container-Grown: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed

from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

L. Critical Root Zone (CRZ): Shall be defined as the tree protection area encompassing from 1.5 (minimum) to 2.0 times the distance between the trunk and drip line, or one linear foot away from the trunk base for every-inch diameter of the trunk, whichever is greater.. Review the extent of the CRZ for impacted trees with Owner prior to start of work.

M. Crown: The portion of a tree beginning at the lowest main scaffold branch extending to the top of the tree. On younger trees, the crown may be comprised of temporary branches.

N. Cultivar: A named plant selection from which identical or nearly identical plants can be produced, usually by vegetative propagation or cloning.

O. Drip Zone: The outermost edge of the tree's canopy or branch spread. The area within a tree's drip line is all the ground under the total branch spread.

P. Finish Grade: Elevation of finished surface of planting soil.

Q. Included Bark: Bark embedded in the union between a branch and the trunk or between two or more stems that prevents the formation of a normal branch bark ridge. Included bark is unacceptable.

R. Kinked Root: A main root that is sharply bent. Kinked roots are unacceptable.

S. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.

T. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

U. Root Collar: Also referred to as the root flare. The base of a tree where the main roots and trunk meet.

V. Scaffold Branches: Large main branches that form the main structure of the crown.

W. Stem-girdling Root: A circling, bent, or straight root that touches or rests on the trunk or root flare that can become a permanent root. Stem-girdling roots are unacceptable.

X. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

Y. Temporary Branch: A small branch that is temporarily retained along the lower trunk of young trees.

Z. Trunk: The main stem of a tree, beginning at the root collar and ending at the lowest main scaffold branch.

AA. Taper: The thickening of a trunk or branch toward its base.

1.4 SUBMITTALS

A. See Division 01 Section “Submittals” for submittal requirements.

B. Product Data: For each type of product.
   1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.

C. Product Samples: At a minimum provide cut sheets/specifications for the following in electronic format for approval by the Owner, additional product samples may be required at the direction of the Owner.
   1. Mulch: one(1) gallon bag minimum of each type of mulch. (Owner would like a physical samples of mulch for approval)
   2. Tree Stakes: one(1) of each type.
   3. Tree Straps: one(1) each.
   4. Guy Material: one(1) linear foot.
   5. Guy Signal: one(1) linear foot.
   6. Tree Wrap: one(1) linear foot.
   7. Tree Protection: one (1) linear foot.

D. Pesticides: Product label, Safety Data Sheet (SDS) labels and manufacturer's application instructions specific to Project.

E. Proper Identification: All plants shall be true to name as ordered or shown on planting plans and shall be labeled individually or in groups by species and cultivar (as appropriate).

F. Contractor shall provide a complete list of all plant material for approval by the Owner a minimum of ten (10) days prior to delivery. Any substitutions of plant material, including but not limited to size, type, species and variety shall be listed and submitted to the Owner for approval.

G. Contractor shall provide the following certificates:
   1. State Inspection Certificate from the origin nursery.
   2. Certificate from origin state.
   3. Quarantine Certificate from origin state.
   4. Any Certificates required by the USDA Animal and Plant Health Inspection Service (APHIS) and ANSI-Z-160 and accompanying Rules and Regulations.

H. Analysis of existing soil shall be per Division 32 Sections “Topsoil” and “Soil Preparation”.

I. Contract Close Out Submittals:
   1. Operating and Maintenance Data: At completion of work, submit One (1) digital copy and one (1) hard copy to the Owner in accordance with Division 01 Section “Contract Closeout”. Include recommended procedures for continued and proper maintenance during a full calendar year.
   2. Warranty for Trees, Plants, and Groundcovers: At completion of work, furnish written warranty to the Owner based upon specified requirements.

1.5 SUSTAINABLE DESIGN SUBMITTALS

A. See Section 01 3329 - Sustainable Design Reporting, for reporting and submittal requirements.

B. Sustainable Design Documentation: Report(s) and separate submittal(s) documenting compliance with all requirements for sustainable design, whether or not specified in this Section, including, but not limited to:
   1. Source location.

2. Other specified sustainable design requirements identified as such in this Section.

1.6 QUALITY CONTROL

A. The Owner reserves the right to reject, at any time or place prior to final acceptance, all plant materials that fail to meet these specifications in the Owner's opinion. Inspection of materials is primarily for quality, size, and variety, but other requirements are not waived even though visual inspection results in approval. Plants are to be inspected where available; however, inspection at the places of supply shall not preclude the right of rejection at the site or at a later time prior to final acceptance. Rejected material shall be removed from the site within twenty-four (24) hours.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Materials: Deliver materials in original containers with tags showing genus, species and size. Protect materials from damage during delivery and while stored at site. The Owner reserves the right to inspect containers before or after installation to verify compliance with Specifications.

B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants or critical root zone.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

C. Trees: Nursery stock shall be harvested and planted during the same growing season. Do not prune, except as approved by the City Forester and Owner. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or tie trees in such a manner as to destroy natural shape. Trees to be inspected and tagged by City Forester at nursery and prior to delivery on site. Provide protective covering during delivery. Plant materials delivered without protective covering may be rejected. Do not drop trees during delivery. All trees shall be labeled with a securely attached waterproof tag bearing a legible plant name. Remove all tags and flagging as directed by the Owner.

D. Handle planting stock by the root ball only.

E. Deliver trees after preparations for planting have been completed and install immediately. If planting is delayed more than six (6) hours after delivery, set planting materials in shade, protect from weather and mechanical damage, and keep roots moist.
1. Set balled stock on ground and cover ball with wood chips, or other acceptable material.
2. Do not remove container-grown stock from containers before planting.
3. Water root systems of trees stored on site with a fine-mist spray. Water as often as necessary to maintain root systems in a moist condition.

1.8 PROJECT/SITE CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Vehicular accessibility on site shall be as directed by Owner. Repair damage to prepared topsoil and existing surfaces, caused by vehicular access and movement during work under this section, to original condition at no additional cost to the City.

C. Utilities: Contractor shall be responsible locating utilities and repair of utilities damaged during the work. Determine location of overhead and underground utilities and perform work in a manner that will avoid damage. Hand excavate, as required. Maintain markings until their removal is mutually agreed upon by the Contractor and Owner.

D. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify the Owner before planting.

E. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

F. Protection: Erect and maintain barricades, warning signs and lights, and provide guards as necessary or required to protect all persons on the site from exposed excavations.

1.9 COORDINATION AND SCHEDULING

A. Coordinate installation of planting materials during normal planting seasons for each type of plant material required. Planting materials should be planted between April 15 and October 1, or at the direction of the Owner. If irrigation is not available at the time of planting then the Contractor is responsible for watering of all plant material and no additional cost to the City, refer to Division 32 Section “Watering”.

B. Plant trees after final grades have been accepted and prior to seeding or sodding, unless otherwise authorized by Owner.

1.10 WARRANTY

A. Warranty: The warranty specified in this Article shall not deprive the City of other rights the City may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Trees, Plants, and Groundcovers shall be warranted for a period of one (1) year after date of Initial Acceptance, against defects including death, structural failures, dieback as determined by the Owner.

C. The warranty shall not be enforced should any plant die due to vandalism after Initial Acceptance.

D. Remedial Actions:
1. Replace any plant materials that have been excessively pruned, more than twenty percent (20%) percent dead, or in an unhealthy or declining condition immediately upon notice from the Owner during warranty period.
2. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
3. Any materials found to be dead, missing, unhealthy, in poor condition, or that has lost their natural shape shall be replaced immediately.
4. The Owner shall be the sole judge as to the condition of the material. Replacement or repair of materials prior to Initial Acceptance does not waive the normal warranty.

E. All plants shall be true to name and meet all conditions of these specifications. Any plant that is not true to name as indicated by form, leaf, flower, or fruiting characteristics shall be replaced at the Contractor’s expense.

1.11 TREE MAINTENANCE DURING CONSTRUCTION PERIOD

A. Maintain trees by pruning, cultivating, watering, mulching, winter watering, weeding, wrapping, unwrapping, restoring planting saucers, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Control as required to keep trees free of insects and disease. Restore or replace damaged tree wrappings, stakes, guying. Trees shall be maintained by the Contractor through the Warranty period of the project, including winter watering.

PART 2 - PRODUCTS

2.1 GENERAL

A. Plant Materials and Landscape Products: Comply with source location product requirements specified in Section 01 6000.

2.2 PLANT MATERIALS

A. General: Furnish and install nursery-grown trees and shrubs conforming to the requirements of ANSI-Z-160, with healthy root systems developed by transplanting or root pruning. Provide well shaped, symmetrical, fully branched, healthy, and vigorous stock free of disease, insects, eggs, larvae, girdling, and defects such as sun scald, injuries, abrasions, and disfigurement. Trees of a larger size than that specified in the plant list may be used with a proportionate increase in size of roots and balls, if acceptable to the Owner. The use of larger plants shall be covered by the Contractor at no additional cost to the City.

B. Label all plants of each size, caliper and variety and caliper with a securely attached waterproof tag bearing legible designation of botanical and common name.

C. All plants shall be the genus, species, and variety designated on the Contract Drawings. No substitutions will be accepted without the prior written approval of the Owner. Contractor must provide proof of non-availability.

2.3 TREES

A. These specifications shall apply to deciduous, broadleaf evergreen and coniferous species. Note that leaf characteristics will not be evident on deciduous trees during the dormant season.

B. Crown: The form and density of the crown shall be typical for a young specimen of the species/cultivar. Changes in form caused by wind, pruning practices, pests, or other factors shall not substantially alter the form for the species/cultivar. These crown specifications do not apply to plants that have been specifically trained in the nursery to be: topiary, espalier, multi-stem, or clump; or unique selections such as contorted or weeping cultivars.
   1. Trees shall have a single, relatively straight trunk, and central leader, unless noted on plans to be “Multi-trunk” or “Clump”. They shall be free of co-dominant stems and vigorous, upright branches that compete with the central leader. If the original leader has been headed, a new leader at least one-half of the diameter of the original leader shall be present.
   2. Main branches shall be evenly distributed along the central leader, not clustered together. They shall form a balanced crown appropriate for the age of the species/cultivar.
   3. Branch diameter shall be no larger than one-half the diameter of the central leader measured one-inch (1”) above where the branch is attached.
   4. The attachment of the largest scaffold branches shall be free of included bark.

5. Temporary branches, unless otherwise specified, should be present along the lower trunk below the lowest scaffold branch, particularly for trees less than one-inch (1”) in caliper. These branches should be no greater than three-eighths-inch (3/8”) diameter. Clear trunk shall be no more than thirty percent (30%) of the total height of the tree, unless otherwise noted

C. Trunk: The tree trunk shall be relatively straight, vertical, and free of wounds, except properly made pruning cuts, which shall be closed over or less than three-quarters-inch (3/4”) diameter open, sunburned areas, conks (fungal fruiting bodies), wood cracks, bleeding areas, signs of boring insects, galls, cankers, stem-girdling ties, or lesions (mechanical injury).
1. Trunk caliper and taper shall be sufficient so that the tree will remain vertical without a stake. Trunk caliper at six-inches (6”) above the soil media (substrate) surface shall be within the diameter range shown for each container size below and as specified in current edition of ANSI Z60.1.

D. Roots: The root system shall be substantially free of injury from biotic (e. g., insects and pathogens) and abiotic (e. g., pesticide toxicity and salt injury) agents.
1. The uppermost roots or root collar shall be within the upper two-inches (2”) of the soil media (substrate). Depth of the root-ball shall be measured from the top of the ball, which in all cases shall begin at the root flare. Soil above the root flare shall not be included in the root-ball depth measurement, and shall be removed.
2. The root collar and the inside portion of the root-ball shall be free of defects, including circling, kinked, and stem-girdling roots. Soil removal or root washing near the root collar may be necessary to inspect for the aforementioned root defects.
3. Roots on the periphery and bottom of the root-ball shall be less than one-eighth-inch (1/8”) diameter.
4. The tree shall be well rooted in the soil media (substrate). Root distribution shall be uniform throughout the soil or media. Structure and growth shall be appropriate for the species/cultivar. When the burlap or container is removed, the root-ball shall remain intact. Trees should have several lateral roots or many fibrous roots spaced evenly around the trunk to provide support so the trees are stable when planted. Trees should have as many small roots as possible. These roots are key to the uptake of sufficient water and nutrients. Fibrous roots can be achieved by root-pruning, using air-pruning containers, or under-cutting or root pruning and transplanting at any stage of production.
5. As a general rule for young nursery-grown trees, there should be two or more structural roots within one- to three-inches (1” – 3”) of the soil surface. “First order lateral roots” is another term that has been used for these roots. If the roots are deeper than three-inches (3”) , the stock shall be rejected.
6. Root-balls that are undersized as specified in current edition of ANSI Z60.1. shall be rejected. Field grown trees for balled and burlap delivery shall have the roots pruned at least six-inches (6”) inside the final root-ball size performed within adequate time for the tree to develop fibrous roots at the outer edge of the root-ball prior to harvest and delivery.

E. Leaves: The size, color, and appearance of leaves shall be typical for the time of year and stage of growth of the species or cultivar. Trees shall not show signs of prolonged moisture stress or extended drought as indicated by wilted, shriveled, or dead leaves.

F. Branches: Shoot growth (length and diameter) throughout the crown shall be appropriate for the age and size of the species/cultivar. Trees shall not have dead, diseased, broken, distorted, or otherwise injured branches.

G. All deciduous trees of one species used in formal rows or groupings shall exhibit cultural uniformity, i.e. “matched” in height, crown width and shape, height to first branch, and trunk taper. For this reason, it is desired that these trees be produced by a single grower.

H. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated, and only if approved by the Owner.

2.4 SHRUBS

A. Container Grown Shrubs: All specifications for container grown plants shall include both plant size and container size. Plant size intervals and reference to height or spread shall be in accordance with the guidelines for the appropriate plant type set forth in ANSI Z60.1; Section 2.2 - Types of Deciduous Shrubs.

B. Container size shall be by container classification (i.e., not by container volume) as set forth in the ANSI Z60.1 Container Class Table.

C. In all cases, container grown nursery stock shall meet the following general requirement:
1. All container grown nursery stock shall be healthy, vigorous, well rooted, and established in the container in which it is growing. Container grown nursery stock shall have a well-established root system reaching the sides of the container to maintain a firm ball when the container is removed, but shall not have excessive root growth encircling the inside of the container.

D. The container shall be sufficiently rigid to hold the ball shape and to protect the root mass during shipping.

E. Minimum shrub sizes shall conform to the following standards: Plant material shall conform to current standards of the American Association of Nurserymen as published in the current edition of American Standard for Nursery Stock.

2.5 PERENNIALS, GRASSES, GROUNDCOVERS, AND VINES

A. All container grown plants shall be healthy, vigorous, well rooted, and established in the container in which they are growing, and be in conformance with ANSI Z60.1. A container grown plant shall have a well-established root system reaching the sides of the container to maintain a firm root ball, but shall not have excessive root growth encircling the inside of the container. Top growth is to be in conformance with established nursery standards.

2.6 TREE-STABILIZATION MATERIALS

A. Trunk-Stabilization Materials: Per City of Thornton Standards & Specifications per plan including tree trunk expandable protector for trees in sod.

B. Tree-Wrap:
1. Two layers of crinkled paper cemented together with bituminous material, four-inches (4”) wide minimum, with stretch factor of thirty-three percent (33%).
2. Tree wrap tape: Tape as approved by the Owner.

2.7 MULCH

A. Organic Mulch: Organic mulch, free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of double shredded Washington Red Cedar (gorilla hair).Submit a one (1) gallon bag sample to Owner for approval. Mulch is to be weed-free.

2.8 PLANT PIT BACKFILL MATERIAL

A. Unless otherwise directed by the Owner, the plant pit backfill material shall consist of the following, thoroughly mixed:
   1. Soil originally excavated from the pit: two thirds (2/3) proportion of total mix.
   2. Soil Amendment as compost as specified in Division 32 Section “Soil Preparation”; one-third (1/3) proportion of total mix.

B. If imported topsoil is required, it shall meet the requirements specified in Division 32 Section “Topsoil”, Article 2.2.

2.9 WATER

A. During the irrigation season (generally May through September), water will be available from on-site quick couplers. When the system is not charged, it shall be the Contractor’s responsibility to supply adequate amounts of water from a water truck or other approved source. Hoses and other watering equipment shall be supplied by Contractor.
   1. Watering Amount: Ten (10) gallons per caliper-inch.

B. Watering: Refer to Division 32 Section “Irrigation Systems”.

C. Maintenance: Refer to Division 32 Section “Operation and Maintenance of Planting”.

D. Winter Watering
   1. Provide winter watering of plant materials as needed, or minimum of four times unless otherwise agreed to. Notify the Owner at least two (2) working days in advance when winter watering is needed, and, upon Owner’s request, adjust watering schedules as needed to allow for Owner’s presence during watering.

   2. Periodically check soil moisture and the condition of plant material throughout the warranty period, and notify the Owner in writing when over/under watering is identified during the irrigation season.

   3. For the period between irrigation system winterization and subsequent spring start-up, monitor weather conditions and provide soil moisture checks at least twice per month and notify the Owner in writing regarding soil moisture conditions.

   4. Contractor is responsible for a minimum of four site visits for winter watering. Notify Owner at least 48 hours in advance of site watering visit. Owner shall be in attendance to document each winter watering in writing as part of the Final Acceptance process.

   5. When winter watering, deliver the following minimum amounts of water to each plant: 15 gal. per B&B tree; 3-5 gal. per #5 shrub/ornamental grass; and 2-3 gal. per 100 s.f. (approx. 2”) in #1 or perennial planting areas. If irrigation system is charged to water, contractor shall winterize system after each use.

   6. Under no circumstances shall plant warranties be voided by Contractor's claims of inadequate or excessive watering.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive landscaping for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.
   1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within the work area.
   2. Verify that adequate overhead clearance exists to planting locations.
   3. Suspend planting operations during periods of excessive moisture until acceptable planting conditions exist.
   4. Uniformly moisten excessively dry soil that is not workable.

B. If contamination is present in the soil within a planting area, notify Owner immediately.
   1. If contamination is discovered during Construction the Owner will determine the best course of action to remediate the contamination, which may include requesting the Contractor perform the removal of contamination and replacement of clean material.
   2. If contamination is determined to be the result of construction operations, Contractor is to remove contaminated material and replace with clean material at the direction of the Owner.

C. Proceed with installation only after unsatisfactory conditions have been corrected and approved by Owner.

D. Cooperate with any other contractors and trades, who may be working in and adjacent to the landscape work areas. Examine Contract Drawings which show the development of the entire site and become familiar with the scope of all work required.

3.2 FINISH AND FINE GRADING

A. See Division 31, Sections “Earth Moving and 32 Sections “Soil Preparation” and “Topsoil”.

3.3 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, turf areas and existing plants from damage caused by planting operations. Repair damage to surrounding areas and site elements noted above resulting from planting operations at no additional cost to the City.

B. Layout, stake and label all individual tree locations for approval by the Owner prior to installing trees.

C. Outline planting beds and mark plant locations within the bed(s) for approval by the Owner prior to installing any plant material or mow bands. Make adjustments as directed at no additional cost to the City.
   1. If formal arrangements or consecutive order of plants is indicated on Contract Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

D. Prepare planting area for soil placement and mix planting soil according to Division 32 Section “Soil Preparation”.

3.4 WEED CONTROL

A. Do not proceed with landscape work until weed growth has been controlled and eliminated, per Division 32 Section “Soil Preparation”.

B. See Division 32 Section “Soil Preparation” for detailed weed control measures.

C. Use pesticides only with the written approval of Owner, and in strict accordance with manufacturer’s instructions.

3.5 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits: Excavate by hand or with a backhoe. Scarify sides of tree pit. Tree spade may not be used to dig tree pits.
   1. Balled and Burlapped Trees: Excavate a minimum two times (2X) as wide as ball diameter at base of pit. The base of the root collar shall be three-inches (1-2”) higher than the grade at which the tree originally grew and finished grade. Slope sides of the pit as shown on the detail.
   2. Container-Grown Shrubs: Excavate approximately two times (2X) times as wide as container diameter. Plants shall be set one-inch (1”) higher than finished grade.
   3. Do not excavate deeper than depth of the root ball, measured from the base of the root flare to the bottom of the root ball.
   4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly compact the added soil to prevent settling.

B. Obstructions:
   1. Utilities: Notify Owner immediately of utilities that conflict or may potentially conflict with proposed plant locations. In such cases, alternative plant locations will be determined by Owner.
   2. Notify the Owner prior to planting if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavation.

C. Drainage: Notify the Owner if subsoil conditions show evidence of water seepage or retention in tree or shrub pits.
   1. Fill the pit with water and allow it to completely drain before planting occurs.
   2. If water does not drain out of pit within twenty-four (24) hours, notify Owner.

3.6 PLANTING TREES AND SHRUBS

A. Balled and Burlapped Stock: per City Standards & Specifications Detail
   1. Set balled and burlapped stock plumb and in center of pit with base of root flare three-inches (1-2”) above adjacent finish grades as indicated.
   2. Remove burlap (and place to side for verification by Owner) from top two-thirds (2/3) of balls and partially from sides, but do not remove from under balls. Remove wire baskets and all twine entirely and place to side for verification by Owner. Remove pallets, if any, before setting. Do not use planting stock if ball is cracked or broken before or during planting operation.
   3. Place backfill around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.

B. Container Grown Stock: per City Standard & Specifications Detail
   1. Carefully remove containers so as not to damage root balls.
   2. Lightly scratch sides of exposed root ball to loosen surface roots.

3. Set plants plumb and in center of pit with top of ball raised at adjacent finish grades or as indicated.
4. Place backfill around ball in layers, tamping to settle backfill and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly, then place remainder of backfill. Repeat watering until no more is absorbed. Water again after placing and tamping final layer of backfill.

C. Tree Staking: Stake trees as shown on the Contract Drawings, Per City Standards & Specifications Detail.

D. Wrapping tree trunks: Wrap trees with tree wrap tape. Start at base of trunk and spiral cover trunk to height of first branches. Overlap wrap, exposing half the width, and securely attach without causing girdling. Use specified tape to secure. Do not use staples. Inspect tree trunks for injury, improper pruning, and insect infestation and take corrective measures required before wrapping.
1. All deciduous trees shall be wrapped between November 1st and November 15th or per the direction of the Owner. All tree wrap shall be removed by May 15.
2. Contractor shall be responsible for wrapping and unwrapping trees during the warranty period.

3.7 PRUNING OF PLANTS

A. Prune only damaged or dead branches as directed by the Owner.

B. All pruning shall conform to current International Society of Arboriculture practices. All pruning shall be done with clean, sharp tools. Branch bark ridges and branch collars must be left intact after the final cut is made. Neither flush cuts or unsightly branch stubs shall be allowed.

3.8 TREE STABILIZATION

A. Trunk Stabilization by Staking: Install trunk stabilization as follows unless otherwise indicated on Contract Drawings.
1. Site-Fabricated Staking Method: Stake trees as indicated on Contract Drawings.
   a. Drive stakes into undisturbed grade outside tree pit as indicated, but keep stakes within the mulch area. Avoid penetrating root balls or root masses.
   b. Securely attach specified wire to stakes.
   c. Support trees with specified wire and tree tie webbing at contact points with tree trunk, reaching to specified stake. Allow enough slack to avoid rigid restraint of tree.
   d. For guyed trees: Attach thirty-six-inch (36”) long x one-half-inch (1/2”) diameter PVC pipe flagging to each wire.
   e. For staked trees: Attach twenty-four-inch (24”) long x one-half-inch (1/2”) diameter PVC pipe flagging to each wire.

3.9 MULCHING

A. Trees: Create a forty-eight-inch (72”) diameter formed soil berm around tree and fill with three-inch (3”) deep specified wood mulch. Mulch shall be kept four to six-inches (4”-6”) away from tree trunk.

B. Shrubs:
1. Mulch backfilled surfaces of pits, planting beds areas, and other areas indicated or as directed by the Owner.
2. Mulch in shrub bed areas: Apply three-inch (3”)thick layer of mulch and finish level with adjacent finish grades. Do not place mulch against stems of plants.

3.10 QUALITY CONTROL

A. Provide quantity, size, genus, species, and variety of trees indicated, complying with current applicable requirements of ANSI Z60.1 “American Standard for Nursery Stock”, and all applicable state and local rules and regulations.

B. Inspection: Owner shall arrange for the City Forester Owner to select and/or inspect plant material at the nursery/grow site or upon delivery to the site, for compliance with requirements for genus, species, variety, cultivar, size, and quality. Selection and approval of plant material shall be at the discretion of the Owner.
   1. The Contractor shall schedule inspection of the plants, at either the supplier or on-site, to be completed in one visit. Any further inspection required due to plants being unavailable, rejected, and or not meeting specifications shall be charged to the Contractor at the current hourly rate for the City personnel performing the inspection.

C. Measurements: Measure trees according to the requirements of the ANSI Z-160, with branches and trunks in their normal position. Do not prune to obtain required sizes. Measure main body of tree for height and spread; do not measure branches or roots tip-to-tip.

3.11 PROTECTION

A. Protect existing utilities, paving and other facilities from damage caused by seeding operations, Contractor shall repair any damage at no additional cost to the City.

B. Restrict vehicular and pedestrian traffic from planted areas. Erect signs and barriers as required or directed by the Owner at no additional cost to the City.

C. Locate, protect and maintain the irrigation system during seeding operations. Repair irrigation system components damaged during seeding operations shall be replaced or repaired to current City irrigation standards at Contractor’s expense.

D. Erosion Control: Take measures and furnish equipment and labor necessary to control and prevent soil erosion, blowing soil and accumulation of wind-deposited materials on the site throughout the duration of work.

E. At time of Initial Acceptance, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

3.12 CLEANING

A. General: Provide and install barriers as required and as directed by Owner to protect planted areas against damage from pedestrian and vehicular traffic until Initial Acceptance.

3.13 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus soil including excess subsoil and unsuitable soil, waste material, including, trash, and debris generated during installation off site at no additional cost to the City.

END OF SECTION

SECTION 32 9413

LANDSCAPE EDGING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Landscape edging.

1.3 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Samples of each of the following:

1. Edging materials and accessories.
2. All items requested by Contractor for Substitution or as an Approved Equal.

C. Electronic copies of a written warranty stating all items included in the warranty, conditions of the warranty, and beginning and ending of warranty period(s).

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during times that landscaping is in progress.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery and while stored at site. The Landscape Architect reserves the right to inspect containers before or after installation to verify compliance with Specifications.

1.6 PROJECT CONDITIONS

A. Utilities: Determine location of above grade and underground utilities and perform work in a manner which will avoid damage. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned. Contractor shall be responsible for utility locating, repair of utilities damaged by Contractor, and establishment of grade controls.

1.7 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other

rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Inadequate or improper maintenance by the Owner shall not be cause for replacement, provided the Contractor shall have submitted a letter or report to the Owner on improper or inadequate maintenance practices and recommended remedial actions.

PART 2 - PRODUCTS

2.1 LANDSCAPE EDGING

A. Steel Landscape Edging: 6 inch depth, 14 GA thick, rolled top, galvanized edging, with line stakes and splicer stakes as recommended by manufacturer. Edger to have holes at end for pins to be installed through edger, rather than pins over top of edger. To be provided by Green Pro., or approved substitute.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive landscape edging for compliance with requirements and for conditions affecting performance of work of this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF EDGING

A. Steel Edging: Install steel edging where indicated according to manufacturer's recommendations. Anchor with steel stakes spaced 12” minimum interlocking, driven below edging.

END OF SECTION