

TECHNICAL SPECIFICATIONS

CITY OF THORNTON

Washington Street Widening – 150th Avenue to E-470 / Bull Canal Relocation

Project No. 19-237 / 19-747A

The latest editions of the 2019 CDOT Standard Specifications for Road and Bridge Construction and Thornton Engineering Construction Standards and Specifications control construction of this project.

The following special provisions supplement or modify the Standard Specifications and take precedence over the Standard Specifications and Plans.

PROJECT SPECIAL PROVISIONS

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REVISION OF SECTION 503 DRILLED SHAFTS

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REVISION OF DIVISION 100 GENERAL PROVISIONS

Unless otherwise noted, all Division 100 General Provisions are deleted and replaced with the City of Thornton's Contract Documents included in Volume 1.

Any references to Division 100 in Divisions 200 through 700 are removed. The City of Thornton General and Special Provisions shall apply for any removed provisions.

Section 105.7 Conformity to Roadway Smoothness Criteria of HMA shall be included in this contract.

Section 106 as revised herein shall be included in the Contract.

Other General Provisions:

- 1. The City's standard details are referenced on the drawings and utilized for this project. Some of the details have been modified for the specific needs of this project. The Contractor shall not obtain City standard detail from the City's website or other sources and shall only use the standard City details presented on the drawings.**

1
**REVISION OF SECTION 106
CONTROL OF MATERIAL**

Section 106 of the Standard Specifications is hereby replaced with the following:

106.01 Quality Control Testing. The Contractor shall be responsible for Quality Control Testing for this project. The following minimum testing shall be included:

1. Sampling and testing for HMA:

Element	Process Control	Acceptance ^{1,2}	Check (CTP)
Asphalt Content	1/500 tons	1/1000 tons	1/10,000 tons
Gradation	1/Day	1/2000 tons	1/20,000 tons
Theoretical Maximum Specific Gravity	1/1000 tons, minimum 1/Day	1/1000 tons, minimum 1/Day	1/10,000 tons
In-place Density	1/500 tons	1/500 tons	1/5000 tons
Joint Density	1 core/2500 linear feet of joint	1 core/5000 linear feet of joint	1 core/50,000 linear feet of joint
Aggregate Percent Moisture	1/500 tons, minimum 1/Day	1/500 tons	Not applicable

Notes for Table 106-1:

¹The minimum number of acceptance tests will be: 5 asphalt content, 3 gradation, 10 in-place density and 5 joint density for all projects.

²When unscheduled job mix formula changes are made (Form 43) acceptance of the elements, except for in-place density, will be based on the actual number of samples that have been selected up to that time, even if the number is below the minimum listed in the schedule. At the Engineer's discretion, additional random in-place density tests may be taken in order to meet scheduled minimums, provided the applicable pavement layer is available for testing under safe conditions. Beginning with the new job mix formula, the quantity it will represent shall be estimated. A revised schedule of acceptance tests will be based on that estimate.

2. Existing Soils:

- 4 Proctor tests for existing soils

3. Concrete Tests for Concrete Work (Bull Canal box structures, Mustang Run, detention pond structures, traffic signal caissons, curb & gutters, etc.):

- One (1) test series shall be taken per 50 cubic yards (or fraction thereof) of the concrete placed per day, or as directed by the Owner.
- Field cured test series: four (4) cylinders, one (1) to be broken at seven (7) days or as directed by the Owner.
- Lab cured test series: four (4) cylinders one (1) to be broken at seven (7) days; two (2) to be broken at 28 days. One (1) to be held for 56 day break should the 28 day breaks fail. Approval based on lab tests verified by field samples if necessary.

2
**REVISION OF SECTION 106
CONTROL OF MATERIAL**

- Determine slump of the concrete sample of each strength test whenever consistency of concrete appears to vary, or when directed by the Infrastructure Engineering Manager, in accordance with AASHTO T119.
 - Determine air content of the concrete sample for each strength test
4. Compaction Testing - Subgrade:
- Field moisture-density tests shall be required at random locations at the rate of one (1) for each 250 linear feet of paving for each travel lane.
5. Compaction Testing – Aggregate Base Course:
- At least one (1) sample of aggregate base course for each 500 tons of material placed shall be tested to determine gradation and Atterberg limits.
 - During placement and compaction, Compaction Curves shall be required for each material used.
 - Field moisture-density tests shall be taken of each lift of material at random locations, at approximate intervals of 250 feet in each travel lane and 100-foot intervals in the parking lot. At least 20% of the tests shall be taken within one (1) foot of manholes, valves and curbs.
6. Compaction Testing - Fill:
- In-place moisture-density / percent relative compaction: 1 per 500 cu yds. or fraction thereof with one additional test required per change in material type being placed with minimum 1 test per lift.

3
**REVISION OF SECTION 106
CONTROL OF MATERIAL**

106.02 Measurement and Payment

The cost of sampling, testing, and corrective action by the Contractor will not be paid for separately but shall be included in the work.

The Pay Item price for Quality Control shall also include any "startup" or incidental costs necessary to provide quality control, including but not limited to any necessary Construction Equipment, offices, buildings, Materials or Equipment, or personnel.

Payments for Quality Control shall be made on a monthly basis in accordance with the following formula:

Contract Amount Completed		Quality Control Amount Paid
25%	=	25%
50%	=	50%
75%	=	75%
100%	=	100%

Payment will be made under:

Pay Item	Pay Unit
Quality Control	Lump Sum

END OF SECTION REVISION

1
**REVISION OF SECTION 107
PERFORMANCE OF CRITICAL WORK**

Section 107 of the Standard Specifications is hereby revised for this project as follows:

107.061 Performance of Safety Critical Work. The following work elements are considered safety critical work for this project:

- (1) Removal of bridge

The Contractor shall submit, for review, an initial, detailed construction plan that addresses safe construction methods for each of the safety critical elements applicable to this project. The Engineer will submit the plans to City of Thornton for a concurrent review. The Engineer's review will be for general conformance with the plans, specifications, best management practices regarding safety of the operation and industry standards. When the specifications already require an erection plan, a bridge removal plan, or a removal of portion of bridge plan, it shall be included as a part of this plan. The detailed construction plan shall be submitted two weeks prior to the safety critical element conference described below. The construction plan shall be stamped "Approved for Construction" and signed by the Contractor. The construction plan will be reviewed for acceptance by the Engineer.

2
**REVISION OF SECTION 107
PERFORMANCE OF CRITICAL WORK**

The Construction Plan shall include the following:

- (1) Safety Critical Element for which the plan is being prepared and submitted.
- (2) Contractor or subcontractor responsible for the plan preparation and the work.
- (3) Schedule, procedures, equipment, and sequence of operations, that comply with the working hour limitations.
- (4) Temporary work required: falsework, bracing, shoring, etc.
- (5) Underground, above grade, and overhead utilities identification and protective steps taken.
- (6) Communication plan as necessary with stakeholders, media, and the public.
- (7) Additional actions that will be taken to ensure that the work will be performed safely.
- (8) Names and qualifications of workers who will be in responsible charge of the work:
 - A. Years of experience performing similar work
 - B. Training taken in performing similar work
 - C. Certifications earned in performing similar work
- (9) Names and qualifications of workers operating cranes or other lifting equipment
 - A. Years of experience performing similar work
 - B. Training taken in performing similar work
 - C. Certifications earned in performing similar work
- (10) The construction plan shall address how the Contractor will handle contingencies such as:
 - A. Unplanned events (storms, traffic accidents, work accidents, etc.)
 - B. Structural elements that don't fit or line up
 - C. Work that cannot be completed in time for the roadway to be reopened to traffic
 - D. Replacement of workers who don't perform the work safely
 - E. Unexpected absence of critical management team
 - F. Equipment failure
 - G. Other potential difficulties inherent in the type of work being performed
- (11) Name and qualifications of Contractor's person designated to determine and notify the Engineer in writing when it is safe to open a route to traffic after it has been closed for safety critical work.
- (12) Erection plan or bridge removal plan when submitted as required elsewhere by the specifications. Plan requirements that overlap with above requirements may be submitted only once.

3
**REVISION OF SECTION 107
PERFORMANCE OF CRITICAL WORK**

A safety critical element conference shall be held two weeks prior to beginning construction on each safety critical element. The Engineer, the Contractor, the safety critical element subcontractors, and the Contractor's Engineer shall attend the conference. Required pre-erection conferences or bridge removal conferences may be included as a part of this conference. Communications staff (Contractor or CDOT) shall also attend in order to address any public/media needs.

After the safety critical element conference, and prior to beginning work on the safety critical element, the Contractor shall submit a final construction plan to the Engineer for record purposes only. The Contractor's Engineer shall sign and seal temporary works, such as falsework, shoring etc., related to construction plans for the safety critical elements, (3) Removal of Bridge, (4) Removal of Portion of Bridge and (5) Temporary Work. The final construction plan shall be stamped "Approved for Construction" and signed by the Contractor.

The Contractor shall perform safety critical work only when the Engineer, or an authorized representative, is on the project site. The Contractor's Engineer shall be onsite to inspect and provide written approval of safety critical work for which he provided signed and sealed construction details. Unless otherwise directed or approved, the Contractor's Engineer need not be onsite during the actual performance of safety critical work, but shall be present to conduct inspection for written approval of the safety critical work.

When ordered by the Engineer, the Contractor shall immediately stop safety critical work that is being performed in an unsafe manner or which will result in an unsafe situation for the traveling public. Prior to stopping work, the Contractor shall make the situation safe for work stoppage. The Contractor shall submit an acceptable plan to correct the unsafe process before the Engineer will authorize resumption of the work.

When ordered by the Engineer, the Contractor shall remove workers from the project that are performing the safety critical work in a manner that creates an unsafe situation for the public in accordance with subsection 108.06.

Should an unplanned event occur or the safety critical operation deviate from the submitted plan, the Contractor shall immediately cease operations on the safety critical element, except for performing any work necessary to ensure worksite safety, and provide proper protection of the work and the traveling public. If the Contractor intends to modify the submitted plan, he shall submit a revised plan to the Engineer prior to resuming operations.

All costs associated with the preparation and implementation of each safety critical element construction plan will not be measured and paid for separately, but shall be included in the work.

The Contractor shall not be relieved from ultimate liability for unsafe or negligent acts or receive a waiver of the Colorado Governmental Immunity Act on behalf of the Department.

1
**REVISION OF SECTION 108
SPECIALTY ITEMS**

Section 108 of the Standard Specifications is hereby revised for this project as follows:

The following items are designated as "Specialty Items" for this project:

Specialty Items

- (1) Fence – Steel Post with Cable on Private Property
- (2) Horse Arena Modifications on Private Property



THornton Standard Specification - Section 200.pdf

1
**REVISION OF SECTION 201
CLEARING AND GRUBBING**

Section 201 of the Standard Specifications is hereby revised for this project as follows:

Subsection 201.01 shall include the following:

All trees and shrubs adjacent to and within the project limits shall be protected with the exception of those specified within the Plans to be removed.

Removal of small brush and trees with trunk diameter (caliper) less than 6-inches will not be measured and paid for separately but shall be included in the work.

Temporary easement areas shall not be cleared and grubbed unless absolutely necessary for construction purposes. Limits of clearing and grubbing shall be field verified by the Owner after field staking has been completed and prior to clearing and grubbing.

Subsection 201.02 shall include the following:

The Contractor shall make necessary arrangements for obtaining suitable disposal locations. If disposal will be at other than established dump sites, the City may require the Contractor to furnish written permission from the property owner on whose property the materials and debris will be placed.

In subsection 201.02 delete the 3rd, 4th, and 5th paragraphs and replace them with the following:

Surface objects and trees, stumps, roots, and other protruding obstructions not designated to remain shall be cleared and/or grubbed as required, to ensure complete removal; however, nonperishable, non-toxic objects which shall be a minimum of two (2) feet below subgrade may remain when such objects will not impede other subsurface operations.

Except in areas to be excavated, stump holes, and other holes from which obstructions are removed shall be backfilled with suitable material and compacted in accordance with subsection 203.06. Materials and debris shall be disposed of in a manner acceptable to the City.

Burning of any materials shall not be permitted without prior written approval of the City, the County Health Department, and Fire Department. If permitted, perishable material shall be burned under the constant care of the Contractor, at times and in a manner that will not endanger the surrounding vegetation, adjacent property, or objects designated to remain. Burning shall be done in accordance with applicable laws and ordinances.

2
**REVISION OF SECTION 201
CLEARING AND GRUBBING**

Subsection 201.04 shall include the following:

Payment will be made under:

Pay Item	Pay Unit
Clearing and Grubbing	Lump Sum

END OF SECTION REVISION

1
**REVISION OF SECTION 202
REMOVAL OF STRUCTURES AND OBSTRUCTIONS**

Section 202 of the Standard Specifications is hereby revised for this project as follows:

In Subsection 202.02 delete the 1st paragraph and replace it with the following:

The Contractor shall raze, remove, and dispose of foundations, signs, structures, fences, pavements, utilities, traffic signal materials, and other obstructions, which are designated for demolition within the project limits, except for utilities and for materials which are to be preserved or salvaged.

Subsection 202.02 shall include the following:

Where portions of structures are to be removed, the remaining portions shall be prepared to fit new construction. The work shall be done in accordance with plan details and in such a manner that materials to be left in place shall be protected from damage. Damage to portions of structures which are to remain in place shall be repaired at the expense of the Responsible Party. Reinforcing steel, projecting from the remaining structure, shall be cleaned and aligned to provide bond with new extension. Dowels shall be securely grouted with City-approved grout. Remaining structures are to be delineated in the as-built drawings.

Storm sewers, culverts, waterlines, and other conduits that are to be removed shall be saw-cut, completely removed, and disposed of off-site. Storm sewers, culverts, waterlines, and other conduits that are to be abandoned in place shall be saw-cut, and completely filled with flash or flow fill. All of the Contractor's costs, for removing and disposing of conduits or abandoning conduit pipes in place shall be included in the bid price for the particular item that requires removal and/or abandonment of structures and obstructions.

Removal of Existing Signs shall include the removal and disposal of all types and classes of traffic signs designated to be removed on the drawings. Pedestals and bases from sign posts and similar structures shall be removed to one (1) foot below the proposed subgrade.

2
**REVISION OF SECTION 202
REMOVAL OF STRUCTURES AND OBSTRUCTIONS**

Fire hydrant, valves, and waterlines:

All salvable material shown on the Plans or as directed shall be removed, without unnecessary damage, in sections or pieces that may be readily transported, and delivered by the Contractor to the location noted above, or as directed by the Engineer. The Contractor shall be held responsible for the safekeeping of all salvable materials during the period of the Contract until they are delivered to the City of Thornton location. The Contractor shall make good or replace at his own expense any such materials damaged, stolen or otherwise lost prior to receipt by City of Thornton. All salvable materials, as designated on the Plans or as directed, shall remain the property of City of Thornton.

There are existing boulders within the project area that are prescribed on the Plans to be removed. The Contractor shall coordinate with the City of Thornton on where to deliver the boulders. Should the City not want the boulders, they shall become the property of the contractor.

Subsection 202.11 shall include the following:

When specifically noted on the drawings, the Removal of Full Depth Asphalt Pavement shall include the removal of all aggregate base course material below the asphalt to native soil. The Removal of aggregate base course under existing asphalt shall be considered incidental to Removal of Full Depth Asphalt Pavement. The assumed depth of existing asphalt, along Washington Street and 152nd Avenue, is 5 to 8 inches.

There will be no measurement and payment for saw cutting required for the removal of asphalt and concrete. Saw cutting shall be considered incidental to bid items which require saw cutting.

The Removal of Pavement Markings for traffic control will not be measured and paid for separately but shall be considered incidental to Removal of Asphalt Mat (Planing) or Removal of Full Depth Asphalt. Variable milling as shown on the Construction Plans will not be measured and paid for separately, but shall be considered incidental to Removal of Asphalt Mat (Planing).

The Removal of Trees shall include tree stumps and roots by pre-approved methods by the City. Remove stumps and roots of removed plants to depths needed for installation of new plants. Fill voids left by stump/root removal with amended topsoil mix as specified in the PLANTING section of these specifications. The Contractor shall visit the site to view all trees that are designated to be removed. Several trees have multiple trunks. Removal of trees with multiple trunks shall be considered removal of one tree.

Removal of concrete flatwork shall include: over excavation; moisture conditioning the over excavated soil; replacing and compacting the over excavated soil, providing suitable material if the over excavated soil is not suitable; disposal of unsuitable material; all in accordance with the soils report to provide a suitable base for fill and/or the pavement section.

3
**REVISION OF SECTION 202
REMOVAL OF STRUCTURES AND OBSTRUCTIONS**

Subsection 202.12 shall include the following:

Payment includes all labor, equipment, saw cutting, and materials necessary to complete the work. All costs associated with stockpiling, safekeeping, and delivering salvaged materials to the City of Thornton shall be included in the work.

No material or debris shall be disposed of within the project limits without the written permission of the Engineer. The Contractor shall advise the Engineer in writing of the intended disposal site before the disposal site is used; and provide documentation confirming the property owner's acceptance of such materials.

There will be no separate measurement or payment of removal of different types of fencing and gates. All types of fencing and gates shall be measured and paid for under pay item Removal of Fence.

Payment will be made under:

Pay Item	Pay Unit
Removal of Tree	Each
Removal of Pipe	Linear Foot
Removal of Concrete Canal	Square Yard
Removal of Irrigation Structure	Each
Removal of Curb and Gutter	Linear Foot
Removal of Concrete Pavement	Square Yard
Removal of Asphalt Mat [Full Depth]	Square Yard
Removal of Gravel	Square Yard
Removal of Bridge (over Bull Canal)	Each
Removal of Wooden Pole	Each
Removal of Ground Sign	Each
Removal of Fence	Linear Foot
Removal of Guardrail Type 3	Linear Foot
Removal of Gravel Driveway [6 inches]	Square Yard
Removal of Light Standard	Each

END OF SECTION REVISION

1
SECTION 203
EXCAVATION AND EMBANKMENT

Section 203 of the Standard Specifications is hereby revised for this project as follows:

Subsection 203.03 shall include the following:

Roadway Embankment Fill: Most of the existing onsite soils are suitable for re-use as engineered fill. However, some isolated areas of foreign, deleterious, or otherwise unsuitable material may be encountered, which shall be omitted for use as engineered fill for support of pavements. Soils used as fill within embankments and beneath paved areas shall be cleared of any deleterious materials and clays, shall have an R-value of 12 and be prepared in accordance with the project geotechnical report. Imported fill, if required should contain a maximum of 70 percent passing the No. 200 sieve, and have a maximum liquid limit of 35 and a maximum plasticity index of 20. Fill material not meeting the above criteria may be acceptable if the swell potential when remolded to 95% of the standard Proctor (AASHTO T 99) maximum dry density at optimum moisture content does not exceed 0.5% under a 200-psf surcharge pressure.

All fill material should be free of vegetation, brush, sod and other deleterious substances and should not contain rocks, debris or lumps having a diameter of more than 4 inches. A geotechnical engineer should evaluate the suitability of all proposed import fill material for the project prior to placement.

Subsection 203.05 (c) shall include the following:

The bid item for Topsoil Stripping (Export of Unsuitable Material) shall not be used as embankment without prior approval from the City. Removal of unsuitable material shall consist of the removal of soils or mixtures of soil and organic matter identified in the Contract or as directed by the Engineer that would be detrimental to the roadway or embankment if left in place in its existing condition.

Subsection 203.05(e) shall include the following:

Stripping shall not be completed outside of the limits of construction or limits of disturbance.

Subsection 203.06, 2nd paragraph shall include the following:

Excavated or removed asphalt mat shall not be used in embankments.

In Subsection 203.11 delete the 1st paragraph.

Subsection 203.11 shall include the following:

Earthwork requiring more than one handling will not be measured and paid for separately but shall be considered incidental to the Excavation and Embankment quantities listed in the bid schedule.

2
SECTION 203
EXCAVATION AND EMBANKMENT

In Subsection 203.11 delete subparagraphs (a) and (b) and replace with the following:

Quantities for Unclassified Excavation Complete in Place and Embankment Complete in Place shall not be measured, but shall be the quantities designated in the Contract. The Contractor is responsible for verifying the quantities prior to completing their bid. If the Contractor believes that the quantities of earthwork are different than those presented on the bid schedule, then the Contractor shall adjust their bid prices accordingly.

Stripping will not be measured and paid separately but shall be considered incidental to the bid items for earthwork.

In Subsection 203.11 delete subparagraph (f) and replace with the following:

Proof Rolling shall be considered incidental to reconditioning and will not be measured and paid for separately.

Subsection 203.12 shall include the following:

Disposal of unsuitable material and importing suitable material will not be paid for and shall be considered incidental to the bid item for Unsuitable Materials. The bid item for Unsuitable Materials shall include but is not limited to excavation, haul, disposal of unsuitable material, importing suitable material, moisture conditioning, compaction, water, and all labor, materials, and equipment required to removal and replace unsuitable material.

Payment will be made under:

Pay Item	Pay Unit
Unclassified Excavation (Complete in Place)	Cubic Yard
Topsoil Stripping (Export of Unsuitable Material)	Cubic Yard
Borrow	Cubic Yard
Muck Excavation	Cubic Yard
Over Excavation	Cubic Yard
Potholing	Hour

END OF SECTION REVISION

1
**REVISION OF SECTION 206
EXCAVATION AND BACKFILL FOR STRUCTURES**

Section 206 of the Standard Specifications is hereby revised for this project as follows:

Subsection 206.01 shall include the following:

Excavation and backfill for all structures including but not limited to storm sewers, waterline, fire hydrants, sanitary sewers, manholes, tees, junction boxes, inlets and culverts is also included in this section.

Subsections 206.06 and 206.07 are hereby deleted and replaced with the following:

There will be no measurement and payment for work covered under this section. The cost for Excavation and Backfill for Structures shall be included in the unit prices bid for all work requiring structure excavation and backfill. This includes compaction, water, and all other work necessary to complete the work requiring structure excavation and backfill. Structure backfill, including bed course material, for pipes and end sections will not be measured and paid for separately, but shall be included in the work for that pay item. Where only end section work is required the structure excavation quantity and the structure backfill quantity will not be measured and paid for separately, but shall be included in the work.

When the Contractor substitutes Structure Backfill (Flow Fill) for Structure Backfill (Class 1) or (Class 2), there will be no adjustment in the price or the quantity paid for structure excavation or structure backfill as a result of reducing the trench width.

END OF SECTION REVISION

1
SECTION 206
SHORING

Section 206 of the Standard Specifications is hereby revised for this project as follows:

Subsection 206.10 shall include the following:

Shoring will not be measured, but will be paid for as a single lump sum for each area described on the plans. Incidental shoring work or shoring in locations other than those described on the plans will be as determined by the Contractor and will not be measured and paid for separately, but shall be included in the work.

Subsection 206.11 shall include the following:

Payment will be made under:

Pay Item	Pay Unit
Temporary Shoring (Bull Canal)	Lump Sum

Payment for shoring will be full compensation for all labor, materials, and equipment required to design, construct, test, maintain, and dewater.

Removal of the shoring shall include removal of all shoring elements. The removal area shall be specified in the plans.

Removal of shoring will not be measured and paid for separately, but shall be included in the work.

END OF SECTION REVISION

1
**REVISION OF SECTION 207
TOPSOIL**

Section 207 of the Standard Specifications is hereby revised for this project as follows:

Subsection 207.01 shall include the following:

Topsoil shall be imported to the site and shall meet the requirements of these specifications. Topsoil shall not be removed and replaced in the temporary construction easements or staging areas.

Topsoil shall not include any materials or elements detrimental to plant growth. Soluble salts measured in saturation extract shall be less than 3 mmhos/cm.

Subsection 207.02 is deleted and replaced with the following:

- A. Planting Soil Mix: ASTM D 5268 topsoil, with pH range of 5.5 to 7, a minimum of 2 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth. Mix ASTM D 5268 topsoil with the following soil amendments and fertilizers in the following quantities to produce planting soil:
 - 1. Ratio of Loose Compost to Topsoil by Volume: 1:4.

- B. Planting Soil Mix: Imported topsoil or manufactured topsoil from off-site sources. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from agricultural land.
 - 1. Additional Properties of Imported Topsoil or Manufactured Topsoil: Screened and free of stones 1 inch or larger in any dimension; free of roots, plants, sod, clods, clay lumps, pockets of coarse sand, paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials harmful to plant growth; free of obnoxious weeds and invasive plants including quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass; not infested with nematodes; grubs; or other pests, pest eggs, or other undesirable organisms and disease-causing plant pathogens; friable and with sufficient structure to give good tilth and aeration. Continuous, air-filled pore space content on a volume/volume basis shall be at least 15 percent when moisture is present at field capacity. Soil shall have a field capacity of at least 15 percent on a dry weight basis.
 - 2. Mix imported topsoil or manufactured topsoil with the following soil amendments and fertilizers in the following quantities to produce planting soil:
 - a. Ratio of Loose Compost to Topsoil by Volume: 1:4.
 - b. Planter Soil Mix for parking lot islands shall be installed to a 2-foot depth.

- C. Lightweight On-Structure Planting Soil: Mix produced by modifying planting soil as follows:
 - 1. Planting Soil: One part(s), except replace all] of sand content with perlite.
 - 2. Additional Perlite: One part(s).
 - 3. Additional Spagnum Muck Peat: One part(s).
 - 4. Additional Lime: Ground dolomitic limestone applied at the rate of 3 lb per cu. yd.

- D. Provide a local source.

2
**REVISION OF SECTION 207
TOPSOIL**

The rain garden growing media shall consist of a minimum of 15% compost mixture and 85% coarse sand by volume.

The rain garden compost mixture consists of 50% Class 1 Seal of Testing Assurance (STA) registered compost (approximate bulk density 1000 lbs/CY) and 50% loosely packed shredded paper (approximate bulk density 50 to 100 lbs/CY) by volume. When using diamond cut shredded paper or tightly packed paper, use the bulk densities provided to mix by weight.

The coarse sand shall be either CDOT Class C Filter Material per CDOT Table 703-10 or sand meeting ASTM C-33.

Subsection 207.04 is deleted and replaced with the following:

Topsoil (Planter Soil Mix) salvaged from the roadways that meet the requirements of Section 207 will not be measured.

No measurement will be made for any work related to topsoil (Planter Soil Mix) imported to the site.

Growing Media salvaged from the roadways that meet the requirements of Section 207 will not be measured.

No measurement will be made for any work related to Growing Media imported to the site.

Subsection 207.05 is deleted and replaced with the following:

Quantities for Planter Soil Mix shall not be measured, but shall be the quantities designated in the Contract and presented in the bid. Only the quantities presented on the bid schedule will be paid.

The addition of manure or soil amendments needed to bring the Planter Soil Mix into conformance with the specifications will not be measured and paid for separately, but shall be included in the work. Stockpiling of Planter Soil Mix and handling of Planter Soil Mix material shall be included in the unit price of the work. Soil Analysis shall not be paid for separately, but shall be included in the cost of the work.

Payment for Planter Soil Mix shall include Planter Soil Mix imported to the site and subsequently placed upon completed cut and fills slopes. Imported Planter Soil Mix shall meet the requirements of this specification. All materials and work require to amend imported Planter Soil Mix, if necessary, so that it meets the requirements of Section 207 shall be included in the unit price bid for Planter Soil Mix. All work required for Planter Soil Mix shall be included in the unit price bid.

3
REVISION OF SECTION 207
TOPSOIL

Quantities for Growing Media shall not be measured, but shall be the quantities designated in the Contract and presented in the bid. Only the quantities presented on the bid schedule will be paid.

The addition of manure or soil amendments needed to bring the Growing Media into conformance with the specifications will not be measured and paid for separately, but shall be included in the work. Stockpiling of Growing Media and handling of Growing Media material shall be included in the unit price of the work. Soil Analysis shall not be paid for separately, but shall be included in the cost of the work.

Payment for Growing Media shall include Growing Media imported to the site and subsequently placed upon completed cut and fills slopes. Imported Growing Media shall meet the requirements of this specification. All materials and work require to amend imported Growing Media, if necessary, so that it meets the requirements of Section 207 shall be included in the unit price bid for Growing Media. All work required for Growing Media shall be included in the unit price bid.

Payment will be made under:

Pay Item	Pay Unit
Topsoil Stripping (Stockpile and Redistribute)	Cubic Yard
Topsoil Stripping (Export of Unsuitable Material)	Cubic Yard
Amended Topsoil (Growing Media)	Ton

- Landscaped Median Soil Preparation
 - Within landscaped medians, fill with 36 inches of A-1 Organics Amended Topsoil or equivalent in no greater than 12 inch lifts. In lieu of using premixed amended topsoil, planting bed soil shall be topsoil and professionally mixed with 27 cubic yards of a Class I or II compost per 1,000 sf of median landscape area and incorporated into the entire soil profile to a depth of 36 inches in no greater than 12 inch lifts after mixing.
- Before incorporation of amendment and in the sole opinion of the city, rip soil to a depth of 12"-18", or as directed by the city, in all staging areas and areas compacted by construction operations. Rip areas of native seed to 18" and all other areas to a minimum depth of 12".
- Submit all load tickets, verifying source, quality and quantity of material delivered to site.
- After representative soil sample analysis, apply the following to all planted areas, including the total square footage of planting beds. Distribute uniformly and thoroughly mix to a depth of 12", unless restricted by existing tree roots:
 - Compost
 - Compost shall be 6 cy/1000 **SF** as minimum 2" depth 'Biocomp' Class 1 non-manure based compost as supplied by A-1 Organics, Eaton, Colorado, or approved equal. Mix shall be screened to 3/8" minus and free from stones, lumps, plants, roots, sticks, weed stolons, seeds, high salt content and other materials harmful to plant life.
 - Minimum 25% and maximum 35% organic matter measured on dry weight basis
 - pH range 6.0 to 7.0 (7.0 is neutral)

- EC electrical conductivity (soluble salts) 2.0-5.0 mmhos/cc @1:5 (compost:water weight ratio)
- Carbon nitrogen C:N ratio 10:1 to 12:1; 12-16 may be acceptable
- Submit for approval at least 14 days prior to site delivery a one-gallon sample with laboratory analysis specific to the sample dated within thirty days of date of submittal.
- Starter Fertilizer
 - 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.
- Do not apply pre-emergent

END OF SECTION REVISION

1
**REVISION OF SECTION 208
EROSION CONTROL**

Section 208 of the Standard Specifications is hereby revised as follows:

Subsection 208.01 shall include the following:

The Contractor shall provide routine inspection and maintenance of final erosion control BMPs and temporary BMPs left on-site for one year after final acceptance of the project by the City. This work shall be completed in accordance with the requirements of this section.

After one year, the Contractor shall remove all temporary BMPs. Inspection reports shall be delivered to the City within 48 hours after each inspection. When maintenance is required, the Contractor shall notify the City 48 hours prior to completing maintenance. The Contractor shall anticipate 24 inspections (twice monthly).

Subsection 208.11 shall include the following:

There will be no measurement and payment made for erosion control maintenance before final acceptance of the project.

There will be measurement and payment made for erosion control maintenance after final acceptance of the project under Erosion Control Maintenance (1-Year).

In subsection 208.11 delete the 1st paragraph and replace it with the following:

Erosion Control Management will not be measured and paid for separately but shall be considered incidental to the project regardless of the number of ECIs required. Erosion Control Management shall include, but is not limited to, erosion control inspections, documentation, meeting participation, SWMP Administration, and the preparation of the SWMP notebook.

There will be no separate measurement or payment for maintenance of individual BMPs while under the Erosion Control Maintenance (1-year) pay item. Erosion Control Maintenance includes, but is not limited to, removal of sediment, and adjustment of erosion logs and/or silt fence.

In subsection 208.12 delete the 5th paragraph after the list of pay items.

2
**REVISION OF SECTION 208
EROSION CONTROL**

Section 208.12 shall include the following:

Erosion Control Management, Removal and Disposal of Sediment (Equipment), Removal and Disposal of Sediment (Labor), Sweeping and Trash Removal, Stabilized Staging Area, Stockpile Management, Dust Control, Good Housekeeping Practices, and Sediment Trap are required as part of the project SWMP and ESCP but will not be measured and paid for separately but shall be considered incidental to the project.

Payment will be made under:

Pay Item	Pay Unit
Erosion Log (Type 1) (12 inch)	Linear Foot
Silt Fence	Linear Foot
Storm Drain Inlet Protection (Type 1)	Linear Foot
Check Dam	Each
Concrete Washout Structure	Lump Sum
Vehicle Tracking Pad	Lump Sum
Erosion Control Post Construction (12 months duration)	Lump Sum

END OF SECTION REVISION

1
**REVISION OF SECTION 209
WATERING AND DUST PALLIATIVES**

Section 209 of the Standard Specifications is hereby revised for this project as follows:

Subsection 209.02 shall include the following:

The Contractor is responsible for obtaining a legal source for water to complete the work as specified in the Contract Documents, including any necessary permits or fees.

Delete subsection 209.07 and 209.08 and replace with the following:

Water required for all work covered under the Contract will not be measured and paid for separately but shall be included in the work. Contractor shall obtain a water meter, for a refundable deposit (\$1,400), from the City of Thornton, which is to be used for site project watering.

END OF SECTION REVISION

1
**REVISION OF SECTION 210
RESET STRUCTURES**

Section 210 of the Standard Specifications is hereby revised for this project as follows:

Delete subsection 210.07 and replace it with the following:

Signs and posts designated to be reset shall be removed, cleaned and reset at the designated locations. Reset Ground Signs shall include attaching the existing sign to a new post. Sign posts shall meet the City of Thornton's Standard detail 700-12.

Subsection 210.10 shall include the following:

When the project includes planing prior to resurfacing, the Contractor shall first lower all valve boxes and manholes below the surface to be planed and then adjust them up to final grade after the paving operation is complete. This work will not be measured and paid for separately but shall be included in the work.

Prior to the final inspection, the Contractor shall thoroughly clean all valve boxes designated for cleaning. This work will not be measured and paid for separately but shall be included in the work.

The Contractor shall coordinate and conduct, with the Engineer and each Owner, a final inspection upon completion of construction. This inspection shall assure that all valve boxes and manholes are in compliance with these requirements. The Contractor shall obtain the Owner's written approval before accepting the work.

The work under Reset Fire Hydrant shall include removal of the existing fire hydrant assembly and installation of a new fire hydrant assembly per the City of Thornton Standard Detail number 200-10 to the location shown on the Project Construction Plans. Work under this pay item shall meet the requirements defined under Section 200 – Water System Standards of the City of Thornton's Standards and Specifications.

2
**REVISION OF SECTION 210
RESET STRUCTURES**

Subsection 210.12 shall include the following:

The Contractor will be paid separately for each ground sign that is reset and accepted by the City. Concrete footings, sign posts, sign panels, mounting and backing angles, will not be measured separately but shall be considered incidental to the unit price bid for Reset Ground Sign.

The Contractor will be paid separately for each fire hydrant that is reset and accepted by the City.

Subsection 210.13 shall be revised to include the following:

Payment for Reset Fire Hydrant shall include, but not be limited to, new materials, fittings, appurtenances, testing, disinfection, thrust blocks, height extensions, potholing, and disposal of existing materials.

Payment will be made under:

Pay Item	Pay Unit
Reset (Utility) Structure	Each
Reset Mailbox Structure	Each
Reset Fence	Linear Foot
Reset (Relocate) Water Meter	Each
Reset Fire Hydrant	Each
Reset Valve	Each
Reset Ground Sign	Each
Adjust Manhole	Each
Adjust Valve Box	Each
Adjust Pull Box	Each

END OF SECTION REVISION

1
SECTION 211
DEWATERING

For all excavation including storm pipe installation, Bull Canal box construction, Mustang Run box installation, water line installation, sanitary sewer installation, etc., the Contractor shall provide suitable equipment materials and labor to remove surface and ground water, lower and control groundwater table levels and hydrostatic pressures to permit the required construction to be performed in accordance with the plans and specifications. Control of surface water shall be considered part of this work.

Contractor shall submit a dewatering plan to the Engineer for review prior implementing any dewatering efforts.

Disposal of water shall be completed in a manner such that it complies with the required permits for disposal, it will not endanger portions of work under construction or completed, it will not cause flooding to streets or adjacent properties, runoff is controlled, and is not a menace to public health or convenience.

The Contractor shall obtain from the Colorado Department of Public Health and Environment (CDPHE) a permit to discharge water removed from excavations and operations. The Contractor shall assume full responsibility for compliance with the terms and conditions of the permit and shall pay all associated permit fees.

Dewatering will not be measured but will be paid by lump sum. The lump sum shall include all work necessary to dewater sections of the Work if groundwater and wet subsurface soil conditions are encountered. Groundwater may be encountered at various depths during excavation for this project. The project work will require adequate dewatering measures to enable construction to proceed in relatively dry conditions. Water control measures shall include, but are not limited to diversions, sumps with pumps or other means necessary to maintain the level of groundwater below subgrade elevation and to divert surface water away from the work area. The Contractor is responsible for investigating and familiarizing himself with respect to all site conditions that may affect the work, including surface water, level of groundwater and time of year the work is to be done.

Payment will be based on the percentage of completed and accepted Work. One third of the lump sum price for this item will be paid after twenty-five percent (25%) of the original Contract amount has been earned, the second third after fifty percent (50%) of the original Contract amount has been earned, and the final third will be paid upon final acceptance of the Project.

The Engineer shall be notified when dewatering operations are required. Dewatering requires approval from the Engineer in order to be paid.

Payment will be made under:

Pay Item	Pay Unit
Dewatering – Washington Street	Lump Sum
Dewatering – Bull Canal Relocation	Lump Sum

END OF SECTION

1
**REVISION OF SECTION 212
SEEDING, FERTILIZER, SOIL CONDITIONER, AND SODDING**

Section 212 of the Standard Specifications is hereby modified to add the City's specific requirements as follows:

DESCRIPTION

This work shall consist of amending all seed and sodding areas with organic matter, inoculants, and a separate surface application of a biological nutrient.

MATERIALS

Biological nutrient (Biosol), all-purpose fertilizer 7-2-3. The biological nutrient shall be: 96% fungal biomass (dry mycelium), 1% water, and 3% potassium-magnesia.

Compost; A-1 organics compost or equal, must be produced at a composting facility meeting EPA 40 CFR 503.13 requirements.

PREPARATION

Existing soils in areas to be seeded shall be ripped and tilled prior to incorporating amendments. Areas with existing grasses and forbs shall be eradicated with applications of a systemic, non-selective herbicide such as glyphosate or approved equal and applied by a licensed applicator prior to ripping and tilling. Minimize tilling of soil within 8 ft of existing trees to avoid damaging root systems.

CONSTRUCTION REQUIREMENTS

Apply compost to all areas to be seeded at a rate of 3 cubic yards per 1000 square feet. Compost shall be worked thoroughly and evenly to an 8-inch depth

Apply biological nutrient after seeding and planting and before application of mulch; **this includes all sod areas, shrub beds, native seeding, and tree planted areas.** No fertilizer shall be applied for wetland seeded areas. Apply at a rate of 1500 lbs per acre to the soil surface; do not work into the soil. No other fertilizer is recommended. Apply prior to placing erosion control blankets.

2
**REVISION OF SECTION 212
SEEDING, FERTILIZER, AND SOIL CONDITIONER**

Subsection 212.02 shall be revised as follows:

1.2 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, pesticides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, herbicide, 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.

3
**REVISION OF SECTION 212
SEEDING, FERTILIZER, SOIL CONDITIONER, AND SODDING**

1.3 SUBMITTALS

- A. See Division 01 Section "Submittals" for submittal requirements.
- B. Product Data: For each type of product indicated.
 - 1. Pesticides: Include product label and manufacturer's application instructions specific to this Project.
- C. Qualification Data: For qualified landscape installer.
- D. Product Certificates: For soil amendments and fertilizers, from manufacturer.
- E. 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. Compost analysis specific to the sample & dated within 30 days of date of submittal.
 - 4. Analysis for each amended planting soil.
- F. 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.
- G. Planting schedule: Submit in writing two copies of proposed planting schedule, indicating dates for topsoil placing, site preparation, pesticide 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.
- H. Maintenance Instructions: Recommended procedures for maintenance of turf and dryland grasses during a calendar year. Submit before expiration of required initial maintenance periods.

**REVISION OF SECTION 212
SEEDING, FERTILIZER, SOIL CONDITIONER, AND SODDING**

I. Contract Closeout Submittals:

1. Operating and Maintenance Data: At completion of work, submit one digital copy and two hard copies to the Project Manager 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.

1.4 QUALITY CONTROL

- A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful 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 installation in addition to requirements in Division 01 Section "Quality Control."
 3. (Blank)
 4. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 5. 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.
 6. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.
 7. 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. 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.

**REVISION OF SECTION 212
SEEDING, FERTILIZER, SOIL CONDITIONER, AND SODDING**

- D. 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 sod shall be free from insects and disease. Species shall be true to their scientific name as specified.
- E. Materials: The Contractor shall submit to the Project Manager 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 Project Manager.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Fertilizer: Deliver inorganic or chemical fertilizer to site in original unopened container bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark, warranty and conformance to state law.
- 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. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.
 - 4. 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.
- C. Material will be inspected upon arrival at project site. Project Manager will reject any opened or unacceptable materials as described above.
- D. Immediately remove unacceptable material from job site.

**REVISION OF SECTION 212
SEEDING, FERTILIZER, SOIL CONDITIONER, AND SODDING**

1.6 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. Vehicular accessibility on site shall be as directed by Project Manager. 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. Schedule work for periods of favorable weather. Do not install sod on saturated or frozen soil. The Project Manager reserves the right to deny sod installation on days that are deemed to be unfavorable for installation.
- D. Existing conditions:
 - 1. Utilities: Determine location of underground utilities. Perform work in a manner to avoid possible damage. Hand excavate, as required.
 - 2. 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 Project Manager before planting.
 - 3. If weeds are present on site, treat with pesticide prior to preparing soil for installing seed as specified in this or other Sections of the City of Thornton Native Seed Guidelines.
- E. Coordination:
 - 1. Coordinate with construction of utilities on site. Do not begin soil amendment until underground work is completed in the area.
 - 2. Coordinate with Contractor(s) approved schedule. Limit construction access to areas where soil amendment 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 twenty four (24) hours after fine grading.
 - 3. Coordinate with Contractors work requiring access to site over landscape areas.
 - 4. Coordinate with installation of underground irrigation system.

1.7 WARRANTY

- A. Follow City of Thornton Native Seed Guidelines

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**REVISION OF SECTION 212
SEEDING, FERTILIZER, SOIL CONDITIONER, AND SODDING**

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Topsoil: See Section "Topsoil".
- B. As recommended by testing lab based on soil sample results.
- C. Water: Contractor to utilize the existing 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. Refer to Division 31 Section "Watering". Water shall be free of substances that may be harmful to sod growth. Hoses and other watering equipment necessary to water the sod to be furnished by Contractor.

2.2 PESTICIDES

- A. General: Pesticide, 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 pesticides unless authorized in writing by Project Manager and authorities having jurisdiction.
 - 1. Pre-Emergent Pesticide (Selective and Non-Selective): Use only with approval by Project Manager. Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.
 - 2. Post-Emergent Pesticide "Round-up" by Monsanto, or approved equal.

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**REVISION OF SECTION 212
SEEDING, FERTILIZER, SOIL CONDITIONER, AND SODDING**

PART 3 - EXECUTION

3.1 EXAMINATION

- 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 Contract 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 Project Manager.
- 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 PREPARATION

- A. Work notification: Notify the Project Manager at least seven (7) working days prior to start of sodding operations.
- B. Limit subgrade preparation to areas that can be planted within twenty four (24) hours.
- C. Newly Graded Subgrades: Prepare soil as required by Division 32 Section "Soil Preparation".

**REVISION OF SECTION 212
SEEDING, FERTILIZER, SOIL CONDITIONER, AND SODDING**

- D. Unchanged Subgrades: If seed is to be planted in areas unaltered or undisturbed by excavating, grading, or surface-soil stripping operations, prepare surface soil as follows:
 1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
 2. Loosen surface soil to a depth of at least 8 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top six inches (6") of soil. Till soil to a homogeneous mixture of fine texture.
 3. Remove stones larger than one-half ($\frac{1}{2}$ ") inch in any dimension and sticks, roots, trash, and other extraneous matter.
 4. Legally dispose of waste material, including grass, vegetation, and turf, off City property.

- E. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

- F. Verify that all areas are graded to drain at a minimum of two percent (2%) or as indicated on the Contract Drawings. Verify that subsurface drainage system and drain inlets if any, are operative.

- G. Verify that irrigation system is operable and provides adequate coverage prior to planting.

- H. Adjustment: Adjust irrigation heads to proper watering height according to depth of seed material but lower than compacted blade height to enable lawn mowers to cut grass freely without damage to the sprinkler system.

- I. When completed, the soil shall be firmed by float dragging, followed by steel raking, to provide for the proper subgrade. The bed shall be totally free from rock or clay clods over one-half inch ($\frac{1}{2}$ ") inch in diameter and be approved by the city.

- J. Repair: Re-establish grade and specified conditions to damaged sod areas prior to placing sod.

3.3 INSTALLATION

- A. Use City of Thornton Native Seed Guidelines

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REVISION OF SECTION 212
SEEDING, FERTILIZER, SOIL CONDITIONER, AND SODDING

3.4 TREE AND PLANT PROTECTION

- A. Refer to City of Thornton Specification Section 105.6 for tree and plant protection requirements.
- B. Protect existing utilities, paving and other facilities from damage caused by sodding operations, Contractor shall repair any damage at no additional cost to the City.
- C. Restrict vehicular and pedestrian traffic from sodded areas until grass is established. Erect signs and barriers as required or directed by the Project Manager at no additional cost to the City.
- D. Locate, protect and maintain the irrigation system during sodding operations. Repair irrigation system components damaged during sodding operations shall be replaced or repaired to current City irrigation standards at Contractor's expense.
- E. 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.

3.5 MAINTENANCE

- A. Use City of Thornton Native Seed Guidelines

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**REVISION OF SECTION 212
SEEDING, FERTILIZER, SOIL CONDITIONER, AND SODDING**

Subsection 212.06 Native Seeding shall include Pawnee Buttes Native Prairie Seed Mix as follows:

A. Seed Mix

1. The specific seed mix shall be Pawnee Buttes Native Prairie Mix or approved equal consisting of the following:

Blue Grama	29%
Buffalograss	25%
Sideoats Grama	20%
Western Wheatgrass	20%
Green Neddlegrass	5%
Sand Dropseed	1%

Seeding rate to be 30 lbs. PLS/acre

Prairie Coneflower	33.33%
Blue Flax	66.66%

Seeding rate to be 3 lbs. PLS/acre

B. Seedbed Preparation

1. The seedbed shall be free of debris, including weeds, plant matter, rocks, clods and other impervious material over 1" in diameter. Seedbed 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.
2. Preparing the seedbed 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, but for best and quickest results, warm season grasses should be seeded in May and no later than July. Dryland seeding of cool season non-irrigated grasses should occur between November 15th & April 15th. Dryland seeding of non-irrigated warm season grasses should occur between March 15th & June 15th.
3. Soil amendment: Biosol and humate product to be broadcast on planted seed bed.
 - 600 lbs/Ac humate broadcast and 1200 lbs/Ac (if high organic results after soil test) to 1800 lbs/Ac (if low organic results after soil test) Biosol Mix 7-2-3 topically applied after drilling (Available at Rocky Mountain Bio Products, Denver, 303-696-8964)
 - OR 600 lbs/Ac humate broadcast and Biosol at 1500 lbs/Ac topically applied after drilling (Available at Pawnee Buttes Seed Company, Greeley, 970-356-7002 or 800-782-5947) or approved equal.

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**REVISION OF SECTION 212
SEEDING, FERTILIZER, SOIL CONDITIONER, AND SODDING**

C. Planting

1. Before planting, COT will approve incorporation of amendment into seedbed.
2. Provide the seed mix for City approval. In most cases, minimum seeding rate is 30-60 lbs PLS/acre with the rate doubled for broadcast seeding. Seed tags, certified copy of seed analysis and load tickets for soil amendment are required.
3. Seeding shall be done immediately after soil preparation to discourage weed competition. Seed shall be evenly distributed over amended ground on a still day into a slightly moist seedbed, using an approved grass drill with double disc openers, packer wheels and (fluffy) seed boxes as appropriate. As appropriate, drill equal quantity of seed ¼" deep in two directions at right angles to each other. Hand-broadcast methods shall be at double the seeding rate and shall be 'raked in' or otherwise covered with soil to a depth of ¼". Hydraulic seeding can only be used in areas not accessible for machine methods; seed and mulch shall not be applied in the same operation.
4. All seeded areas shall be hydro-mulched with wood (not paper) fiber 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. 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 blankets with biodegradable blanket pins.
5. If irrigated, within 12 hours of seeding, water seeded area frequently and lightly. Water enough to keep the soil moist, but not so heavily as to cause soil washing and loss of the grass seed.
6. Seeded slopes approved as 3:1 shall be covered with biodegradable erosion control seed blankets.
7. Germination during the growing season is expected within 3-6 weeks. Spot regrading, 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.
8. Flower/forbe seed may be added to mixes where grasses will not be mowed, but shall not substitute for quantities of seed. Species that readily reseed themselves seem to work best.

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D. Establishment

1. Keeping the seed moist is the key to germination and initial growth. New seeding will need water within the first seven days. High seeding rates, shallow drilling of no greater than ½" and narrow (2-4") seeder row spacing have proven to be critical in obtaining rapid establishment.
2. If irrigated, design the irrigation system for 'head to head' coverage, using rotor and spray heads with matched precipitation rates.
 - Establishment irrigation means applying water a minimum 2 times/day until seed germinates to the three leaf stage. After the three leaf stage and until the grass is 3-4" tall, water 2 times/day with a total 3/10" water/day.
 - Cool season grasses need ¾ to 1" of water per week, between March 1st to November 1st. Warm season grasses grow and need water from May 15th to September 15th.
 - After the first mowing and for the next two growing seasons (April-October), water 1" every two weeks. Adjust establishment irrigation inches by natural precipitation amounts.
3. The establishment period for irrigated seed can be a minimum of two growing seasons. After two seasons, water is applied as desired to create a particular landscape style, generally 1" water/month. Establishment of non-irrigated seed can take three to five growing seasons or more.
4. Initial Acceptance of seeding will require meeting the Stormwater Discharge Permit obligations. This work also includes meeting obligations and requirements of the Corps of Engineers Nationwide Permit for wetland mitigation seeded area coverage, as applicable.
5. Trees and shrubs in natural seed areas (chosen from Ultra-low Water Demand List) require irrigation zoned separately from seeded areas.

E. Maintenance | Weed Control

1. Mowing
 - Timely mowing operations are the industry standard used to manage weed control without chemicals. No mowing for the first six weeks after seeds sprout; mow weeds before annual seed set. It may be necessary to mow during the first growing season, depending on when grass was seeded. It is usually necessary to mow in the second year, depending on timing and amount of additional required reseeding.
 - Dryland areas should be mowed when weeds reach 8" or every 45 days. Irrigated areas should be mowed every three weeks or when grass reaches a maximum height of 12".
 - Mow grass with a flail type mower, not a sickle mower, to a height of 6". The goal of mowing is to knock down the weeds and just skim the tops of the new grass. Remove weeds by hand over 6-8" tall that are not controlled by mowing, generally once a month

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2. Chemical Treatment
 - For perennial weed control, use spot chemical spraying or hand weeding after grass plants are up and fairly mature, minimum past the three to five leaf stage. Remove weeds by hand over 6-8" tall that are not controlled by chemical treatment, generally once a month.
 - Apply herbicide only with the written approval of the City and as recommended by a professional applicator. Apply a selective pre- and post-germination herbicide that is labeled for use with the species listed on the seed mix, to control weeds for the maintenance period before Initial Acceptance and during the warranty period between Initial and Final Acceptance.
 - The use of Journey selective, pre-emergent herbicide or equivalent shall be required in areas infested with Cheatgrass (*Bromus tectorum*) and other grassy weeds.
 - Herbicide application for control of annual winter growing weeds usually occurs near August 15th and for perennial weeds near October 15th.
3. Litter and Debris Removal: Remove all litter and debris larger than two inches in size, such as rocks, plastic, paper, metal and glass and dispose of off site.

F. City Acceptance Criteria for Seeded Area

1. Initial Acceptance may occur when the City has received and approved all product certifications and quantities and given written acknowledgement that the designated area has been prepared, seeded, mulched and maintained to meet the specification requirements.
 - Contractor shall maintain seeded area until Initial Acceptance.
 - Regrading, reseeding, remulching and weed control is required until Initial Acceptance for areas of little or no seed germination and to repair areas damaged by erosion, wind, vandalism, fire or other causes.
 - Initial Acceptance of seeded area shall meet Stormwater Discharge Permit obligations.
2. Final Acceptance may occur one year after Initial Acceptance when the stand of grass displays uniform coverage at minimum three to five leaf stage of the seed mix planted (minimum 80% healthy grass coverage over any 10 square foot area and bare spots not exceeding 10" by 10"), with all species of the mix being well represented, minimal weeds present and the area free of surface irregularities (no rills & gullies), as determined by the City.
 - Final Acceptance of seeded area shall meet Stormwater Discharge Permit obligations and obligations and requirements of the Corps of Engineers Nationwide Permit for seeded area coverage, as applicable.
 - Any areas that do not comply with Final Acceptance criteria shall be reseeded by the Contractor in accordance with these specifications, using specified materials and methods.
 - Hydromulch may not be required in reseeded areas.

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METHOD OF MEASUREMENT

The quantity of native seeding will not be measured but shall be the quantity designated in the Contract, except that measurements will be made for revisions requested by the Engineer, or for discrepancies of plus or minus five percent of the total quantity designated in the Contract. The quantity of native seeding shall include soil preparation, fertilizer, soil conditioner, and seed applied, completed, and accepted.

The Contractor shall furnish the Owner with seed certifications and analysis, fertilizer analysis, delivery tickets, and bag weight tickets prior to placing any seed or fertilizer.

Any seed or fertilizer placed by the Contractor without the Owner's approval will not be paid for.

The work associated with Landscape Restoration is to be paid by lump sum for all work associated with repair, adjustments, and replacement of existing landscaping and existing irrigation systems reset and accepted by the Owner as complying with the Plans and Specifications. Work shall be done in accordance with City of Thornton Standard Specifications.

BASIS OF PAYMENT

The accepted quantity of native seeding will be paid for at the contract unit price for each of the pay items listed below that appear in the bid schedule.

Payment will be made under:

Pay Item	Pay Unit
Seeding (Native)	Acre
Compost Soil Amendment	Cubic Yard

Payment shall be made at the applicable contract unit price for Bid Item and shall include full compensation for all labor, equipment, tools, and materials necessary to complete the work. Payment for landscape restoration shall include all landscaping, sod, piping, wiring, valves, sprinkler heads, drip emitters, fittings, excavation, backfill, and all other items of work involved in the reset and modifications necessary to the irrigation systems to complete the work.

Soil preparation, water, seed, fertilizer, hydro mulch, and soil conditioner, incorporated into the seeding sodding or soil conditioning will not be paid for separately but shall be included in the work.

Adjusting or readjusting seeding or fertilizing equipment will not be paid for separately but shall be included in the work.

END OF SECTION REVISION

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**REVISION OF SECTION 213
MULCHING**

Section 213 of the Standard Specifications is hereby revised for this project as follows:

Subsection 213.04 shall include the following:

The quantity of pea gravel mulch will not be measured but shall be the quantity designated in the Contract, except that measurements will be made for revisions requested by the Engineer, or for discrepancies of plus or minus five percent of the total quantity designated in the Contract. Measurement for acres will be by slope distances.

Mulch around plantings shall be 3" depth of approved 5/8" diameter washed pea gravel. Mulch samples shall be approved by owner's representative prior to placement. Use no landscape fabric under mulch.

Subsection 213.05 shall be revised to include the following:

The accepted quantities will be paid for at the contract unit price for the various items below that appear in the bid schedule.

Payment will be made under:

Pay Item	Pay Unit
5/8 Inch Dia Washed Pea Gravel Mulch (3 Inch Depth)	Ton

END OF SECTION REVISION

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**REVISION OF SECTION 214
PLANTING**

Section 214 of the Standard Specifications is hereby revised to add the City's specific requirements as follows:

3.9 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.

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- 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 Project Manager 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.

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- Y. Temporary Branch: A small branch that is temporarily retained along the lower trunk of young trees.
- Z. (Blank)
- AA. Trunk: The main stem of a tree, beginning at the root collar and ending at the lowest main scaffold branch.
- BB. Taper: The thickening of a trunk or branch toward its base.

3.10 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 the following samples for approval by the Project Manager, additional product samples may be required at the direction of the Project Manager.
 - 1. Mulch: one(1) gallon bag minimum of each type of mulch.
 - 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.
- 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 Project Manager 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 Project Manager 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".

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PLANTING**

- I. Contract Close Out Submittals:
 - 1. Operating and Maintenance Data: At completion of work, submit One (1) digital copy and two (2) hard copies to the Project Manager 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 Project Manager based upon specified requirements.

3.11 QUALITY CONTROL

- A. The Project Manager 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 Project Manager'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. Trees tagged at nursery by City Forester.

3.12 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 Project Manager 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 Project Manager. 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. 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 Project Manager.
- D. Deliver bare-root stock plants within twenty-four (24) hours of digging. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting. Transport in covered, temperature-controlled vehicles, and keep plants cool and protected from sun and wind at all times.

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- E. Store bulbs, corms, and tubers in a dry place at sixty degrees to sixty-five degrees (60° to 65°) F until planting.
- F. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
 - 1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again (2) two weeks after planting.
- G. Handle planting stock by the root ball only.
- H. 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.

3.13 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 Project Manager. 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 Project Manager.
- D. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify the Project Manager 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.

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3.14 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 Project Manager. 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 Project Manager. Stake trees for City approval before planting.

3.15 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 City Forester and or Project Manager. Warranty shall not cover defects resulting from lack of adequate maintenance, neglect or abuse by City staff, hail, or incidents that are beyond Contractor's control.
- 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 Project Manager during warranty period.
 - 2. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
- 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.

3.16 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 until Initial Acceptance of the project.

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PART 4 - PRODUCTS

4.1 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 Project Manager. 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 City Forester and or the Project Manager. Contractor must provide proof of non-availability.

4.2 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.

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- 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.
 2. The cut made when re-growing the top should be just above the major structural roots. The "shank" that results from this procedure should be at a consistent height above the structural roots and no longer than five-inches (5"), to ensure that the trees are consistently planted at the correct depth. The base of the trunk should not have a large pruning cut from re-growing the top.
- 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.

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- 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 City Forester and or the Project Manager.

4.3 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.

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E. Minimum shrub sizes shall conform to the following standards:

1. Tender shrubs (Type 0) that do not produce top growth that is winter hardy:

Height or Spread	Minimum number of canes	Minimum spread of roots
fifteen-inches (15")	three (3) canes	Nine-inches (9")

2. Small shrubs (Type 1) that grow to a mature height of not more than three feet (3'):

Height or Spread	Minimum number of canes	Minimum spread of roots
fifteen-inches (15")	four (4) canes	Nine-inches (9")

3. Intermediate shrubs (Type 2) that grow to a mature height between three feet (3') and seven feet (7'):

Height or Spread	Minimum number of canes	Minimum spread of roots
Two feet (2')	four (4) canes	twelve-inches (12")

4. Large shrubs (Type 3) that grow to a mature height exceeding seven feet (7'):

Height or Spread	Minimum number of canes	Minimum spread of roots
four feet (4')	six canes (6)	twenty-inches (20")

4.4 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.

4.5 TREE-STABILIZATION MATERIALS

A. Trunk-Stabilization Materials:

1. Deciduous Tree Stakes: Rough-sawn, sound, new softwood with specified wood preservative treatment by pressure process, free of knots, holes, cross grain, and other defects, two-inch (2") diameter by six feet (6'), pointed at one end.
2. Evergreen Tree Stakes: Two foot (2') steel T-posts; green color.
3. Guys and Tie Wires: ASTM A 641/A 641M, Class 1, #14 galvanized-steel wire, two-strand, twisted.
4. Tree-Tie Webbing: UV-resistant nylon webbing with brass grommets, size as indicated.
5. Safety signals for guy and staking wire: one-half-inch (1/2") diameter PVC pipe, length as indicated.

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- 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 City Forester and or the Project Manager.

4.6 MULCH

- A. Landscape Mulch: Organic mulch, free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of chipped wood material not larger than four-inches (4") in length. Submit a one (1) gallon bag sample to Project Manager for approval. Mulch is to be weed-free.
- B. Double shredded western red cedar (i.e. gorilla hair)

4.7 PLANT PIT BACKFILL MATERIAL

- A. Unless otherwise directed by the Project Manager, the plant pit backfill material shall consist of the following, thoroughly mixed. Use this material where trees to be removed are located on the Drawings:
 - 1. Soil originally excavated from the pit: two thirds (2/3) proportion of total mix.
 - 2. Compost as Soil Amendment 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.
- C. Parking Lot Island backfill shall be 2-foot depth of amended topsoil.

4.8 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 "Watering".
- C. Maintenance: Refer to Division 32 Section "Landscape Maintenance".

4.9 MISCELLANEOUS MATERIALS

- A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees, as approved by the City Forester and or the Project Manager. Deliver in original, sealed, and fully labeled containers. Mix and apply according to manufacturer's instructions.
- B. Pre-Emergent Pesticide: As approved by the City Forester and or the Project Manager.
- C. Pesticides: EPA registered and approved, and as approved by the City Forester and the Project Manager.

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PART 5 - EXECUTION

5.1 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. (Blank)
 - 4. Suspend planting operations during periods of excessive moisture until acceptable planting conditions exist.
 - 5. Uniformly moisten excessively dry soil that is not workable.

- B. If contamination is present in the soil within a planting area, notify Project Manager immediately.
 - 1. If contamination is discovered during Construction the Project Manager 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 Project Manager.

- C. Proceed with installation only after unsatisfactory conditions have been corrected and approved by Project Manager.

- 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.

5.2 FINISH AND FINE GRADING

- A. See Division 31, Sections "Earth Moving and 32 Sections "Soil Preparation" and "Topsoil".

5.3 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 Project Manager prior to installing trees.

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- C. Outline planting beds and mark plant locations within the bed(s) for approval by the Project Manager 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".

5.4 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 Project Manager, and in strict accordance with manufacturer's instructions.

5.5 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 (3") 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 Trees and 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 Project Manager immediately of utilities that conflict or may potentially conflict with proposed plant locations. In such cases, alternative plant locations will be determined by Project Manager.
 - 2. Notify the Project Manager prior to planting if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavation.
- C. Drainage: Notify the Project Manager 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 Project Manager.

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5.6 PLANTING TREES AND SHRUBS

- A. Balled and Burlapped Stock:
1. Set balled and burlapped stock plumb and in center of pit with base of root flare three-inches (3") above adjacent finish grades as indicated.
 2. Remove burlap 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 set at side of planting pit for removal approval by city. 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:
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 one-inch (1") above 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.
- 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 City Forester and or the Project Manager. All tree wrap shall be removed by May 15.
 2. Contractor shall be responsible for wrapping and unwrapping trees during the warranty period.

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5.7 PRUNING OF PLANTS

- A. Prune only damaged or dead branches as directed by the City Forester and or the Project Manager.

5.8 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. Avoid penetrating root balls or root masses.
 - b. Securely attach specified wire to stakes
 - c. (Blank)
 - d. 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.
 - e. For guyed trees: Attach thirty-six-inch (36") long x one-half-inch (1/2") diameter PVC pipe flagging to each wire.
 - f. For staked trees: Attach twenty four-inch (24") long x one-half-inch (1/2") diameter PVC pipe flagging to each wire.

5.9 MULCHING

- A. Trees: See City of Thornton Detail.
- B. Shrubs: See City of Thornton Detail.

5.10 INSTALLATION OF MISCELLANEOUS MATERIALS

- A. Apply antidesiccant using power spray to provide an adequate film over trunks, branches, stems, twigs, and foliage.
- B. When deciduous plants are moved in full-leaf, Project Manager may direct the use of an antidesiccant at nursery before moving and again two (2) weeks after planting. Antidesiccant to be supplied and applied by Contractor at no additional cost to the City.

5.11 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.

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- B. Inspection: Contractor shall arrange for the Project Manager 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 Project Manager and/or Forestry.
 - 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.
 - 2. The Contractor shall pay all expenses for the Project Manager and City Forester to visit the source for plants including airfare, taxi, hotels and meals.
- 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 root tip-to-tip.

5.12 PROTECTION

Protect existing trees and shrubs designated to remain. Tape and mark trees designated to remain prior to construction start-up. Provide protective barriers when deemed necessary by the Owner. Hand dig as needed to prevent damage to roots 2" in diameter or larger. Do not store equipment or materials under driplines of existing trees.

Existing trees and shrubs designated to remain that have been damaged, destroyed, or removed by Contractor's activities shall be repaired or replaced at Owner's direction, at no additional cost to the Owner, prior to Initial Acceptance. Deciduous tree replacements shall be minimum 2" caliper B&B in size and of an approved variety. Shrub replacements shall be 5-gallon material of an approved variety.

Trees and shrubs with apparent damage caused by the Contractor that are not replaced prior to Initial Acceptance, but that show further decline prior to Final Acceptance, shall be removed and replaced at the Owner's direction, at no additional cost to the Owner.

Existing trees and shrubs designated to remain that have no apparent damage at the time of Initial Acceptance, but that die or suffer significant decline prior to Final Acceptance, shall be removed and replaced by the Contractor with new material prior to Final Acceptance, with pricing and payment based on unit pricing outlined in the Schedule of Contract Items and Prices for new trees and shrubs.

Irrigation service to replacement plantings shall be provided at no additional cost to the Owner.

- 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 Project Manager 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.

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- 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 Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

5.13 CLEANING

- A. General: Provide and install barriers as required and as directed by Project Manager to protect sodded areas against damage from pedestrian and vehicular traffic until Final Acceptance.

5.14 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.

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Subsection 214.04 shall be revised to include the following:

LANDSCAPE MAINTENANCE

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 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-sodding, mowing, watering of plant material and pruning, irrigation system repair and maintenance, and coordination with City staff.

1.3 SUBMITTALS

- A. Maintenance Reports: Submit detailed maintenance quarterly reports and schedules for the Maintenance and Guarantee Period for review and approval by the City.
- B. Material List: Submit a detailed list of materials to be used for seeding, fertilization, pesticide, plant health, and mulching.
- C. Equipment List: Submit a detailed list of equipment and chemical controls to be used for all landscape maintenance purposes.
- D. Work Examples: Submit list of three (3) projects completed in the last two (2) years of similar complexity to this project. Include the name and location of the project, the City's name, email address, and telephone number, and the name of the project landscape architect, email address, and telephone number. Include certifications held by contractor and subcontractor employees who will oversee the work during the Maintenance Period.

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1.4 CONTRACTUAL REQUIREMENTS

- A. Maintenance Period: The Maintenance Period shall commence from the date of Initial Acceptance on an existing Contract, or a start date established by a separate maintenance contract in accordance with these Specifications. The Maintenance Period shall continue for one (1) year.
- 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 City. Areas outside defined areas, as illustrated on the Contract Drawings, will be maintained by the City. The limits of the work area is shown in the Contract Drawings in the Grading and Erosion Control Plans.
- C. Performance of Work: The Contractor's equipment shall be accepted by the City prior to the commencement of the Maintenance Period. If the City finds any items unacceptable, the Contractor shall make the revisions noted by the City at no cost to the City.
- D. Scheduling / Progress Reports:
 - 1. Scheduling: Prior to the beginning of the Maintenance Period, the Contractor shall submit for approval by the City a detailed schedule identifying all activities which are to be performed. Examples of such commitments include the regular intervals for weed control, fertilization, pesticide applications and mowing and other operations and the month and week which are scheduled for other major activities such as reseeding and mulching. It is not the City's intent to require the Contractor to meet each deadline on a specific day, but merely to identify the general time periods for such activities. The Contractor may modify the schedule due to weather conditions, providing that the City is notified in advance of any changes.
 - 2. Notification: The Contractor shall be required to notify the City a minimum forty-eight (48) hours in advance of all major work so the City has the option of being present at the time of the work. Examples of such work are: clean cultivation, mowing, spraying, seeding, mulching or other activities relating to the repair of landscape items. If proper notification is not given by the Contractor, the City shall have the right to require the Contractor to reschedule any such work until such time that the City is available. The above provision applies only to work which could be perceived as normal or regularly scheduled maintenance, emergency repairs do not apply.
 - 3. Progress Reports: The Contractor shall submit quarterly progress reports. The written progress reports shall be sent to the City, prior to quarterly on-site meetings, outlining the work completed, damage incurred, and problems encountered. Progress reports shall contain digital photo documentation of work.
 - 4. Site Meetings: The Contractor shall meet, on site, with the City and City staff on a quarterly basis to review the project status.
 - 5. After Hours Contact: The Contractor shall provide one (1) after hours contact, and telephone number.
- E. Maintenance Coordination: The Contractor shall coordinate maintenance operations and activities with the City.
- F. Failure to Perform: In the event that, in the City's opinion, action has not been taken on the part of the Contractor to properly maintain the project, the City may take whatever action deemed necessary to affect such repairs and any costs incurred will be deducted from the Contract amount.

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- G. Licenses, Taxes, and Insurance:
1. The Contractor agrees to obtain and pay for all licenses required by the City, State, and Federal governments that are necessary for legally conducting business. The Contractor shall maintain all licenses and permits required for maintenance activities (e.g. pesticide application).
 2. Taxes: City is tax exempt.
 3. Insurance: The Contractor shall maintain all insurance policies in accordance with the General Contract Conditions of the contract through the entire term of the Maintenance and Guarantee period.
- H. Payment Schedule: Payments shall be made as indicated in Measurement and Payment section.

PART 2 – PRODUCTS

2.1 NOT USED

PART 3 – EXECUTION

3.1 NATIVE SEEDING AREAS

- A. Refer to Rev Section 212 “Native Seeding” for satisfactory establishment criteria
- B. Initial Acceptance will not occur until seeded areas meet the City of Thornton Guidelines. The Maintenance Period shall begin at Substantial Completion and continue for the period specified until Acceptance of native seed areas. Acceptance of native seeded areas will not be given until the maintenance period has ended and the City is satisfied with the germination, coverage, and the vegetation is in a healthy and vigorous growing condition in accordance with the Specifications. During this time, the Contractor shall be responsible for watering, mowing, spraying, weeding, fertilizing and all related work as necessary to ensure that seeded areas are in a vigorous growing condition. The Contractor shall provide all supervision, labor, material and equipment to develop and maintain seeded areas.
- C. The Contractor shall protect the site during the Maintenance Period. All damage that occurs to the seeded areas during the Maintenance period, including vandalism, shall be repaired by the Contractor with approved materials at no additional cost to the City.
- D. Maintain and establish native seed areas by weeding, mowing, trimming, replanting, watering and performing other operations as required to establish healthy, viable vegetation. Roll, regrade, and replant bare or eroded areas and re-mulch to produce healthy vegetation. Provide materials and installation the same as those used in the original installation.
1. Fill in as necessary soil subsidence that may occur because of settling, damage, or other processes.
 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
 3. Apply treatments as required to keep seeded areas free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticide and reduce hazards.

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- E. All watering shall be done in such a way as to encourage establishment, deep root growth and drought tolerance.
1. Watering: Utilize irrigation system to water native seeded areas to obtain establishment of an acceptable grass stand, and to supplement natural moisture levels during dry periods.
 - a. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas. Obtain approval of City of irrigation system and schedule proposed for use.
 - b. Water native grasses with fine spray at a minimum rate of one-half inch (1/2") per week for six (6) weeks after planting unless rainfall precipitation is adequate.
 - c. Do not over-water in a manner which kills drought-tolerant components of the seed mix.
- F. Mowing:
1. Year One: Mowing of native grasses in the first year after seeding shall be avoided unless approved by the City. If mowing in the first year is allowed, then mow only in the early growing season or late in the fall to allow grass seeds to drop. Mowing shall be at a height of six inches (6") to eight inches (8").
- G. Weed Control:
1. Weed control shall be done for the duration of the Maintenance Period and until Initial Acceptance per the Establishment section in Rev Section 212 "Native Seeding". Weed control shall be completed by one (1) or more of the following methods approved by the City:
 - a. Mowing: Mowing of undesirable species shall be done per the approval of the City as a weed control method. Undesirable species shall not be allowed to seed on the site. Avoid distribution of weed seeds by catching all clippings, bagging clippings and removing them from the site. Existing grass stands to remain shall not be mowed until late fall or early spring to encourage seed drop.
 - b. Chemical Control: If necessary, apply to perennial and annual weeds by a licensed applicator trained in plant identification at no additional cost to the City. Obtain the City's approval prior to applying pesticide. Apply per manufacturer's recommendations. Contractor is responsible for ensuring seed establishment and that seed is not adversely affected by pesticide applications. The Contractor shall use pesticide for specific species as recommended by CSU Agricultural Extension Service or the City Naturalist.
 - c. Spot Application Chemical Control: Apply pesticide by hand applicator directly to invasive annual and perennial weeds. Allow a minimum two (2) weeks between application and any seeding activities or depending on the product used.

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- H. Reseeding:
 - 1. Evaluate native grass areas quarterly during the Maintenance Period to review the germination and coverage. Use the following criteria:
 - a. Reseed all areas that meet the following conditions:
 - 1 Areas of bare or dead grass greater than twenty-four inches (24") by twenty-four inches (24") square
 - 2 Areas of weed density are per the Acceptance section in Division 32 Section Native Seeding".
 - 2. Reseed unacceptable areas as defined above. Reseeding, soil preparation and mulching shall comply with Rev Section 212 "Native Seeding" and Section "Soil Preparation". If approved, seed mixes may be revised (% of species) to better suit site conditions. If requested by the City, the mix shall be revised at no additional cost to the City. Where drill seeding is not feasible, hand broadcast seed and rake into the soil to achieve 1/4- to 1/2-inch coverage of soil. The seed application rate shall be doubled in all areas where it is mechanically broadcast and quadrupled in areas requiring hand broad casting. Hydroseeding is not allowed.
- I. 3. Timing of reseeding shall be as specified herein. With written approval of the City, the Contractor may reseed later.

3.2 TREE, SHRUB, AND PLANT CARE

- A. Pruning: Refer to Rev Section 212 "Trees, Shrubs, and Groundcovers" for maintenance requirements.
- B. All plants are the responsibility of the Contractor during the Maintenance Period.
- C. Replacement of Plants: Remove and replace dead, diseased, dying or damaged plants (including material damaged by vehicles or vandalism) within fourteen (14) calendar days of notification by the City or the City Forester. Upon the City's written approval, the Contractor may replace rejected plants later, provided that the Contractor removes all rejected plants within fourteen (14) calendar days of the notice to replace such plants. If the rejected plants are not removed within fourteen (14) calendar days, the City may remove and replace these plants and any costs associated with the removal and replacement shall be deducted from the Contract price. All areas damaged by replacement operations are to be fully restored to their original condition as specified. Plant material damaged by vehicles or vandalism shall be replaced by the Contractor at no cost to the City. Guarantee all plantings to be true to name and to meet all conditions of these specifications. Any plant which is not true to name as indicated by leaf, flower form or fruiting characteristics revealed within Maintenance Period shall be replaced by the Contractor at the Contractor's expense.

3.3 IRRIGATION SYSTEM AND WATER MANAGEMENT

- A. Contractor shall check all irrigation systems for proper operation after each mowing, and any deficiencies or adjustments shall be repaired prior to the next watering cycle. Any damage to system caused by Contractor's operations shall be repaired without charge to City.
- B. Contractor is responsible for following all Thornton Water restrictions and establishment rules for new landscapes.

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- C. Contractor shall be responsible for providing an Establishment Watering Schedule, Transition Watering Schedule and a Maintenance Watering Schedule to the City, the Operation Supervisor and the RainBird Field Representative (when applicable).
1. All irrigation schedules and zone controller charts shall ensure that there will be no ponding or runoff of water during any of the scheduled times.
 2. Prior to any plant material being installed all schedules shall be provided to the City and the Operations Supervisor.
 3. The water schedule templates are available from City of Thornton Water Conservation and the City. See Appendix
 4. Contractor shall make any modifications to the programming as requested by the City.
 5. Initial Irrigation (Days 1-21):
 - a. Plants shall be adequately watered for the first twenty-one (21) days after installation or until seeds have germinated and emerged or sod has become firmly rooted.
 - 1 Exact timing of irrigation cycles will depend on weather conditions, soil conditions, and speed of emergence of grass seed.
 - 2 Short, frequent irrigation cycles shall be used.
 - 3 Split cycles or the 'cycle and soak' feature must be employed to reduce erosion or run off in seeded areas.
 - 4 Do not exceed three inches (3") of total water per week.
 - 5 Coordinate the irrigation system schedule and programming with the City, and City staff. City may choose to involve other parties from the City or irrigation equipment manufacturer.
 - 6 Do not over-water native seeded areas in a manner which adversely impacts germination and growth of any components of the seed mix.
 - 7 Contractor shall submit a meter reading before and after establishment to verify water use.
 6. Transition Irrigation (Days 21-60):
 - a. Less frequent, but longer watering cycles will provide moisture at depths that will encourage seedlings to continue to develop and sod to develop deeper roots.
 - b. Allow the surface soils to dry slightly between watering to encourage deeper rooting.
 - c. Watering shall be done utilizing historic evapotranspiration rates for the current watering month(s).
 - d. Do not over-water native seeded areas in a manner which adversely impacts germination and growth of any components of the seed mix.
 7. Maintenance Irrigation (Days 61 – End of Maintenance Period):
 - a. Irrigate as needed to maintain an optimum stand of turf while minimizing water use.
 - b. Irrigation frequency shall be adjusted monthly, at a minimum, based on historical evapotranspiration rates and plant (turf and tree) water requirements.
 - c. It is the responsibility of the Contractor to coordinate with City, Operations Staff, and local Rainmaster Field Representative the programming of irrigation controllers, to properly irrigate plant materials and turfgrass.
 - d. Do not over-water native seeded areas in a manner which adversely impacts germination and growth of any components of the seed mix.
- D. Time of Irrigation: Watering shall occur during the approved Thornton Water allowed water window. Coordinate times with the City.

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- E. Winterization of Irrigation System: The Contractor shall be responsible for winterizing the irrigation system and pumps, if applicable, for the first winter after Initial Acceptance.
 - 1. Remove water from system by use of compressed air.
 - 2. Remove water from drip lines by opening flushing plugs.
 - 3. Submit a meter reading after winterization of the system has occurred to Parks Water Conservation.
 - 4. Winterization shall occur no later than October 15th unless a variance has been granted from the City.

- F. Spring Start-Up: The Contractor shall be responsible for starting up the irrigation system in the spring (April 15).
 - 1. Fully activate the system including controller start-up, in order to demonstrate that it is in full working order.
 - a. Any repairs that are needed as shall be corrected by the Contractor at no additional cost to the City.
 - 2. Correct all deficiencies and make any adjustments to ensure proper system function.
 - 3. Submit a meter reading prior to spring start-up to the City.

- G. It shall be the responsibility of the Contractor to ensure the satisfactory operation of the entire irrigation system and workmanship within the project area. The entire system, including materials, shall be maintained to be complete and remain operable in every detail by the Contractor throughout the Maintenance Period, and the Contractor agrees to make any adjustments or repair any defects occurring within the Maintenance Period within 7 calendar days of notification by the City.
 - 1. The Contractor shall replace any materials with manufacturer's defects at no additional cost to City.
 - 2. Replacement of any equipment shall match that installed and designed on the irrigation plans unless a variance is approved in writing from the City.
 - 3. Problems resulting in leakage or water waste shall be repaired within 12 hours of notification.
 - 4. If an emergency repair is necessary, the Contractor is responsible for shutting down valves on the mainline.
 - a. If the Contractor neglects to perform these duties within the specified time, the City may make such repairs at the Contractor's expense.
 - b. In the case of an emergency, where in the judgment of the City, delay would cause serious loss or damage, repairs or replacement may be made by verbal communication and without notice being sent to the Contractor, and the Contractor shall pay the cost thereof.

- H. Any settling of irrigation trenches/backfill material during the Maintenance Period shall be repaired by the Contractor's at no additional cost to the City.

- I. Contract documents shall govern irrigation replacement during Maintenance Period the same as new work.

- J. Replacements are to be made at no additional cost to the City.

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REVISION OF SECTION 214
PLANTING

- K. All damage to irrigation system during the Maintenance Period, including vandalism, shall be repaired and/or replaced by the Contractor with approved materials at no additional cost to the City.

3.4 INSPECTION AND ACCEPTANCE

- A. Formal Inspections: The project will be inspected during the Maintenance and Guarantee Period at the following points:
 - 1. Quarterly Inspections
 - 2. Contract Completion Inspection
- B. Quarterly Inspections: Shall occur quarterly from the date of Initial Acceptance. The review will consist of a review of all maintenance contract responsibilities. The Contractor shall keep a quarterly report to be turned in at inspections to review work done to date, including any subcontracting, frequency of schedule, notifications made, materials list, equipment list etc.
- C. Contract Completion Inspection and Acceptance: The Contractor must give seven (7) days of notice to the City requesting a Contract Completion Inspection. During the inspection, the Contractor shall prepare a punch list of any defects discovered during the inspection and submit the punch list to the City. When all work has been completed per the Contract Documents, the Contractor may request in writing from the City Initial Acceptance.

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**REVISION OF SECTION 214
PLANTING**

METHOD OF MEASUREMENT

Subsection 214.05 shall include the following:

The quantity of planting to be measured will be the number of plants, of the types and sizes designated in the Contract, that are actually planted and accepted.

Measurement will be based on the percentage complete for the lump sum contract amount for Landscape Maintenance.

BASIS OF PAYMENT

Subsection 214.06 shall include the following:

The accepted quantities of planting will be paid for at the contract unit price for each of the various items listed below that appear in the bid schedule.

Payment for the total cost of the item will be made at the completion of planting. Cost of the performance bond shall be included in the cost of the plant items.

Payment will be made at the lump sum contract price, and shall include required materials, transportation, equipment, labor, disposing, hauling off, watering, dust control, equipment inspections, fertilizing, weeding, winterization, reseeding, weed control, plant materials and replacement, disking, raking, spreading, fine grading, mowing, furnishing and installation of seeds, mulch installation and maintenance of temporary protection by fencing or other means, coordination with the City, and quarterly logs as required in accordance with the Contract Drawings and Specifications.

Payment will be made under:

Pay Item	Pay Unit
Prairie Sentinel Hackberry	Each
Kentucky Coffee Tree	Each
Tannenbaum Mugo Pine	Each
Chanticleer Pear	Each
Gro-Low Sumac	Each
Froebel Spirea	Each
Sandstone Boulders	Ton
Landscape Maintenance (1 Year)	Lump Sum

END OF SECTION REVISION

1
**REVISION OF SECTION 216
SOIL RETENTION COVERING**

Section 216 of the Standard Specifications is hereby revised for this project as follows:

In Subsection 216.07, 1st paragraph, delete the last sentence and replace with the following:

Soil Retention Blanket shall be measured and paid for by the square yard complete in place.

Earth anchors will not be measured and paid for separately, but shall be included in the work.

In Subsection 216.08, 1st paragraph, delete the last sentence and replace with the following:

Payment for Soil Retention Blanket shall include, but not be limited to, earth anchors and all labor, materials, and equipment to complete the work.

Pay Item	Pay Unit
Soil Retention Blanket (Coconut) (Biodegradable Class 1)	Square Yard

END OF SECTION REVISION

1
**REVISION OF SECTION 304
AGGREGATE BASE COURSE**

Section 304 of the Standard Specifications is hereby revised for this project as follows:

Delete Subsection 304.02 and replace it with the following:

Aggregate base course materials shall be from a source approved by the City. The Contract shall provide a submittal including all material properties for review and approval prior to construction.

Materials for the base course shall be Aggregate Base Course (Class 6) as shown in subsection 703.03 – Aggregate for Bases.

The Aggregate Base Course (Class 6) shall meet the gradation requirements and have a resistance value of at least 78 when tested by the Hveem Stabilometer method.

Acceptance will be based on random samples taken from each lift.

Subsection 304.04 shall include the following:

Materials shall be placed on an approved subgrade which has been proof-rolled within the past 24 hours and found to be stable and non-yielding. Should weather conditions change, such as freezing, precipitation, etc., aggregate base materials shall not be placed until the subgrade is reapproved.

Delete Subsection 304.07 and replace it with the following:

Measurement shall be based on tons taken from the weight tickets provided to the City at time of delivery to the site.

Delete Subsection 304.08 and replace it with the following:

The accepted quantities of aggregate base course, of the class specified, will be paid for at the contract price bid per ton, as shown in the bid schedule.

Payment will be made under:

Pay Item	Pay Unit
Aggregate Base Course (Class 6)	Ton
Aggregate Base Course (Class 6) (Driveways, 6" Depth)	Ton
Aggregate Base Course (Class 6) (Access Roads, 6" Depth)	Ton
Aggregate Base Course (Class 6) (Subgrade, Under HMA)	Ton

Water will not be measured and paid for separately but shall be included in the work.

Commercial mineral fillers, when used, shall be considered incidental to the bid item for Aggregate Base Course

END OF SECTION REVISION

1
**REVISION OF SECTION 306
RECONDITIONING**

Section 306 of the Standard Specifications is hereby revised for this project as follows:

In subsection 306.02 delete the 1st sentence and replace it with the following:

The top 8 inches of the existing subgrade shall be reconditioned by blading and rolling.

Subsection 306.02 shall include the following:

Prior to paving or placing aggregate base course or geogrid, the upper 12 inches of the subgrade should be uniformly scarified, moisture conditioned, and compacted as specified in Section 508.2 of the COT Standard Specifications. The pavement subgrade should be thoroughly proof-rolled with a heavily loaded pneumatic tired vehicle. Areas that deform (rut or deflect) excessively under the wheel loads should be removed and replaced prior to paving. Proof-rolled areas should be paved within 48 hours or less. If precipitation occurs after the proof-roll and prior to paving, then the area should be dried and again be proof-rolled as necessary.

Subsection 306.04 shall include the following:

Payment will be made under:

Pay Item	Pay Unit
Reconditioning (12 Inch)	Square Yard

Proof rolling shall not be measured and paid for separately and shall be considered incidental to Reconditioning.

END OF SECTION REVISION

1
SECTION 308
TRENCH STABILIZATION

Trench Stabilization will be measured by the actual tonnage of trench stabilization material installed at the Bull Canal and Mustang Run box culverts. Delivery tickets will confirm the amount of material actually installed and shall be provided to the Engineer.

The unit price bid for trench stabilization material shall include all of the Contractor's costs of whatsoever nature. The unit price shall include but not be limited to: furnishing and installation of trench stabilization material in the bottom of an unstable excavation or trench upon direction of the Engineer and all other necessary material, work, and equipment required to complete this item in accordance with the Drawings and Specifications.

The use and payment for trench stabilization material shall be only where required and as authorized by the Engineer.

The accepted quantities will be paid for at the contract unit price for each of the bid items listed below that appear in the bid schedule. Compaction, water, removal of unsuitable material, and all other work necessary to complete the below items will not be measured and paid for separately but shall be included in the work.

Payment will be made under:

Pay Item	Pay Unit
Trench Stabilization Material (Bull Canal Culvert)	Ton
Trench Stabilization Material (Mustang Run)	Ton

END OF SECTION

1
**REVISION OF SECTION 401
PLANT MIX PAVEMENTS – GENERAL**

Section 401 of the Standard Specifications is hereby revised as follows:

Subsection 401.01 shall include the following:

The City may require a pre-paving meeting of all parties involved in supply, haul, laydown inspection, quality control and quality acceptance of HMA. Areas of responsibility and contact names and numbers should be shared. A construction (joint) plan will be submitted at the pre-paving meeting.

In Subsection 401.02(a) delete the 5th paragraph and replace with the following:

The job-mix formula for Pavement shall be established by a testing laboratory approved by the Owner and at the Contractor's expense. Copies of all test data shall be provided to and approved by the Owner prior to construction.

Subsection 401.11 is deleted and replaced with the following:

When ordered by the Engineer or specified in the Contract, a tack coat shall be applied between pavement courses. Tack Coat will not be measured and paid for separately but shall be considered incidental to the project.

Subsection 401.16 shall include the following:

Removing Depressions:

Where local irregularities in the existing asphalt surface would otherwise result in a course more than 1-inch thicker than the nominal thickness after compaction, the surface shall be brought to uniform profile by placing a leveling course of Grade S bituminous pavement. Then thoroughly tamping or rolling until it conforms to the surrounding surface.

When the Contractor elects to conduct operations to eliminate depressions and place the surface course simultaneously, he shall furnish such additional spreading and compacting equipment as required to maintain the proper interval between the several operations, and only as approved by the Owner.

Subsection 401.22 shall include the following:

Costs associated with the pre-paving meeting shall be considered a part of the work and will not be paid for separately.

END OF SECTION REVISION

1
REVISION OF SECTION 403
HOT MIX ASPHALT

Section 403 of the Standard Specifications is hereby revised for this project as follows:

Subsection 403.02 shall include the following:

The design mix for hot mix asphalt shall conform to the following:

◆ Table 403-1							
Property	Test Method	Value for Grading					
		SX(75)	S(75)	SX(50)	S(50)		Patching
Air Voids, percent at: N (design)	CPL 5115	3.5 – 4.5	3.5 – 4.5	3.5 – 4.5	3.5 – 4.5		3.5 – 4.5
Lab Compaction (Revolutions): N (design)	CPL 5115	75	75	50	50		75
Stability, minimum	CPL 5106	30	30	30	30		30
Aggregate Retained on the 4.75 mm (No. 4) Sieve for S, SX and SG, and on the 2.36mm (No. 8) Sieve for ST and SF with at least 2 Mechanically Induced fractured faces, % minimum*	CP 45	60	60	60	60		60
Accelerated Moisture Susceptibility Tensile Strength Ratio (Lottman), minimum	CPL 5109 Method B	80	80	80	80		80
Minimum Dry Split Tensile Strength, kPa (psi)	CPL 5109 Method B	205 (30)	205 (30)	205 (30)	205 (30)		205 (30)
Grade of Asphalt Cement, Top Layer		PG 76-28		PG 58-28			PG 76-28
Grade of Asphalt Cement, Layers below Top			PG 64-22		PG 58-28		PG 64-22
Voids in the Mineral Aggregate (VMA) % minimum	CP 48	See Table 403-2	See Table 403-2	See Table 403-2	See Table 403-2		See Table 403-2
Voids Filled with Asphalt (VFA), %	AI MS-2	65-75	65-75	65-75	65-75		65-75
Dust to Asphalt Ratio Fine Gradation Coarse Gradation	CP 50	0.6 – 1.2 0.8 – 1.6	0.6 – 1.2 0.8 – 1.6	0.6 – 1.2 0.8 – 1.6	0.6 – 1.2 0.8 – 1.6		0.6 - 1.2 0.8 – 1.6
<p>Note: AI MS-2 = Asphalt Institute Manual Series 2</p> <p>Note: Mixes with gradations having less than 40% passing the 4.75 mm (No. 4) sieve shall be approached with caution because of constructability problems.</p> <p>Note: Gradations for mixes with a nominal maximum aggregate size of one-inch or larger are considered a coarse gradation if they pass below the maximum density line at the #4 screen. Gradations for mixes with a nominal maximum aggregate size of 3/4" to 3/8" are considered a coarse gradation if they pass below the maximum density line at the #8 screen. Gradations for mixes with a nominal maximum aggregate size of #4 or smaller are considered a coarse gradation if they pass below the maximum density line at the #16 screen.</p> <p>*Fractured face requirements for SF may be waived by RME depending on project conditions.</p>							

2
REVISION OF SECTION 403
HOT MIX ASPHALT

Hot mix asphalt may contain up to 20% of recycled asphalt pavement. Recycled asphalt pavement shall meet requirements of Section 504.2 of the City of Thornton's Standards and Specifications.

All mix designs shall be run with a gyratory compaction angle of 1.25 degrees and properties must satisfy Table 403-1. Form 43 will establish construction targets for Asphalt Cement and all mix properties at Air Voids up to 1.0 percent below the mix design optimum. CDOT will establish the production asphalt cement and volumetric targets based on the Contractor's mix design and the relationships shown between the hot mix asphalt mixture volumetric properties and asphalt cement contents on the Form 429. CDOT may select a different AC content other than the one shown at optimum on the Contractor's mix design in order to establish the production targets as contained on the Form 43. Historically, Air Voids adjustments typically result in asphalt cement increases from 0.1 to 0.5 percent. Contractors bidding the project should anticipate this change and factor it into their unit price bid.

Table 403-2

Nominal Maximum Size*, mm (inches)	Minimum Voids in the Mineral Aggregate (VMA)			
	***Design Air Voids **			
	3.5%	4.0%	4.5%	5.0%
37.5 (1½)	11.6	11.7	11.8	N/A
25.0 (1)	12.6	12.7	12.8	
19.0 (¾)	13.6	13.7	13.8	
12.5 (½)	14.6	14.7	14.8	
9.5 (⅜)	15.6	15.7	15.8	
4.75 (No. 4)	16.6	16.7	16.8	16.9
	* The Nominal Maximum Size is defined as one sieve larger than the first sieve to retain more than 10%. ** Interpolate specified VMA values for design air voids between those listed. *** Extrapolate specified VMA values for production air voids beyond those listed.			

The Contractor shall prepare a quality control plan outlining the steps taken to minimize segregation of HMA. This plan shall be submitted to the Engineer and approved prior to beginning the paving operations. When the Engineer determines that segregation is unacceptable, the paving shall stop and the cause of segregation shall be corrected before paving operations will be allowed to resume.

Hot mix asphalt for patching shall conform to the gradation requirements for Hot Mix Asphalt Grading SX for the top lift and Grading S for the bottom lifts.

A minimum of 1 percent hydrated lime by weight of the combined aggregate shall be added to the aggregate for all hot mix asphalt.

Acceptance samples shall be taken at the location specified in Method A of CP 41.

3
**REVISION OF SECTION 403
HOT MIX ASPHALT**

Subsection 403.03 shall include the following:

The Contractor shall construct the work such that all roadway pavement placed prior to the time paving operations end for the year, shall be completed to the full thickness required by the Plans. The Contractor's Progress Schedule shall show the methods to be used to comply with this requirement.

At locations where new Hot Mix Asphalt is to abut existing asphalt, saw cut the existing pavement a minimum of 1 foot back from the existing edge with a neat line and remove pavement. A tack coat shall be applied along the vertical abutting face of the existing asphalt.

A tack coat shall be applied to all milled surfaces prior to applying an asphalt pavement overlay. A tack coat shall be applied along the vertical face of all curb and gutter prior to asphalt paving.

At patches, compaction shall initially be completed along the outside edges of the patch, and then proceed from the low side to the high side of the patch. The new asphalt patch shall have a minimum compacted thickness equal to the existing pavement thickness and be level and well matched to the existing pavement.

The Contractor shall commence placing hot mix asphalt within 3 working days after the street has been milled, and within 1 working day after the subgrade has been proof rolled, weather permitting.

The Contractor shall collect the scale ticket on each load when it is delivered to the project site, and ensure that the information required in by the City is shown on each ticket.

The scale tickets shall be available on site for City to inspect.

Each day the Contractor shall provide to the Engineer envelopes which contain the previous day's signed tickets and the following:

1. On each envelope: Project number, date of paving, type of material, daily total and cumulative total.
2. One of the following:
 - a) Two adding machine tape tabulations of the weight tickets with corresponding totals run and signed by different persons,
 - b) One signed adding machine tape tabulation of the weight tickets that has been checked and signed by a second person,
 - c) Signed check tape of computer scale tickets that have a cumulative total. These scale tickets must be consecutive and without voids adjustments.
3. A listing of any overweight loads on the envelope, including ticket numbers and amount over legal limit.
4. A comparison of the actual yield for each day's placement to the theoretical yield. Theoretical yield shall be based on the actual area paved, the planned thickness, and the actual density of the mixture being placed. Any variance greater than +2.5% shall be indicated on the envelope and a written explanation included.

4
**REVISION OF SECTION 403
HOT MIX ASPHALT**

The Contractor shall provide a vehicle identification sheet that contains the following information for each vehicle:

- 1) Vehicle number
- 2) Length
- 3) Tare weight
- 4) Number of axles
- 5) Distance between extreme axles
- 6) All other information required to determine legal weight.
- 7) Legal weight limit.

Delete Subsection 403.05 and replace with the following:

403.05 The accepted quantities of hot mix asphalt will be paid for in accordance with subsection 401.22, at the contract unit price per ton for the bituminous mixture.

Payment will be made under:

Pay Item	Pay Unit
Hot Mix Asphalt (Grading SX) (75) (PG 76-28)	Ton
Hot Mix Asphalt (Grading S) (75) (PG 64-22)	Ton
4" Temporary HMA (Grading S) (75) (PG64-22)	Ton

Aggregate, asphalt recycling agent, asphalt cement, additives, hydrated lime, and all other work and materials necessary to complete each hot mix asphalt item will not be paid for separately, but shall be included in the unit price bid. When the pay item includes the PG binder grade, any change to the submitted mix design optimum asphalt cement content to establish production targets on the Form 43 will not be measured and paid for separately, but shall be included in the work. No additional compensation will be considered or paid for any additional asphalt cement, plant modifications and additional personnel required to produce the HMA as a result in a change to the mix design asphalt cement content.

Historically, typical asphalt cement increases reflected on the Form 43 are from 0.1 to 0.5 percent. However, the Contractor should anticipate the AC increases typical of his mixes. Contractors bidding the project should anticipate this change and factor it into their unit price bid.

Asphalt cement used will not be measured and paid for separately, but shall be included in the work.

5
REVISION OF SECTION 403
HOT MIX ASPHALT

Excavation and preparation of areas to be patched will not be measured and paid for separately, but shall be included in the work.

Tack Coat will not be paid for separately but shall be considered incidental to the project.

Temporary asphalt installation and removal required for sanitary sewer, waterline, and storm sewer patches will not be paid for separately but shall be considered incidental to the project.

Additional Hot Mix Asphalt required to bring the final surface to the noted finished grade elevations as a result of the variable milling as shown on the Construction Plans will not be measured and paid for separately, but shall be considered incidental to Hot Mix Asphalt (Grading SX)(75)(PG 76-28)(Roadway 2 Inch Top Lift).

END OF SECTION REVISION

1
**REVISION OF SECTION 407
PRIME COAT, TACK COAT, AND REJUVENATING AGENT**

Section 407 of the Standard Specifications is hereby revised for this project as follows:

Delete Subsection 407.09 and replace with the following:

Prime Coat, Tack Coat, and Rejuvenating Agents will not be measured and paid for separately. The cost for these items shall be considered incidental to all bid items requiring Prime Coat, Tack Coat, and Rejuvenating Agents.

END OF SECTION REVISION

1
**REVISION OF SECTION 412
PORTLAND CEMENT CONCRETE PAVEMENT**

Section 412 of the Standard Specifications is hereby revised as follows:

Subsection 412.03 is revised to include the following:

Fibrous Reinforcing

- A. Fibrous reinforcing shall be used in Portland cement concrete used for curb, gutter, sidewalks, curb turn fillets, cross pans.
- B. The following shall be submitted to the Engineer.
 - 1. One copy of manufacturer's printed product data, clearly marked, indicating proposed fibrous concrete reinforcement materials. Printed data should state 1.5 lbs. of fiber to be added to each cubic yard of each type of concrete.
 - 2. One copy of manufacturer's printed batching and mixing instructions.
 - 3. One copy of a certificate prepared by the concrete supplier stating that the approved fibrous concrete reinforcement materials at the rate of 1.5 pounds per cubic yard were added to each batch of concrete delivered to the project site. Each certificate shall be accompanied by one (1) copy of each batch delivery ticket indicating amount of fibrous concrete reinforcement material added to each batch of concrete.
- C. Fibrous concrete reinforcement shall consist of:
 - 1. One hundred (100) percent virgin polypropylene fibrillated fibers specifically manufactured for use as concrete reinforcement, containing no reprocessed olefin materials. Fibrous concrete reinforcement shall be as manufactured by Fibermesh Company, 4019 Industry Drive, Chattanooga, Tennessee 37416, or approved equivalent. Substitutions may be considered at the discretion of the Engineer.

Subsection 412.10 shall include the following:

Concrete for concrete pavement and cross pans shall be placed on a minimum of 11-inches of Class 6 aggregate base course in accordance with Section 304 of the Project Specifications.

Subsection 412.17 shall include the following:

Roadway smoothness incentive for Portland Cement Concrete Pavement is not included in this project.

2
**REVISION OF SECTION 412
PORTLAND CEMENT CONCRETE PAVEMENT**

Subsection 412.23 shall be replaced with the following:

The quantities of Concrete Pavement furnished and placed will be the number of square yards completed and accepted.

Reinforcement including dowels, tie bars, and other joint material will not be measured.

Curb and Gutter adjacent to concrete pavement will be measured and paid for in accordance with Section 609.

Subsection 412.24 shall be replaced with the following:

General. The accepted quantities will be paid for at the contract unit price for each of the pay items listed below that appear in the bid schedule.

Payment will be made under:

Pay Item	Pay Unit
Concrete Pavement (6 Inch)	Square Yard

The price per square yard of Concrete Pavement shall be full compensation for furnishing and placing all materials, including concrete, joints, dowels, tie bars, joint materials, texturing, sawing, finishing, and rumble strips.

Reinforcing steel shall be considered incidental to the unit price bid for Concrete Pavement.

Furnishing, installing, and monitoring vibrators and vibrator monitoring device will not be measured and paid for separately, but shall be included in the work for Concrete Pavement.

Incentive and Disincentive Payments (I/DP) will not be made for concrete pavement for this project.

Furnishing, calibrating and use of maturity meters, wire and other appurtenances including the molding, curing and breaking of cylinders for calibration and placement of calibration slabs will not be measured and paid for separately, but shall be included in the work.

END OF SECTION REVISION

1
**REVISION OF SECTION 420
GEOSYNTHETICS**

Section 420 of the Standard Specifications is hereby revised for this project as follows:

Subsection 420.04 shall include the following:

The areas to be treated with Geogrid Pavement Reinforcement shall be as designated on the plans. The pavement surface shall be broomed clean immediately prior to beginning the crack reduction geotextile treatment using a self-propelled power broom.

The asphalt cement binder shall be applied to the pavement surface at the rate of approximately 0.25 gallon per square yard. The exact application rate shall be as recommended by the geotextile manufacturer, and at a temperature of 300 to 350 °F. Paving geotextile shall be applied, in accordance with the manufacturer's recommendations, immediately after the application of asphalt cement binder.

Construction equipment, including dump trucks, shall not make sudden stops or starts or sharp turning movements on the geotextile. Dump trucks shall not park on the geotextile prior to dumping into the asphalt paver.

Traffic shall be kept off all newly placed binder and geotextile material until the asphalt surface has been placed.

The minimum temperature of the hot mix asphalt at the time compaction begins shall be 250 °F.

The Contractor shall make arrangements with the geotextile supplier to have a technician, skilled in this paving geotextile work, present at the project site during this work to give any technical assistance needed.

Subsection 420.09 shall include the following:

Geogrid, geomembranes and geotextiles will be measured by the square yard of surface area covered, complete in place.

Subsection 420.10 shall include the following:

Payment will be made under:

Pay Item	Pay Unit
Geogrid Pavement Reinforcement	Square Yard
Geotextile (Weed Barrier)	Square Foot

Securing pins, staples, adhesives, sewn seams, asphalt cement, brooming, skilled technician, and other work and materials necessary for placement will not be measured and paid for separately but shall be included in the work.

END OF SECTION REVISION

1
**REVISION OF SECTION 503
DRILLED SHAFTS**

Section 503 of the Standard Specifications is hereby revised for this project as follows:

Subsection 503.22 shall include the following:

Drilled shafts will be measured by the linear foot from the elevation shown on the plans to the bottom of the hole as drilled.

Each approved splice of the reinforcing cage for additional length of shaft will be measured as ½ linear foot of additional length of drilled shaft.

Subsection 503.23 shall include the following:

The unit price of drilled shafts shall be full compensation for making all excavations; hauling and disposal of excavated material; provision and disposal of slurry, performing all necessary pumping; furnishing and placing required concrete and reinforcement steel, including the reinforcement projecting above the tops of the drilled shafts necessary for splicing and any intermediate reinforcement splices; furnishing and placing of CSL tubes; all backfilling; furnishing, placing, and removing temporary casings; furnishing permanent casing if required to complete the work; and for furnishing all tools, labor, equipment, and incidentals necessary to complete the work. Costs associated with repairing defects found in the drilled shaft shall be included in the cost of the drilled shaft.

Obstruction encounter and removal will not be measured and paid for separately but shall be included in the work.

Payment will be made under:

Pay Item	Pay Unit
Drilled Caisson (36 Inch)	Linear Foot
Drilled Caisson (54 Inch)	Linear Foot

END OF SECTION REVISION

1
**REVISION OF SECTION 506
RIPRAP**

Section 506 of the Standard Specifications is hereby revised for this project as follows:

Delete Subsection 506.04 and replace with the following:

The Contractor shall collect the scale ticket on each load of riprap when it is delivered to the project site. Measurement for riprap will be based on the weight tickets

Delete Subsection 506.05 and replace it with the following:

Excavation for the installation of Riprap shall be considered incidental to the work and will not be paid for.

Payment will be made under:

Pay Item	Pay Unit
Riprap (12 inch)	Cubic Yard
Riprap (36 Inch) (Special)	Cubic Yard
Pond A - Soil Riprap (24 Inch)	Cubic Yard
Pond B – Soil Riprap (24 Inch)	Cubic Yard
Pond C – Soil Riprap (24 Inch)	Cubic Yard

END OF SECTION REVISION

1
**REVISION OF SECTION 507
SLOPE AND DITCH PAVING**

Section 507 of the Standard Specifications is hereby revised for this project as follows:

Subsection 507.13 shall include the following:

Slope and ditch paving of the other various types will be measured by the square yard of surface area, regardless of depth.

When the plans call for concrete lined ditch less than 4 inches thick but the actual thickness placed is greater than the plan thickness, measurement and payment will be made only for the thickness shown on the plans.

Subsection 507.14 shall include the following:

The accepted quantities will be paid for at the contract unit price for the various items below that appear in the bid schedule.

Payment will be made under:

Pay Item	Pay Unit
4 Inch Concrete (Canal)	Square Yard
6 Inch Concrete (Canal)	Square Yard

END OF SECTION REVISION

1
**REVISION OF SECTION 514
PEDESTRIAN AND BIKEWAY RAILING**

Section 514 of the Standard Specifications is hereby revised for this Project to include the following:

Subsection 514.06 – Construction Requirements shall include the following:

All pedestrian railing shall be shop fabricated.

Submittals and shop drawings are required to be submitted in accordance with the Special and General Conditions of the Contract for all railing on this Project.

The Contractor shall fabricate and submit a full-scale section of the pedestrian railing for approval by the Owner after the review of the shop drawings. The test section shall be submitted at least four (4) weeks in advance of the start of fabrication. The Owner may order changes to the fabrication if the results observed in the test section are unacceptable. The test section shall not be installed on the Project unless it is accepted. Otherwise, the rejected sample shall be returned to the Contractor for correction or disposal.

All non-structural connections within a panel to be sealed via weld all around in order to inhibit moisture penetration and corrosion between components.

Railing shall be coated with a three-layer coating system consisting of zinc rich primer, an epoxy intermediate coat, and a fluoropolymer finish coat. **Color shall be Federal Color 30450 (Beige).** At least four (4) weeks prior to coating the railings, the Contractor shall submit two (2) color samples for the Owner's approval. The Owner will either approve the color for use on the test section, or shall be entitled to order a change in the color, and request additional coating samples. All color samples shall be submitted on a 6"x6"x1/8" steel plate.

If rust or rust bleeding occurs on the railing at any time prior to the final inspection, by any reason, the Contractor shall remove the rusted section and completely clean the section of all paint and primer, and completely re-prime and re-paint the entire section at no additional cost to the Project.

Anchor bolts shall be long enough to protrude between 0.5 and 1.0 inches above the nut after installation of the railing base plate, washer and nut. Bolts protruding more than 0.5 inches beyond the nut once tightened shall be trimmed to be 0.5 inches or less beyond the nut.

Subsection 514.08 – Basis of Payment shall include the following:

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
Pedestrian Railing (Steel)	Linear Foot

END OF SECTION REVISION

1
**REVISION OF SECTION 601
STRUCTURAL CONCRETE**

Section 601 of the Standard Specifications is hereby revised for this project as follows:

Subsection 601.19 shall include the following:

Concrete will be measured by the cubic yard in accordance with the dimensions shown on the plans. Plan quantities reflect deductions for all voids designed into the structure except, deductions will not be made for the volume occupied by pipes or conduits less than 3 inches diameter, ducts for prestressing steel, reinforcing steel, anchors, weep holes, piling, and form liner textures and nominal chamfers.

Box culvert concrete shall consist of structural concrete, of the designated class, required for concrete box culvert construction including wingwalls and headwalls, shown on the plans, completed and accepted.

Wall concrete shall consist of reinforced structural concrete, of the designated class, required for the construction of walls which are not part of bridges or box culverts, completed and accepted.

Miscellaneous concrete shall consist of the structural concrete of the designated class shown on the plans, except bridge, box culvert or wall concrete, completed and accepted.

Subsection 601.20 shall include the following:

The accepted quantities will be paid for at the contract unit price per unit of measurement for each of the pay items listed below that appear in the bid schedule.

Payment will be made under:

Pay Item	Pay Unit
Concrete Class D (Headwall, Wingwall, Toewall for Box Culvert)	Cubic Yard
Concrete Class D (Box, headwalls, wingwalls) (w/ Epoxy Rebar)	Cubic Yard
Pond A,B&C – Maintenance Trail (6" depth) [Class B Concrete]	Cubic Yard
Pond A,B&C - Concrete Class D [Weir Wall and Toewall]	Cubic Yard
Pond A,B&C - Trickle Channel (4') [Class B Concrete]	Linear Foot

END OF SECTION REVISION

1
**REVISION OF SECTION 602
REINFORCING STEEL**

Section 602 of the Standard Specifications is hereby revised as follows:

Delete subsection 602.07 and replace it with the following:

Reinforcing steel will not be measured separately.

Delete subsection 602.08 and replace it with the following:

Reinforcing Steel for concrete structures will not be measured and paid for separately but shall be considered as incidental to the individual concrete structures listed on the bid schedule.

Epoxy Coated rebar is required on the Bull Canal Relocation structures.

END OF SECTION REVISION

1
**REVISION OF SECTION 603
CULVERTS AND SEWERS**

Section 603 of the Standard Specifications is hereby revised for this project as follows:

Subsection 603.01 shall include the following:

The Contractor shall install protection around the work site where pipe is being installed to secure excavation for culverts and sewers. Protection shall be adequate to keep the traffic, pedestrians, and cyclists from accidentally entering trenches.

The City of Thornton's Standard specification, "SECTION 300 – SANITARY SEWER SYSTEM STANDARDS", shall control the work required for the installation of sanitary sewer infrastructure. The specifications are included in Appendix B at the end of these project special provisions.

Subsection 603.02 shall include the following:

Materials furnished shall be new and undamaged. Everything necessary to complete installations shall be furnished and installed whether shown on approved drawings or not and installations shall be completed and fully operational.

Acceptance of materials or the waiving of inspection thereof shall in no way relieve the Contractor of the responsibility for furnishing materials meeting the requirements of the specifications.

Materials delivered to the job site shall be adequately housed and protected so as to ensure the preservation of their quality and fitness for the work.

Subsection 603.03 shall include the following:

During construction, care must be taken to avoid any ground water, storm water, construction debris, soil, or any other foreign materials from entering any active City of Thornton storm sewer. The use of sanitary sewer or storm sewer systems for the purposes of dewatering is strictly prohibited.

Delete subsection 603.12 and replace it with the following:

Water control and dewatering required to install storm sewer pipe, ditch culverts, inlets, and manholes shall be considered incidental to the applicable bid items being installed. All work shall be completed in dry conditions.

Conduit used for culverts storm drains of the different types and sizes will not be measured but will be the net length of pipe called for on the Plans, except when field changes are ordered or when there are errors on the Plans. In case of exceptions, the quantity to be measured shall be the actual net length of conduit measured along the bottom centerline. Extra length of conduit due to joint creep will not be measured and paid for.

Delete subsection 603.13 and replace it with the following:

The accepted quantities will be paid for at the contract unit price for each of the pay items listed below that appear in the bid schedule. Except as otherwise indicated on the Plans or in the special provisions, all joints, elbows, concrete collars, connecting bands and other connecting devices will not be paid for separately but shall be included in the work.

2
**REVISION OF SECTION 603
 CULVERTS AND SEWERS**

Trench protection will not be paid for separately but shall be considered incidental to the unit price bid for culverts and sewers

Payment will be made under:

Pay Item	Pay Unit
Connect to Existing	Each
18 Inch RCP (CIP)	Linear Foot
24 Inch RCP (CIP)	Linear Foot
30 Inch RCP (CIP)	Linear Foot
42 Inch RCP (CIP)	Linear Foot
23x14 Inch RCP Elliptical (CIP)	Linear Foot
30x19 Inch RCP Elliptical (CIP)	Linear Foot
38x24 Inch RCP Elliptical (CIP)	Linear Foot
18 Inch RCP End Section	Each
24 Inch RCP End Section	Each
30 Inch RCP End Section	Each
11x4 Foot RCBC - Precast – Mustang Run	Linear Foot
8 Inch PVC Sanitary Line	Linear Foot
12 Inch PVC Sanitary Line	Linear Foot

Payment for Reinforced Concrete Pipe, End Sections, and PVC Pipe shall be full compensation for all work necessary to complete the bid item including, but not limited to water control and dewatering, structure excavation, structure backfill, bedding, stabilization material, joints, elbows, concrete collars, reinforced concrete caps, connecting bands, other connecting devices, and disposal of excess excavated material. Excavation and backfill will not be measured and paid for separately, but shall be included in the work

Concrete pipe joint fasteners, required on all end sections, will not be measured and paid for separately, but shall be included in the work.

Concrete walls required under all end sections, will not be measured and paid for separately, but shall be included in the work.

Temporary asphalt installation and removal required for sanitary sewer, waterline, and storm sewer patches will not be paid for separately but shall be considered incidental to the project.

END OF SECTION REVISION

1
**REVISION OF SECTION 604
MANHOLES, INLETS, AND METER VAULTS**

Section 604 of the Standard Specifications is hereby revised for this project as follows:

Subsection 604.02 shall include the following:

Materials furnished shall be new and undamaged. Everything necessary to complete installations shall be furnished and installed whether shown on approved drawings or not and installations shall be completed and fully operational.

Acceptance of materials or the waiving of inspection thereof shall in no way relieve the Contractor of the responsibility for furnishing materials meeting the requirements of the specifications.

Materials delivered to the job site shall be adequately housed and protected so as to ensure the preservation of their quality and fitness for the work.

Subsection 604.04(a) shall include the following:

During construction, care must be taken to avoid any ground water, storm water, construction debris, soil, or any other foreign materials from entering any active City of Thornton storm sewer. The use of sanitary sewer or storm sewer systems for the purposes of dewatering is strictly prohibited.

In subsection 604.06 delete the 1st, 2nd, and 3rd paragraphs and replace with the following:

Manholes and inlets shall be measured by each complete unit including but not limited to ring and cover or grating frames, and reinforcing steel. The manhole diameter is labeled within the plans.

Manhole ring and cover will not be measured separately and will be included in the work.

Inlet grating and frame will not be measured separately and will be included in the work.

2
**REVISION OF SECTION 604
MANHOLES, INLETS, AND METER VAULTS**

Subsection 604.07 shall include the following:

Payment for Detention Pond Outlet Structure shall include, but not be limited to, grate, trash screen, orifice plates, access manholes, and all labor, materials, and equipment required to complete the work.

Payment will be made under:

Pay Item	Pay Unit
Inlet Type C (10 Foot)	Each
Inlet Type R L 5 (5 Foot)	Each
Inlet Type R L 5 (10 Foot)	Each
Inlet Type R L 10 (5 Foot)	Each
Inlet Type R L 15 (5 Foot)	Each
Inlet Type R L 15 (10 Foot)	Each
5' Diam. Manhole (Box Culvert Manhole Access) (w/ Epoxy Rebar)	Each
Detention Pond Outlet Structure – Pond A,B,&C	Each
Manhole Slab Base (4 Foot) (10 Foot)	Each
Manhole Slab Base (5 Foot) (10 Foot)	Each
Manhole Slab Base (5 foot) (15 Foot)	Each

The accepted quantities will be paid for at the contract unit price for each of the pay items in the bid schedule.

END OF SECTION REVISION

1
**REVISION OF SECTION 605
SUBSURFACE DRAINS**

Subsection 605.07 shall include the following:

Pipe underdrain will be measured by the linear foot of pipe of the size specified placed and accepted.

Delete subsection 605.08 and replace it with the following:

The accepted quantities of subsurface drains will be paid for at the contract unit price for each of the pay items listed below that appear in the bid schedule.

Payment will be made under:

Pay Item	Pay Unit
4 Inch Perforated Pipe Underdrain	Linear Foot
4 Inch Solid Pipe Underdrain	Linear Foot

Payment shall be full compensation for all work and materials required to complete the item including but not limited to cleanouts, drainage geotextile, drainage core, securing devices, adhesives, sewn seams, pipe, bend fittings, filter material, excavation, and backfill. Payment for subsurface drain outlet shall include the erosion control pad, the animal guard, and the delineator post.

END OF SECTION REVISION

1
**REVISION OF SECTION 607
FENCES**

Section 607 of the Standard Specifications is hereby revised for this project as follows:

Subsection 607.04 shall include the following:

All labor, materials, and equipment required to complete the work of Fences will not be measured separately but shall be included in the work.

Subsection 607.05 shall include the following:

Payment for Fences shall include, but not be limited to, all labor, materials, and equipment required to complete the work.

Payment will be made under:

Pay Item	Pay Unit
Fence Wire With Metal Posts	Linear Foot
Fence Wire With Treated Wooden Posts	Linear Foot
Fence Wood	Linear Foot
12 Foot Gate Double	Each

END OF SECTION REVISION

1
**REVISION OF SECTION 608
SIDEWALKS AND BIKEWAYS**

Section 608 of the Standard Specifications is hereby revised for this project as follows:

Delete subsection 608.01 and replace it with the following:

This work consists of the construction of bituminous or concrete sidewalks, bikeways, curb ramps, colored and patterned concrete pavements, and concrete sidewalk curb walls in accordance with these specifications and in conformity with the lines and grades shown on the Plans or established.

Delete subsection 608.02 and replace it with the following:

Materials shall meet the requirements specified in the following subsections:

Joint Fillers	705.01
Aggregate for Bases	703.03
Bed Course Materials	703.07

Concrete for sidewalks and curb ramps shall be CDOT class D and conform to the following minimum requirements:

Required Field Compressive Strength	4500 psi at 28 days
Nominal Sized Course Aggregate	3/4 –inches
Maximum Slump	4-inches
Air Content Range	5% to 8%
Water Cement Ratio	0.45

Concrete shall be mixed with Fibermesh reinforcing strands (or approved equal), at the rate of 1.5 pounds per cubic yard. Mixing, placing and finishing shall be performed according to manufacturer's recommendations.

Sidewalk ramp detectable warning field shall be cast-in-place red East Jordan Iron Works or approved equal.

Subsection 608.03(c) shall include the following:

Prior to placing concrete for sidewalks, curb ramps, and colored patterned concrete, a minimum of 4 inches of class VI aggregate base course shall be placed in accordance with Section 304 of the Project Specifications.

Subsection 608.03(d) shall include the following:

Where identified on the Plans, concrete shall be color stained and have a patterned surface texture. The surface finish or pattern and coloring shall be as shown on the Plans.

2
**REVISION OF SECTION 608
SIDEWALKS AND BIKEWAYS**

Subsection 608.03(f) shall include the following:

Concrete shall not be left exposed for more than 2 hours between the time finishing is completed and commencement of curing treatment unless approved by the Owner.

It shall be the Contractor's responsibility to protect the concrete from the elements, vandalism, and physical damage. Any concrete showing any signs of exposure to precipitation, flowing water or freezing, or showing any signs of physical damage shall be removed and replaced by the Contractor at his expense.

Sections of concrete sidewalks, and curb and gutters which develop random cracking shall be removed and replaced, or repaired in a satisfactory manner approved by the Owner, at the Contractor's expense.

Subsection 608.05 shall include the following:

Colored and patterned concrete shall be measured by the square yard of finished surface. Coloring material and fibrous reinforcement shall be not be measured and paid for separately but shall be included in the work.

Detectable warnings will be included in curb ramps and not measured separately. Materials and work for detectable warnings will not be measured and paid for separately but shall be included in the work.

3
**REVISION OF SECTION 608
SIDEWALKS AND BIKEWAYS**

Subsection 608.06 shall include the following:

Payment will be made under:

Pay Item	Pay Unit
Concrete Sidewalk (6-Inch Thick)	Square Yard
Concrete Curb Ramp (6-Inch Thick)	Square Yard
Median Cover Material (6-Inch Patterned Concrete)	Square Foot
Concrete Sloped Median Nose Type 1	Each

Joints of all types will not be measured and paid for separately but shall be included in the work.

Aggregate base course will be measured and paid for in accordance with Section 304.

Fibrous concrete reinforcement material will not be measured and paid for separately but shall be included in the work.

Detectable warnings shall be included in the curb ramp pay item and not measured separately. All materials, equipment, work for detectable warnings will not be measured and paid for separately but shall be included in the work.

END OF SECTION REVISION

1
**REVISION OF SECTION 609
CURB AND GUTTER**

Section 609 of the Standard Specifications is hereby revised as follows:

Subsection 609.01 shall include the following:

The work under this section shall also include construction of the proposed Curb Opening/Sediment Pad as shown on the Project Construction Plans.

Delete subsection 609.02 and replace it with the following:

Except as provided below the materials used shall meet the requirements of the following subsections:

Bed Course Material	703.07
Joint Filler	705.01
Reinforcing Steel	709.01

Concrete for curb and gutter shall conform to the following minimum requirements:

Required Field Compressive Strength	4500 psi at 28 days
Nominal Sized Course Aggregate	3/4 –inches
Maximum Slump	4-inches
Air Content Range	5% to 8%
Water Cement Ratio	0.45

Concrete shall be mixed with Fibermesh reinforcing strands (or approved equal), at the rate of 1.5 pounds per cubic yard. Mixing, placing and finishing shall be performed according to manufacturer's recommendations.

Subsection 609.03 is revised to include the following:

Materials required for construction of the proposed Curb Opening/Sediment Pads shall be controlled based on specifications herein. Dimensions, layout and details for construction of the proposed Curb Opening/Sediment Pads shall be in accordance with the Project Construction Plans.

Subsection 609.03(f) is revised to include the following:

Concrete shall not be left exposed for more than 2 hours between the time finishing is completed and commencement of curing treatment unless approved by the Owner.

It shall be the CONTRACTOR's responsibility to protect the concrete from the elements, vandalism, and physical damage. Any concrete showing any signs of exposure to precipitation, flowing water or freezing, or showing any signs of physical damage, shall be removed and replaced by the CONTRACTOR at his expense.

2
**REVISION OF SECTION 609
CURB AND GUTTER**

Subsection 609.06 is revised to include the following:

Materials and work required to construct the proposed Curb Opening/Sediment Pads will not be measured separately, but shall be included in the work.

Measurement for Type 2 gutter, Type 2 curb and gutter, and concrete pavement at intersections shall be measured in accordance with CDOT Standard Plan No. M-609-1.

Subsection 609.07 shall include the following:

Materials, equipment and labor required to construct the proposed Curb Opening/Sediment Pads will not be paid for separately, but shall be included in the work.

Payment will be made under:

Pay Item	Pay Unit
Curb and Gutter, Type 2 (Section II-B)	Linear Foot
Curb and Gutter, Type 2 (Section I-B)	Linear Foot
Median Splash Block	Linear Foot

END OF SECTION REVISION

1
**REVISION OF SECTION 613
LIGHTING**

Section 613 of the Standard Specifications is hereby revised for this project as follows:

Subsection 613.01 shall include the following:

The City of Thornton's Standard specification, "SECTION 700 – TRAFFIC TECHNICAL SPECIFICATIONS", shall control the work required for the installation of lighting. The specifications are included in Appendix C at the end of these project special provisions.

All work shall be done in accordance with these specifications, the National Electrical Code, and in conformity with the details shown on the Construction Plans.

The Contractor shall coordinate with the City to establish the final location of proposed street lights.

Subsection 613.02 shall include the following:

LED Luminaire Warranty. The Contractor shall ensure that the LED Roadway Luminaire has a minimum warranty of 10 years for all parts, materials and shipping required to repair or replace the luminaire. The Contractor shall provide the manufacturer's warranty to the Engineer prior to installing the luminaire.

The warranty shall cover all failures including:

1. Failure in luminaire housing, wiring, connections, drivers and photoelectric control devices.
2. More than 10 percent decrease in lumen output
3. Significant change in color

The warranty shall begin upon the date the Contractor receives the luminaire. The bill of lading shall be provided to the Engineer prior to final payment of the lighting.

Technical Support. During the warranty period, technical support shall be available from the manufacturer via telephone within 24 hours of the time the call is made from the Contractor, and this support shall be made available from factory certified personnel or factory certified installers at no additional charge to the Department.

Subsection 613.11 shall include the following:

Street lights will be measured by the number of completed street lights, and accepted. Material, equipment, potholing, and labor required to construct the proposed street lights, approved and complete in place, will not be measured separately, but shall be included in the work.

2
**REVISION OF SECTION 613
LIGHTING**

Lighting control centers will be measured by the number of centers installed.

Meter pedestals will be measured by the number of pedestals installed.

Conduit will be measured by the linear foot in place.

All wiring necessary for the complete installation of traffic signals and street lights will be measured as a single lump sum.

Subsection 613.12 shall include the following:

Materials, equipment, potholing, and labor required to construct the proposed Roadway Light Fixtures, approved and complete in place, will not be paid for separately, but shall be included in the work.

Material, equipment, potholing, and labor required to construct the Electrical Distribution (Copper), approved and complete in place, will not be paid separately, but shall be included in the work.

Material, equipment, potholing, and labor required to construct the Meter Pedestal, approved and complete in place, will not be paid separately, but shall be included in the work.

When the Contractor, at his option, installs larger conduit than specified, it will be paid for at the original contract price for the size specified.

The following items will not be measured and paid for separately, but shall be included in the work:

1. Soil testing for foundations
2. Junction boxes, splice boxes, pull wire, weatherheads, adaptors, and expansion joints for conduit
3. Additional pull or splice boxes installed at the Contractor's option
4. Saw cutting; trenching; excavation; backfill; jacking; drilling pits; underground electrical warning tape; removal of pavement, other work necessary to complete conduit installation
5. Electrical conductor tagging
6. Direct burial cable in conduit
7. Testing of the lighting installation, including temporary power and all required cable connections

3
REVISION OF SECTION 613
LIGHTING

The lump sum price bid for wiring will be full compensation for all electrical circuitry necessary to complete the lighting and traffic signal installation as shown on the plans. All conductors in conduit, regardless of type, are part of the wiring item and will not be measured and paid for separately.

Included in the cost of Pull Boxes will be a layer of gravel beneath the Pull Box.

Payment will be made under:

Pay Item	Pay Unit
2 Inch Electrical Conduit (Bored)(Traffic Signal)	Linear Foot
2 Inch Electrical Conduit (Street Lights)	Linear Foot
Traffic Signal Meter Pedestal and Connect to Power	Lump Sum
Pull Box (11x18x12) (Street Lights)	Each
Traffic Signal Wiring	Lump Sum
Street Light and Luminaire (Single Mast Arm)	Each
Street Light and Luminaire (Dual Mast Arm)	Each
3 Inch Electrical Conduit (Bored) (Traffic)	Linear Foot
4 Inch Electrical Conduit (Traffic)	Linear Foot
Pull Box (20"x33"x15") (Traffic Signal)	Each
Pull Box (30"x48"x24") (Traffic Signal)	Each
Luminaire (LED) (Traffic Signal)	Each
3 Inch Electrical Conduit (Interconnect)	Linear Foot
Pull Box (24"x36"x24") (Interconnect)	Each
Street Light Meter Pedestal and Connect to Power	Lump Sum
Illuminated Sign	Each
Location Marker (Utility) (Flat Slat)	Each

END OF SECTION REVISION

1
**REVISION OF SECTION 614
TRAFFIC CONTROL DEVICES**

Section 614 of the Standard Specifications is hereby revised for this project as follows:

Subsection 614.01 shall include the following:

The City of Thornton's Standard specification, "SECTION 700 – TRAFFIC TECHNICAL SPECIFICATIONS", shall control the work required for the installation of traffic control devices. The specifications are included in Appendix C at the end of these project special provisions.

In subsection 614.13 delete the 4th Paragraph and replace it with the following:

Ground signs will be measured by the number of signs installed and accepted by the City. Concrete footing, sign posts, hardware, mounting and backing angles, will not be measured separately. Sign Panel will be measured by the square foot installed and accepted by the City.

Subsection 614.14 shall include the following:

Payment for Sign Panel and Ground Sign shall include, but not be limited to, all labor, materials, and equipment required to complete the work.

Payment will be made under:

Pay Item	Pay Unit
Sign Panel (Class I)	Square Foot
Steel Sign Post (1.75x1.75 Inch Tubing)	Each
Signal Head Backplate	Each
Pedestrian Signal Face (12)	Each
Traffic Signal Face (12-12-12)	Each
Traffic Signal Controller Cabinet (Type 333 SD-ITS) and Base	Each
Pedestrian Push Button	Each
Pedestrian Push Button Post Assembly	Each
Fire Preemption Unit & Timer	Each
Vehicle Detection System (Single Camera)	Each
Traffic Signal-Light Pole Steel (1-65 Foot Mast Arm)	Each
Traffic Signal-Light Pole Steel (1-70 Foot Mast Arm)	Each
Traffic Signal-Light Pole Steel (1-75 Foot Mast Arm)	Each
Controller (Type ATC Econolite Cobalt Rackmount LT))	Each

END OF SECTION REVISION

1
**REVISION OF SECTION 619
WATER LINES**

Section 619 of the Standard Specifications is hereby revised for this project as follows:

Subsection 619.01 shall include the following:

The City of Thornton's Standard specification, "SECTION 200 – WATER SYSTEM STANDARDS", shall control the work required for the installation of water infrastructure. The specifications are included in Appendix A at the end of these project special provisions.

Subsection 619.03 shall include the following:

Connection to existing water main for the irrigation water service line shall be in accordance with City of Thornton Standard Detail number 200-14.

Subsection 619.04 shall include the following:

All materials, equipment, and work required for Connection to Existing Water Main will not be measured and paid for separately but shall be included in the work.

Water lines of the various types and sizes will be measured by the linear foot in place and shall include all fittings. Valves including valve boxes will be measured by the actual number of the specified type and size used in the completed water lines, and accepted.

Blowoff assemblies, air vents, access vaults, and steel marker posts will be measured by the actual number of the specified type and size used in the completed water lines, and accepted.

Subsection 614.05 shall include the following:

Payment for Connection to Existing Waterline shall include, but not be limited to, all labor, materials, and equipment required to complete the work.

Structure excavation and structure backfill for water lines will not be measured and paid for separately but shall be included in the work.

2
**REVISION OF SECTION 619
WATER LINES**

Payment will be made under:

Pay Item	Pay Unit
Connect to Existing Waterline	Each
10 Inch Steel Pipe Casing	Linear Foot
4 Inch PVC Water Line	Linear Foot
4 Inch HDPE Water Line	Linear Foot
12 Inch PVC Water Line	Linear Foot
24 Inch DIP Water Line	Linear Foot
2 Blowoff Assembly	Each
4 Inch Gate Valve	Each
12 Inch Gate Valve	Each
24 Butterfly Valve	Each
Air Vent	Each
Steel Marker Post	Each
Access Vault (5' Diam. Manhole)	Each

END OF SECTION REVISION

1
**REVISION OF SECTION 623
IRRIGATION SYSTEM**

Section 623 of the Standard Specifications is hereby deleted for this project and replaced with the following:

This work includes finishing and installing irrigation systems in conformance with Sections 809 of the City of Thornton's Specifications and Design of Irrigation Systems on City Maintained and Public Park Properties.

PART 1 - GENERAL

- 1.1 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 expansion and adjustment to existing irrigation system including but not limited to piping, valves, fittings, heads and wiring, and final adjustments to insure complete coverage.
 - D. Water connections.
 - E. Replacement of unsatisfactory materials.
 - F. Clean-up, Owner Reviews, and Project Acceptance.
 - G. Tests. An irrigation audit shall be performed, as part of the irrigation system Initial Acceptance process with a 'post establishment' irrigation schedule provided for city staff use. The audit shall be performed by a Certified Landscape Irrigation Auditor in good standing with the Irrigation Association.
 - H. Winterization and Spring Start-up.
- 1.2 RELATED SECTIONS
- A. Examine all sections related to project work.
- 1.3 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.

2
**REVISION OF SECTION 623
IRRIGATION SYSTEM**

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.

1.4 QUALITY ASSURANCE

A. Installer Qualifications - Installer shall have had considerable experience and demonstrate ability in the installation of two wire 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 Owner, 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. Design Criteria

1. Drawings are generally diagrammatic and indicative of the work to be installed. Avoid conflicts between irrigation system, plantings, paving and structures. Due to the drawing scale, it is not possible to indicate all offsets, fittings and sleeves which may be required at no expense to the Owner. Investigate conditions affecting work and furnish such offset, fittings and sleeves as may be required. Notify the Owner of any field obstructions, grade changes, or other factors preventing installation of irrigation system as drawn or specified.

C. Special Requirements:

1. 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.
2. Coordination with Other Contractors - Protect, maintain, and coordinate Work with Work under other Section.
3. 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.

3
**REVISION OF SECTION 623
IRRIGATION SYSTEM**

- D. Pre-Construction Conference - Owner 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. Owner shall notify qualified representatives of each party concerned with that portion of Work to attend conference, including but not limited to City Parks Maintenance Superintendent, Owner, 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.

- E. Licensed Electrician and Code Compliance:
 - 1. 120/240V electrical work shall be performed by a licensed Master Electrician and shall meet local code, the NEC and Xcel energy's most recent standards for electric installation and use.

- 1.5 SUBMITTALS - Prepare and make submittals in accordance with conditions of the Contract.
 - A. Materials List - Submit one 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 as shown in Section 1010.

 - 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 draftsman. 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 initial acceptance walk-through, submit for review a final set of as-builts. Dimensions, from two permanent points of reference (building corners, sidewalk, road intersections or permanent structures), location of following items:
 - a. Connection to existing water service lines.
 - 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. Water meters
 - k. Locations of all sleeving including size, quantity and depth of sleeve

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- l. Flow sensors
 - m. Pressure regulating valves
 - 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 one written operating instruction 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 Owner has reviewed record (as-built) drawings.
 - b. Provide one controller chart for each automatic controller installed.
 - 1) 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.
 - 2) 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 Owner, 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.
- D. Maintenance Materials
 - 1. Deliver the following items to the Owner at or before time of initial acceptance and obtain receipt:
 - a. Two manual drain valve keys with tee handles and key end to fit drain valves and gate valves.
 - b. Two quick coupler keys and two matching hose swivels for each type of quick coupling valve installed.
 - c. Two sets of special tools required for removing, disassembling and adjusting each type of distribution head and valve installed.
 - d. Two keys for each automatic controller installed.
 - e. 11"x14" laminated plan sheet showing color-coded irrigation zones referenced by controller number.
 - f. Decoder programmer.

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- 1.6 DELIVERY, STORAGE, AND HANDLING - 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.
- A. 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.
- 1.7 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 or replaced by Contractor to the satisfaction of the Owner. All costs of such repairs shall be charged to and paid by Contractor.
 2. Protect buildings, walks, walls, fences 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 and shrubs:
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.

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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.

1.8 WARRANTY/GUARANTY: - Contractor shall warrant materials against defects for a period of one year from date of Initial Acceptance. Contractor shall guaranty workmanship for similar period.

- A. Settling of backfilled trenches that may occur during guaranty period shall be repaired at no expense to Owner, including complete restoration of damaged property.
- B. Expenses due to vandalism before Initial Acceptance shall be borne by Contractor.
- C. Owner will maintain turf and planting areas during warranty period, so as not to hamper proper operation of irrigation system.

1.9 MAINTENANCE:

- A. Maintain new irrigation improvements until Initial Acceptance. Maintenance activities include adjustment of valves and irrigation heads, re-nozzling as needed to optimize coverage, filling settled irrigation trenches, freeze protection, programming of controller, and monitoring of the entire irrigation system assuring proper coverage to all areas. After Initial Acceptance the Owner is responsible for maintenance.
- B. Winterization and Start Up - include cost in bid for winterizing complete system at conclusion of sprinkling season (in which system received Initial Acceptance) within 3 days notification by the Owner. System shall be voided of water using compressed air or similar method reviewed by Owner. Reopen, operate, and adjust system malfunctions accordingly the following season within 3 days of notification by Owner.

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- 1.10 EXTRA STOCK - In addition to installed system furnish the following items to Owner:
- A. 10 Pop-up spray heads with nozzles of each type used.
 - B. 4 Rotor heads of each type used
 - C. 4 Rotary pop-up head with nozzles of each type used

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. General Piping:
 - 1. Pressure Supply Lines (Mainline downstream of backflow prevention units) – Use Class 200, SDR-21, rated at 200 psi, conforming to the dimensions and tolerances established by ASTM Standard D2241. Use Class 200 PVC RT (3" and larger) and PE3408 HDPE DR11 for bored mainlines.
 - 2. Non-pressure Lines (Lateral Lines) – Use Class 200, SDR-21, rated at 200 psi, conforming to the dimensions and tolerances established by ASTM Standard D2241
 - 3. PVC Sleeving - Class 200 PVC with solvent welded joints
- B. Plastic Pipe and Fittings:
 - 1. Identification Markings:
 - a. Identify all pipe with following indelible markings:
 - 1) Manufacturer's name.
 - 2) Nominal pipe size.
 - 3) Schedule of class.
 - 4) Pressure rating.
 - 5) NSF (National Sanitation Foundation) seal of approval.
 - 6) 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.
 - 1) Threads - Injection molded type (where required).
 - 2) Tees and ells - Side gated.
 - b. Threaded Nipples - ASTM D2464, Schedule 80 with molded threads.
 - c. 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.
 - d. 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.

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- 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.
- C. Gate Valves (Leemco or approved equal):
1. 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.
- D. Quick Coupling Valves (Buckner or approved equal) - Brass two-piece body designed for working pressure of 150 PSI; operable with quick coupler. Equip quick coupler with locking rubber cover.
- E. Valve Boxes (Carson or approved equal. Jumbo boxes for 1 and 1 ½", Super Jumbo boxes for 2" valves, and Super Jumbo boxes for Drip valves):
1. Master Valve & Flow sensor, Make and model as shown on Drawings and details.
- F. Electrical Control Wiring:
1. Low Voltage:
 - a. Electrical Control Wire - Shall be American Wire Gauge (AWG) Type UF cable, UL approved for direct underground burial, No. 12 direct burial copper decoder wire or larger, if required to operate system as designed (Rainmaster TW-CAB-14).
 - b. Tracer Wire - AWG UFUL approved No. 14 gauge direct burial copper wire or larger.
 - c. Wire Colors: Wire color shall be continuous over its entire length. Use wire colors to match colors used on existing system. Or as directed by owner.
 - 1) Tracer Wire – Yellow.
 - d. Control Wire connections and splices shall be made with Rainmaster TW-SPLICE-14 direct bury splice.
 - e. Mainline and Lateral Line Tracer Wire – Install one continuous AWG UL No. 14 gauge tracer wire as detailed above all mainline and lateral lines. Loop wire into control box. Color shall be yellow.

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- G. Automatic Controller – Make and model as shown on Drawings
- H. Electric Control Valves - Size and type shown on Drawings having manual flow adjustment, pressure regulator, and manual bleed nut.
- I. Sprinkler Heads - As indicated on Drawings (or approved equal). Fabricated riser units in accordance with details on Drawings - with fittings and nipples of equal diameter as riser inlet in sprinkler body.
- J. Backflow Preventer – Make and model as shown on Drawings

PART 3 – EXECUTION

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

3.2 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 Owner. 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.

3.3 INSPECTION: - 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.

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

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3.4 PREPARATION:

A. Staking shall Occur as Follows:

1. Mark, routing of pressure supply line and flag heads for first few zones. Contact Owner 48 hours in advance and request review of staking. Proposed locations of all trees shall be field staked by Contractor and approved by Owner prior to Owner review of irrigation staking. Owner will advise installer as to the amount of staking to be prepared. Owner 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. Obtain Owner's review and approval prior to beginning the work.
3. Mainline bends exceeding 45 degrees are prohibited. Use of 90-degree bends on mainline is prohibited.
4. Contractor shall contact Owner if field spacing varies by +/- 10% of the spacing shown on the Irrigation Plans. If Contractor fails to notify Owner of variances exceeding 10%, Contractor assumes full responsibility for the costs associated with any required system modifications deemed necessary by the Owner or Owner.
5. If Project has significant topography, freeform planting beds, or other amenities, which could require alteration of irrigation equipment layout as deemed necessary by Owner, do not install irrigation equipment in these areas until Owner has reviewed equipment staking.

B. 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. No trench shall be left open overnight without specific prior approval by the owner. Sufficient barricades to protect the public shall be provided at all times, as approved by Owner.

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 - 30 inches from top of pipe. Refer to detail.
 - b. Non-pressure Piping (rotor) - 18 inches from top of pipe. Refer to detail.
 - c. Non-pressure Piping (pop-up) - 18 inches from top of pipe. Refer to detail.
 - d. Control Wiring/Communication Cable - Side of pressure main or at 18-inch depth if installed in a separate trench with no mainline piping. Refer to detail.

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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.

3.5 **INSTALLATION** - Locate other equipment as near as possible to locations designated. Owner shall review deviations prior to installation.

- A. **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. Provide 324 yellow-coated tracer wire along entire lengths of mainline & lateral piping. Do not splice tracer wire at tees. Where tees are needed, run tracer wire to the end of the teed pipe, then double back to tee and proceed.
 1. **Solvent Weld PVC Pipe** - Lay pipe and make all plastic to plastic joints in accordance with manufacturer's recommendations.
 - a. Bundle control wires at tees and ells to be thrust blocked and wrap pipe with at least four (4) layers of 6-mil plastic sheeting or other approved bond breaker prior to pouring thrust blocks. Do not encase control wires or fittings in concrete.
 - b. Joint restraints on all gasketed PVC mainline pipe three inches and larger (3"+): Install joint restraints per the plans and/or manufacture's recommendations. Prior to backfilling any joint restraints, the Owner shall be present to verify that the restraints were installed in the proper locations and that all bolts have been tightened to the manufacture's specifications. Any restraints that are buried prior to inspections shall be excavated to allow for review and inspection at no additional cost to the Owner.
 - c. Obtain Owner's approval of mainline pipe prior to backfilling.
- B. **Control Wiring:**
 1. **Low Voltage Wiring:**
 - a. Wire the master valve with as required by the controller manufacturer.
 - b. Bury control wiring between controller and electric valves in pressure supply line trenches, strung as close as possible to main pipelines with such wires to be consistently located below and to one side of pipe, or in separate trenches.
 - c. Bundle all 24 volt wires at 10 foot intervals and lay with pressure supply line pipe to one side of the trench.
 - d. Provide an expansion loop at every pressure pipe angle fitting, every electric control valve location (in valve box), and every 500 feet. Form expansion loop by wrapping wire at least 8 times around a 3/4 inch pipe and withdrawing pipe.
 - e. Loop 5 ft. minimum of 2 wire cable into all valve boxes.
 - f. Make all splices and E.C.V. connections using Rainmaster TW-SPLICE-14 connectors or similar dry splice method.

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- g. Install all control wire splices not occurring at control valve in a separate splice valve box.
 - h. Install one control wire for each control valve.
- C. Automatic Controller - Install where shown on Drawings as detailed.
- D. Electric Control Valves - Install cross-handle four inches below finished grade where 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.
- E. Quick Coupling Valves - 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.
- F. 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.
- G. Gate Valves - Install where shown on Drawings as detailed.
- H. 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 Owner. 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. Owner may request nozzle changes or adjustments without additional cost to the Owner.
- I. Backflow Preventer - Install where shown on Drawings as detailed.
- J. Backfilling - Obtain Owner's inspection & approval of piping and wire placement prior to 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 Owner. Leave trenches slightly mounded to allow for settlement after backfilling is completed. Trenches shall be finish graded prior to walk-through of system by Owner.

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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.
- K. Piping Under Paving:
1. 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 no cost to Owner. Obtain permission to cut or break walks and/or concrete from Owner.
- L. Water Supply and Point of Connection - Install where shown on Drawings as detailed.
- M. Rain Sensor - Install where shown on Drawings as detailed.
- N. Drain valve - Install where shown on Drawings as detailed.
- 3.6 ADJUSTING - 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%.
- A. If it is determined that irrigation adjustments will provide proper coverage, and improved water distribution as determined by Owner, 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.
 - B. All sprinkler heads shall be set perpendicular to finish grade unless otherwise noted on Construction Plans or directed by Owner.
 - C. 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.

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3.8 FIELD QUALITY CONTROL:

A. TESTING & FLUSHING

Hydrostatic Testing: Notify the Owner 72 hours in advance and request observation of hydrostatic test. Prior to test, partially backfill trenches, leaving joints exposed. Test mainline with closed ball valves in place by pressuring to 120 psi for a two-hour period. No more than zero (0) psi loss shall occur and no visible leaks shall be detected within a two-hour period in a passing test of mainline & ball valves. Remove and repair piping, connections, and valves that leak.

A second pressure test shall be conducted with control valves in place. Pressurize mainline to at least 100 psi, with ball valves open and control valves closed, and visually check for leaks over a two-hour period. Control valve assemblies shall be drip-free at the end of this test.

Flushing: After hydrostatic testing and installation of swing joints for heads, flush lines thoroughly to remove all foreign matter before setting heads. Extend swing joints to levels above grade and flush for a minimum of one minute under full head of pressure.

B. Testing Controller Operations:

1. Functional test of the control system shall be performed and demonstrate that all parts of the control system function as specified or intended, as per Owner and Manufactures approval. The functional test for each system shall consist of not less than 30 days of continuous, satisfactory operation of the complete system serviced by a controller or as determined by owner.
2. Any materials determined to be faulty as part of the installation shall be replaced or corrected by the Contractor at his expense in a manner respective to the Plans, Details and other sections of this Specification. In the event of a system failure due to faulty installation, programming or workmanship, the 30 day period will be repeated until testing is complete.

C. System Operations Orientation:

1. System Operation Training Session: A training and orientation session for Parks staff shall be required.
 - a. The Owner, Contractor, the irrigation subcontractor, a representative of the manufacturer or distributor, and representatives of Parks maintenance shall be present. The date and time of the session and attendees present shall be subject to approval by Owner.
 - b. The completed "As-Built" plans and "Controller Chart(s)" shall be reviewed.
 - c. Controller features, flow sensing, alarms and programming will be reviewed.
 - d. Hand held operation of field units will be demonstrated.

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D. Walk-Through for Substantial Completion:

1. Arrange for Owner'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 Owner at time of walk-through and additionally, open all valve boxes if directed.
4. Generate a list of items to be corrected prior to Initial Acceptance.
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 Owner 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 Owner with prints of irrigation as-builts prior to scheduling substantial completion walk-through.
8. An irrigation audit shall be performed as part of the irrigation system Initial Acceptance process with a 'post establishment' irrigation schedule provided for city staff use. The audit shall be performed by a Certified Landscape Irrigation Auditor in good standing with the Irrigation Association if required by Owner.

E. Walk-Through for Initial Acceptance:

1. Arrange for Owner's presence 48 hours in advance of walk-through.
2. Show evidence 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 Owner at time of walk-through to insure correction of all incomplete items.
4. Items deemed not acceptable by Owner shall be reworked to complete satisfaction of Owner.
5. If after request to Owner for walk-through for Initial Acceptance of irrigation system, Owner 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 Owner to conduct and document further walk-throughs as deemed necessary to insure compliance with Contract Documents.

- 3.9 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.

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3.10 WINTERIZATION AND START UP:

- A. Provide one full winterization within seven (7) days of Owner's request in the Fall following Initial Acceptance.
- B. If the system must be pressurized during winter months for winter watering, the Owner may elect to re-winterize the system using its own staff and equipment or may require the Contractor to re-winterize. Winterization by the Owner will not relieve the Contractor of warranty responsibilities.
- C. Within seven days of Owner's request in the Spring, provide systems start up, testing, and adjustment.

3.11 WINTER WATERING

- A. Winter watering of deciduous and evergreen trees and other plant material shall be arranged and at the expense of the Responsible Party until such time as Final Acceptance is received. Winter watering generally means a deep soaking once a month when temperatures are above 40° F.
- B. The Contractor shall water rights-of-way and median landscapes, in magnesium chloride stress areas, a minimum once in early

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BASIS OF PAYMENT

Subsection 623.33 shall include the following:

- A. The accepted quantities will be paid for at the contract price for the various items below that appear in the bid schedule.

Payment will be made under:

Pay Item	Pay Unit
Irrigation System	Lump Sum
Irrigation Electric Meter Pedestal and Connection to Power	Lump Sum

- B. Pricing for all work items shall include site restoration & sodding, except for wire and pipe trenching, where site restoration and sodding shall be priced and paid for separately on a per linear foot unit price basis.
- C. Winterizations and spring startup will be priced and paid for on a 'per time' unit price basis as outlined in the SCHEDULE OF CONTRACT ITEMS AND PRICES.

END OF SECTION REVISION

**REVISION OF SECTION 625
CONSTRUCTION SURVEYING**

Section 625 of the Standard Specifications is hereby revised for this project as follows:

Subsection 625.11 shall include the following:

All survey records generated shall be the property of the City of Thornton.

Subsection 625.13 shall include the following:

Before granting Initial Acceptance, the following items shall be completed, reviewed and approved by the Engineer:

1. Verification that all Monuments and Stakes have been reset in accordance with sub-section 625.08
2. All Survey Records in accordance with sub-section 625.11

Payment will be made under:

Pay Item	Pay Unit
Construction Surveying - Survey Monument Type 3A	Lump Sum
Construction Surveying – Survey Monument type 6	Lump Sum
Construction Surveying	Lump Sum

END OF SECTION REVISION

REVISION OF SECTION 627 PAVEMENT MARKINGS

Section 627 is hereby revised for this project as follows:

DESCRIPTION

This Work consists of furnishing and applying pavement marking in accordance with these specifications, the Manual of Uniform Traffic Control Devices for Streets and Highways (MUTCD), the Colorado supplement, thereto, and in conformity to the lines, dimensions, patterns, locations, and details shown on the Plans or established.

The City of Thornton's Standard specification, "SECTION 700 – TRAFFIC TECHNICAL SPECIFICATIONS", shall control the work required for the installation of pavement markings. The specifications are included in Appendix C at the end of these project special provisions.

MATERIALS

In general, paint will not be used unless approved by the Owner. On existing pavement, Preformed Plastic Pavement Markings shall be used. On new pavement, Preformed Plastic Inlayed Pavement Markings shall be used.

1. Preformed Plastic Pavement Markings and Legends

A. General

1. The prefabricated markings described shall consist of white or yellow pigmented plastic films with reflective glass spheres, uniformly distributed throughout their entire cross-sectional area, and shall be capable of being affixed to bituminous or Portland cement concrete pavements by either a pressure sensitive precoated adhesive or a liquid contact cement. The markings shall be provided in complete, a form that shall facilitate rapid application and protect the markings in shipment and storage. The contractor shall use proper solvents and/or adhesives for application, all equipment necessary for proper application, and recommendations for application that shall assure an effective performance life. The marking film shall have resealing characteristics such that it shall fuse with itself and with previously applied marking materials of the same composition under normal conditions of use.
2. Prefabricated legends and symbols shall conform to the applicable shapes and sizes as outlined in the MUTCD.

B. Classification

The markings shall be highly durable retroreflective pliant polymer materials, designed for longitudinal and word/symbol markings subjected to high traffic columns and severe wear conditions, such as shear action from crossover, or encroachment on typical longitudinal configurations such as edge lines, barrier lines and lane lines.

- C. Symbols, legends, long lines, skips, stop bars and crosswalks shall be 3M Series 270 ES or approved equal. For concrete pavement, long lines and skips shall be 3M Series 380I-5ES or approved equal.

**REVISION OF SECTION 627
PAVEMENT MARKINGS**

2. Marking Paint

Marking paint generally will not be approved for permanent markings. The use of pure acrylic high solids for hot application and quick dry to paint centerlines and edge lines on roads, crosswalks, stop zones, parking lots, storage zones, aisles, etc. as approved by the City of Thornton Project Manager shall contain no lead and comply with the EPA's voluntary 30/50 program, and meet the performance standards of federal specifications TT-P-1952. Prior to application, surfaces must be thoroughly dry and free from dirt, loose paint, oil, grease, and other contaminants. Paint may be thinned if necessary up to two (2)%, thin per manufacturer's recommendation. The paint shall be applied at air, surface, and product temperature above 50° F or per manufacturer's specifications.

% solids by weight	77.5 +/- 3%
Viscosity	80 - 90 K.U.
Sheen	Flat
Wet film per coat	14 – 16 mils
Dry film per coat	8.4 – 9.6 mils
Application rate	1 gal / 100 sf
Unit weight	14 lbs. / gal

3. Thermoplastic Marking

A. Shall be in conformance with CDOT SSRBC Section 713.12.

4. Reflectorized Glass Beads

A. A blended material consisting of spheres containing refractive indices of 1.50 and 1.65 and conforming to the following specifications:

1. Manufactured from high grade optical crown glass of a composition designed to be highly resistant to traffic wear and to the effects of weathering.
2. Colorless, clean and transparent.

B. Material

The reflectorizing glass beads shall conform to the following:

1. Refracture Index - When testing by the liquid immersion method at 77° F, 70% of the spheres shall have an average index of not less than 1.50, and 30% shall have an average index of not less than 1.65.

3
REVISION OF SECTION 627
PAVEMENT MARKINGS

1.50 Index Glass Beads

U.S. Standard Sieve Number	% Passing by Weight
20	95 – 100
30	75 - 95
50	9 - 32
80	0 - 15

1.65 Index Glass Beads

U.S. Standard Sieve Number	% Passing by Weight
50	100
80	90 – 100
100	75 - 90
200	0 - 5

CONSTRUCTION REQUIREMENTS

The contractor shall field layout pavement markings for installation, via chalk or paint lines, for approval of owner prior to installation of material. Permanent pavement markings shall have an epoxy binder applied and be tape unless another material is approved in writing by the Traffic Engineer.

Pavement markings shall be so applied as to assure continuous uniformity in the dimensions of the stripe.

Laydown tolerances for each pavement marking shall be one (1) inch longitudinally and one quarter (1/4)-inch transversely.

Permanent pavement markings installed on new asphalt shall be inlaid and installed within four (4) hours of placement of the final lift of asphalt pavement. Pavement markings on existing and new concrete pavement shall be recessed in a one fourth ($\frac{1}{4}$) inch groove not to exceed one half ($\frac{1}{2}$) inch wider nor two (2) inches longer than the tape being laid and shall be glued with an epoxy binder. Permanent pavement markings on existing asphalt shall have an epoxy binder applied and be tape.

The pavement marking shall be applied to the pavement either to the right or left of the application unit, dependent upon roadway lane being used. The unit shall not occupy more than one lane of roadway while operating.

**REVISION OF SECTION 627
PAVEMENT MARKINGS**

The finished lines shall have well defined edges and be free of waviness. Tolerance shall be one (1) inch longitudinally and one fourth ($\frac{1}{4}$) inch transversely. The minimum thickness of thermoplastic line shall be three thirty-seconds ($\frac{3}{32}$) inch at the edges, not less than one eighth ($\frac{1}{8}$) inch at the center. Measurements shall be taken as an average throughout any 10-foot section of the line. The material, when formed into traffic stripes, must be readily renewable by placing an overlay of new material directly over an old line of compatible material. Such new material shall bond itself to the old line in such a manner that no splitting or separation takes place. All of the equipment necessary to the preheating and application of the material shall be so designed that the temperature of the material can be controlled within the limits necessary to its pourability for good application.

The marking material as specified shall be installed at the manufacturer's recommended temperature.

At the time of installation of thermoplastic materials, the pavement shall be clean, dry, and free of laitance, oil, dirt, grease, paint, or other foreign contaminants. Pavement and ambient temperatures shall be at least 50° F.

An epoxy resin primer shall be applied to concrete surfaces prior to the application of the thermoplastic pavement marking. The epoxy resin primer shall be installed per the thermoplastic manufacturer recommendations.

The marking material shall not be applied until the epoxy resin primer reaches the tacky stage. An infrared heating device may be employed to shorten the curing time of the epoxy.

If the City of Thornton Project Manager determines that a new asphalt surface has become soiled, prior to placement of the pavement markings, a pavement primer will be required and preformed plastic pavement markings shall be applied as approved.

The epoxy resin primer material may be accepted at the job site on the basis of a manufacturer's certification, or a sample may be sent to the laboratory for testing, in which case three (3) weeks shall be allowed between sampling and intended use.

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REVISION OF SECTION 627
PAVEMENT MARKINGS

BASIS OF PAYMENT

Payment shall be made under:

Pay Item	Pay Unit
Preformed Plastic Pavement Marking – White (Type 1)	Square Foot
Preformed Plastic Pavement Marking (Word-Symbol) (Type 1)	Square Foot
Preformed Plastic Pavement Marking (Xwalk-Stop Line) (Type 1)	Square Foot
Performed Plastic Pavement Marking – Yellow (Type 1)	Square Foot
Temporary Pavement Marking	Gallon

Removal of existing pavement markings, when required, shall be considered incidental to “Pavement Marking Paint (Low VOC Solvent Base)”.

Temporary pavement markings required for traffic control shall be considered incidental to the Lump Sum price for Traffic Control.

END OF SECTION REVISION

**REVISION OF SECTION 630
CONSTRUCTION ZONE TRAFFIC CONTROL**

Section 630 is hereby revised for this project as follows:

Section 630.17 is deleted and replaced with the following

Traffic control devices, flagging, traffic control inspection and traffic control management will not be measured. A suggested phasing plan and tabulation of traffic control devices are included on the drawings. The phasing plan is only a suggestion and the tabulations are for information only. It shall be the Contractors responsibility to prepare construction phasing plans and traffic control plans for the project.

Section 630.18 is deleted and replaced with the following

Construction traffic control will be paid for on a lump sum basis. Payment for traffic control necessary to complete the work shall be full compensation for furnishing, erecting, cleaning, maintaining, resetting, repairing, replacing, moving, removing, and disposing of the construction traffic control devices. The lump sum payment will also include flagging, traffic control inspection and traffic control management.

The lump sum bid price shall be based on the Contractor’s construction phasing plans and traffic control plans.

All construction traffic control devices that are not permanently incorporated into the project will remain the property of the Contractor.

Construction traffic control as determined by the approved project Traffic Control Plan (TCP), will be paid for as follows:

<u>Contract Amount Completed</u>		<u>Traffic Control Paid</u>
Upon First Utilization	=	25%
25%	=	50%
75%	=	90%
100%	=	100%

The percent of original contract amount earned will be determined by comparing the amount earned for bid items, other than traffic control devices and mobilization, with the original contract amount minus the amounts bid for traffic control devices and mobilization.

Payment shall be made under:

Pay Item	Pay Unit
Traffic Control	Lump Sum

Temporary pavement markings required for traffic control shall be considered incidental to the work required for “Traffic Control”.

Removal of temporary pavement markings, when required, shall be considered incidental to the work required for Traffic Control.

2

**REVISION OF SECTION 630
CONSTRUCTION ZONE TRAFFIC CONTROL**

Temporary asphalt required for Traffic Control will not be paid for separately but shall be considered incidental to the project.

END OF SECTION REVISION

TRAFFIC CONTROL PLAN – GENERAL

The key elements of the Contractor's method of handling traffic (MHT) are outlined in subsection 630.10(a). The components of the TCP for this project are included in the following:

- (1) Subsection 104.04 and Section 630 of the Standard Specifications.
- (2) Standard Plan S-630-1, Traffic Controls for Highway Construction, and Standard Plan S-630-2.
- (3) Schedule of Construction Traffic Control Devices (provided for information only).
- (4) Signing Plans
- (5) Construction Phasing Plans and Details (provided for information only).

The Contractor shall provide, erect and maintain proper traffic control devices until the site is open to traffic. The Contractor shall submit a traffic control plan to the City of Thornton for approval prior to construction. Traffic control shall also include safety and control of pedestrians and bicyclists on the sidewalks and trails in and around the project site.

Unless otherwise approved by the Engineer, the Contractor's equipment shall follow normal and legal traffic movements. The Contractor's ingress and egress of the work area shall be accomplished with as little disruption to traffic as possible. Traffic control devices shall be removed by picking up the devices in a reverse sequence to that used for installation. This may require moving backwards through the work zone. When located behind barrier or at other locations shown on approved traffic control plans, equipment may operate in a direction opposite to adjacent traffic.

The responsibility under the Contract for all traffic control resides with the Contractor and any participation by law enforcement personnel in Contractor traffic control activities will be referenced in either the Special Provisions or General Notes of the Plans. Nothing in this Contract is intended to create an entitlement, on the part of the Contractor, to the services or participation of the law enforcement organization.

The flow of vehicular, pedestrian, and bicycle traffic on public streets and roadways shall be maintained at all times during construction in accordance with the rules, regulations, and conditions as set forth in the traffic control permit issued by the City of Thornton Project Manager. Signs, barricades, lights, and warning devices shall be constructed and used in accordance with the MUTCD and the Colorado supplement. The ATSSA Guide shall be strictly followed by the Responsible Party during the progress of the work.

The Responsible Party shall be responsible for the provision of a safe travel way on all streets, roadways sidewalks, and trails on and adjacent to the job site. The Responsible Party shall erect or cause erection of proper traffic control warning devices around all excavations, embankments, and obstructions and shall be responsible for the proper maintenance of said erected devices, in accordance with the traffic control permit and the MUTCD.

TRAFFIC CONTROL PLAN – GENERAL

The Responsible Party shall cause suitable warning lights to be provided and kept lighted at night or other times when visibility is limited. The Responsible Party shall provide flaggers and/or off-duty police protection as may be determined by the City of Thornton Project Manager for the protection of the public, as well as workers on the job site.

The Responsible Party shall coordinate with the Traffic Engineer so that arrangements may be made by the Responsible Party for detours, parking, and access to property adjacent to work, etc., 48 hours prior to their need. A minimum notification of one (1) week is required when detouring a street.

The Responsible Party shall not work within any portion of a street without receiving a Traffic Control Permit from the Traffic Engineer prior to such work. Full roadway closures will be reviewed on a case by case basis. The City reserves the right to refuse to allow full road closures. Requirements for such closures will be determined at the time of issuance of permit. The responsible party will be responsible for all public notices, public meetings, and requirements as outlined in the Traffic Control Permit.

No work shall be allowed at signalized intersections or on arterial roadways which impedes normal traffic flow from 5:00 a.m. to 9:00 a.m., and 3:30 p.m. to 7:00 p.m., except during emergencies or with prior approval of the Traffic Engineer. Failure to complete work within the traffic control permit may result in a "stop work" order.

The Responsible Party shall be responsible for all damages to the work due to failure to place barricades, signs, lights, flaggers, and other workers to protect it. Whenever evidence of such damage is found prior to acceptance, the Traffic Engineer may order the damaged portion immediately removed and replaced by the Responsible Party.

During the construction of this project, traffic shall use the present traveled roadway unless otherwise approved by the Traffic Engineer.

The Contractor shall not have construction equipment or materials in the lanes open to traffic at any time, unless approved by the Traffic Engineer.

During the resurfacing work, only one lane may be closed to traffic at any time unless approved by the Engineer. Traffic shall not be delayed for more than 5 minutes or as directed by the Traffic Engineer.

Except in cases of emergency, maintenance, or protection of work already completed, no work shall be allowed between the hours of 7 p.m. and 7 a.m.; nor on Saturday, Sunday, or legal holidays unless approved by Infrastructure Engineering in each case. When any inspector is required to work outside the hours of 7 a.m. to 4 p.m. on regular City business days, overtime shall be charged to the Responsible Party. However, such Inspectors shall remain employees of the City for all purposes. Requests for overtime shall be made to Infrastructure Engineering at least 48 hours in advance. Payment for such overtime work shall be made to the City prior to final acceptance.

TRAFFIC CONTROL PLAN – GENERAL

Due to lane closure and working time restrictions, the Contractor may utilize steel plates during utility relocation work and during storm sewer, sanitary sewer, and waterline system installations. Steel plates shall be temporarily placed over the open trench prior to opening the work area to traffic. The Contractor is responsible for designing the steel plates, including thickness, width, and secure connection to the existing pavement. The design must meet Load and Resistance Factor Design (LRFD) specifications, and shall include a PE stamp on the design.

When steel plates are used, the pavement area to be overlapped by the plate shall be planed to the depth of the plate to eliminate a vertical edge for traffic. The use of steel plates and detour pavement requires a Methods Statement, including an emergency action plan in the case of any material failures. In the case of failures, any lane closures taken outside of the Traffic Control Plan – General specification shall be treated as a working time violation.

All work associated with the usage of steel plates will not be measured and paid for separately but shall be included in the work.

All costs incidental to the foregoing requirements shall be included in the original contract price for Traffic control.

Unless otherwise authorized by the Engineer, one lane in each direction must be maintained on all affected roadways. No turn movement restrictions will be permitted.

END OF SECTION REVISION

1
UTILITIES

Known utilities within the limits of this project are:

UTILITY / ADDRESS	CONTACT / EMAIL	PHONE
Xcel Energy – Transmission 555 Zang St. Ste 250 Lakewood CO 80228	William Braasch	(303) 618-5049
Xcel Energy – Gas 1123 W. 3 rd Avenue Denver, CO 80223	Branda Sloan Branda.L.Sloan@xcelenergy.com	(303) 628-2276 (720) 354-2000 cell
Century Link 5325 Zuni Street Denver, CO 80221	Justin Metzler	(303) 525-7086
Comcast 8490 Umatilla Street Federal Heights, CO 80260	Katrina Hart	(303) 646-7628
United Power 9586 East I-25 Frontage Road Longmont, CO 80504	Jared Odom	(303) 637-1317
Adams County Fiber Optic – 12 Five Star Schools	Perry Movick Perry.Movick@adams12.org	(720) 933-9982
City of Thornton Traffic Operations 12450 Washington Street Thornton, CO 80241	Vinicio Carrillo vinie.carrillo@cityofthornton.net	(720) 977-6484
City of Thornton Infrastructure Engineering 12450 Washington Street Thornton, CO 80241	Dan Schiltz daniel.schiltz@cityofthornton.net	(720)-977-6226

The work described in these Plans and Specifications requires coordination between the Contractor and the utility companies in accordance with the City's General Conditions in conducting their respective operations as necessary to complete the utility work with minimum delay to the project.

The Contractor shall keep each utility company advised of any work being done to its facility or near its facility, so that the utility company can coordinate its inspections for final acceptance of the work with the Engineer.

The Contractor shall contact Xcel Energy Builder's Call Line at (1-800-628-2121) 30 days in advance of requiring connection to power sources to allow Xcel Energy adequate time for administration and processing of the new street lighting and billing. The Contractor shall be responsible for coordination of power source work to be performed by Xcel Energy. The Contractor shall contact the Xcel Energy Builder's Call Line to coordinate the power sources for both street lighting and the traffic signal as shown on the Plans.

The Contractor shall anticipate abandoned gas and electric lines within the project site. The Contractor shall coordinate with Xcel Energy to locate abandoned lines. Some of the abandoned lines may not be able to be located by Xcel Energy. The Contractor shall coordinate the work so as to avoid delays caused by any abandoned utility lines. No additional payment will be made for coordinating, locating, working around, or removing abandoned utility lines. All work associated with abandoned utility lines shall be considered incidental to the project.

2
UTILITIES

The Contractor shall at times be required to work in close proximity to dry utilities such as electric lines, gas lines, telephone lines, cable television lines, and miscellaneous fiber optic lines. This work may include locating the utilities, potholing utilities, careful excavation around utilities to create slack in the lines for minor vertical adjustments, and forming walls around utilities including PVC sleeves through the wall. This work shall be coordinated with the utility companies and shall be considered incidental to the work requiring the utility adjustments.

The work listed below will be performed by the utility owners or their agents. The cost of the work listed below shall be the responsibility of the utility owner except for supplying power to the street lights and traffic control boxes. Supplying power to the project will be paid for by the Contractor through a force account with the City:

UTILITY COMPANY WORK		
UTILITY	ID NUMBER	DESCRIPTION
United Power	XE1	Relocate switch cabinet
	XE2	Install new pad mount transformer
	XE3	Connections from irrigation control meter to transformer
	XE4	Connections from lighting meter to transformer
COMCAST	COM1	Adjust fiber optic box to finished grade
	COM2	Adjust telephone junction box to finished grade
	COM3	Relocate underground fiber optic lines
	COM4	Relocate telephone pedestal
	COM5	Adjust telephone pedestal to finished grade
	COM6	Relocate fiber optic box

3
UTILITIES

GENERAL:

The Contractor shall comply with Article 1.5 of Title 9, CRS ("Excavation Requirements") when excavation or grading is planned in the area of underground utility facilities. The Contractor shall notify all affected utilities at least two (2) business days, not including the day of notification, prior to commencing such operations. The Contractor shall contact the Utility Notification Center of Colorado (UNCC) at (8-1-1) or 1-800-922-1987 to have locations of UNCC registered lines marked by member companies. All other underground facilities shall be located by contacting the respective company.

Utility service laterals shall also be located prior to beginning excavating or grading.

The location of utility facilities as shown on the plan and profile sheets, and utility plans, and herein described, were obtained from the best available information.

Unless otherwise noted. All costs incidental to the foregoing requirements will not be paid for separately but shall be included in the work.

Refer to the Construction Plans for more information regarding utility work and coordination.

END OF SECTION

1
FRICO COORDINATION

The Contractor shall coordinate with the Farmers Reservoir and Irrigation Company (FRICO). FRICO has required the following:

1. Schedule and conduct a preconstruction meeting at the site with FRICO at least 72 hours prior to the commencement of construction activities.
2. Provide FRICO written notification at least 48 hours prior to beginning construction.
3. Provide a closed utility locate ticket to FRICO representatives at the pre-construction meeting to verify that all existing utilities have been located.
4. Immediately after construction is complete, install marker posts adjacent to FRICO's property on both sides of the canal that identify the crossing and its contents.
5. Provide As-Built Drawings with the actual profile and alignment within FRICO ROW (including x-y-z coordinates at all grade changes and at intervals not to exceed 25 feet) to FRICO at completion of the project. Coordinates are to be in NAD83 State Plane or lat/long format.

FRICO coordination will not be measured and paid for separately but shall be included in the work.

END OF SECTION

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1
**FORCE ACCOUNT ITEMS
DESCRIPTION**

This special provision contains the Department's estimate for force account items included in the Contract. The estimated amounts marked with an asterisk will be added to the total bid to determine the amount of the performance and payment bonds. Force Account work shall be performed as directed by the Engineer.

BASIS OF PAYMENT

Payment will be made in accordance with subsection 109.04. Payment will constitute full compensation for all work necessary to complete the item.

Force account work valued at \$5,000 or less, that must be performed by a licensed journeyman in order to comply with federal, state, or local codes, may be paid for after receipt of an itemized statement endorsed by the Contractor.

Force Account Item	Quantity	Estimated Amount
F/A Obtain Power	F.A.	\$ 10,000
F/A Smoothness Incentive Payment	F.A.	\$ 10,000

F/A Obtain Power – The Contractor shall coordinate with United Power to obtain power and connect it to the street lights, traffic signal, and irrigation equipment. United Power will be paid under this force account. All of the Contractor's cost related to obtaining power is incidental. This is for payment, if necessary, to United Power.

F/A Roadway Smoothness Incentive – Payment for Roadway Smoothness Incentive will be made in accordance with the Standard Specifications Subsection 105.07.

END OF SECTION