CHEYENNE URBAN FORESTRY

TREE SELECTION AND PLANTING

AND

RETENTION AND PROTECTION

SPECIFICATIONS

SECTION 02950 **TREES AND SHRUBS**

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PART 1 - TREE SELECTION AND PLANTING

1.01 SUMMARY

A. Work Included: Provide trees, and planting of same if requested, complete as shown and as specified including a one (1) year guarantee/warranty period if trees are provided and planted by the contractor.

1.02 QUALITY ASSURANCE

A. Certificates

1. Submit certificates of inspection required by law for transportation of each shipment of plants along with the invoice.

2. File copies of certificates after acceptance of material. Inspection by Governmental agencies at place of growth does not preclude rejection of plants at the project site.

B. Applicable Standards: Apply standards for plant materials as described in the following:

1. "American Standard for Nursery Stock, ANSI Z60.1-1996" or a current edition, American Association of Nurserymen, Inc.

1.03 PROJECT CONDITIONS

A. Planting work shall be done under the direct supervision of a qualified superintendent working on the site with experienced laborers familiar with planting procedures.

B. Contractor shall be responsible for obtaining any permits associated with planting in public rights-of-way and/or storage of materials.

C. Existing Conditions:

1. Vehicular accessibility on site shall be as directed by Director of Forestry or project supervisor. Repair damage to prepared grounds and surfaces caused by vehicular movement during

work under this section to original condition at no additional cost to Owner.

1.04 SEQUENCING AND SCHEDULING

A. Construction Sequencing:

1. Schedule plant installation work just ahead of sodding operations where possible to allow sprinkler system or other watering coverage coincidental with grass watering. However, make whatever interim watering provisions that are necessary to maintain plants until such time as sprinkler systems are completely operational and plant material has been accepted as installed.

1.05 SUBMITTALS

A. Samples: If required, submit samples three (3) weeks prior to delivery to site. Attach product name, address of manufacturer and/or supplier to each sample.

1. Mulch: Wood - One (1) pint.
2. Organic Soil Amendments: One (1) Pint of each type.
3. Tree Strap: One (1).
4. Fertilizer (as recommended from soil lab): Manufacturer's product information, as well as receipts of purchase.

1.06 WORK SCHEDULE

A. Contractor shall inform the City Forestry Office of anticipated work schedule.

1.07 INSPECTION AND TAGGING OF PLANT MATERIAL

A. Contractor shall notify the City Forestry Office when all (or most) of the plant materials are available for inspection. Only materials in compliance with Section 2.01 shall be acceptable. Trees delivered to the site without the City's tags, if specified, and/or trees damaged in shipment may be rejected.

B. Unavailable Material: If proof is submitted that any plant specified is not obtainable, a proposal will be considered for use of the nearest equivalent size or variety with corresponding adjustment of contract price. Substantiate such proof in writing no later than 30 days after the award of contract.

C. Special Conditions: The above provisions shall not relieve Contractor of the responsibility of obtaining specified materials in advance if special growing conditions or other arrangements must be made in order to supply specified materials.

1.08 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Labeling: Furnish standard products in manufacturer's standard containers bearing original labels legibly showing quantity, analyses, genus/species/variety/ cultivar and name of manufacturer/grower. Labeling need not apply to collected material. However, contractor shall warrant that plant material is true to species specified.

B. Transportation: During transportation, Contractor shall protect plant material from desiccation and all other damage.

C. Storage: Store products with protection from weather or other conditions which would damage or impair the effectiveness of the product.

D. Handling: Do not lift or handle container plants by tops, stems or trunks at any time. Do not bind or handle plants with wire or rope at any time.

E. Anti-Desiccant: At Contractor's option, spray all evergreen or deciduous plant material in full leaf with anti-desiccant just before transporting. Apply an adequate film over trunks, branches, twigs and foliage.

1.09 ANALYSES OF SAMPLES AND TESTS

A. Sampling: Owner reserves right to take and analyze samples of materials for conformity to specifications at any time. Furnish samples upon request.

B. Rejected Materials: Contractor shall remove rejected materials immediately from the site at his/her own expense. Contractor shall pay cost of testing materials not meeting specifications.

1.10 WARRANTY

A. Warranties:

1. Correct Species: Warrant that all plant materials are true to species, variety and cultivar.

2. Vigor: Warrant that all trees planted under this Contract shall be healthy and in flourishing condition of active growth (in the

opinion of the City) one year from date of Initial Acceptance.

3. Delays: All delays in completion of planting operations which extend the planting into more than one planting season shall extend the Warranty Period correspondingly.

4. Condition of Plants: Plants shall be free of dead or dying branches and branch tips, mechanical injury, and co-dominant stems. All foliage shall be of normal density, size and color. Plants shall be free of sun-scald, disease and insect infestations and shall have healthy buds. All plants shall be symmetrical. All root-balls shall be properly bound with burlap and wire baskets. Extremely dry or crushed root-balls will be rejected. Trees shall be dug and transplanted in the same growing season.

5. Replacements: As soon as weather conditions permit, replace, without cost to City, all dead plants and all plants not in a vigorous, thriving condition, as determined by City's Representative during and at the end of the Warranty Period. Replacement materials shall be subject to the same inspection process and all other requirements of original material.

6. Exclusions: Contractor shall not be held responsible for failures due to neglect by City or vandalism during Warranty Period. Report such conditions to City's Representative.

1.11 REPLACEMENTS

A. Warranty: For a period of one (1) year after Initial Acceptance of all work and at no additional cost to the City, the Contractor shall replace any plant material that is dead, or that is, in the opinion of the City's Representative, in unhealthy or unsightly condition, or that has lost its natural shape due to dead branches or excessive pruning of dead branches.

1. Execute replacement plantings within ten (10) days of notice to replace such plants.

B. Failed Materials:

1. Plant materials exhibiting conditions which are determined unacceptable due to poor installation by the Contractor shall be repaired and/or replaced at no additional cost to the City.

2. Contractor shall closely match replacements to adjacent specimens of the same species. Apply all requirements of these specifications to all replacements.

C. Incorrect materials:

1. During Warranty Period, replace at no cost to City all plants revealed as being untrue to name.

2. Provide replacements of a size and quantity to match the planted materials at the time the mistake is discovered.

SECTION 2 PRODUCTS

2.01 PLANT MATERIALS

A. General: Only plant material suited for growth in United States Department of Agriculture hardiness zones 2, 3, & 4, will be acceptable for this project.

1. Growing Conditions: Plants shall be nursery-grown in accordance with good horticultural practices under climatic conditions similar to those of project for at least two (2) years unless otherwise specifically authorized.

2. Collected Plant Material: All plant material which, due to size or quantity, cannot be nursery grown, may be collected. Contractor, and if possible, the Director of Forestry or Representative will review this plant material in its native state before collection as is reasonably practical. The Director of Forestry or Representative reserves the right to reject this same material once it reaches the site if, in his/her opinion, it is not of the same quality as when it was initially reviewed.

3. Appearance: All plants shall be exceptionally heavy, symmetrical, tightly knit, and so trained or favored in development and appearance as to be superior in form for their species, with regard to number of branches, compactness, and symmetry. Trees which have multiple leaders, unless specified, or damaged or crooked leaders, will be rejected. Trees with abrasions of the bark, sun-scald, disfiguring knots, or improper pruning cuts shall be rejected.

4. Vigor: Plants shall be sound, healthy and vigorous, well branched and densely foliated when in leaf. They shall be free

of disease and insect pests. They shall have healthy, well-developed root systems. Plants shall be free from physical damage or adverse conditions which would prevent thriving growth.

5. Plants shall be harvested and transplanted during the same growing season.

B. Condition of Root System: The root-balls of all trees must be completely free of circling or girdling roots.

C. Measurements:

1. General: Measure plants when branches are in their normal upright position. Height and spread dimensions specified refer to main body of plant and not branch tip to tip. Take a caliper (trunk diameter) measurement at a point on the trunk six inches (6") above natural ground line for trees up to four inches (4") in caliper and at a point twelve (12") inches above the natural ground line for trees over four inches (4") in caliper.

2. Substitutions: Substituted plants shall be true to species and variety and shall conform to measurements specified except that plants larger than specified may be used if accepted by City.

2.02 ORGANIC MATERIALS

A. Organic Materials shall consist of material with a pH of less than seven point five (7.5), an organic content of at least 40%, and a salt index of less than three (3) mmhos/cm. The material shall be finely shredded and free of sticks, stones, lumps, and noxious weeds.

B. If requested, the contractor shall submit a sample to the City's Representative for approval ten (10) days before delivery to the site.

C. Contractor shall, at his/her own expense, supply test results from an approved soils testing laboratory if requested by the City's Representative.

2.03 COMMERCIAL FERTILIZERS

A. If required, each planting site shall have the fertilizer specified on the soil lab report thoroughly incorporated into the tilled planting site.

2.04 STAKING MATERIAL

A. Wire supports shall be 12-gauge, double strand, galvanized steel.

B. Tree brace straps, designed for specifically staking trees, shall be provided at connection of guy support wires to tree trunk. Straps shall be 12"x1½" nylon/cotton weave with ¾" brass grommet at each end.

C. Staking poles shall be standard "T", six feet (6') high steel or wood fence posts, dark green or approved color.

2.05 WATER

A. Clean and fresh.

B. Transport as required.

2.06 MULCHING MATERIAL

A. Trees in turf areas shall be mulched with a chipped bark and/or wood mulch not larger than four inches (4") in length.

2.07 ANTI-DESICCANT

A. Anti-desiccants for retarding excessive loss of plant moisture and inhibiting wilt shall be sprayable, water insoluble vinyl-vinyledine complex which will produce a moisture retarding barrier not removable by rain or snow.

2.08 TREE WRAP

A. Tree wrapping material shall be four inches (4") wide, brown in color, and specifically manufactured for tree wrapping.

SECTION 3 EXECUTION

3.01 LAYOUT AND EXCAVATION OF PLANTING AREAS

A. Layout and Staking: Lay out plants at locations shown on drawings. Use three foot (3') stake to indicate tree location.

B. Review: Locations of plants shall be checked in the field and shall be adjusted to exact position before planting begins. Right is reserved to refuse review at this time if, in the City's Representative's opinion, an insufficient

quantity of plants are available. Contact City's Representative before planting begins.

C. Planting Site: Till the soil, in an area four times the width of the root-ball, to a depth of eight inches, if the area to be tilled will not conflict with structures, plants, or infrastructure. In this stage, incorporate organic soil amendments and/or fertilizer according to Section 2.02 A., and 2.03 A. Mix the amendments into the soil during the soil tilling process. Organic soil is added at a rate of one inch in depth covering the area tilled. Fertilizer is added according to product label for tree use.

D. Excavate B&B tree pits to a width at least twice the diameter of the ball, but to a depth of two (2") inches less than the height of the root-ball, as noted below in section 3.02.

E. Equipment for Digging Plant Pits: Use of a tree spade to dig plant pits is prohibited. A backhoe is acceptable, with scarification of the tree pit after excavation - see Section 3.02-C below.

3.02 PLANTING OPERATIONS

A. General:

1. Protect plants at all times from sun or drying winds.

2. Keep plants that cannot be planted immediately upon delivery in the shade, well-protected and well-watered.

B. Handling and De-potting of Plant Materials:

1. Avoid all damage to containers and root-balls. If root-ball is cracked or broken during handling, plant shall be rejected.

C. Installation:

1. Plant Pit: Dig pit depth two inches (2") less than the height of the root-ball. Scarify sides of plant pit, thoroughly breaking up all surfaces and eliminating all "glazed" areas.

2. Remove bottom of the wire basket prior to setting into the pit.

3. Positioning: Plants shall be set in the center of the pit, kept plumb and straight, and backfilled with the mixture of native soil and specified organic material removed from the planting pit. All B&B stock shall have binding twine cut free from the ball

and trunk. After placement, remove the remainder of the wire basket. Cut and remove burlap from upper two-thirds of root-ball.

4. Back-filling:

a. Backfill shall be the same soil taken out to dig the hole.

b. Use backfill mix to backfill plant pits. Brace each plant plumb and rigidly in position until planting soil has been tamped around the bottom of the root-ball.

c. Contractor shall remove excessive excavated planting backfill material from the site as directed by the City's Representative.

5. Staking and/or Guying: Stake or guy as outlined in Section 3.03.

E. Adjustment: Adjust plants so that after full settlement has occurred, the grade at the base of the plants is not less than one (1") inch and not more than two (2") inches above the adjacent planting finish grade.

F. Tree Wells: A two to three-inch (2"-3") high earth berm shall be formed on the perimeter of the planting pit, unless otherwise specified. (For mulching see Section 3.04 A.)

G. Tree Wrap: Wrap, as detailed, all trees in the month of October and remove upon full leaf expansion in the spring.

H. Watering: Water all plants immediately after completion of planting operations with a deep watering device or surface application allowing water to soak into the root-ball and backfill soil. Contractor shall provide watering services for proper frequency and amount for the health and full development of all contractor-installed plant materials until Final Acceptance and as required during the guarantee period, including winter months.

1. The amount will be no less than ten gallons of water for each one inch caliper measure.

2. Frequency will depend upon the plant available retention of water in the soil.

I. Labels: Do not remove nursery-type plant labels or any City of Cheyenne tags from the trees until after Initial Acceptance.

3.03 STAKING AND GUYING

A. General:

1. Trees shall be able to stand upright without support. Trees shall be staked, if so indicated on planting detail plan.

2. All plant materials shall remain plumb and straight for all given conditions from installation through the guarantee period.

B. Staking:

1. Trees shall be staked and guyed as detailed below.

2. Locate (two) stakes in a line with the trunk of the tree, perpendicular to prevailing wind. Drive stakes at least twenty-four (24) inches down into undisturbed soil.

3. Wire support straps shall be placed around the trunk in a single loop. Run wire through grommets on support strap. Trees shall be guyed so as to allow the tree trunk to sway two inches (2").

3.04 MULCHING

A. Install a three to four-inch (3" to 4") deep layer of mulch within the area enclosed by the soil ring, and not in contact with tree trunk.

3.05 CLEAN-UP

A. Keep all areas of work clean, neat and orderly.

B. Clean up and remove all materials and debris from the entire work area prior to Initial Acceptance.

3.06 MAINTENANCE

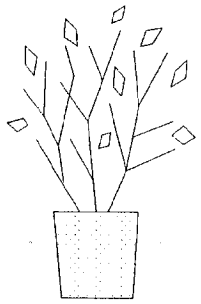
A. If the irrigation system is not available for proper watering at the time of installation, the Contractor shall provide and maintain temporary piping, hose, and water equipment as required to convey water from the source. Failure of the irrigation system shall not relieve Contractor of the

responsibility to provide the required water.

3.07 WINTER WATERING

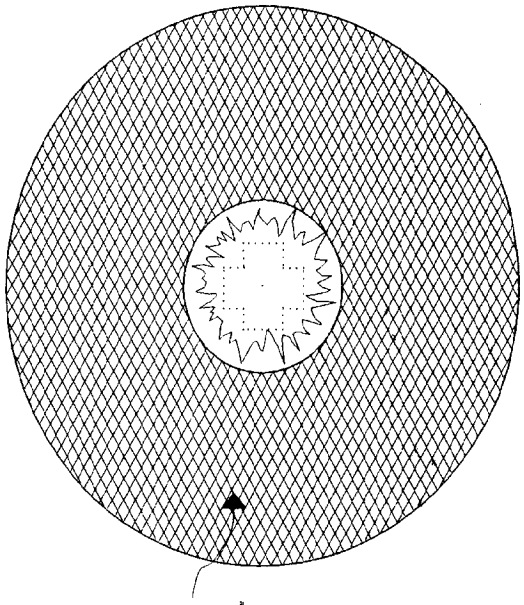
A. Contractor shall provide winter watering of all trees and other materials as needed during the warranty period. Contractor shall maintain a log of all watering and maintenance operations.

PLANTING METHOD FOR CONTAINERIZED TREES & SHRUBS



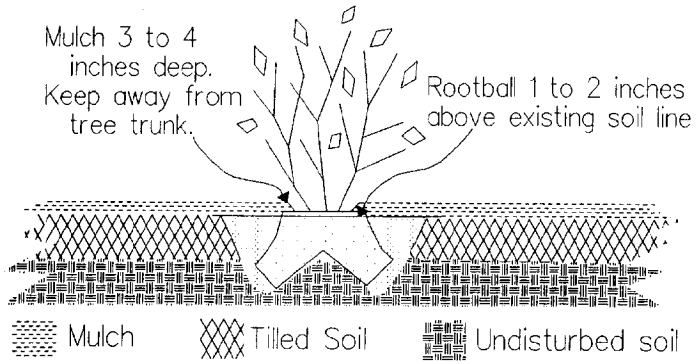
Containerized
Tree or Shrub

Overhead view of Planting Site
Showing rootball split four ways



Soil tilled 5 times wider
than rootball, to a depth
of 8 inches or more.

Split rootball four ways to cut circling roots



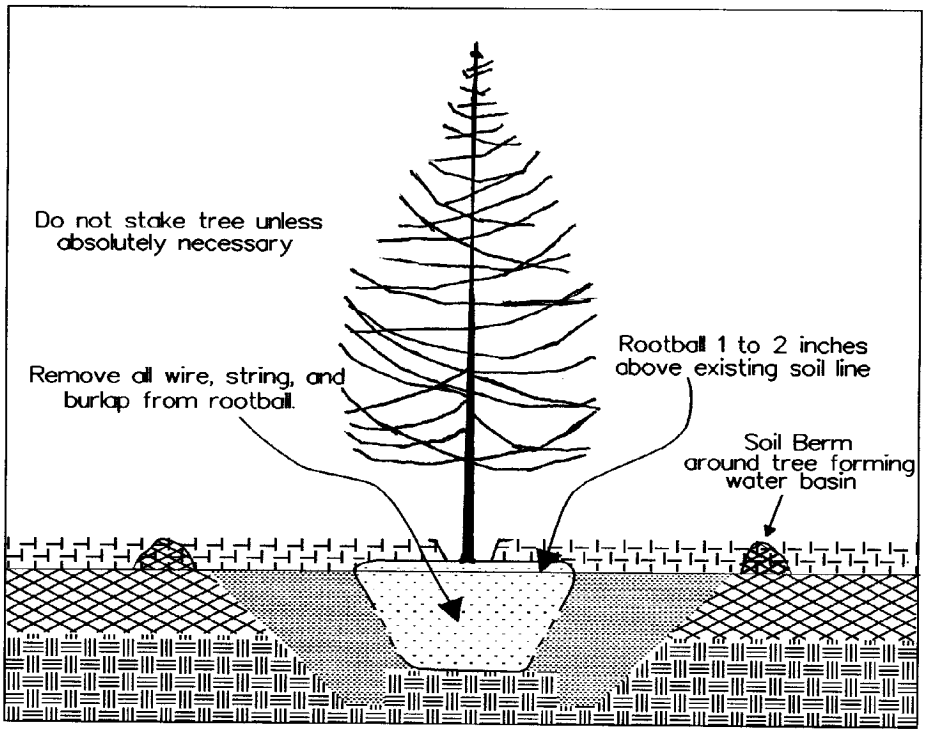
Mulch Tilled Soil Undisturbed soil

Soil taken from planting hole used as backfill

Cheyenne Urban Forestry Division

02950-13

Balled & Burlapped (B&B) Tree Planting Method



Undisturbed soil. Tree rootball must be set on solid soil.

Prepare tree planting site, five times larger than root ball.
Till soil to 8 inch depth, mix in composted organic material.

Soil taken from planting hole used as backfill around rootball.

Mulch layer of wood chips or bark 3 to 4 inches deep.
Keep mulch 3 inches away from tree trunk.

Soil watering ring, if desired, from remaining backfill.

END OF TREE SELECTION AND PLANTING SPECIFICATIONS

PART 2 - TREE RETENTION AND PROTECTION

4.00 GENERAL REQUIREMENTS

A. There should be daily supervision of field crews by the City Forestry Staff or Project Consulting Arborist during the critical phases of the project: for example, demolition of existing concrete; root pruning; construction of retaining walls or sand walls; and construction of new curb or sidewalk in tree protection areas.

B. To prevent or minimize soil compaction, designated routes for equipment and foot traffic by work crews shall be determined prior to commencing construction activities, and shall be indicated in the tree protection plan. These routes shall be marked at the site, prior to commencement of construction, with tree protection fencing and signage as specified in Sections 6.05 & 6.06 (tree protection fencing).

C. Motorized equipment and trailers, including but not limited to tractors, Bobcats, bulldozers, trackhoes, trucks, cars, and carts shall not be allowed access within tree protection areas. Should access be necessary within designated tree protection areas, the existing grade shall be covered with six (6) to eight (8) inches of wood mulch to help distribute the weight of equipment and to minimize soil compaction and rutting. Plywood and/or mulch are not acceptable bridging materials for driving over exposed tree roots. Exposed tree roots shall not be driven over. The Director of Forestry or Project Consulting Arborist shall be notified and shall approve of the access and driving surface prior to its use.

D. Materials and supplies shall not be stockpiled or stored within the tree protection area. Should temporary storage be necessary within designated tree protection areas, the existing grade shall be covered with double, overlapping sheets of ¾ inch thick plywood, or six (6) to eight (8) inches of wood mulch to help distribute the weight of materials or supplies and to minimize soil compaction.

E. Under no circumstances shall any objects or materials be leaned against or supported by a tree's trunk, branches, or exposed roots. The attachment or installation to trees of any sign, cable, wire, nail, swing, or any other material that is not needed to help support the natural structure of the tree is prohibited. Standard arboricultural techniques such as bracing or cabling that are performed by professional arborists are acceptable upon approval by the Director of Forestry or Project Consulting Arborist.

F. A monetary fine may be imposed by the project coordinator if the fenced tree protection area is breached.

4.01 DEFINITIONS

A. TREE PROTECTION AREA: Generally, a tree protection area should consist of the ground encompassing from 1.5 (minimum) to 2.0 times the distance between the trunk and dripline, or one linear foot away from the trunk base for every inch diameter of the trunk, whichever is greater. (See section B below). Areas of ground covered by pavement, buildings, or other permanent structures where the presence of roots is minimal or negligible, are excluded. The area under or within the tree's dripline is also referred to as the "Critical Root Zone". (See section C below).

With groups of trees or where an array effect is present, there may be discontinuous (non-overlapping) perimeters of tree protection areas which result in difficult to maintain or ineffective tree protection fencing. In these cases, even though tree protection areas do not overlap, they should be treated as though they do if the distance between the perimeters of such areas is less than thirty (30) feet. In effect, this will artificially enlarge the area of tree protection, but will result in a clearly defined, manageable area.

B. DRIPLINE: The outermost edge of the tree's canopy or branch spread. The area within a tree's dripline is all the ground under the total branch spread.

C. CRITICAL ROOT ZONE: Generally, all of the ground area included in the dripline.

D. DIAMETER (CALIPER): The size (in inches) of a tree's trunk is measured at: **[1]**-six (6) inches above grade for trunk diameters up to and including four (4) inches; **[2]**-twelve (12) inches above grade for trunk diameters from four (4) inches up to and including eight (8) inches; and **[3]**-four and a half (4½) feet above grade for trunk diameters greater than eight (8) inches; in accordance with guidelines established in the "Guide for Plant Appraisal" (see Section 5.00). All measurements should be rounded to the nearest inch.

E. HIGH-VALUE SHRUB: Any specimen shrub with an appraised value of $100.00 or more.

F. PROJECT CONSULTING ARBORIST: An independent consultant with a degree in a field related to arboriculture, and at least five years field

experience in tree preservation or on-site monitoring of public works or construction projects involving tree retention and protection. The consultant should be an active member in the American Society of Consulting Arborists and International Society of Arboriculture.

5.00 REFERENCE STANDARDS AND GUIDELINES

A. Contractor shall comply with applicable requirements and recommendations of the most current versions of the following standards and guidelines. Where these conflict with other specified requirements, the more restrictive requirements shall govern.

1. ANSI Z133.1-2000
American National Standard for Arboricultural Operations

2. ANSI A300 (Part 1) 2001 Pruning, (Part 2)-1998 Fertilization, (Part 3)-2000 Support Sytems
Standard Practices for Trees, Shrubs and Other Woody Plant Maintenance

3. GUIDE FOR PLANT APPRAISAL-9TH EDITION
Authored by the Council of Tree and Landscape Appraisers; published by the International Society of Arboriculture.

6.00 TREE RETENTION AND PROTECTION

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

6.01 DEMOLITION OF EXISTING CONCRETE

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

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

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

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

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

E. Motorized equipment and trailers, including tractors, Bobcats, bulldozers, trackhoes, trucks, cars, and carts are to be limited to access on the existing paved street only. Access is not allowed behind the curb within tree protection areas.

F. Should access be necessary within designated tree protection areas, the existing grade shall be covered with double, overlapping sheets of ¾ inch thick plywood, or six (6) to eight (8) inches of wood mulch to help distribute the weight of equipment and to minimize soil compaction and rutting. Plywood and/or mulch are not acceptable bridging materials for driving over exposed tree roots. Exposed tree roots shall not be driven over. The Director of Forestry or Project Consulting Arborist shall be notified and shall approve of the access and driving surface prior to its use.

6.02 CONSTRUCTION OF SIDEWALKS, CURBS, CONCRETE PAVING AND DRAINAGE INLETS

The following procedures shall be used when constructing sidewalks, curbs, concrete paving, and drainage inlets.

A. Keep all materials and equipment within the street bounded by existing curbs.

B. Protect exposed roots from contamination by stabilization materials and concrete.

C. Locate concrete washout areas away from roots and tree protection areas.

D. When excavating for the construction of inlets, excavated soil shall be deposited in trucks and hauled off or deposited temporarily on ¾ inch thick plywood outside the critical root zone. Excavated and fill soil shall not be deposited, even temporarily, on unprotected natural grade.

E. After proper pruning (see section 6.04), as needed, cover exposed roots within thirty (30) minutes to minimize desiccation. Roots may be covered with soil, mulch, or moistened burlap (7 ounce or equivalent), and shall be kept moist during the period until the final grade is established.

F. Where possible, sidewalks should be raised, narrowed, curved, or relocated to prevent cutting and removing major roots (e.g., roots greater than three inches in diameter).

G. Place a sheet of six (6) mil or thicker plastic over the grade within affected portions of tree protection areas prior to pouring concrete sidewalks, curbs, inlets, ramps, and driveway approaches. The plastic will assist in providing a non-leaching barrier between the concrete, soil and roots.

H. Construct new sidewalks on, or above, the existing grade instead of excavating into root zones. The new grade shall not interfere with sheet-flow drainage.

I. Limit grading to a maximum of two (2) inches fill over the natural grade within critical root zones. Fill should consist of sandy loam topsoil. Clay soils shall not be used as fill. When using fill soil, the existing surface to receive fill should be scarified prior to filling. Any filling operation should not occur during water saturated soil conditions.

J. Existing soil may be used as a form for back of curb and gutter, with or without the use of a thin masonite-type form, although a masonite form is preferred. This will minimize excavation in the critical root zone and prevent undue injury to the roots. This method is unnecessary in areas outside the critical root zone. Place a layer of Typar BioBarrier between the curb and tree roots to help inhibit root growth that may exploit small cracks in the curb. Were appropriate, use curbs with discontinuous footings to maintain the natural grade near the base of trees adjacent to the curbing, and to minimize injury to roots and root flares.

K. Provide for easy concrete removal and replacement where an obvious raised root may cause sidewalk cracking in the future. This can be accomplished by installing an expansion joint on either side of the root or by etching the concrete on either side of the root to allow that particular section to be broken out and replaced. Compaction rating for the replacement walkway should not exceed 80% Proctor density. Tree roots will continue to slowly add girth every year; therefore, the base material needs to be malleable (e.g., suitable sub grade aggregates, crushed granite, or compacted sand) to prevent a fulcrum or pressure point which can crack or heave the walkway.

L. Where appropriate, and under the direction of the Director of Forestry or Project Consulting Arborist, root restricting barriers can be installed with a minimal amount of disturbance. There are several promising landscape related materials used as barriers to root growth, especially away from sidewalks, curbs and streets. Three such materials are: (1) a stiff nylon

woven fabric (Q899 nylon fabric with extra firm finish from Jason Mills, Westwood, NJ); (2) 14-mesh or smaller copper wire screen; and (3) Typar BioBarrier (REEMAY, Inc., Old Hickory, TN). The nylon fabric has holes approximately 1/26th-inch square separated by strands approximately 1/26th-inch thick, with strands fused together. Copper screen has been shown to be effective in controlling seedling root growth. Typar BioBarrier is a commercial product developed specifically to control roots of trees, and consists of a felt-like spun-bounded polypropylene fabric to which polyethylene pellets are attached at one and a half (1½) by one and a half (1½) inch spacing. The pellets are impregnated with the herbicide Trifluralin and release it slowly over time (many years). After a two (2) foot deep, narrow trench is dug adjacent to the curb, sidewalk, or other structure involved, and after any affected roots are properly pruned (see section 6.04), the material of choice should be placed against the side of the wall closest to the roots that were severed (side of the wall farthest from the structure being protected). Note: This procedure should not be used if large, existing roots (four (4) inches or larger in diameter) will be severed. The nylon fabric and copper screen will constrict roots to the size of the openings in the material; beyond the constrictions, roots will be greatly stunted except for knobs that form against the barriers. The barrier should be installed at least eighteen (18) to twenty-four (24) inches deep (in a vertical plane).

M. In areas where roots have to be removed for construction of drain inlets, roots shall be severed prior to excavation to eliminate unnecessary tearing of roots by equipment.

1. Excavate soil by hand at the construction cut limit to a depth of thirty (30) inches or to the depth of the required root cut, whichever is less.
2. Prune roots as specified in section 6.04.
3. Protect exposed roots as specified in section 6.02,E.

N. Concrete or chemicals spilled within tree protection areas should be completely removed. Contamination soil shall be completely removed at the time of the spill and removed by hand without disturbance to root systems. Appropriate soil should be added as necessary to restore the grade.

6.03 IRRIGATION OR UTILITY INSTALLATION

A. PROTECTION OF TREES AND HIGH-VALUE SHRUBS:
Contractor shall protect all trees and high-value shrubs from injury due to irrigation related work. All injuries to trees and high-value shrubs shall be mitigated to the satisfaction of the City, and, if appropriate in accordance with guidelines established in the "Guide for Plant Appraisal". All costs of

such mitigating shall be charged to and paid by the Contractor.

All irrigation lines shall be indicated on construction plans and pre-approved by the Director of Forestry or Project Consulting Arborist. Unless absolutely necessary, no irrigation lines shall be located within 10 feet of any existing tree trunk. (See Section B-5 below).

B. EXISTING TREES

1. The Director of Forestry or Project Consulting Arborist shall be notified prior to any trenching or excavation known or suspected to involve cutting of more than: **[1]**- two roots, three inches or more in diameter; and/or **[2]**-four roots between two (2) and three (3) inches in diameter. The Director of Forestry or Project Consulting Arborist shall be notified immediately in the event that roots in excess of that described above are cut, torn, ripped, or otherwise injured.

2. All trenching or other work under the dripline of any tree shall be done by hand or by other methods which will prevent breakage or other injury to branches and roots.

3. Where it is necessary to excavate within the critical root zone of existing trees, contractor shall use all possible care to avoid injury to trees and tree roots. Excavation, in areas where two (2) inch diameter and larger roots occur, shall be done by hand with approved hand tools. Where possible, tree roots two (2) inches or larger in diameter shall be tunneled or bored under and shall be covered with moistened burlap to prevent excessive drying.

4. Wherever a trenching machine exposes roots smaller than two (2) inches in diameter, such roots extending through the trench wall shall be hand pruned (see section 6.04). All trenches within critical root zones shall be closed within twelve (12) hours-if this is not possible, the trench walls shall be covered with burlap and kept moistened. Prior to backfilling, Contractor shall contact the Director of Forestry or Project Consulting Arborist to inspect the condition and treatment of roots larger than two (2) inches in diameter injured by trenching.

5. Horizontal directional boring(auger tunneling), rather than open trenching, should be used for irrigation line or other utility

installation within one half (½) foot linear distance from the trunk base for every inch of trunk diameter, if root disruption or utility installation occurs on no more than one side of the tree. If trenching or utility installation will occur on two or more sides of a tree trunk (e.g., N,S,E, or W), then horizontal directional boring should be used if line installation is within one (1) foot linear distance from the trunk base for every inch of trunk diameter.

6.04 ROOT PRUNING

Tree roots shall not be pruned or cut unless their removal is unavoidable or absolutely necessary. The Director of Forestry or Project Consulting Arborist shall be notified prior to any operation known or suspected to involve cutting of more than: **[1]**- two roots, three (3) inches or more in diameter; and/or **[2]**- four (4) roots between two (2) and three (3) inches in diameter. The Director of Forestry or Project Consulting Arborist shall be notified immediately in the event that roots in excess of that described above are cut, torn, ripped, or otherwise injured.

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

B. Removal of roots greater than one (1) inch diameter or parts of roots that are injured or diseased should be performed as follows:

1. Preserve the root bark ridge (similar in structure and function to a branch bark ridge). Directional root pruning is the recommended technique and should be used during hand excavation around tree roots. Roots are similar to branches in their response to pruning practices. With directional root pruning, objectionable and severely injured roots are properly cut to a lateral root, if possible, that is growing downward or in a favorable direction.

2. All roots needing to be pruned or removed shall be cut cleanly with sharp hand tools, with oversight by the Director of Forestry or Project Consulting Arborist. No wound dressings shall be used.

3. Recommended root pruning tools:
   a. By-Pass type lopper.
   b. By-Pass type pruner.
   c. Large and small hand saws.
   d. Wound scriber.
   e. Trowel or small shovel.
   f. Garden Fork.
   g. Hand broom.

C. ROOT PRUNING NEAR SIDEWALKS

1. Root pruning should be done carefully, by hand, to achieve the objective of reducing future sidewalk problems as well as preserving the trees. Removing anchoring roots or causing injuries in anchoring roots and root flares can cause future decay and windthrow hazards. Indiscriminate cutting of vigorous roots results in their resprouting so that several more new roots may grow from the cut end, back under the sidewalk, thereby reducing the time between sidewalk repairs. Roots can be managed in the ground without significant harm to trees, if care is taken to avoid injuries that lead to root and trunk decay.

2. Directional root pruning is recommended because it considers the tree's response to root pruning and decay. With directional root pruning, roots are cut to a large lateral, if possible, that is growing downward or in a more favorable direction. The pruned root ends will be less likely to resprout, since a large lateral can assume the new terminal role of the root.

   Proper removal of selected roots or parts of roots can direct roots away from sidewalks in the future. Procedures for root pruning directly next to sidewalks are as follows:

   a. Hand dig a trench six (6) to eight (8) inches in depth at the edge of the planting strip and sidewalk.

   b. Remove all roots less than two (2) inches in diameter in this trench back to a desirable lateral root, preserving the root bark ridge. If careful excavation does not reveal a desirable lateral root within twelve (12) inches of the exposed root

in question, then the exposed root shall be pruned properly so that a minimal amount of root is removed.

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

3. All roots between two (2) and four (4) inches in diameter should be examined by the Director of Forestry or Project Consulting Arborist in terms of their role in anchoring the tree.

a. All roots that contribute significantly to anchorage should be preserved. Remove all other roots in this size range to sound, downward growing lateral roots that are at least one half (½) the size of the root being removed.

b. All roots larger than four (4) inches in diameter are to be preserved unless their removal is absolutely necessary. Preservation of large roots may require: **[1]**- reducing the sidewalk width near the root flare; and/or **[2]**- ramping or bridging the sidewalk over the roots to allow for root growth.

4. Tree guying subsequent to root pruning:

Upon review of on-site root pruning and constructing grading limits, the Director of Forestry or Project Consulting Arborist shall determine if existing trees subject to root pruning should be guyed or otherwise stabilized. Contractor shall retain a qualified tree service company to complete tree guying and stabilization in accordance with National Arborist Association standards as referenced in Section 5.00. Tree service company shall be licensed by the City of Cheyenne, through the Director of Forestry's Office.

6.05 TREE PROTECTION FENCING

A. Tree protection fencing should be installed two (2) feet behind the existing curb in areas where the street surface will be removed and replaced. Tree protection areas shall be designated on construction documents, and

fencing locations should be staked for approval by the Construction Manager and Director of Forestry or Project Consulting Arborist.

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

1. Galvanized chain-link - six (6) feet in height. Posts should be installed on ten (10) foot centers (maximum), at a depth of three (3) feet minimum. Installation of post shall not result in injury to surface roots or root flares of trees.

2. Colored (orange), molded plastic construction fencing-four (4) feet in height.

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

D. Tree protection fencing shall be installed prior to any site activity and shall remain until its removal is authorized by the Director of Forestry or Project Consulting Arborist.

6.06 TREE PROTECTION SIGNAGE

A sign shall be mounted on tree protection fencing at fifty (50) foot intervals warning constructing personnel and the public to keep out of the tree protection areas.

7.00 PROJECT SITE MONITORING

As determined by the Director of Forestry for projects of sufficient size to warrant such, a Project Consulting Arborist should be retained to enforce and monitor the Tree Retention and Protection objectives. The project site should be monitored a minimum of two (2) times weekly-more frequently at the start of the project until all procedures and specifications are understood and properly executed by all parties. Specific monitoring schedules should be developed at preconstruction meetings and modified as deemed necessary by the appropriate parties.

8.00 INJURIES TO EXISTING PLANTS - DAMAGE PENALTIES

A. TREE AND HIGH-VALUE SHRUB APPRAISAL:

All trees and high-value shrubs will be evaluated and appraised by the Director of Forestry or Project Consulting Arborist, and a list of all tree values for the project will be on file in the Construction Manager's office. Any tree or other plant requiring retention or protection that is not on the list shall be appraised by the Director of Forestry or Project Consulting Arborist

as necessary to comply with this damage penalty.

Documentation for appraisals will consist of:
[1]-measurement of plant size; **[2]**-identification by common and botanical names; **[3]**-current condition (overall health, injuries, overt hazard status, etc.) and **[4]**-location factors as described in the "Guide for Plant Appraisal". Photographs may be taken of certain trees and shrubs to document debilitating condition factors.

The threshold level for plants to be appraised shall be $100.00; only those trees and shrubs estimated to have a monetary value greater than $100.00 shall be appraised.

B. Trees and other plants designated as requiring retention or protection shall be identified and located on construction plans. Loss of, or partial injury to, any of these plants due to Contractor neglect or improper construction activities will result in liquidated damages for the assessed value of the tree as determined by the Director of Forestry or Project Consulting Arborist.

C. Trees determined as requiring "general protection" or "special protection" in the construction areas and in other key locations should be clearly identified by the Director of Forestry or Project Consulting Arborist. Loss or partial injury to any of these trees due to Contractor neglect or improper construction activities will result in liquidated damages for the assessed value of the trees as determined by the Director of Forestry or Project Consulting Arborist. Injury to a portion of these trees will be assessed by the Director of Forestry or Project Consulting Arborist and a corresponding portion of the liquidated damages will be assessed to the Contractor.

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

E. Trees or roots visibly and unnecessarily injured will cause the City to withhold from the Contractor an assessed amount conforming to the requirements stipulated above, for a period of one full year. After that period the impact of the injury to any tree will be assessed by the Director of Forestry or the Project Consulting Arborist.

F. If any trees or shrubs designated to be retained or protected are injured and replacement is justified, a number and equivalent diameter inches of trees or

shrubs of same or similar species shall be furnished and planted by the Contractor. The total inch diameter of the replacement plant(s) shall equal the diameter of the plant(s) to be replaced, in accordance with the "Guide for Plant Appraisal".

9.00 SUBMITTALS

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

B. Proposed methods, materials, and schedule for root pruning, branch pruning, and other tree maintenance shall be submitted for approval. The Director of Forestry or Project Consulting Arborist shall mark the location of root pruning lines in the field prior to the operation. If possible, root pruning should occur between autumnal leaf fall and spring foliation. Root pruning during the growing season shall require approval of the Director of Forestry or Project Consulting Arborist.

10.00 TREE AND OTHER PLANT MAINTENANCE DURING AND AFTER COMPLETION OF CONSTRUCTION

A. Proper maintenance should include, but without limitation to: structural and remedial pruning; watering; mulching; remediating soil compaction; fertilization; insect and disease control; soil and tissue analysis; aeration; and wound treatment.

B. The timing, duration and frequency of necessary maintenance practices should be determined by the Director of Forestry or Project Consulting Arborist, based on factors associated with the site and affected plants.

END OF TREE RETENTION AND PROTECTION SPECIFICATIONS