

1.0 **DESIGN REQUIREMENTS**

- 1.1 Unless specified by the UBC Okanagan Campus Plan Design Guidelines and site-specific design requirements, all standard municipal hardscapes should conform to BC Landscape Standard and Master Municipal Construction Documents (MMCD), current editions.
- 1.2 Landscape structures should reference the appropriate architectural sections of the Technical Guidelines.
- 1.3 All landscape, area and exterior lighting designs shall be reviewed by UBC Okanagan Facilities Management before Tender Drawings are complete.
- 1.4 It is imperative that hard landscape steps, furniture, walls and railings are designed to be resistant to skateboarding damages. After-the-fact add-on straps and studs are less desirable than surfaces that have been pre-considered as targets, and aesthetically designed to deter skateboarders. Preferred deterrents should be considered at the schematic design stage. Design strategies should include incorporation of air gaps, notching, and offsets in seat walls, uneven surfaces, and other creative alignments and articulation of surfaces, walls, steps and railings.
- 1.5 Building façade and tree pruning require using heavy equipment such as manlifts. Both soft and hard landscaping must be designed to accommodate the loading and movement of this equipment in and around buildings.
 - .1 Structural soils, root protection and plants must be considered in these areas.
 - .2 Coordinate as early as possible in the conceptual and design development phases with UBC Facilities Management.

*****END OF SECTION*****

1.0 DESIGN REQUIREMENTS

- 1.1 As per UBC Board of Governors Policy #12, UBC practices Integrated Pest Management.
- 1.2 With rare exceptions related to public health or special landscape elements, the use of toxic chemical pesticides for cosmetic purposes is suspended from application on UBC landscape and grounds.
- 1.3 UBC Municipal Services endeavors to test and research new techniques and organic pest control agents such as sustainable alternatives to toxic chemicals. However, landscape designers should acknowledge the high potential for planting loss due to virulent weed growth in the context of low maintenance regimes typical of institutional landscapes such as UBC's Campus core.
- 1.4 Landscape plantings and hardscapes should be designed to minimize the need for toxic pesticides and herbicides. Design strategies should include:
 - .1 Selecting pest and disease resistant trees and plant material.
 - .2 Selecting hardy, vigorous, drought tolerant plants that can resist being overwhelmed by weed growth.
 - .3 Emphasizing mass plantings of sub-shrubs and evergreen groundcovers to shade the soil surface and inhibit weed development.
 - .4 Specifying soils growing media, container and field-grown plant material that are guaranteed free of pernicious weeds and seeds as per Canadian Landscape Standard, and Canadian Nursery Stock Standard.
 - .5 Specifying organic mulches that are guaranteed free of weeds and seeds.
 - .6 Providing adequate water through irrigation to ensure optimum plant growth and health.
 - .7 Specifying polymeric jointing sand or equivalent jointing materials in paving joints to inhibit organic residues and weed growth in paving joints.
 - .8 Placing trees at distances from building that when mature, do not provide a route for squirrels and racoons to access buildings.

*****END OF SECTION*****

1.0 DESIGN REQUIREMENTS

- 1.1 The principals of CPTED should be considered and reviewed at each stage of the project from pre-design through to occupancy, with reference to the extensive literature on this subject.
- 1.2 Project design features that address CPTED issues should be flagged for consideration in the plan reviews by representatives of Facilities Management, Campus Planning, Health Safety and Environment, and Campus Security.
- 1.3 On complex, large projects, consideration should be given to including a CPTED consultant to the Project Team.

*****END OF SECTION*****

1.0 **GENERAL**

1.1 **Scope**

- .1 This guideline addresses the quality scope of maintenance services expected prior to acceptance of new landscapes by UBC Okanagan Facilities Management inclusive of pest and disease control, warranty and replacement of plant material, stakes, guywires, manual watering, irrigation adjustment and winterizing etc.

1.2 **Related Work**

- .1 Section 32 01 93.01 Tree and Shrub Preservation
- .2 Section 32 93 05 Relocation of Existing Plant Material
- .3 Section 32 80 00 Irrigation
- .4 Section 32 91 00 Planting Preparation
- .5 Section 32 93 00 Plants
- .6 Section 32 92 00 Turf and Grasses
- .7 Section 32 92 23 Sodding

1.3 **Workmanship**

- .1 All work shall conform to the standards and practices outlined in the Canadian Landscape Standards – current edition; to be executed by skilled tradespersons well equipped and adequately supervised, and performed in accordance with these Standards. The Contractor shall have at least five years' experience and must provide written proof of experience and projects to the UBCO Manager of Custodial & Landscape Services.

1.4 **Supervision**

- .1 Supervisors shall have practical experience and knowledge of plant material and pest and disease control.
- .2 The Contractor shall be responsible for detection, recognition and timely control of plant pests and diseases. The Contractor shall have an up-to-date knowledge of the most effective, non-toxic, organic insecticides, miticides and fungicides, together with the ability to diagnose ailments. Obtain written approval from UBC prior to their application. **Note that use of toxic chemical pesticides for cosmetic purposes is suspended on UBC Campus.**

1.5 **Record of Maintenance Operations**

- .1 Work Schedule: Provide a schedule outlining the tasks to be undertaken through the year. These shall include as a minimum: fall/spring clean-up, fertilizer application, mulch application, irrigation, garbage clean-up, pruning, turf top-dressing and aeration.
- .2 The Contractor shall prepare a monthly summary of maintenance work and site conditions and submit it to the Manager of Custodial & Landscape Services at the end of each calendar month, for the duration of the maintenance period.

1.6 **Scope of Work**

- .1 Provide all equipment, material and labour for work specified herein including the following:
 - .1 Turf management, mowing, fertilizing, weed eradication, removal of clippings, aerating, top dressing, watering.
 - .2 Management of trees, shrubs, groundcover, aquatic plants, pest and disease control,

growth control, fertilizing, weeding, watering and cultivation, and mulching.

- .3 Complete blow out and drainage of the irrigation system prior to winter and the complete reinstatement of system operations in the spring.

1.7 Duration and Warrantee

- .1 The landscape maintenance period shall begin at the time each plant is planted and shall continue for 55 days from the date of certified Substantial Performance of the Work.
- .2 The warranty on plants and trees will be for one (1) full year commencing from the end of the date of certified Substantial Performance of the Work.
- .3 Interim warranty inspections shall be scheduled as follows: the first to be conducted at the end of 55 day maintenance period, then following at approximately 6 and 9 month intervals.
- .4 The above interim inspections and an end-of-warranty inspection will be coordinated by the project management group and will include the warrantor, the UBCO Manager of Custodial & Landscape Services.

1.8 Notification

- .1 Notify the UBCO Manager of Custodial & Landscape Services if any disease or insect problems arise.
- .2 Pest control measures to be implemented by the Contractor shall be reviewed and approved in writing by the UBCO Manager of Custodial & Landscape Services prior to their use. Provide the Project Landscape Architect and the UBCO Manager of Custodial & Landscape Services with a minimum 72 hour notification in writing prior to application of chemical vegetation controls. Post notice in area of spraying 72 hours before, during, and five (5) days after application.
- .3 Notify both the Project Landscape Architect and UBCO Facilities Manager of Custodial & Landscape Services of any physical changes and/or discrepancies which may affect the implementation of the contract as specified herein or which may endanger the public.

1.9 Inspection

- .1 Regular inspections shall be conducted by the Project Landscape Architect accompanied by UBCO Facilities Manager of Custodial & Landscape Services prior to approval of application for payment in order to review work completed and identify deficiencies.

2.0 MATERIALS AND DESIGN REQUIREMENTS

2.1 Materials

- .1 The Contractor shall provide all materials, labour and equipment necessary to perform the operations as specified herein and as required to provide the optimum environment for the establishment of plant material.
- .2 Mulch: Shall be composted bark mulch with 50mm and minus Douglas Fir / Hemlock bark chips, dark brown in colour and free of cedar chips, soil, wood, stones, roots, plastic and other deleterious matter or pre-approved equal.
- .3 Provide a sample of each mulch component to Caro Analytical Services for inspection, testing and approval. Sample and test results shall include the name of the project, the name of the

Consultant and/or UBC and the date. Approved sample shall be standard throughout. Caro Analytical Services, 102-3677 Hwy 97 N, Kelowna BC V1X 5C3 (250-765-9646).

- .4 Provide copies of all test results and samples to the Project Landscape Architect and UBCO Facilities Manager of Custodial & Landscape Services.

2.2 General

- .1 The Contractor shall maintain the project free from any defect resulting from work done or material supplied by the Contractor. The Contractor shall, to the satisfaction of the Project Landscape Architect and UBCO Facilities Management, rectify any defect that exists within the Maintenance Period. The Contractor must warrant all growing medium, soil amendments and fertilizers used on this project.
- .2 The Contractor shall be responsible for regular examination of the site during the term of the Contract and shall adjust the work schedule to suit site conditions.

2.3 Maintenance of Lawn Areas

- .1 The Contractor shall be responsible for the maintenance of all lawn areas. Maintenance of lawn areas shall include all measures necessary to maintain lawn in a vigorous, healthy, normal growing condition. Begin maintenance immediately after installation and continue for one full year after Substantial Performance.
- .2 All mowed lawn areas shall be cut at minimum once a week, and twice a week during heavy growth periods to ensure maximum height of 2.5" (70mm)/ cut height of 1.5" (37.5mm).
- .3 Equipment shall be sharp, level and prevent burning or gouging of lawn.
- .4 All clippings and debris shall be removed at the time of mowing, and disposed of off site. This includes but is not limited to wet or dry grass clippings on bollards, lampposts, concrete walls, curbs and steps, asphalt paving, signs, sign posts, benches, sidewalks, pre cast concrete paving, tree trunks and stakes, and shrub planting etc.
- .5 The Contractor shall monitor the site for lawn areas that are not in a healthy growing condition and reseed them as soon as conditions are favourable. Areas showing shrinkage due to lack of watering shall be top dressed and seeded with the original mix.
- .6 Regular and adequate watering shall be provided in order to promote healthy lawn growth. In the event of watering restrictions which prohibit the use of the automatic irrigation system or in areas which lack an automatic irrigation system, manual watering shall be performed in quantities and at intervals required to promote healthy, vigorous grass growth.

2.4 Maintenance of Plants and Planted Areas

- .1 The Contractor shall be responsible for the maintenance of all plants and trees. Maintenance shall include all measures necessary to maintain plants in a vigorous, healthy, normal growing condition, providing an appearance characteristic of their species and appropriate to their surroundings. Such maintenance shall include but not be limited to general cultivation, weed, pest and disease control, mulching, moisture conservation and watering, fertilizing, plant protection, pruning, and general clean-up. Begin maintenance immediately after installation and continue for 60 days after Substantial Performance.
- .2 All plant material shall be alive and in a healthy growing condition at the end of the maintenance period. Plant material which is not in such a condition shall be removed from the

- site and replaced.
- .3 Remove and replace dead plants and plants not in healthy growing condition upon notification. Make replacements in same manner as specified for original plantings and within 10 days of written request from Project Landscape Architect or UBCO Facilities Manager of Custodial & Landscape Services, weather and conditions permitting.
 - .4 All planted areas, including the base of all trees, shall be scarified with appropriate hand tools designed for this purpose. This operation shall be carried out 2 to 3 times per growing season, and as required to prevent caking of surface soil or mulch. Where and when applicable, mulch should be replaced yearly or when required by erosion, decay, cultivation or vandalism.
 - .5 It shall be the responsibility of the Contractor to maintain an adequate level of soil fertility through the regular application of mulches, suitable fertilizers, and the control of soil acidity where required. Lime shall be applied to plant areas where acidity is excessive (i.e. below pH 4.5). No lime shall be applied where specific planting requires an acid condition such as Ericaceous shrubs, rhododendrons and other acid liking broadleaf evergreens.
 - .6 The Contractor shall apply, at least twice during growing season, slow release fertilizers to all plants. Apply fertilizer to plants in early spring, after danger of frost has past, and again mid autumn, at manufacturer's suggested rate or as required to promote health growth. Fertilizer shall be slow release, sulphur coated urea base, such as Agrico-Evergro Total (23-3-23) or approved equal. The Contractor shall provide receipts for fertilizers along with the regular maintenance log book.
 - .7 Regular and adequate watering shall be provided in order to promote healthy plant growth. In the event of watering restrictions which prohibit the use of the automatic irrigation system or in areas which lack an automatic irrigation system, manual watering shall be performed in quantities and at intervals required to promote healthy, vigorous plant growth. Planted areas shall be watered at frequencies required to replace moisture at the root zone. Reform damaged watering saucers at the base of all trees.
 - .8 Replace or respread damaged, missing or disturbed mulch. Remove dead, broken or hazardous branches from plant material.
 - .9 All trees shall be protected against wind and snow damage by adequate staking, guying, tying or wrapping as conditions require. Guys, wire ties and stakes shall be examined at frequent intervals, and adjustments or renewals made to prevent abrasions or other damage to plants. Keep tree supports in proper repair and adjustment. Remove tree supports and level watering saucers at the end of the one year maintenance period.
 - .10 **Note that use of toxic chemical pesticides for cosmetic purposes is suspended on UBC Campus.** Obtain written approval from the UBCO Facilities Manager of Custodial & Landscape Services prior to application of toxic chemical pesticides for any extenuating circumstances.
 - .11 Apply any registered pest control product in accordance with Federal and Provincial regulations as and when required to control insects, fungus and disease.

2.5 Maintenance of Trees Impacted by Construction

- .1 The Landscape Contractor shall be responsible for the maintenance of all trees negatively impacted and/or modified by construction activities related to the specific project development.
- .2 Post-construction care of impacted trees will include but not be limited to the following:
 - .1 Water
 - .2 Fertilizer
 - .3 Pruning related to construction damages

2.6 Weed Control

- .1 The Contractor shall be responsible for the regular inspection and removal of weeds from all landscape portions of the project. **Note that use of toxic chemical pesticides for cosmetic purposes is suspended on UBC Campus.** Weeding shall be done at a weekly interval during the maintenance period, followed by an inspection by the UBCO Facilities Manager of Custodial & Landscape Services along with the Contractor. Any weeds that are identified shall be removed within 1 week of inspection. In no cases shall weeds be allowed to be greater than 50 mm in spread. Weeds should be removed in their entirety, including root systems or any other below-ground parts.
- .2 Weeds are defined as undesirable plants and will include all plant species not intentionally planted or seeded, unless mutually agreed upon by the Project Landscape Architect and/or UBCO Facilities Manager of Custodial & Landscape Services and Contractor. Weeds will include, but not be limited to such plants as annual bluegrass, barnyard-grass, chickweed, crabgrass, clover, couch-grass, dandelion, groundsel, horsetail, mallow, morning glory, prickly lettuce, mustards, oxalis, pigweed, pineapple weed, plantain, shepherd's purse, smart weed, snapweed, sowthistle, stork's bill, thistle and will also include invasive, non-native species such as Scotch broom, Himalayan blackberry, purple loosestrife. Weeds will also be defined as any of the grass seedlings that germinate and develop in the mulched shrub bed areas that are caused by an over-application in the seeding or hydroseeding operation.
- .3 The Contractor shall monitor the site for the presence of weeds growing in pathways, roadways, shoulders, rock work, and hard construction. All weeds in these areas shall be removed once per month.
- .4 The type of weeds in an area shall determine the method of treatment. Weed control may consist of, but is not limited to the following:
 - .1 hand-pulling, digging, cultivation,
 - .2 encouraging the growth of desired plants which can compete with weeds, and
 - .3 timing the mowing of grass areas to correspond with the seeding cycle of weeds.
- .5 In situations where there is doubt concerning the necessity or effectiveness of a weed control measure, the decision of the UBCO Facilities Manager of Custodial & Landscape Services will finalize the best course of action.

2.7 Irrigation

- .1 Regulate proper application of water through the irrigation system to ensure healthy plant growth.
- .2 Winterize the irrigation system well before freeze-up in fall.
- .3 Damage to the sprinkler heads or other parts of the system resulting from Contractor's operations shall be replaced without charge to UBC.
- .4 Failures in the irrigation components due to other causes, such as wear, vandalism, accidents caused by others, etc., shall be reported to the Project Landscape Architect UBCO Facilities Manager of Custodial & Landscape Services.
- .5 All irrigation heads shall be kept clear of debris so that good coverage results.

2.8 Litter and Waste Clean-Up

- .1 Clean-up of litter and landscape waste shall be considered part of normal maintenance work. Litter shall include, but not be limited to, bottles, cans, plastic, rubber and all paper. Landscape waste shall include, but not be limited to, windfall, prunings, weeds, grass clippings, fallen leaves, stones and surplus or other waste materials as a result of landscape

maintenance and construction operations.

- .2 All waste shall be gathered and removed from the site at the end of each day's maintenance operations. All litter shall be gathered and removed from the site weekly.

*****END OF SECTION*****

1.0 **GENERAL**

1.1 **Scope**

- .1 This guideline addresses the protection and care of existing trees, shrubs and plantings that have been designated for retention on, or adjacent to, new building sites and landscape sites on the UBC Campus.

1.2 **Coordination**

- .1 Coordinate as early as possible in the conceptual and design development phases with UBCO Facilities Management.
- .2 Coordinate throughout construction phases with UBCO Manager of Custodial & Landscape Services regarding any site changes, potential damages or pruning required to existing trees to be retained.
- .3 Coordinate with UBCO Manager of Custodial & Landscape Services during construction regarding any impacts or potential damages to any existing shrubs or plantings designated for retention.

1.3 **Standards**

- .1 Tree and Development: A Technical Guide to Preservation of Trees During Land Development, Matheny and Clark.
- .2 Canadian Landscape Standard, current addition.

1.4 **Definitions**

- .1 The Critical Root Zone of a tree is an arboricultural rule of thumb for establishing minimum area for tree root protection. It is applied in this guideline for determining Tree Protection Zones and location of tree protection fencing (see 2.1.1 and Fig. 1 below).
- .2 Tree Protection Zone is equivalent to the Critical Root Zone and is defined and enclosed by the Tree Protection Fencing for an individual tree designated for tree preservation and protection.

1.5 **Related Work:**

- .1 Section 32 91 00 Planting Preparation
- .2 Section 32 93 00 Plants
- .3 Section 32 93 05 Relocation of Existing Plant Material

2.0 MATERIALS AND DESIGN REQUIREMENTS

2.1 Tree Relocation and Protection Plans

- .1 For trees to be relocated and/or retained on site, the Project Landscape Architect should provide Tree Protection/Relocation Plans indicating surveyed grades at base of trunks, DBH, extents of drip lines and location of Tree Protection Fencing. Specifications and cross-sectional details for applicable preservation strategies including, but not limited to, requirements covered in this general guideline must be included in construction documents.

2.2 Consulting Arborists and UBCO Manager of Custodial & Landscape Services

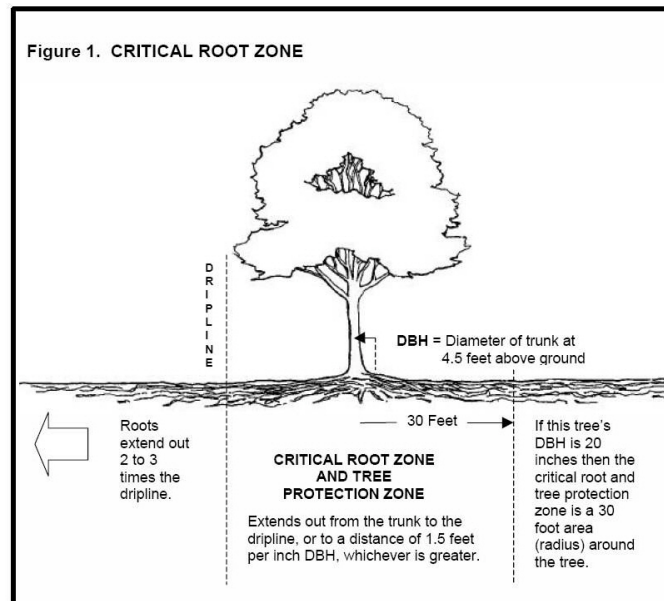
- .1 Where significant heritage trees, or complex tree preservation strategies are anticipated, UBCO recommends that a project-specific, ASCA Registered Consulting Arborist be retained as an integral member of the design development team. The Consulting Arborist is to advise on specific pre- and post-development strategies or to provide expert analysis, details and/or specifications required to optimize tree retention and preservation.
- .2 The UBCO Manager of Landscape & Building Services will be UBCO's representative on Campus and will advise on related Campus tree issues with consultants, project managers and site supervisors as required.

2.3 Approvals, Inspections and Supervision

- .1 The Campus Landscape Architect, Project Landscape Architect, Consulting Arborist, and UBCO Manager of Landscape & Building Services shall coordinate as early as possible in the project to identify trees to be retained, protected, transplanted or removed and clearly establish tree preservation measures and significant design criteria.
- .2 Contractor to meet with Project Landscape Architect, Consulting Arborist, and UBCO Manager of Custodial & Landscape Services as required for review of Tree Protection Plan prior to any fencing or hoarding on site.
- .3 During the construction phase, the Contractor shall contact UBCO Manager of Custodial & Landscape Services immediately regarding any changes impacting tree preservation on site or to trees immediately adjacent to site boundary.
- .4 Tree Protection Fencing must be approved by the UBCO Manager of Custodial & Landscape Services prior to the commencement of site work.

2.4 Tree Protection

- .1 Tree Protection Fencing must be erected before the onset of construction in relationship to each tree's Critical Root Zone (see fig.1 below). To be as follows:
 - .1 To be orange snow fencing securely fastened to metal stakes or a 50 x 100 mm (2" x 4") wood frame with uprights driven into the ground. Fencing will be 1.8m (4') in height and extend to at least the dripline, or to a distance of 1.0m (1.5') of DBH (diameter breast height) radius for every 1.8cm (1") of trunk diameter at DBH (diameter breast height), whichever is the greater (see fig. 1 below).
 - .2 Tree Protection Fencing for woodlots or groups of plantings, shall be placed at least 1.0 meter beyond the dripline of outer canopies.



- .2 If site constraints or tree characteristics make the above specifications impractical or impossible, either site design or building layout must be revised, or an alternative fencing layout and/or trunk-root protection strategy must be developed and approved in consultation with the Project Consulting Arborist or UBCO Manager of Custodial & Landscape Services prior to initiation of construction and hoarding activities.

2.5 Tree Protection Signage

- .1 Tree Protection Fencing should be signaged at reasonable intervals to discourage hoarding, grade changes and heavy equipment intrusions into Tree Protection Zones. Use either UBC standard signage shown below or an approved equivalent. For significant, heritage or high value trees, signage may be required to display appraised tree value.



2.6 Root Curtain

- .1 A temporary Root Curtain shall be required to cover exposed roots along the cut face of excavations made adjacent to Tree Protection Zones. The Root Curtain is intended to minimize root damage and soil erosion and conserve moisture within the soils and roots. The Root Curtain is to consist of heavy wire mesh lined with burlap and supporting posts.

2.7 Tree Mulch and Antidesicant

- .1 Based on scope of site disturbance and/or adverse drought conditions, the Consulting Arborist or UBCO Manager of Custodial & Landscape Services may require that mulch or antidesicant shall be applied to trees either at the beginning or at any time during the construction process.
- .2 Tree chip mulch, including parts of the leaf, twig, bark and stem wood should be free of pests or diseases and should not contain Western Red Cedar or Black Walnut.
- .3 Antidesicant shall be specified by the Project Consulting Arborist UBCO Manager of Custodial & Landscape Services, and applied by a Certified Arborist according to manufacturer's recommendations.
- .4 Provide a sample of the proposed tree mulch and source, and/or antidesicant for approval by UBCO Manager of Custodial & Landscape Services.

2.8 Site Work

- .1 All underground utilities, drainage and irrigation lines shall be routed outside the Tree Protection Zone. If utility lines must traverse the Tree Protection Zone, they shall be air-spaded or tunneled under the tree at depths and distances recommended by Project Arborist.
- .2 Any pruning required prior to or during construction must be performed by a Certified Arborist.
- .3 Any injury or tree damage during construction must be reported immediately to UBCO Manager of Custodial & Landscape Services who will recommend remedial actions as required to be carried out.
- .4 Any grading, construction or other work that is expected to encounter tree roots must be monitored by the Project Consulting Arborist or UBCO Manager of Custodial & Landscape Services.
- .5 Erosion control devices such as silt fencing, debris basins and water diversion structures shall be installed to prevent siltation and/or erosion within the Tree Protection Zones.
- .6 Any roots damaged during construction shall be exposed to sound tissue and cut cleanly with proper pruning equipment. Under no circumstances shall roots be severed by unqualified personnel using excavation equipment or inappropriate tools.
- .7 If temporary access roads must pass over the root area of trees to be retained, a road bed of 6"-10" wood-chip mulch with a supportive mat of boards or other rigid material shall be created to protect the roots and soil. The road bed shall be replenished as necessary to maintain a 6-10" depth. Consult with Consulting Arborist or UBCO Manager of Custodial & Landscape Services for site-specific recommendations.

- .8 Spoil from trenches, building basements, or other excavations shall not be placed within the Tree Protection Zones.
- .9 No burn piles or debris pits shall be placed in the Tree Protection Zone. No ashes, drywall concrete tailings or other debris or garbage may be dumped or buried within the Tree Protection Zone.

2.9 Care and Treatment of Retained Trees

- .1 During the construction process, the Contractor will ensure adequate watering is provided within the Tree Protection Zone of each tree so designated. The Contractor will consult with UBCO Manager of Custodial & Landscape Services for recommendation on a watering schedule.
- .2 Contractor will exercise due diligence, stop work immediately and contact Project Landscape Architect, Consulting Arborist, and/or UBCO Manager of Custodial & Landscape Services should any unforeseen site changes impact the success of tree preservation on site.

*****END OF SECTION*****

1.0 **GENERAL**

1.1 **Related Guidelines**

- .1 MMCD Master Municipal Construction Documents, current edition
- .2 Transportation Association of Canada, Geometric Design Guide for Canadian Roads, current edition

2.0 **MATERIALS AND DESIGN REQUIREMENTS**

2.1 **Design Requirements**

- .1 All standard municipal roadways should conform to MMCD and the Transportation Association of Canada's, Geometric Design Guide for Canadian Roads, current editions.
- .2 All road repair, remediation and rehabilitation shall be compliant with MMCD, current edition.

*****END OF SECTION*****

1.0 **MATERIALS AND DESIGN REQUIREMENTS**

1.1 **General Requirements**

- .1 All expanses of paving associated with all Public Realm spaces must be detailed to accommodate maximum anticipated vehicular loading. Vehicles and heavy equipment such as snorkel lifts required intermittently to service buildings, large trees, or respond to emergencies, must be accommodated without damage to surfacing due to loading.
- .2 Any utility upgrades or other projects that disturb and damage existing paving shall reinstate paving to original condition in compliance with relevant guidelines.
- .3 Where manholes, catch basins and service covers occur within expanses of unit paving, concrete surrounds should be considered as an additional detail to minimize uneven settling of adjacent paving – especially where increased vehicular loading is anticipated.

1.2 **Unit Pavers**

- .1 Public Realm unit paving should be installed such that:
 - .1 No end paving unit to be smaller than 8" x 8".
 - .2 A complete bonded installation of paving units at the ends and/or edges of paving each course is achieved.
 - .3 A minimum overlap of paving units is specified thus avoiding the incidence of running straight joints or near straight joints.
 - .4 Groupings of similar sized paving units are avoided (e.g. linear runs of 100 mm units would be unacceptable.)
 - .5 Sharp-angled cuts are to be avoided.
- .2 All edges of unit paving associated with all Public Realm spaces with anticipated vehicular access, must be detailed with contiguous, robust edge support loading without incurring acute or long term collapse and failure. Example would be reinforced concrete banding.
- .3 Polymeric jointing sand is recommended in preference to standard jointing sand to increase paving integrity and longevity, and to inhibit weed growth.

*****END OF SECTION*****

1. GENERAL

1.1 Related Scope of Work and UBC Guidelines

- .1 Section 05 00 00 Metals
- .2 Section 09 90 00 Painting & Coating
- .4 UBC Campus Design Guidelines (Vancouver and Okanagan) – for metal screens and finishes installed in the public realm.

1.3 Description

- 1. The Guidelines apply to all work completed on both UBC Vancouver and UBC Okanagan campuses unless stated otherwise.
- 2. Work includes fencing, screens, guardrails and shelters within 10m of any building.

1.4 Coordination

- 1. In instances where conflicts are found between the UBC Technical Guidelines and provincial regulations or codes, please notify the UBCV Technical Review Team Architect or UBCO Facilities Management.
- 2. These guidelines are intended to be read by design consultants and their content integrated into construction drawings and specifications. Construction documents are not to reference the technical guidelines directly.
- 3. The Coordinating Registered Professional (CRP) is required to coordinate these requirements with other disciplines.

1.5 Submittals

- .1 Submit required documents to consultants in accordance with Section 013300 Submittal Procedures
- .2 O&M Submittals
 - .1 Product specifications, type and colour.
 - .2 Final reviewed shop drawings for metal fabrications and where required, signed and sealed by a professional engineer registered in the Province of BC.
- .3 Provide Letter of Assurance for 1.5.2.2 above

2. MATERIALS

- 1 All fencing, screens and shelters within 10 meters of a building shall be constructed using non-combustible materials such as metal.

END OF SECTION

1.0 DESIGN REQUIREMENTS

- 1.1 UBC preferences for site furnishings including benches, waste receptacles, and light standards are referenced in the UBC Okanagan Campus Plan and Design Guidelines.
- 1.2 Bollard placement must conform to current Public Realm Plan and provide minimum 2.2m spacing between bollard to allow passage of landscape and snow removal equipment.
- 1.3 Site furnishings must be attached using load-appropriate anchors and tamper-proof bolts and fittings.
- 1.4 Minimum one year warranty on all site furnishings.
- 1.5 Minimum five year warranty on garbage receptacles.

2.0 MATERIALS

- 2.1 Materials shall be corrosion resistant.
- 2.2 Materials shall be resistant to vandalism and to damage from skateboarders.
- 2.3 Use of recycled materials is encouraged.
- 2.4 Selection of materials should be environmentally responsible including consideration of embodied energy of production and avoidance of endangered wood sources.
- 2.5 Local supply of materials is preferred.

*****END OF SECTION*****

1.0 **GENERAL**

1.1 Section 32 80 00 refers to those portions of the work that are unique to the complete installation of a fully automatic underground irrigation system, including all necessary preparatory work and all electrical, wiring and plumbing connections, and maintenance work during the guarantee period. This section must be referenced and interpreted simultaneously with all sections pertinent to the works described herein.

1.2 **SCOPE OF WORK**

- .1 Supply and installation of sleeves, mainline, lateral lines, control zone valves, dripline, spray heads, root watering systems, controller enclosure, controller, and all related items necessary to provide a properly operating automatic irrigation system to distribute water in a way that adequately maintains the landscape while conserving and protecting water resources.
- .2 Maintenance of irrigation system.

1.3 **REFERENCE STANDARDS**

- .1 ASTM D1248 – High Density Polyethylene (HDPE) Pipe
- .2 ASTM D2241 – Poly Vinyl Chloride (PVC) Plastic Pipe (SDR-PR)
- .3 ASTM D2564 – Solvent Cement for PVC Pipe and Fittings
- .4 CSA B137.0-12 – Thermoplastic Pressure Piping

1.4 **CODES AND REGULATION**

- .1 All work shall be installed in accordance with the requirements of local and applicable provincial and federal regulations. Any work shown on the drawings or described in the specifications which is at variance with the regulations shall be changed to comply with the requisite authority at no cost to the Owner.
- .2 Workers' Compensation Board regulations shall be followed.

1.5 **PERMITS AND FEES**

- .1 The Contractor shall be responsible for obtaining all permits and licenses applicable to the work to be done and shall include costs for such permits and licenses in the tender price.
- .2 Provide Contract Administrator with signed and approved copies of all required permits, including the following:
 - .1 Backflow test report
 - .2 Inspection reports

1.6 **CONTRACT DRAWINGS**

- .1 Drawings are diagrammatic and indicate the general arrangement of systems and work included in the contract. Do not scale drawings.

1.7 **QUALITY ASSURANCE**

- .1 The trade contractor performing this work shall be a “Certified Irrigation Technician – Level 2” having met the certification standards established by *The Irrigation Industry Association of British Columbia*, and having experienced, trained and insured personnel qualified for the scope of work.

- .2 A written guarantee of the installed irrigation system shall be provided to the Owner covering workmanship and materials for a minimum of one (1) year from the date of substantial completion. The contractor shall warranty maintenance on the system for a minimum of one (1) year, including but not limited to spring start-up, adjustments and maintenance operations as required, and winterization.
- .3 Manufactured products, including but not limited to irrigation heads, quick couplers, controllers, valve boxes and valves, will be warranted as per the manufacturer's standard warranty period or a minimum of one (1) year, whichever is greater.
- .4 The Contractor shall be certified in High Density Polyethylene Butt-Fusion as certified by the *British Columbia Institute of Technology* or approved equivalent when HDPE is specified.

1.8 SUBMITTALS

- .1 The Contractor shall submit evidence of project personnel having certification in High Density Polyethylene Butt-Fusion prior to commencing the work.
- .2 The Contractor shall submit shop drawings, product literature, and specifications for approval by the Owners Representative prior to construction.
- .3 A suitably scaled as-built drawing shall be submitted, preferably in AutoCAD 2008 or newer format along with three (3) printed copies of the as-built. Retain a qualified survey instrument operator to record exact location of all irrigation components installed, including but not limited to the controller cabinet, master valve, mainline, sleeves, control zone valves, main water connection, blow-out fittings, pipe drains, lateral end flush valves, sprinklers and any other similar features and components. Show all other deviations from the irrigation design drawing provided to the Contractor. All components of the irrigation system shall be shown as installed, with clear measurements from an identifiable reference point. Ensure all zones are labelled correctly.
- .4 The as-built drawing shall be submitted prior to issue of Substantial Completion. The Contractor shall maintain the as-built record drawing throughout the maintenance and warranty period and issue a revised As-Built Irrigation Drawing at Final Acceptance if any changes are made. The as-built drawings shall be certified by the irrigation designer as being an accurate record of installation.
- .5 Operation and Maintenance Manuals
 - .1 Prepare and deliver to the Owner prior to substantial completion of construction two (2) copies of the following information in 3-ring binders:
 - .2 Parts sheets on every material and component installed under this Contract.
 - .3 Guarantee statements.
 - .4 Complete operating and maintenance instruction on all major equipment.
 - .5 Winterization and spring start-up procedures.
 - .6 Chart of approximate watering times for peak and shoulder season showing all proposed run times for each zone relative to differing precipitation rates and water requirements.
 - .7 Maintenance materials to be furnished: Two (2) sets of tools required for adjusting each type of sprinkler supplied on this project. One (1) quick coupler key and matching hose swivel for each type of quick coupler installed.

- .8 One (1) full sized printed copy of the as-built, two (2) 11" x 17" sized printed copies of the as-built on rip-proof and waterproof paper (dura-copy at Can Cadd Reproductions).

1.9 SITE CONDITIONS

- .1 Verify the existence and location of all underground utilities and services prior to commencement of the work.
- .2 Consult with the Owner's Representative to adjust the design, if necessary, to suit existing site conditions and grades prior commencement of the work.
- .3 Ensure sequencing of this work is carried out in coordination with the work of other trades. It is essential to coordinate the installation of sleeves under hard surfaces and irrigation piping through open tree soil trenches to ensure their installation is completed when the work area accessible.
- .4 Protect from damage existing landscape features, plant material, structures, irrigation work in progress, and the work of other trades.

1.10 SUBSTITUTION

- .1 Where materials are specified by brand name and model number, such specifications shall be deemed to facilitate a description of the materials and material quality and shall establish a standard for performance and quality against which proposed substitutes shall be evaluated.
- .2 Substitution requests shall not be considered unless submitted in writing with sufficient descriptive literature and product samples to permit product comparison.
- .3 All product substitutions shall be of equal or greater performance, value and water efficiency than the original design. All proposed sprinkler substitutions must be accompanied with verifiable water efficiency performance data provided by the manufacturer or an independent industry source such as the *Centre for Irrigation Technology* (CIT), Fresno.
- .4 Alternate materials shall match the specified materials in performance, flow, and pressure loss so as not to compromise the intent of the design.
- .5 The written approval of the Owner's Representative is required to the use of materials that are different from those shown in the design. Materials installed which have not been pre-approved by the Owner's Representative are subject to removal and replacement with approved materials at the Contractor's expense.

1.11 NOTIFICATION OF CONSULTANT

- .1 Report to the Owner's Representative, in writing, any conditions or defects encountered on the site during or prior to construction upon which the work of this section depends and which may adversely affect its performance.

- .2 Notify the Owner's Representative and obtain approvals for inspection and testing of irrigation system as specified in this section. Provide the Owner's Representative and Owner minimum 48-hours' notice prior to required inspections or meetings.

1.12 TESTS AND INSPECTIONS

- .1 System installation inspections shall be held on a regular basis.
- .2 In addition to coordinating the inspection schedule, the irrigation contractor shall, in the presence of the Irrigation Consultant conduct the following tests and inspections:
 - .1 Inspection of mainline and sand bedding prior to burial.
 - .2 Pressure tests of mainline.
 - .3 Layout inspection and operation test of subsurface dripline prior to burial.
 - .4 Coverage and operation tests.
 - .5 HDPE pipe strap test.
 - .6 Vault drainage test.
- .3 Keep work uncovered and accessible until successful completion of inspection or test.

1.13 BACKFLOW PREVENTION ASSEMBLY TEST

- .1 Conduct backflow prevention assembly test as BC Water Works Association standard using qualified personnel.

1.14 MAINLINE PRESSURE TEST

- .1 Perform mainline pressure test to identify potential leaks and ensure mainline *can* operate at design pressure and maintain pressure.
- .2 Conduct mainline pressure test prior to backfilling of mainline.
- .3 Fill mainline with water and expel all air from pipe. Maintain water in pipe as follows:
 - .1 3 hours for PVC mainline
 - .2 3 hours for HDPE mainline (not including set up time)
- .4 Subject mainline to hydrostatic pressure of 150psi or twice the optimum design pressure of the mainline and not to exceed 200psi.
- .5 Stop supply of make-up water to mainline and record hydrostatic pressure in mainline.
- .6 Visually inspect mainline and fittings for leaks.
- .7 Record hydrostatic pressure in mainline 3 hours after supply of make-up water stopped.
- .8 Determine test result based on difference in recorded pressures at beginning and end of test as follows:
 - .1 Passed test: Equal to or less than 5% difference
 - .2 Failed test: Great than 5% difference
- .9 Identify source of leak and replace all defective material and workmanship as necessary to eliminate leak.

- .10 Repeat mainline pressure test and make replacements as necessary until a passed result is achieved.

1.15 SYSTEM COVERAGE AND OPERATION TEST

- .1 Conduct coverage and operation test after installation of complete irrigation system and prior to issuance of Certificate of Substantial Performance:
 - .1 Head spacing does not exceed the distances shown on Contract Drawings
 - .2 Where applicable, irrigation piping should be installed to follow the contours of the land to minimize low head drainage situations.
 - .3 Heads, boxes, vaults and trenches are at specified elevation relevant to finished grade and not subject to settlement or lifting
- .2 Conduct operational tests to verify that:
 - .1 Controller can be programmed manually on site and remotely via Owner's Centralus system.
 - .2 Controller can send and receive communication with Owner's central control system 10 consecutive times without a missed communication.
 - .3 Controller responds to flow sensor.
 - .4 Operating pressure is within design parameters.
 - .5 Each zone can be operated automatically and in succession via programmed controller.
 - .6 Performance provides head to head coverage.
 - .7 There is no overspray onto different control zones, hard surfaces or other improvements.
 - .8 All components are flush to grade.
 - .9 All valves are labelled, and valve installed in valve box with minimum 50mm clearance between bottom of valve and top of drain rock.

1.16 DRIPLINE/EMITTER INSPECTION

- .1 Perform inspection and testing of dripline/emitter manifold and lines to identify potential leaks and confirm manifold, driplines and emitters *can* operate at design pressure. Conduct inspection and testing prior to backfilling of manifold, driplines or emitters.
- .2 Fill manifold and lines with water at operating pressure and maintain pressure for 1 hour. Visually inspect manifold, driplines and fittings for leaks. Confirm that emitters are functioning correctly. Identify sources of leaks and replace any and all defective materials and workmanship as necessary to eliminate leak.
- .3 Repeat inspection and testing and make replacements as necessary until no further leaks are identified.

1.17 HDPE PIPE STRAP TEST

- .1 Conduct HDPE pipe strap test at least 1 hour after fusion weld has been made prior to backfilling of HDPE pipe on those fusion welds where, upon visual or tactile inspection, the bead does not roll back properly or is not consistent in height or width.

- .2 HDPE pipe strap consists of:
 - .1 Cut fusion weld from pipe, allowing 200mm on either side of weld to work with.
 - .2 Cut pipe lengthways through fusion weld to create a strap 25mm wide.
 - .3 Bend strap back on itself.
 - .4 If weld breaks repeat test on another fusion weld, chosen by Contract Administrator. If second fusion weld fails then all welds become suspect and the HDPE pipe cannot be installed until the reason for the fusion joint failures is determined.
 - .5 If fusion weld does not break, then the weld is acceptable and no further testing of similar welds is required.
 - .6 Replace or repair tested pipe strap.

1.18 VAULT DRAINAGE TEST

- .1 Conduct vault drainage test when vault is installed and backfilled and prior to installation of backflow prevention device and water supply line in vault.
- .2 Fill point of connection vault with water to a depth of 300mm and leave water to drain.
- .3 Determine test result based on time required for water to drain below finish grade of drain rock in bottom of vault:
 - .1 Passed test: 1 hour or less.
 - .2 Failed test: greater than 1 hour.

1.19 MEASUREMENT FOR PAYMENT

- .1 Supply and installation of irrigation point of connection will be measured as a lump sum. The work includes: Permits and fees, water meter, master valve, flow sensor, backflow prevention assembly, vaults and lids, fittings, pipe, excavation, trenching, sleeves, backfill and restoration, all incidentals necessary for the proper installation of complete water service to the irrigation system.
- .2 Supply and installation of irrigation control system will be measured as a lump sum. The work includes: permits & fees, supply, installation, testing, programming, and adjustment of irrigation system controller, electrical conduits, controller cabinets, vaults, valve boxes, lids, fittings, wire, excavation, trenching, backfill, and restoration, and all incidentals necessary for the proper installation and operation of a complete irrigation control system.
- .3 Supply and installation of pipes, valves, sprinklers and dripline will be measured as a lump sum. The work includes, but is not limited to: supply, installation, testing and adjustment of irrigation pipe, sleeves and conduit, zone control valves, drip control zone kits, electric control wire, common wire, flow sensor wire and spare wires, drain valves, isolation valves, pressure regulators, swing joint assemblies, sprinklers, bubblers, emitters, dripline and root watering systems, air relief valves, flush valves, fittings, vaults, valve boxes and lids, excavation, trenching, backfill and restoration, all incidentals necessary for the proper installation and operation of a complete irrigation system.
- .4 Supply all labour and materials necessary for adjustment of existing systems to meet approval of Contractor Administrator.

- .5 Payment for record drawings and operating manual will be measured as a lump sum.
- .6 Payment for irrigation tests, inspections, maintenance, winterizations, and spring start-ups during warranty period will be incidental to the work under this section.

2.0 PRODUCT

2.1 VAULT AND LID

- .1 Acceptable vaults and matching lids for point of connection equipment are dependent on service size and include the following:
 - .1 ¾": one (1) Kon Kast 1031 vault, base and Excel 4840-1 lid
 - .2 1" to 2": one (1) Kon Kast 1102 vault, base and Excel 3974-2 lid
 - .3 2 ½" to 3": two (2) Kon Kast 1102 vault, base and Excel 3974-2 lids
- .2 Lids to have recessed hinges and locking hardware.

2.2 VAULT DRAIN

- .1 Perforated Schedule 40 PVC pipe, 100mm diameter with threaded inlet cover having 13mm grated openings.

2.3 BACKFLOW PREVENTION ASSEMBLY

- .1 Acceptable double check valve assemblies are:
 - .1 Watts Series 007 Double Check Valve Assemblies

2.4 WATER SERVICE AND METER

- .1 Unless already installed or otherwise required by the water utility having jurisdiction over the site provide a metered water service, including but not limited to:
 - .1 Backflow prevention assembly
- .2 Supply and install water meter in accordance with requirements of water utility.
- .3 Conform size of water meter to mainline diameter and allow for minimal pressure losses.
- .4 Acceptable water meter assemblies are:
 - .1 ¾" to 1": Sensus iPerl
 - .2 1 ½" +: Sensus Omni Turbo (T2) Water Meter

2.5 FLOW SENSORS

- .1 For use with the Hunter ACC2 series controllers, flow sensors to be impeller type with FCT fittings for pipe installation. FCT to be sized based on flow. Acceptable flow sensors are:
 - .1 Hunter HFS Hunter Flow-Sync sensor, sensor requires FCT fitting for pipe installation.

- .2 For use with the Hunter ICC2 controllers, acceptable flow sensors are:
 - .1 Hunter Flow-Clik sensor with interface module, sensor requires FCT fitting for pipe installation.
- .3 Acceptable wires for flow sensor shall be shielded, direct burial communication cable and includes the following:
 - .1 Belden cable
 - .2 Approved equal

2.6 MASTER VALVE

- .1 Acceptable master valves are as follows:
 - .1 Hunter IBV Series
- .2 Ensure master valve is sized to maximum and minimum flow parameters shown on Contract Drawings.

2.7 PRESSURE REDUCING VALVE

- .1 Acceptable water pressure reducing valves are Watts Series 25AUB-Z3.

2.8 BLOW-OUT ASSEMBLY

- .1 Blowout assembly to be 1" brass ball valve with plug and brass swing joint assembly.

2.9 IRRIGATION CONTROLLER

- .1 Irrigation controller to be compatible with Centralus™ Software unless otherwise specified. Acceptable controllers are:
 - .1 Hunter ICC2
 - .2 Hunter ACC2
 - .3 Hunter ACC2 Decoder
 - .4 Hunter Node-BT
- .2 Controllers to be installed with the following accessories:
 - .1 Hunter A2C-LAN communication module
 - .2 Hunter Roam-XL-R remote receiver unit

2.10 CONTROLLER MEDIA CONVERTER

- .1 If a fiber optic line is installed, the controller will require the following:
 - .1 LBH100A-H-SSC Hardened Media Converter Switch, 10/-100- Mbps Copper to 1310-nm, 40km, SC
 - .2 LHC015a-R2 10-/100-Mbps Autosensing Media Converter, Single-Mode, 1310-nm, 40km, SC
 - .3 Both products are available for purchase at UBCO IT Services, BuyIT.

2.11 WEATHER SENSORS

- .1 Acceptable weather sensors are:

- .1 Hunter Solar Sync
- .2 Hunter Rain Klik
- .3 Or as specified on the contract drawings.

2.12 CONTROLLER TO DECODER COMMUNICATION

- .1 Communication between controller and the field decoders at the electric control valves shall be accomplished using the Hunter IDORG wire.
- .2 Field Decoders (either 1, 2, 4, or 6 station configurations with ability to operate multiple solenoids per station) come pre-addressed.
- .3 Decoder to solenoid: standard pair 18AWG/1 mm to 150ft. (twisted improves surge resistance).
- .4 Programmable decoder station IDs (from controller to panel).

2.13 CONTROL WIRE

- .1 Control wire from irrigation controller to electric control valve to be minimum #14 gauge, direct burial, type TWU-40 wire. Control wire to be any colour other than white, blue, purple or red.
- .2 Common wire from irrigation controller to electric control valve to be minimum #12 gauge direct burial, type TWU-40 wire. Common wire to be white in colour.
- .3 Master valve wire from the controller to valve to be minimum #14 gauge direct burial, type TWU-40 wire. Wire to be red in colour.
- .4 Spare control wire to be blue in colour.
- .5 Spare common wire to be white in colour.
- .6 All connectors to be new, two-step, CSA approved for the watertight applications and assembled according to the manufacturer's recommendations.

2.14 TWO WIRE CONDUCTOR

- .1 Two-wire conductor shall be Hunter ID1ORG.
- .2 Single conductor spare decoder wire shall be direct burial CSA approved #14 AWG Blue.
- .3 All control wire installed shall use a Polyethylene outer jacket.
- .4 All connectors to be new, two-step, CSA approved for the watertight applications and assembled according to the manufacturer's recommendations.

2.15 GROUNDING AND BONDING

- .1 Ground assembly consists of CSA and BC Electrical Code endorsed products per irrigation controller manufacturer's recommendations for grounding.

2.16 ELECTRICAL PRODUCTS

- .1 All electrical products shall be CSA approved and bear the CSA label. Alternatively, where a product does not bear the required CSA label, it shall be approved in writing, by the authority having jurisdiction.
- .2 Wire conduit shall be Grey PVC DB2 non-metallic electric conduit as shown on drawings, minimum 2" diameter.

2.17 POLYVINYL CHLORIDE (PVC) PIPE

- .1 Conform to CSA B137.3-93.
- .2 New condition, extruded from virgin, high impact materials, solvent weldable with belled ends, continually and permanently marked showing manufacturer's name, material, size, pressure rating, and CSA approval.
- .3 PVC pipe to be as follows:
 - .1 Class 200 PVC pipe for pipe sizes $\frac{3}{4}$ " to 3" in diameter.
 - .2 Bell and spigot gasket joint pipe complete with concrete thrust blocking for pipe sizes 4" in diameter and greater.

2.18 LOW DENSITY POLYETHYLENE PIPE

- .1 New condition CSA Series 100, LDPE in new condition, extruded from virgin materials, continually and permanently marked showing manufacturers name, material, size, and pressure rating.

2.19 HIGH DENSITY POLYETHYLENE PIPE

- .1 New condition CSA Approved, extruded from virgin materials, continually and permanently marked showing manufacturer's name, materials, size, and pressure rating.
- .2 Material to be listed by the Canadian Standards Association (CSA) and Plastic Pipe Institute (PPI) as a PE-3408 resin with a hydrostatic design basis (HDB) of 1600psi for water at 23°C. Material to comply with ASTM D-1248 as a Type III Class C, Category 5, Grade P34 material and with ASTM D-3350 as a 345434C cell material.
- .3 Acceptable HDPE pipe is dependent on operating pressure and to have Standard Density Ratios (SDR) as follows:
 - .1 Max. pressure up to 100psi: SDR 17.0
 - .2 Max. pressure exceeding 100psi: SDR 11.0

2.20 SLEEVING

- .1 Schedule 40 PVC for irrigation sleeve in bored hole or under hard surface
- .2 Irrigation sleeve diameter to be minimum 3" or twice the diameter of main or lateral line running through it, whichever is greater.

2.21 VALVE BOXES

- .1 Irrigation valve boxes are to be as follows:
 - .1 Carson 910 Round or equivalent
 - .2 Carson 1419 Standard Regular or equivalent
 - .3 Carson 1730 Super Jumbo Rectangular or equivalent.
- .2 Valve box and matching T Cover Lid and extensions to be commercial grade and green in colour.

2.22 WIRE SPLICE BOXES

- .1 Wire splice box and matching lid and extensions to be commercial grade and grey in colour. Wire splice box to have locking lid with stainless steel bolt locking device and appropriate washers.

2.23 ELECTRIC CONTROL VALVE

- .1 Acceptable electric control valves are:
 - .1 Hunter ICV Series
- .2 Size electric control valve in accordance with valve manufacturer's recommendations for the design flow.
- .3 Include pressure regulating modules as required to provide the optimum operating pressure for each irrigation circuit and head/outlet specification.
- .4 Install ball valve upstream of 1" valves and gate valve on larger valves.

2.24 DRIP ZONE KITS

- .1 Drip zone kit shall be as shown on the drawing.
- .2 Drip zone kits shall include one (1) schedule 40 PVC ball valve and filter.
- .3 The valve box shall contain maximum of two (2) valves per box.
- .4 Drip zone kit shall have two (2) schedule 80 PVC union per drip zone kit.
- .5 Acceptable drip zone kits are as follows:
 - .1 2 to 20 GPM: Hunter ICZ-101-40
 - .2 20 to 60 GPM: Hunter ICZ-151-XL

2.25 FILTERS

- .1 Hunter HY-100
- .2 Hunter HY-151

2.26 QUICK COUPLER VALVE

- .1 Acceptable quick coupler valves are as follows:
 - .1 ¾": Hunter HQ-33DRC
 - .2 1": Hunter HQ-44RC

2.27 ISOLATION VALVE

- .1 Acceptable isolation valves include the following:
 - .1 Up to 2": Red White #206 or Toyo 206a
 - .2 Over 2": Mueller A-2362 Resilient Wedge Gate Valve

2.28 SWING JOINT ASSEMBLY

- .1 Fabricated with three (3) threaded Schedule 40 PVC elbows and one threaded Schedule 80 PVC nipple.
- .2 Length of nipple shall be such a length to permit installed head or valve to be set as specified.
- .3 Diameter of nipple to match inlet for valve or head shown on Contract Drawings.

2.29 SPRINKLERS – SPRAYHEAD

- .1 Acceptable sprayhead sprinklers are as follows:
 - .1 Hunter Pros-04-PRS30 CV
 - .2 Hunter Pros-04-PRS40 CV

2.30 SPRINKLERS – ROTOR

- .1 Acceptable rotors are as follows:
 - .1 Hunter PGJ-04-V
 - .2 Hunter PGP-ULTRA-04-CV
 - .3 Hunter I-20-04-PRB
 - .4 Hunter I-25-04-SS
 - .5 Hunter I-40-SS

2.31 ROOT ZONE WATERING SYSTEM

- .1 Acceptable root zone watering systems are:
 - .1 Hunter RZWS-18-50-CV
 - .2 Hunter RZWS-36-50-CV
- .2 Each RZWS tube to be installed with Hunter P/N RZWS-SLEEVE

2.32 LANDSCAPE DRIPLINE

- .1 Acceptable driplines include the following:
 - .1 Hunter HDL-09-CV

2.33 DRIP EMITTERS

- .1 Rain Bird Xeri bugs, sized as shown on drawing.

2.34 BUBBLERS

- .1 Acceptable bubblers are Hunter RZWS-CV with fabric sleeve.

2.35 LATERAL FLUSH ASSEMBLY

- .1 Ball valve with street elbow and flexible hose on swing joint assembly complete with 10" round valve box.

2.36 AIR RELIEF VALVES

- .1 Hunter PLD-AVR Air/Vacuum relief valve.

2.37 FITTINGS

- .1 New condition Schedule 40 PVC conforming to ASTM D-2466-97 standards and of the same material as pipe. Fittings to be designed for solvent welding to PVC pipe except where valves and risers require threaded joints.
- .2 Nipples to be threaded Schedule 80 PVC and manufactured from same material as pipe.
- .3 At the point where the supply source changes from metal to PVC pipe, the metal end of the pipe must be an FIPT (female) adapter and the PVC fitting a MIPT (male) adapter.
- .4 Flange couplers may be used upon approval of Contract Administrator.
- .5 Fittings for LDPE pipe to be PVC insert fittings complete with stainless steel gear clamps.
- .6 Fittings for HDPE pipe to be butt fusion type for end-to-end joints.
- .7 SDR rating of HDPE fittings must match the SDR rating of the HDPE pipe specified.
- .8 HDPE pipe fittings to be molded or fabricated by the pipe manufacturer. HDPE pipe fittings and flange adapters made by contractors or distributors are prohibited.
- .9 Fittings for dripline and drip emitters to compatible with specified dripline or emitter and as recommended by manufacturer. Acceptable fittings are:
 - .1 Hunter LOC series fittings size to dripline

2.38 PIPE SOLVENT AND PRIMER

- .1 PVC pipe solvent and primer combinations recommended by manufacturer and suitable for use with specified materials and application.
- .2 Use solvent and primer as directed by manufacturer. Use only solvent and primer that meets local codes.
- .3 The use of wet and dry solvent and primer is prohibited.

2.39 THRUST BLOCK

- .1 Thrust blocks to be 20MPa at 28 day strength. Thrust blocks can be either:
 - .1 Poured in place concrete.
 - .2 Pre-cast concrete block.

2.40 BACKFILL MATERIAL

- .1 Native excavated material shall be clean excavated soil, free from organic matter, stones larger than 25mm, building debris, and other foreign substances.
- .2 Sand: pit run sand.
- .3 25mm drain rock.

3.0 EXECUTION

3.1 EXISTING CONDITIONS

- .1 Report existing conditions at variance with Contract Drawings to Contract Administrator.
- .2 Verify locations of underground utilities prior to commencing excavation and conduct work so to prevent interruption and damage to services and utilities. Make good all damages to same at Contractor's cost.
- .3 Verify location of all services in building walls before boring or drilling holes. Make good all damages to same at Contractor's cost.
- .4 Protect existing conditions and completed work from disturbance during Work. Make good all damages to same at Contractor's cost.
- .5 Adjustments to installation of irrigation system to avoid existing conditions, completed work and utilities will be permitted subject to prior approval by Contract Administrator.

3.2 LAYOUT

- .1 Locations of irrigation components shown on plans are schematic in nature. Coordinate actual location of irrigation components with landscaping, building and physical features of site. Confirm proposed changes to location of irrigation components in writing with Contract Administrator prior to installation. Changes that markedly alter the irrigation design in the opinion of the Contract Administrator require submission of Shop Drawings and updated Design Report to the Contract Administrator for their permission to proceed. Record all approved revisions on a marked up set of Contract Drawings.
- .2 Layout and stake irrigation system per Contract Drawings to confirm:
 - .1 Layout is within project boundary and property lines
 - .2 Site grades are consistent with Contract Drawings
 - .3 Damage to root system of existing trees is minimized
 - .4 Installation of irrigation components to be minimum of 1 meter outside the dripline of existing trees.
 - .5 Minimum horizontal and vertical clearances from electrical and other utilities are met.
 - .6 Location of all sleeving, mainlines, pedestals, vaults, valve boxes, splice boxes.

.3 EXCAVATION

- .1 Excavate to ensure depth and bedding requirements are met.
- .2 All excavation is unclassified. Report any material or site condition that cannot be excavated by normal mechanical or normal means or that may affect excavation to required depth to Contract Administrator prior to excavation.
- .3 Identify and recycle all suitable materials recovered during construction.
- .4 Remove and dispose of buried debris exposed during excavation, including decommissioned irrigation materials and underground utilities, which may impede the proper installation and operation of irrigation system.

3.3 VAULT AND LID

- .1 Install vault in location on Contract Drawings or in alternate location approved or directed by Contract Administrator.
- .2 Support and brace point of connection components, piping and valves within vault using adjustable aluminum pipe stands complete with riser, pipe clamps, base plate and galvanized or stainless steel fittings in the quantity per service size indicated as follows:
 - .1 ¾": 2 supports
 - .2 1" to 2": 3 supports
 - .3 2 ½" to 3": 3 supports per vault
- .3 Use Schedule 80 fittings for all fittings inside vault.
- .4 Make connections of PVC pipe and metal pipe using male threads on PVC pipe and female threads on metal pipe.
- .5 Install vault drain and connect to drain pit, dry well, manhole or catch basin.

3.4 IRRIGATION CONTROLLER

- .1 Install irrigation controller in cabinet as per Contract Drawings.
- .2 Coordinate controller installation with that of other electrical components.
- .3 Install controller and wiring in accordance with local, provincial and national electrical codes.
- .4 Install communication components per manufacturer's recommendations and establish communication between controller and Owner's Central Control System, including relays or boosters as necessary.
- .5 Prior to issuance of Certificate of Substantial Performance request irrigation program from Contract Administrator and set controller program accordingly.

3.5 WEATHER SENSOR

- .1 The sensor shall be mounted within 200 feet of the irrigation controller.

3.6 CONTROL WIRE

- .1 Install control wire per code by qualified personnel employed by the company holding the electrical permit.
- .2 Bury control wire per applicable code and in no case above the bottom side of parallel pipe.
- .3 Bed control wire in sand with minimum 50mm sand around control wire. Where control wire is in same trench as pipe, place wire beside pipe with horizontal clearance of a minimum of 50mm and in accordance with BC Electrical Code depth.
- .4 Bundle multiple lengths of wire in same trench or conduit with ties at maximum 3.0m intervals.
- .5 Install wire with 600mm length of coiled slack at all changes of direction, in wire splice boxes and at connections to controlled components.
- .6 Identify all control wires entering controller cabinet with permanent label or tag indicating zone number of valves operated by each control wire.
- .7 Maintain consistent wire colour through wire splice box.
- .8 Minimize wire splices. Where wire splices are unavoidable make splice only in wire splice box using specified connector.
- .9 Identify spliced wire with permanent label or tag indicating zone number of spliced control valve.
- .10 Where specified on Contract Drawings, install extra control wire to wire splice box. Provide 600mm length of coiled slack of each wire end in wire splice box. Identify extra control wire as 'extra' wire with permanent label or tag.

3.7 GROUNDING AND BONDING

- .1 Install ground assembly in location shown on Contract Drawings or the revised location approved by the Contract Administrator.
- .2 Use the rod, plate and wire configuration as recommended by the manufacturer of irrigation controller and per BC Electrical Code.

3.8 SLEEVING

- .1 Install irrigation sleeves in locations shown on Contract Drawings.
- .2 Install irrigation sleeve to minimum depth as follows:
 - .1 Mainline Piping
 - .1 24" below walkways
 - .2 36" below driveways, roads and plazas

- .2 Lateral Piping
 - .1 12" below walkways
 - .2 24" below driveways, roads and plazas
- .3 Install sleeves to extend 1.0m past edge of hard surface into soft landscape surface.
- .4 Cap sleeve with removable plug or cover. Maintain plug in sleeve until such time as pipe or wire is ready to be installed.
- .5 Bed sleeve as follows:
 - .1 Under walkways, 100mm of sand placed all around
 - .2 Under driveways, roads, and plazas, compacted base aggregate all around per materials shown on Drawings.
- .6 Bury a piece of detectable metal on top of each end of sleeve to enable location of sleeve end by metal detector after burial.
- .7 Stake location of each end of sleeve prior to backfilling such that top of stake is 300mm above finished grade and maintain. Label exposed end of stake with the word "sleeve".
- .8 Record location of sleeve ends and label size of sleeve on record drawings.
- .9 Remove sleeve stake after submission of Record Drawings.

3.9 VALVE BOXES

- .1 Install manual and electric control valves, control zone kits and quick coupler valves in valve boxes or concrete vault as shown on Drawings.
- .2 Except as shown otherwise on Contract Drawings or approved otherwise by Contract Administrator, locate valve boxes in planting beds and locate for ease of access, maintenance, and testing.
- .3 Install valve box flush with finish grade and arrange in a neat and orderly manner.
- .4 Valve box must have 150mm depth of 25mm drain rock. Wrap valve box in landscape fabric.
- .5 Provide minimum 150mm clearance between valve box and all components within.
- .6 Valve box must not contact irrigation pipe. Use matching valve box extensions as required.

3.10 WIRE SPLICE BOXES

- .1 Locate wire splice box in planting bed where possible and locate for ease of access, maintenance, and testing.
- .2 Install wire splice box per Contract Drawings and arrange in a neat and orderly manner.

- .3 Do not install valves in wire splice box.

3.11 ELECTRIC CONTROL VALVE

- .1 Install in valve box per manufacturer's recommendations and Contract Drawings.
- .2 Identify electric control valve with permanent label or tag indicating zone number.
- .3 Ensure 50mm gap between bottom of valve and top of drain rock.

3.12 DRIP ZONE KITS

- .1 Install in valve box per manufacturer's recommendations and Contract Drawings.
- .2 Identify electric control valve with permanent label or tag indicating zone number of valve.
- .3 Ensure 2" gap between bottom of valve and top of drain rock.

3.13 QUICK COUPLERS

- .1 Install in valve box per manufacturer's recommendations and Contract Drawings.

3.14 ISOLATION VALVE

- .1 Install in valve box per manufacturer's recommendations and Contract Drawings.
- .2 Where points of connections are located within a building, install isolation valve immediately downstream of where pipe exits building, installed in rectangular valve box.

3.15 BLOW-OUT ASSEMBLY

- .1 Install blow-out assembly immediately in vault at point of connection. In the case where the point of connection is inside a building, install blow-out connection immediately downstream of isolation valve where mainline pipe exits building.

3.16 FILTERS

- .1 Install filter in same valve box as valve, per manufacturer's recommendations and Contract Drawings.

3.17 SWING JOINT ASSEMBLY

- .1 Fabricate assembly of triple swing joint using three threaded Schedule 40 PVC elbows and one threaded Schedule 80 PVC nipple.
- .2 Install swing joint assembly to rotate counterclockwise when depressed.
- .3 Tape threads of PVC fittings with Teflon tape and make hard hand tight.

3.18 SPRINKLERS

- .1 Install per manufacturer's recommendations and in location shown on Contract Drawings.

- .2 Location of heads as illustrated on Contract Drawings is intended as a guide to layout of heads. Establish actual head locations in the field to ensure complete and adequate coverage of all areas to be irrigated and no overspray onto adjacent surfaces and improvements. Do not exceed head spacing shown on Contract Drawings.
- .3 Where obstructions or site improvements hinder or block head to head coverage advise Contract Administrator and determine best method to maximize coverage.

3.19 ROOT ZONE WATERING SYSTEM

- .1 Install root zone watering system as follows:
 - .1 Install sock over tube.
 - .2 Position units evenly spaced, adjacent to the root zone and within the canopy of the tree.
 - .3 Fill tube with pea gravel to 2" below bubbler.
 - .4 Connect to lateral pipe.
 - .5 Cover grate with duct tape or landscape fabric to prevent ingress of foreign material during construction. Remove prior to substantial completion.

3.20 LANDSCAPE DRIPLINE

- .1 Do not install driplines or emitters of different flow lengths or spacing on the same zone.
- .2 Place dripline on prepared surface. Surface to be free of sharp rocks or other objects that may damage dripline. Surface to be at grade necessary for dripline to be at specified depth after placement of remainder of topsoil or growing medium.
- .3 Placement of dripline by trenching using hand or mechanical methods permitted only if specified as such on Contract Drawings or upon written approval of Contract Administrator.
- .4 Thoroughly flush each zone after installation and before beginning regular operation of drip zone.
- .5 Stake dripline in beds every 450mm on centre.

3.21 DRIP EMITTERS

- .1 Install per manufacturer's recommendations and as shown on Contract Drawings.

3.22 LATERAL FLUSH ASSEMBLY

- .1 Install flush assembly on swing joint in valve box.
- .2 Coil hose in valve box.

3.23 PIPE AND FITTINGS

- .1 Verify that all pipe, fittings, primer and cements are compatible for proper installation.
- .2 Do not locate open side of trench any closer than 300mm from hard surface or feature.

- .3 Keep inside of pipe and outside of pipe ends always clean. Cap or plug open pipe ends to keep out dirt and debris.
- .4 Cut PVC pipe ends at right angle to pipe length. Clean burrs prior to joining pipe and fittings.
- .5 Immediately prior to joining pipe and fittings wipe contact surfaces clean with primer on clean rag.
- .6 Apply light coat pipe of cement on inside of fitting and heavier coat on outside of pipe. Insert pipe into fitting and give a quarter turn to seat cement. Wipe excess cement from outside of pipe.
- .7 Wrap male threads of threaded fittings with minimum 3 wraps of Teflon tape immediately prior to making connection.
- .8 Flush all irrigation pipe fully to remove accumulation of dirt and debris prior to installation of heads, dripline, emitters and filters. Flush all laterals in a manner approved by the manufacturer to prevent clogging of screens, nozzles and emitters.
- .9 Conduct mainline pressure test and HDPE pipe strap test and obtain approval of Contract Administrator prior to backfilling lines.
- .10 Sidewall fusion of HDPE is not acceptable.
- .11 Set mainlines and laterals on and backfill with sand to clearance limit shown on Drawings.
- .12 Install thrust blocks at all changes in direction of PVC pipe 2 ½" in diameter or greater, and for any change in direction of gasketed pipe.

3.24 THRUST BLOCK

- .1 Place thrust block to support the pipe joints from separating, not to prevent the pipe from heaving. Do not cover top of pipe with concrete thrust blocking at change from a horizontal alignment to a vertical alignment.
- .2 For thrust blocks installed in disturbed soils increase the thrust block area by 50%.
- .3 Place 2 ply of 6mil polyethylene between pipe and thrust block.
- .4 Allow concrete to set before backfilling trench or pressurizing line.
- .5 Obtain approval from Contract Administrator prior to backfilling thrust block.

3.25 CLEAN UP AND RESTORATION

- .1 Remove all waste and debris resulting from irrigation installation from site.
- .2 Restore all disturbed surfaces to original condition and repair all trench settlement.

3.26 INSTRUCTIONS TO OWNER

- .1 Instruct Owner in complete operating and maintenance procedures for irrigation system, including start-up, winterization, and programming.
- .2 Review Record Drawings and Operating Manual with Owner on site.

3.27 MAINTENANCE - GENERAL

- .1 Inspect, operate, maintain and adjust irrigation system through the Landscape Maintenance Period until issuance of Certificate of Acceptance to ensure it operates as intended, including but not limited to:
 - .1 Adjust irrigation schedule to ensure survival, health and growth of plant material and respond to soil conditions, climate, and seasons of site.
 - .2 Clean sprinkler heads and adjust coverage to eliminate over watering, under watering and overspray onto adjacent surfaces.
 - .3 Monitor and clean filtration equipment.
 - .4 Restore grass areas, planting beds, hard surfaces and improvements affected by trench settlement and erosion.
 - .5 Respond to requests from Contract Administrator for program adjustments, servicing, adjustments and repairs.

3.28 MAINTENANCE – WINTERIZATION

- .1 During Maintenance Period be responsible for winterization of irrigation system at end of growing season and prior to onset of air temperatures below 0° Celsius. Be liable for any damage resulting from late or improper winterization.
- .2 Request presence of Owner at winterization at least 5 days prior to proposed winterization date.
- .3 Winterization includes but is not limited to:
 - .1 Saturation of soil with water to a depth of 300mm to provide deep watering of all lawn areas, planting beds and tree pits.
 - .2 Deactivation of controller
 - .3 Drainage and blow-out assembly of entire irrigation system.

3.29 MAINTENANCE – SPRING START-UP

- .1 During Maintenance Period be responsible for spring start-up of irrigation system at beginning of growing season or within 10 days of request for start-up from Owner. Be liable for any damage resulting from late or improper start-up.

- .2 Ensure Owner is present for spring start-up. Request presence of Owner at least 5 days prior to proposed start-up.
- .3 Spring start-up includes but is not limited to:
 - .1 Checking and testing for leaks
 - .2 Cycling irrigation control program through all zones to ensure proper function and performance
 - .3 Checking and adjusting heads and emitters to achieve even coverage with minimum overspray onto other surfaces.
 - .4 Test backflow prevention assembly. Submit test results to Contract Administrator.
 - .5 Saturation of soil with water to a depth of 300mm to provide deep watering of all lawn areas, planting beds and tree pits

3.30 GUARANTEE

- .1 Submit written guarantee, in approved form, stating that all work showing defects in materials, workmanship or operation will be repaired or replaced at no cost to Owner for a period of one year from date of Substantial Performance.
- .2 Guarantee includes the supply of labour, materials and equipment necessary for the repair and replacement of damaged or defective materials and workmanship. Guarantee also includes spring start-up, winterization, maintenance, necessary testing, program corrections or adjustments and restoration of settled trenches.
- .3 Guarantee will not apply to materials or workmanship damaged after Substantial Performance by causes beyond the Contractor's control, such as vandalism or abuse.

*****END OF SECTION*****

1.0 **GENERAL**

1.1 **Scope**

- .1 This guideline addresses the materials, and equipment necessary for the supply, placement, and amendment of the growing medium.

1.2 **Related Work:**

- .1 Section 32 93 00 Plants
- .2 Section 32 93 05 Relocation of Existing Plant Material

1.3 **Definitions**

- .1 For the purpose of this guideline, the term "Growing Medium" shall mean a mixture of mineral particulates, microorganisms and organic matter which provides suitable medium for supporting intended plant growth. Commercially available landscape soils or native site soils, if proposed for use, will also be subject to landscape soil assessment analysis.
- .2 "On-Site Topsoil" refers to topsoils (native or commercially processed) on location at project site, or reallocated, stockpiled and transported from elsewhere on UBC Campus lands. On-Site Topsoil may be excavated, stockpiled, protected and amended in-situ as required by the project. If proposed for project use, On-Site Topsoil will also be subject to landscape soil assessment analysis and amendment.
- .3 "Soil Consultant" refers to the professional Agrologist with training in landscape soil analysis and interpretation, who is responsible for laboratory services and recommendations.
- .4 "Contractor" refers to the Contractor responsible for the Landscape Works on a project, whether this is the General Contractor, a Landscape Contractor, or a Landscape Sub-Contractor, or a combination of Contractors and Sub-Contractors.

2.0 **MATERIALS AND DESIGN REQUIREMENTS**

2.1 **Existing Conditions**

- .1 On-site topsoil designated to remain undisturbed in-situ, must be assessed, tested, amended, protected from compaction and weed infestation, and otherwise managed for the duration of the project as required and/or directed according to project drawings, specifications, soil test results or as directed by the Project Landscape Architect in consultation with UBCO Facilities Manager of Landscape and Building Services.
- .2 On-site topsoil infested with pernicious perennial weeds such as horsetail, vetch or morning glory etc. shall be excavated to depth necessary to prohibit future recurrence and removed from UBCO Campus. Alternative remedial strategies must be presented in writing and reviewed and approved by the Project Landscape Architect in consultation with UBCO Facilities Manager of Landscape and Building Services.
- .3 On-site topsoil intended for use as growing medium, or as component of growing medium, shall be protected against contamination from invasive or pernicious weeds, insect pests, plant pathogenic organisms and other extraneous and non-organic materials and environmental toxins or contaminants.
- .4 Onsite subsoil must not be used as a component of growing medium unless endorsed by Soil Consultant and whereby it can be amended to meet requirements of growing medium.

- .5 Following rough grading, examine existing sub-grade conditions and signify acceptance in writing to the Project Landscape Architect.
- .6 Ascertain the size and location of all existing services and sub-grades prior to the work.
- .7 Repair any damage resulting from failure to exercise such precautions immediately at no cost to UBC.

2.2 Testing

- .1 The Contractor who is responsible for supply of growing media and/or conservation of on-site topsoil should be responsible for the testing of the growing media. Testing shall be carried out by Pacific Soil Analysis Inc., at #5 - 11720 Voyageur Way, Richmond, B.C. (Ph. 604 - 273-8226), or an equal approved prior to closing of tender.
- .2 Separate tests and analysis shall be conducted for the following:
 - .1 All distinct types of growing media used on the project including imported soil, retained on-site topsoil, relocated or mixed on-site media, any other distinct formulated soil substitute or mixture.
 - .2 All media formulated or designated for a special purpose including but not limited to planting, lawns, sports fields, on-slab, extensive or intensive green roofs, living walls, structural soils for street tree planting.
- .3 The test shall determine the characteristics and quantity of the amendments to be used to bring the growing media and/or on-site topsoil to a satisfactory chemical and physical condition.
- .4 Sand shall be tested for sieve size analysis.
- .5 Before adjusting the growing media and/or on-site topsoil as required by the soils testing, submit soils analysis to the Project Landscape Architect and UBCO Facilities Manager of Landscape and Building Services for approval. The Project Landscape Architect shall confirm in writing the growing media and/or on-site topsoil amendments and fertilizer to be applied. The Contractor is responsible for amendment of the growing media and/or on-site topsoil as per the confirmed recommendations.
- .6 Soil testing must be completed and recommendations approved by Project Landscape Architect prior to installation of any plant material. Failure to do so may result in the rejection of the growing media and/or retained topsoil, removal of growing media or retained topsoil from the site at no cost to UBCO, and replacement with approved growing media as required.

2.3 Product Handling and Storage

- .1 All materials to be handled and adequately protected to prevent damage or contamination.
- .2 Stockpile materials in bulk form in paved area(s) approved by Project Landscape Architect. Take all precautions to prevent contamination of basic materials from wind blown soil particles, weed seeds and from insects. Contamination of the ingredients may result in their rejection for use. Where paved surfaces are not available prevent contamination of on-site soil or sub-soil or construction materials.
- .3 Store fertilizer and chemical ingredients in the manufacturer's original containers.
- .4 Store growing medium and/or excavated topsoil in a dry area or covered and protected from

- .5 weed infestation, contamination, damage, water saturation, compaction or erosion.
- .5 Maintain all stockpiled growing medium, excavated topsoil and all related amendments free of weed infestation prior to installation and throughout the duration of the project.

2.4 Inspection

- .1 The UBCO Facilities Manager of Landscape and Building Services should be notified prior to soil placement to inspect growing medium.

2.5 Samples

- .1 Samples should be submitted for any amendments that are to be used:
 - .1 Sample size will be approximately 2 litres volume and be representative of the stockpile (properly sampled).
 - .2 Samples must be submitted, tested, and approved by the UBCO Facilities Manager of Landscape and Building Services in writing before the growing medium is amended. Failure to do so may result in the rejection of the growing medium, removal of the growing medium from the site at no cost to UBCO, and replacement with approved growing medium.

2.6 Growing Media for Standard Applications

- .1 All growing media must conform to the Canadian Landscape Standard Current addition as well as the following guidelines and specifications applicable to projects on UBC Campus.
- .2 The following guidelines apply to standard applications where media are formulated for use on-grade, over sub-soil, and designated for application to on-grade lawns, trees and plantings as per Canadian Landscape Standard, Table 6-2: Properties of Growing Medium for Level 1 "Well Groomed" Area.
- .3 Growing medium shall be composed of proportions of mushroom manure or mushroom manure / peat moss mix, silts and clays, and sand, which provides suitable medium for supporting intended plant growth. Amendments shall be required based on the soil analysis.
- .4 Growing medium shall be free of pernicious weeds or their roots, sticks, building materials, wood chips, chemical pollutants and other substances at levels toxic to plants, and other extraneous materials which detract from the desirable physical and chemical properties for landscaping purposes. Death of plants during the first year which may be attributed to nematodes or toxic materials in the growing medium did not meet this requirement at the time of installation, and may result in a requirement that the Contractor remove and replace dead plants and faulty growing medium. Excessive growth of weeds (as determined by the Project Landscape Architect) in a growing medium may be an indication that unacceptable levels of weed seeds or weed parts were present in the growing medium at the time of installation. Such a determination may result in a requirement that the Contractor remove and replace all affected medium and/or all weeds and weed roots and reduce the growth of weeds to acceptable levels.
- .5 Organic matter: mushroom manure, composts, or mixtures of manure, compost or peat will be considered for organic matter amendment. Provide samples to Pacific Soil Analysis (or pre-approved equal), for testing and approval. Approved sample shall be standard throughout.
- .6 Pump river sand: sand shall be pumped from a river and free of salt, debris, weeds and toxic chemicals. Sand shall be minimum 50% medium (< 0.5 mm and > .25 mm). Provide sample to Pacific Soil Analysis (or pre-approved equal) for inspection and approval. Approved sample shall be standard throughout.

- Sand must be mixed into growing medium prior to placement. Rototilling of sand into installed growing medium is not acceptable.
- .7 Growing medium shall require not more than 0.5 kg / sq. m. (100 lb. / 1,000 sq. ft.) of dolomite lime to reach the required pH level.
 - .8 Organic content shall be within the ranges as per Canadian Landscape Standard, Table 6-2: Properties of Growing Medium for Level 1 "Well Groomed" Area, for the intended application. This requirement may be met by mixing growing medium components or by topdressing and Rototilling in an approved type of organic matter, based on the recommendation from the soil testing laboratory. (See Section 32 93 00 Plants, 3.6.2 - Fertilizer Application and Soil Amendments).
 - .9 Drainage of growing medium can be measured only after the growing medium is in place. Mixing and handling of growing medium shall be done in such a manner that the minimum saturated hydraulic conductivity as per Canadian Landscape Standard, Table 6-2: Properties of Growing Medium for Level 1 "Well Groomed" Area is achieved. Areas with compacted soil after installation must be cultivated to restore the uncompacted nature found throughout the project.

2.7 Special Purpose Media for Non-Standard Applications

- .1 Special Purpose Media includes all media for specialized application that requires formulation or amendment which diverges from the generalized specifications and tolerances shown above under Growing Media for Standard Applications and Canadian Landscape Standard, Table 6-2: Properties of Growing Medium for Level 1 "Well Groomed" Area. Special Purpose Media may include, but not be limited to: on-slab plantings, modular planters, extensive and intensive green roofs, living walls and street tree plantings in pavement.
- .2 Complete specifications and details for Special Purpose Media shall be developed collaboratively with the Project Landscape Architect following the recommendations of a Soil Consultant, Structural Engineer, and related project consultants as required before inclusion in contract specifications and drawings.
- .3 Specifications and details for Special Purpose Media shall be reviewed and approved by the Project Landscape Architect in consultation with UBCO Facilities Manager of Landscape and Building Services.
- .4 Structural Soils used for the installation of trees in urban pavements, plazas and streets will be the preferred planting medium for this type of tree planting. Alternatively, Structural Cell technologies and associated medium may be used if authorized by the Project Landscape Architect in consultation with UBCO Facilities Manager of Landscape and Building Services.
- .5 Specifications and details for Specialized Media shall be provided by Project Landscape Architect in contract documents congruent in scope and equivalent with specifications above detailing Growing Media for Standard Applications and Canadian Landscape Standard, Table 6-2: Properties of Growing Medium for Level 1 "Well Groomed" Area.

2.8 Growing Media Amendments

- .1 Required amendments for any landscape growing media or soils, will be the result of:
 - .1 Recommendations from Soil Consultant made after growing media testing and analysis.

- .2 Availability of organic matter amendment.
- .3 The presence or absence of an irrigation system.
- .4 The following amendment materials may be required to be added to the growing medium to conform to Soil Test findings.
 - .1 Organic matter: as per 2.6.8 above.
 - .2 Pump river sand: as per 2.6.6 above.
- .2 Fertilizer and Chemical Ingredients:

Fertilizer and chemical Ingredients may be required by the Project Landscape Architect based on growing media test results to be added to each growing medium to conform to the growing medium standards specified above, and/or as based on the Soil Testing findings as recommended by Soil Consultant.

 - .1 Fertilizers must be those detailed in the landscape soil analysis report. The Landscape Contractor will not make any substitutions or change of application rates unless having attained written approval of the Project Landscape Architect.
 - .2 Fertilizers and liming ingredients will be delivered to the site in their original manufacturer's packaging. All materials will be dry and free flowing to facilitate uniform distribution.
 - .3 Mulch: refer to Section 32 93 00 Plants.
 - .4 Drainage and Filter Fabric:
 - .1 Drain rock: 3/4" - 1" diameter round rock washed free of all fines and organic materials.
 - .2 Filter fabric: heat bonded, rot-proof, non-woven fabric, or approved equal.

2.9 Preparation of Existing Grade

- .1 Verify that grades are correct. If discrepancies occur, notify Project Landscape Architect and do not commence work until instructed by Project Landscape Architect.
- .2 Eliminate uneven areas and low spots, ensuring positive and free drainage.

2.10 Placement

- .1 Remove debris, roots, branches, stones in excess of 50 mm diameter and other deleterious materials. Remove soil contaminated with calcium chloride, toxic materials and petroleum products. Remove debris which protrudes more than 25 mm above surface. Dispose of removed material off site, at no expense to UBC.
- .2 Scarify entire area which is to receive growing medium to depth of 100 mm. Scarify those areas where equipment used for hauling and spreading has compacted soil.
- .3 No growing medium shall be loaded, transported or spread when it is so wet that its structure is likely to be altered, or risk of compaction exists.
- .4 Spread growing medium with adequate moisture in uniform layers over approved, unfrozen

subgrade, where sodding and planting is indicated.

- .5 Manually spread growing medium to achieve final grades around trees, shrubs and obstacles.
- .6 Installed growing medium to 25 mm above design grades to allow for settlement.
- .7 Place the growing medium to the following dimensions (Refer to Canadian Landscape Standard Table 6-5 Current Edition):
 - .1 Trees – Min. 600mm (24") deep and twice the diameter of the rootball around each tree.
 - .2 Shrubs – Min 450mm (18") depth.
 - .3 Groundcover - Min 300mm (12") depth.
 - .4 (Low and High Traffic) Lawns – Min 150mm (6") depth.

2.11 Finish Grading

- .1 Leave surfaces smooth, uniform and firm against deep foot printing.
- .2 Fine grade growing medium to 25 mm above finished grades shown on drawings. Eliminate rough spots and low areas to ensure positive drainage. Prepare loose, friable beds by means of cultivation and subsequent raking. Final grades to be approved by UBCO Facilities Manager of Landscape and Building Services prior to further work proceeding.
- .3 After planting, spread 75 mm layer of specified approved mulch evenly over all exposed growing medium finished grades, to the satisfaction of the UBCO Facilities Manager of Landscape and Building Services. Refer to Section 32 93 00 Plants for guidelines on mulch specification.

2.12 Acceptance

- .1 UBCO Facilities Manager of Landscape and Building Services will inspect growing medium in place and determine acceptance of material, depth of growing medium and finish grading, prior to plant installation.
- .2 Approval of growing medium may be subject to soil testing and analysis if any doubt exists concerning its conformity to the requirements as per Canadian Landscape Standard, Table 6-2: Properties of Growing Medium for Level 1 "Well Groomed" Area, or any of the subparagraphs under paragraph 2.1 of this Section.

2.13 Surplus Material

- .1 Dispose of materials not required by UBCO Facilities Management off site, at no cost to UBCO.

*****END OF SECTION*****

1.0 **GENERAL**

1.1 **Scope**

- .1 This guideline addresses the materials, methodology and services necessary for complete installation of seeded or hydro-seeded lawns and meadows, which includes the control of noxious and pernicious weeds within seeded lawns and meadows.

1.2 **Related Work**

- .1 Related Work in Other Sections:
 - .1 Section 32 80 00 Irrigation
 - .2 Section 32 91 00 Planting Preparation
 - .3 Section 32 93 00 Plants

1.3 **Pertinent Standards and Legislation**

- .1 Conform to the requirements of the latest editions of the following standards and legislation:
 - .1 British Columbia Landscape Standard – Current Edition
 - .2 British Columbia Standard for Turfgrass Sod
 - .3 British Columbia Weed Control Act
 - .4 Canada Seed and Fertilizer Act
 - .5 Canada Pest Control Products Act

1.4 **Submittals**

- .1 Provide Project landscape Architect and UBCO Facilities Manager of Landscape and Building Services with guaranteed analysis of the seed mixtures. Submit specification data of seed prior to installation. Submit soil analysis of growing medium with seed specification data.
- .2 Provide sample product label and a sample of seed to the Project Landscape Architect and UBCO Facilities Manager of Landscape and Building Services.

1.5 **Inspections and Approvals**

- .1 Notify Project Landscape Architect, UBCO Facilities Manager of Landscape and Building Services at least forty-eight (48) hours before seeding or hydro-seeding for inspection of finished grades. All lawn and grass installations are subject to inspection and may be rejected for failure to comply with contract specifications at any time until Total Performance. Reseeding of deficient areas shall be done at no expense to UBC.
- .2 Notify Project Landscape Architect, UBCO Facilities Manager of Landscape and Building Services as required by project type, at the completion of work for an inspection for Substantial Performance.
- .3 Final inspection of seeded lawns and meadows will be made at the end of the specified warranty period. For release from the Contract, all lawns and meadows must be alive and in a healthy, satisfactory growing condition at the time of inspection. The Project Landscape Architect and UBCO Facilities Manager of Landscape and Building Services reserve the right to extend the Contractor's responsibility for another growing season, if in his/her opinion, development and growth of lawn and meadows is not sufficient to ensure satisfactory future growth.

- .4 The UBCO Facilities Manager of Landscape and Building Services at his/her discretion may waive one or more inspections, but this shall not impair the right of the UBCO Facilities Manager of Landscape and Building Services to inspect work or materials which have been damaged or in any way do not conform to the contract specifications.
- .5 Contractor to be present during all required inspections as specified or as may be required by the UBCO Facilities Manager of Landscape and Building Services.

2.0 MATERIALS AND DESIGN REQUIREMENTS

2.1 Product Handling

- .1 Deliver seed and hydro-mulch in original, labeled, and undamaged containers. During shipping, storage and installation, protect seed and hydro-mulch materials against moisture.

2.2 Protection

- .1 Protect all seeded areas against trespassing, and from pedestrian or vehicular damage at all times until Acceptance. If any seeded areas are damaged, they shall be repaired by the Contractor as required.

2.3 Approved Equals

- .1 All seed mixes and hydro-mulches as specified or pre-approved equals.

2.4 Warranty

- .1 All workmanship and materials covered under Work of this Section shall be warranted for a period of one (1) full year from the date of Substantial Performance.

2.5 Materials

- .1 Fertilizer shall be as recommended for season of application (as per industry standards).
- .2 Dolomite Lime: Shall be finely and uniformly ground containing not less than 90% calcium carbonate.
- .3 Lawn and Meadow Seed:
 - .1 Seed mixtures shall be suited to the climate, growing medium, site orientation, sun exposure, terrain, establishment and lawn class designation or intended use under which they are to be grown.
 - .2 Selections of seed mixtures should take into account the current infestations and impacts of Chaffer Beetle and associated damages by crows and raccoons. Seed mixtures may be available which inhibit the proliferation of this pest. Designing with alternate groundcover or planting should also be considered. Consult with authorities, seed suppliers and UBCO Facilities Manager of Landscape and Building Services as required.
 - .3 Seed shall have a minimum germination rate of 75% and minimum purity of 97% except where otherwise required by the professional selecting such seed.
 - .4 Professional consultation is required in selecting or designing special purpose mixes for naturalizing or restoration purposes.

- .5 The seed mixture shall be mixed, labeled and supplied by a recognized seed supplier. Labels shall include complete details including species names germination percentages, purity of analysis, year of production, and contact info for supplier.

2.6 Hydro-Seeding Materials

- .1 Hydro-mulch materials shall consist of a mixture of fiber, seed, fertilizer and water designed for hydro-seeding and dyed for ease of monitoring application.
- .2 Hydro-mulch shall contain no growth or germination inhibiting factors, be dry, be free of invasive and other foreign materials.
- .3 Hydro-mulch shall be supplied in packages bearing the manufacturers label clearly indicating weight and product name.
- .4 Fiber should be coloured, fibrous, wood cellulose or paper based mulch, not containing any growth or germination inhibitors and shall be manufactured so that it will form a uniformly suspended homogeneous slurry when added to the fertilizer, seed and water in a tank when agitated.
- .5 When applied, the hydro-mulch shall be applied uniformly and in such a manner as to prevent puddling and movement of the soil surface and be capable of forming an absorptive mat, which will allow moisture to percolate into the underlying soil.
- .6 Hydro-mulch may contain a colloidal polythacuride (or equivalent) industry accepted, non-asphaltic, tackifier for adhesion to the mulch material to form a mat on slopes as erosion control, and to avoid chemical agglomeration during mixing in the hydro-mulching equipment.

2.7 Fertilizer

- .1 Apply fertilizer at manufacturers' recommended rates. Ensure equal distribution. Mix into top 50 mm. (2") of growing medium by disking, raking or harrowing. Application of fertilizer shall be 48 hours before seeding lawns.

2.8 Liming

- .1 Add lime as required to ensure pH 6.0 to 6.5. Mix into full depth of growing medium. Coordinate with soils analysis.

2.9 Subgrade Preparation and Finishing

- .1 Obtain approval of Project Landscape Architect and UBCO Facilities Manager of Landscape and Building Services of subgrade and growing medium prior to seeding of lawns or grasses. Ensure that growing medium is placed to required depths and tolerances as specified and detailed in the Contract Documents and spread evenly over the approved subgrade. Ensure the growing medium is firm against footprints, loose in texture and free of all stones, roots branches etc. as required under Section 32 91 00 Planting Preparation.
- .2 Where lawns interface with drip-strips or the like in close proximity to building façades, design should account for potential soiling of glass and painted surfaces with grass clippings. Therefore, baffles, extrusions or other design details should be considered to minimize or alleviate this impact.
- .3 Ensure finish grade surfaces are tamped with roller before seeding, and finish grades are congruent with project drawings as specified.

- .4 Grades:
 - .1 Lawns and grass areas must be graded at slopes safe for mowing by maintenance crews and safe for all other Campus users. Maximum allowable slope for lawns is 5:1. Slopes over 5:1 are only permitted where pre-approved by Campus Landscape Architect in consultation with UBCO Facilities Manager of Landscape and Building Services. (See also Section 31 22 00 Grading, 1.1.1)
 - .2 Areas to be seeded shall be at grades as shown at the time of seeding.
 - .3 Restore all areas to be seeded which are misshapen or eroded to original specified condition, grade and slope as directed just prior to seeding. Minor adjustment and refinement of finish grade to be made as directed by the UBCO Facilities Manager of Landscape and Building Services.
 - .4 Crown or slope for surface drainage and eliminate all low spots or depressions.
- .5 If the surface of the growing medium is dry, lightly moisten the growing medium immediately prior to seeding.

2.10 Seeding

- .1 Scheduling:
 - .1 Seeding should be carried out during periods when seasonal conditions are likely to ensure successful germination and continued growth of all species in seed in the grass mix.
 - .2 All seeding should be conducted during calm weather, and shall be done on soil that is free of ground frost, snow, and standing water.
 - .3 Hydro-seeding shall not be carried out during periods of moderate to heavy rainfall.
- .2 Methods
 - .1 Seed shall be applied by mechanical dry seeding, hydro-seeding or as specified for designated areas within the site(s) to be developed.
 - .2 All seeding should be conducted during calm weather, and shall be done on soil that is free of ground frost, snow, and standing water.
 - .3 Hand seeding shall only be carried out when patching limited areas of lawns or where site conditions preclude the above two methods.
- .3 Rates of Application
 - .1 Rates of application of seed species mixtures, hydro-mulch and other components shall be based on analysis of season, climate, terrain, growing media and establishment and maintenance conditions for intended use.
- .4 Mechanical Dry Seeding
 - .1 Fertilizer, if required, shall be uniformly applied at the rate required and worked well into topsoil by hand cultivating, raking or disking and harrowing to a minimum depth of 5cm (2in).

- .2 All grass seed, nurse crop seed and fertilizer shall be measured accurately prior to application.
- .3 Seed and fertilizers shall be applied evenly by means of an accurately calibrated, approved mechanical dry seeder at the rate required, or as specified.
- .4 Seed shall be applied in two intersecting directions, except where conditions dictate seeding in one direction only.
- .5 Seeded areas shall be lightly raked and rolled after seeding to ensure good contact between seed and growing medium.
- .6 Mulch may be applied with seed or spread manually following seeding, or with an approved mulcher. Straw mulches must be free of hay, foreign seeds or contaminants detrimental to seed growth and establishment. No area shall be seeded that cannot also be mulched on the same day. The mulch shall be applied to form a uniform mat over the entire area.

2.11 Hydro-Seeding

- .1 The quantities of each of the materials to be charged into the hydro-seeder / mulcher tank shall be accurately measured whether by mass or by mass-calibrated volume measurements.
- .2 Materials for hydro-seeding shall be added to the tank while it is being filled with water, and in the following sequence: seed, fertilizer, and where applicable, fibrous materials.
- .3 Materials shall be thoroughly mixed and agitated into a homogeneous water slurry in the various combinations as described and specified, and shall be distributed according to recommended seed-sowing rates to uniformly cover the surface area with the hydro-seeder / mulcher.
- .4 Hydro-seeding equipment shall:
 - .1 have the tank volume certified by an identification plate or sticker that shall be affixed in plain view on the equipment and shall not be removed or altered.
 - .2 be thoroughly cleaned prior to any and all seeding applications.
 - .3 be capable of sufficient agitation to mix the materials into a homogeneous slurry and to maintain the slurry in a homogeneous state until it is applied.
- .5 After charging, no water or other material shall be added to the mixture in the hydro-mulcher.
- .6 Water slurry and other components should not be left in the tank for more than four hours unless required for specific purposes of application.
- .7 Wildflower seed mix, if required, should be applied prior to or during grass hydro-seeding.
- .8 The wildflower seed mix shall be such that it meets the requirements of the Seed Act and be free of any invasive plant species or potentially invasive pernicious weeds.
- .9 Hydro-seeding shall be done with care to ensure that the fertilizer in solution does not come in contact with the foliage of any trees, shrubs or other susceptible vegetation. Seed or mulch shall not be sprayed in areas or on objects not expected to grow grass.
- .10 Existing site equipment, roadways, landscaping, reference points, monuments, markers, structures and vehicles shall be protected as required from over-spray damage.

- .11 Over-spray or damage that occurs during hydro-seeding shall be rectified by the Contractor at no expense to UBCO.
- .12 Temporary fencing, barriers, barricades or signage shall be provided and maintained to protect newly seeded areas from damage including but not limited to, erosion, pedestrian and vehicular traffic or wildlife.

2.12 Maintenance

- .1 Refer to Section 32 01 90 Operation and Maintenance of Planting for complete maintenance guidelines.
- .2 The maintenance period begins at the time lawns and meadows are planted and continues for 55 days from the date of Substantial Performance.
- .3 Maintenance shall consist of all measures necessary to keep grass healthy, in a vigorous growing condition and well rooted into the underlying soil. Maintenance shall include, but shall not be limited to the following:
 - .4 Maintenance of Lawn Areas:
 - .1 Mowing: Once fully established, mow out at regular intervals as required to maintain grass at a standard maximum height of 60mm (2-1/2"). Not more than 1/3 of the blade shall be cut at any one mowing. Heavy clippings shall be removed immediately after mowing and trimming.
 - .2 Edging / Trimming: All lawn perimeters and around walkways, curbs, walls, bed edging, utilities and other fixtures shall be edged and trimmed at each mowing or at intervals sufficient to maintain a crisp and neat appearance. Absolutely do not use line trimmers around trees and shrubs. Sprinkler heads shall be trimmed to clear as often as necessary to keep them operating properly. The hard surface areas adjacent to the lawns shall be swept and cleaned after each operation.
 - .3 Fertilizing: Post-establishment fertilizer shall follow initial mowing and shall be carried out when grass is dry. Unless otherwise specified, use fertilizer that will provide at least 0.45kg/92.9 sq. m. (1 lb/1000 sq. ft.) of lawn area.
 - .4 Watering shall be carried out when required and with sufficient quantities to prevent grass and underlying growing medium from drying out.
 - .5 Rolling shall be carried out when required to remove any minor depressions or irregularities.
 - .6 Weed control shall be carried out before the density of weeds reaches 10 broadleaf weeds or 50 annual weedy grasses per 37 sq. M. (400 square feet).
 - .7 Weed control shall reduce the density of weeds to zero or near zero as dictated by intended use and lawn class (see Canadian Landscape Standard).
 - .8 Any lawn areas showing deterioration or bare spots shall be repaired immediately. All areas showing shrinkage due to lack of watering shall be top dressed and seeded with a seed mix matching the original seed mix.
 - .9 All lawn areas shall be adequately protected with warning signs and fencing as directed by Project Landscape Architect. Fencing shall be maintained in good condition to provide a continuous barrier until Acceptance. Except as otherwise

required by the work of the Contract, the fencing shall be removed from the site only upon Acceptance.

- .10 Clean-up: Clean-up shall include removal of clippings from all walks, curbs and other paving.
- .5 Maintenance of Meadow Areas:
 - .1 Mowing: Once fully established, mow one time per year after seed has dried on mature plants – i.e. end of September through to mid-October. Additional mowings may be supplemented as required by site location, site condition, site usage, vigor and growth rate of meadow mix. Do not mow if the soil and meadow area are wet. Let clippings fall but clean all clippings from hard surface areas. During the growing season, unless otherwise specified, mow 1.5 meter width next to walkways, plazas, parking areas and roadways for a more tidy appearance.
 - .2 Edging / Trimming: Unless otherwise specified, all meadow perimeters and around walkways, curbs, walls, bed edging, utilities and other fixtures shall be edged and trimmed at each mowing or at intervals sufficient to maintain a crisp and neat appearance. Absolutely do not use line trimmers around trees and shrubs. Sprinkler heads shall be trimmed to clear as often as necessary to keep them operating properly. The hard surface areas adjacent to the meadows shall be swept and cleaned after each operation.
 - .3 Fertilizing: No fertilizer shall be used on meadows unless otherwise specified for special site or conditions.
 - .4 Watering shall be carried out only to ensure proper establishment of meadow and if required with sufficient quantities to prevent grass and underlying growing medium from drying out. Otherwise, post-establishment meadows should not require watering.
 - .5 Any meadow areas showing deterioration or bare spots shall be repaired immediately. All areas showing shrinkage due to lack of watering during establishment period shall be top dressed and seeded with a seed mix matching the original seed mix.
 - .6 Weed Control: the use of toxic pesticides for cosmetic purposes has been suspended on UBC Campus. Manual weed control is the preferred method and may be the only permitted methodology. Remove and replace significantly affected lawn and meadow areas. Consult with Project Landscape Architect and UBCO Facilities Manager of Landscape and Building Services for approval of any alternative organic weed control substances or methodologies.
 - .7 All meadow areas shall be adequately protected with warning signs and fencing as directed by Project Landscape Architect. Fencing shall be maintained in good condition to provide a continuous barrier until Acceptance. Except as otherwise required by the work of the Contract, the fencing shall be removed from the site only upon Acceptance.
 - .8 Maintenance clean-up: Clean-up shall include removal of clippings from all walks, curbs and other paving.

2.13 Clean-Up

- .1 All excess materials and other debris resulting from site development and seeding operations shall be removed from the job site.

END OF SECTION

1.0 **GENERAL**

1.1 **Scope**

- .1 This guideline addresses the materials, methodology and services necessary for complete installation of sodded lawns, which includes the control of noxious and pernicious weeds within seeded lawns and meadows.
- .2 Due to the current prevalence of damages associated with Chaffer Beetle, the scope of sod installation should be limited if not suspended where practical in favour of seeding with resistant seed mixtures, or designing with alternate groundcover or planting. See Section 32 92 00, Turf and Grasses, 2.6.3.2.

1.2 **Related Work**

- .1 Related Work in Other Sections:
 - .1 Section 32 80 00 Irrigation
 - .2 Section 32 91 00 Planting Preparation
 - .3 Section 32 93 00 Plants
 - .4 Section 32 92 00 Turf and Grasses

1.3 **Pertinent Standards and Legislation**

- .1 Conform to the requirements of the latest editions of the following standards and legislation:
 - .1 Canadian Landscape Standard – Current Edition
 - .2 British Columbia Standard for Turfgrass Sod
 - .3 British Columbia Weed Control Act
 - .4 Canada Seed and Fertilizer Act
 - .5 Canada Pest Control Products Act

1.4 **Submittals**

- .1 Provide UBCO Facilities Manager of Landscape and Building Services with guaranteed analysis of the grass mixture and purity of sod. Submit specification data of sod prior to installation. Submit soil analysis of sod growing medium with sod specification data.

1.5 **Inspections and Approvals**

- .1 All sod installations are subject to inspection and may be rejected for failure until Total Performance. Replace rejected materials and remove from site at no expense to UBCO.
- .2 Notify UBCO Facilities Manager of Landscape and Building Services at the completion of work for an inspection for Substantial Performance.
- .3 Final inspection of sodded lawns will be made at the end of the specified warranty period. For release from the Contract, all sodded lawns must be alive and in a healthy, satisfactory growing condition at the time of inspection.

2.0 **MATERIALS AND DESIGN REQUIREMENTS**

2.1 **Product Handling**

- .1 During shipping, storage and installation, protect sod against drying, to the requirements of the B.C. Standard for Turfgrass Sod.

2.2 **Protection**

- .1 Protect all sodded areas against trespassing and from damage at all times until Acceptance. If any sodded areas are damaged, they shall be repaired as required by the Contractor.

2.3 **Warranty**

- .1 All workmanship and materials covered under Work of this Section shall be warranted for a period of one (1) full year from the date of Substantial Performance.

2.4 **Materials**

- .1 Fertilizer shall be as recommended for season of application (as per industry standards).
- .2 Dolomite Lime: Shall be finely and uniformly ground containing not less than 90% calcium carbonate.
- .3 Sod:
 - .1 Suitability: All turfgrass sod shall be suited to the locality, site conditions and intended function of each project or area.
 - .2 Sod shall be nursery grown turfgrass sod, true to type, conforming to the B.C. Standard for Turfgrass Sod. "Non-Netted" Sod only will be accepted.
 - .3 The quality grade of sod (based on B.C. Standard for Turfgrass Sod) shall be No. 1 Premium Grade grown on a screened alluvial sand base, cultivated on a sterilized soil base to ensure a weed free product. The maximum fines (silt and clay) in the alluvial sand base to be no more than 1% by weight.

Sod to be:
 - .1 'Supreme' (30% Kentucky Blue, 30% Fescue, 40% Perennial Rye) as grown by Anderson Sod Farm, 10821 Farms Road, Mission, B.C., 604-826-2383
 - .2 Or approved equal. Equivalency to be reviewed and approved by the UBCO Facilities Manager of Landscape and Building Services.
 - .4 Submit sieve analysis for turf farm sand if requested by UBCO Facilities Manager of Landscape and Building Services.
 - .5 The grass mixture in sod shall be suited to the location and intended use and shall be as described in the B.C. Standard for Turfgrass Sod unless otherwise specified.
- .4 Weed Control: the use of toxic pesticides for cosmetic purposes is voluntarily suspended on UBC Campus. Manual weed control is the preferred method and may be the only permitted methodology. Remove and replace significantly affected sod. Consult with Project

Landscape Architect and UBCO Facilities Manager of Landscape and Building Services for approval of any alternative organic weed control substances or methodologies.

2.5 Fertilizer

- .1 Apply fertilizer at manufacturers' recommended rates. Ensure equal distribution. Mix into top 50 mm. (2") of growing medium by disking, raking or harrowing. Application of fertilizer shall be within 48 hours of laying sod.

2.6 Liming

- .1 Add lime as required to ensure pH 6.0 to 6.5. Mix into full depth of growing medium. Coordinate with soils analysis.

2.7 Subgrade Preparation and Finishing

- .1 Obtain approval of UBCO Facilities Manager of Landscape and Building Services of subgrade and growing medium prior to laying any sod. Ensure that growing medium is placed to required depths and tolerances as specified and detailed in the Contract Documents and spread evenly over the approved subgrade. Ensure the growing medium is firm against footprints, loose in texture and free of all stones, roots branches etc. as required under Section 32 92 00 Turf and Grasses.
- .2 Ensure finish grade surfaces are tamped with roller before laying sod, and finish grades are congruent with project drawings as specified.
- .3 Grades:
 - .1 Sodded lawns must be graded for safe operation of maintenance equipment and must not exceed 3:1 maximum slope, 5:1 preferred (please refer to Section 31 22 00 Grading).
 - .2 Areas to be sodded shall be at grades as shown at the time of sodding, less an allowance for the thickness of the sod.
 - .3 Restore all areas to be sodded which are misshapen or eroded to original specified condition, grade and slope as directed just prior to sodding. Minor adjustment and refinement of finish grade to be made as directed by the Consultant.
 - .4 Crown or slope for surface drainage and eliminate all low spots or depressions.
- .4 If the surface of the growing medium is dry, lightly moisten the growing medium immediately prior to laying sod.

2.8 Sod Laying

- .1 Use full rolls where possible. No bits or sod remnants are allowed.
- .2 Only lay sod within acceptable weather conditions during March through mid-October. Do not lay sod during periods of high summer temperatures, or drought when no consistent, supplementary irrigation is available to retain sod and underlying medium in moist condition. Do not lay sod during periods of heavy rainfall and when excessive puddling is apparent on site.

- .3 Lay sod in rows with ends staggered. Butt all sections closely. Do not overlap or allow gaps wider than 2mm between sections. Top of sod to be flush with adjacent walking surfaces.
- .4 Protect new sod from heavy foot traffic during laying. Place planks or plywood if necessary to prevent damage. Lay within 24 hours after delivery to prevent deterioration. Any sod laid after the 24 hour period will be rejected.
- .5 Lay sections on slopes at right angles to the direction of the slope. Stake sod into place with wood stakes driven flush with the surface in any locations having slopes steeper than 3:1 (NOTE: Sloped lawns over 3:1 are only permitted where pre-approved by UBCO Facilities Manager of Landscape and Building Services. Interval spacing on stakes shall not exceed 500mm. Prior to pedestrian traffic being allowed onto the sod, and only after the sod is well rooted into the growing medium, pegs or stakes shall be removed or driven to an elevation 50mm below the finished surface.
- .6 Cut sod where necessary only with sharp tools.
- .7 Water thoroughly to penetrate the full depth of the growing medium as specified.
- .8 When sod has dried sufficiently, roll with 113kg. (250lb.) roller to obtain smooth uniform surface and ensure a good bond between soil and sod.
- .9 Erosion control netting shall be installed in sodded areas where required, erosion control mesh or netting shall be placed and secured with stakes or staples set firmly into the ground to a minimum depth of 150mm. Spacing of stakes or staples shall be adequate to ensure complete anchorage of the sod to the ground.

2.9 Maintenance

- .1 Refer to Section 32 01 90 Operation and Maintenance of Planting for complete maintenance guidelines.
- .2 The maintenance period begins at the time lawns and meadows are planted and continues for 55 days from the date of Substantial Performance.
- .3 Maintenance shall consist of all measures necessary to keep grass healthy, in a vigorous growing condition and well rooted into the underlying soil. Maintenance shall include, but shall not be limited to the following:
 - .1 Mowing shall be carried out at regular intervals as required to maintain grass at a standard maximum height of 60mm (2-1/2"). Not more than 1/3 of the blade shall be cut at any one mowing. Edges of sodded areas shall be neatly trimmed. Heavy clippings shall be removed immediately after mowing and trimming.
 - .2 Edging / Trimming: All lawn perimeters and around walkways, curbs, walls, bed edging, utilities and other fixtures shall be edged and trimmed at each mowing or at intervals sufficient to maintain a crisp and neat appearance. Absolutely do not use line trimmers around trees and shrubs. Sprinkler heads shall be trimmed to clear as often as necessary to keep them operating properly. The hard surface areas adjacent to the lawns shall be swept and cleaned after each operation.
 - .3 Fertilizing: Post-establishment fertilizer shall follow initial mowing and shall be carried out when grass is dry. Unless otherwise specified, use fertilizer that will provide at least 0.45kg/92.9 sq. m. (1 lb/1000 sq. ft.) of lawn area.

- .4 Watering shall be carried out when required and with sufficient quantities to prevent grass and underlying growing medium from drying out.
- .5 Rolling shall be carried out when required to remove any minor depressions or irregularities.
- .6 Weed control shall be carried out when the density of weeds reaches 10 broadleaf weeds or 50 annual weedy grasses per 37 sq. M. (400 square feet).
- .7 Weed control shall reduce the density of weeds to zero.
- .8 Any sodded areas showing deterioration or bare spots shall be repaired immediately. All areas showing shrinkage due to lack of watering shall be top dressed and seeded with a seed mix matching the original seed mix.
- .9 All sodded areas shall be adequately protected with warning signs and fencing as directed by Consultant. Fencing shall be maintained in good condition to provide a continuous barrier until Substantial Performance. Except as otherwise required by the work of the contract, the fencing shall be removed from the site only upon Acceptance.
- .10 Clean-up: Clean-up shall include removal of clippings from all walks, curbs and other paving.

*****END OF SECTION*****

1.0 **GENERAL**

1.1 **Scope**

- .1 This guideline addresses the handling, care, installation, materials, warranty and replacement of plant material installed for new landscape and building projects on UBCO Campus.

1.2 **Related Work**

- .1 Section 32 93 05 Relocation of Existing Plant Material
- .2 Section 32 91 00 Planting Preparation
- .3 Section 32 92 00 Turf and Grasses
- .4 Section 32 92 23 Sodding
- .5 Section 32 01 90 Operation and Maintenance of Planting

2.0 **MATERIALS AND DESIGN REQUIREMENTS**

2.1 **Pertinent Standards and Legislation**

- .1 All materials and execution to conform to the latest edition of the following standards or as otherwise specified in contract documents:
 - .1 CLNA, Canadian Standards for Nursery Stock, current addition.
 - .2 Canadian Landscape Standard, current addition.
 - .3 ISA / ANSI, ANSI-A300, Standards for Tree Care Operations.

2.2 **Planting Layout, Massing and Plant Selection**

- .1 Consider the limits and frequencies of institutional maintenance practices at UBCO, and design accordingly for efficiency, servicing accessibility, low maintenance, weed control, pest, disease and drought tolerance.
 - .1 Regardless of whether irrigation will be installed on site, the selection of predominately drought tolerant plants should be emphasized.
 - .2 Where stormwater detention features are incorporated into the landscape, careful condition of the full range of hydrological fluctuations throughout the season should be considered. Plant selection and/or supplementary irrigation and drainage should be considered to avoid inappropriate plant selections, or conditions that are unreasonably dynamic. Hydrophilic plants should not be mixed with hydrophobic plants.
 - .3 Massing of plants, in terms of alignment and dimensions, should be such that plantings are accessible by maintenance staff for weeding, pruning trimming without causing undue damage to plantings.
 - .4 Plants selected for massing should be adapted to perform well in massing pattern and resist premature decline due to over-planting, and should be resistant to branch damage from maintenance foot traffic.
 - .5 Fragile plants or plants with intense care requirements should be avoided. Plants should be selected for their robustness and capacity to endure urban conditions.
 - .6 Care should be taken with selection of massing plants for steep slopes to ensure drought tolerance, quick coverage, appropriate growth habit, good vigor, soil stabilizing capacity and limited maintenance requirements. (See Section 31 22 00 Grading regarding slopes).

- .7 Plants should be selected that do not contain toxic substances or produce dusts, exudates or odours that cause irritation, chemical burns, poisoning or allergic reactions. Check authoritative references. See also, WorkSafe BC, Toxic Plant Warnings.
- .8 Avoid plant species that are known to have a high susceptibility to insect and disease infestations. Select plant species that are known to exhibit a high degree of pest and disease resistance.
- .9 Avoid plant species that spread into thickets with underground rhizomes. Where variances to this guideline may have been granted by reviewers, plantings with these characteristics must be contained with enclosed root barrier of the required depth to prohibit root migration into adjacent plantings, structures, buildings, ponds, irrigation or drainage systems.
- .10 Avoid all plant species identified as “Invasive Plants” by the Invasive Species Council of BC.

2.3 Tree Selection and Placement

- .1 In general, tree species selected for use on UBC Campus *conform to the UBCO Campus Design Guidelines Section 2.3 and* should be:
 - .1 Low maintenance.
 - .2 Tolerant of local conditions.
 - .3 Resistant to branch failure and wind-throw.
 - .4 Pest and disease resistant.
 - .5 Structurally sound requiring no significant compensatory or remedial pruning.
 - .6 Free from problem characteristics such as:
 - Heaving root systems.
 - Significantly messy plant parts (i.e. leaves, fruit, seeds etc.)
 - Allergenic or objectionable properties (excessive pollen, dust or malodorous).
- .2 Individual trees selected for planting must be:
 - .1 Nursery trained with a single leader (exception: multi-stemmed species such as Vine Maple).
 - .2 Verified free of pests and diseases.
 - .3 Verified free of pernicious weeds in the rootball or container.
 - .4 Verified free of girdling roots.
- .3 Tree planted within 60 cm of walkway or paved surface must have a 45 cm deep root barrier installed along edge of surfacing prior to addition of topsoil and tree planting.
- .4 Trees should be sited with consideration of their maximum height and spread at maturity. Trees should not be placed:
 - .1 With branches overhanging buildings, light wells or air-intakes.
 - .2 Under overhead signs, canopies, or building overhangs.
 - .3 Too close to building facades, in front of entryways or obstructing walkways, roadways or traffic signage.
 - .4 In significant conflict with site lighting structures or lighting dispersal pattern intentions.
 - .5 Within 1.5 meters of underground utility, valve box, service vault or catch basin etc.
 - .6 In locations that would subject the tree to excessive soil/root compaction due to pedestrian or vehicular traffic.
 - .7 In extensively built-out locations with limited soil volume, such as narrow plantings, between roads and walkways or narrow roadway medians, unless special provisions are made (see .4 below).
- .5 Current *arboriculturally* theory and practice recognizes that trees grow in health and vitality in

proportion to soil volume below the surface. Sub-standard soil conditions or limited soil volumes under pavements can significantly reduce tree performance and longevity, cause premature damage to pavement and underground services, and have implications for public safety.

Consultants and project managers are strongly encouraged to plan, budget and design to optimize soil conditions for root systems under pavements. The primary methods most commonly recommended for increasing soil volume under pavements are:

- .1 Structural Soil: "...is a designed medium which can meet or exceed pavement design and installation requirements while remaining root penetrable and supportive of tree growth". (Cornell University, Urban Horticulture Institute)
- .2 Suspended Pavements and Structural Cells: "A modular, pre-engineered cell system ... to meet the needs of water management, soil and tree roots...[and] create large spaces under pavement...supported and protected from root damage by the cell structure."

The following references are suggested for further information and sample details:

- .1 Urban, James. *Up by the Roots: Healthy Soils and Trees in the Built Environment*. Champaign, Ill. : International society of Arboriculture, c2008.
- .2 Hopper, Leonard J., ed. *Landscape Architectural Graphic Standards*. Hoboken, N.J.: John Wiley & Sons, c2007. (see: *Tree Planting in Urban Areas*, p361)
- .3 Cornell Urban Horticulture Institute Structural Soil: An Innovative Medium Under Pavement that Improves Street Tree Vigor:
<http://www.hort.cornell.edu/uhi/outreach/csc/article.html>.

2.4 Coordination

- .1 Coordinate review of all planting designs and tree selections during design development phases with the UBCO Facilities Manager of Landscape and Building Services ensure congruence with UBC Okanagan Campus Plan Design Guidelines.
- .2 Coordinate review of planting designs and tree selections during design development phases with Campus Landscape Architect in conjunction with UBCO Facilities Manager of Landscape and Building Services as required to ensure plant selections and arrangements are congruent with current maintenance operations, institutional horticultural practices and resource scheduling.
- .3 Review any plant or tree substitutions during design or construction phases with UBCO Facilities Manager of Landscape and Building Services to ensure appropriateness as per 2.4.1 and 2.4.2 above.
- .4 Coordinate review of all planting designs requiring specialized care or technologies such as botanical collections, green roofs, living walls and bioengineered landscapes during design development phases with Campus Landscape Architect in conjunction with UBCO Facilities Manager of Landscape and Building Services to ensure appropriateness as per 2.4.1, 2.4.2 and 2.4.3 above.

2.5 Delivery, Storage and Protection

- .1 All plant material is to be off-loaded, handled and moved on site so as to avoid dropping and sudden impacts to roots and rootballs.
- .2 Contractor to ensure all plant material is free of damages, defects, noxious perennial weeds and is true to type as specified on plant list. Sub-standard plant material or weed infested plant material shall not be accepted or installed by the contractor.

- .3 The contractor shall be responsible for the storage, protection and installation of all plant material.
- .4 Immediately store and protect plant material which will not be installed within 1 hour after arrival at site in storage location approved by UBCO Facilities Manager of Landscape and Building Services.
 - .1 Protect stored plant material from frost, wind, sun, drought and physical damage as follows:
 - .1 For bare root plant material, preserve moisture around roots by heeling-in or burying roots in hem/fir mulch or topsoil and watering to full depth of root zone.
 - .2 For pots and containers, maintain moisture level in containers. Heel-in fibre pots and all other containers as required for increasingly adverse weather conditions.
 - .3 For balled and burlapped and wire basket root balls, keep moist before planting by heeling-in with mulch or soil.
 - .4 Place all plants stored on site in such a way as to protect branches, rootballs and roots from damage.
- .5 Verify existence and location of any on-site utilities. Contact the UBCO Facilities Manager of Landscape and Building Services immediately for directions as to procedure should any piping or utilities be encountered during excavation.
- .6 Protect existing equipment, sidewalks, landscaping reference points, monuments and markers. Make good all damage incurred during this work.
- .7 Make every effort to protect plants in storage adjacent to any construction work.
- .8 Erect temporary continuous barriers, and/or tree protection fencing where necessary to ensure safety of existing plants and trees. Refer to Section 32 01 93.01 Tree and Shrub Preservation.
- .9 Replace, at no expense to UBCO, any plant material damaged as a result of the work of this section.
- .10 Protect fertilizers from moisture.
- .11 Notify the Project Landscape Architect a minimum of forty-eight (48) hours prior to each delivery.

2.6 Warranty

- .1 Warranty should stipulate that plant material will remain free of defects as per contract plant lists and landscape specifications, for one (1) full year from the date of certified Substantial Performance of the Work.
- .2 End of warranty inspection will be conducted by the UBCO Facilities Manager of Landscape and Building Services.

2.7 Inspection

- .1 Make all trees and plant material available for inspection at one location well in advance of scheduled planting time. Notify the UBCO Facilities Manager of Landscape and Building

Services when plants are available for inspection.

- .2 All plants are subject to inspection and may be rejected for failure to comply with contract specifications at any time until Substantial Performance. Replace rejected material and remove from the site at no cost to UBCO.
- .3 Notify the UBCO Facilities Manager of Landscape and Building Services at the completion of work for an Inspection for Substantial Performance.
- .4 Final inspection of all planting will be made at the end of the specified warranty period. For release from the Contract, all plant materials supplied or transplanted must be alive and in a healthy, satisfactory growing condition at the time of inspection.
- .5 The UBCO Facilities Manager of Landscape and Building Services at his discretion may waive one or more inspections, but this shall not impair the right of the Project Landscape Architect to inspect work or materials which have been damaged or in any way do not conform to the contract specifications.
- .6 Contractor to be present during all required inspections as specified or as may be required by the UBCO Facilities Manager of Landscape and Building Services.

2.8 Replacements

- .1 Replace all plant material found dead, or not in a healthy, satisfactory growing condition or which, in any other way, do not meet the requirements of the project or contract specifications, at Contractor's expense, during and up to end of the warranty period.
- .2 The cost of replacements resulting from theft, accidental damage, vandalism, carelessness on the part of others shall not be borne by the Contractor.
- .3 All required replacements shall be plants of the same size and species as specified on the plant list and shall be supplied and planted in accordance with the drawings, specifications and change orders.
- .4 Replace defective or dead plants, trees, lawns or plantings as required during the 1 year maintenance and warranty period to the satisfaction of the Project Landscape Architect and UBCO Facilities Manager of Landscape and Building Services.

2.9 Substitutions

- .1 If it is impossible to obtain the particular plant material listed on the Landscape Drawing, the Contractor may be permitted to suggest substitutions with types and variations possessing the same characteristics. The Contractor must request any substitutions of trees in writing at least three (3) months and shrubs and groundcover at least two (2) months prior to planting. Substitutions must be approved by the Project Landscape Architect in consultation with UBCO Facilities Manager of Landscape and Building Services.

2.10 Plant Material Identification

- .1 Plant material that has been located by the Project Landscape Architect and tagged for the project is to have the identification tags removed only after inspection and instruction by the Project Landscape Architect after delivery to the site.

2.11 Planting Time

- .1 Plant only during the season or seasons which are normal for such work determined by

weather conditions and as approved by the Project Landscape Architect.

- .2 Do not plant during freezing and/or abnormally hot, dry weather.

2.12 Maintenance

- .1 Refer to Section 32 01 90 Operation and Maintenance of Planting for complete maintenance guidelines.
- .2 The maintenance period begins at the time each plant is planted and continues for 55 days from the date of Substantial Performance.
- .3 Maintenance includes necessary watering, cultivation, weeding, pruning, mowing, aerating, disease and insect control as required with organic pesticides, replacement of unacceptable material, straightening plants which lean or sag, adjustment of plants which settle or are planted too low, and any other procedures consistent with good horticultural practice necessary to insure normal, vigorous and healthy growth of all work under contract.
- .4 Maintain all accessories such as tree stakes, etc., in good condition including adjustment to keep tree stakes tight. Repair or replace all such accessories when required.

2.13 Area of Plant Supply and Search

- .1 Before substitutions of plant material are considered, documented due diligence that the specified material is not available at nurseries throughout Pacific Northwest (Canada and United States) must be provided. Area of supply shall include but shall not be limited to the area as mentioned herein.

2.14 Plant Material

- .1 Trees, shrubs, groundcovers, perennials etc., shall be nursery grown of sizes and quantities shown in plant lists on landscape drawings and specification.
- .2 Conform to the Canadian Landscape Standard and Canadian Standards for Nursery Stock. In particular:
 - .1 "Nursery stock shall be true to name, and of the size or grade stated."
 - .2 "Quality must be typical for the species when grown under proper cultural practices...viable, substantially free from pests and disease, and undamaged."
 - .3 "Between digging and delivery, roots must not be subject to long exposure to drying winds, sun, or frost, between digging and delivery."
 - .4 "Root balls and containers must be free from pernicious, perennial weeds."
 - .5 "All normal quality nursery stock must have an adequate fibrous root system that has been developed by proper cultivating practices, particularly transplantings or root pruning."
 - .6 "Plants must be grown in the container for a minimum of three months or have a well established root system reaching the sides of the container to maintain a firm ball."
- .3 Plant materials should be transplanted or root-pruned at the nursery at least once within the year prior to planting.

- .4 Take precautions during digging, handling and shipping of plant material to avoid injury to plant parts, branches and root systems.
- .5 Trees designated B&B shall be properly dug with firm, natural balls of soil retaining as many fibrous roots as possible, in sizes and shapes as specified in the Canadian Standards for Nursery Stock. Balls shall be firmly wrapped with non-synthetic, rottable burlap and secured with nails and/or heavy, non-synthetic rottable twine. The root collar shall be apparent at surface of ball. Trees with loose, broken, processed or manufactured root balls shall not be accepted.
- .6 Trees and plants designated as transplants, bareroot or collected plants, shall not be dug or installed before dormancy or after bud break.
- .7 All plants, typical of their species or variety, shall have a normal habit of growth and shall be first quality, sound, healthy, vigorous, well branched, and densely foliated, free of disease, insect pests, eggs or larvae, healthy well furnished root systems free of binding or girdling roots.
- .8 Plants must conform to the measurements specified in the plant list. Measurements specified are minimum size acceptable for each variety. Plants that meet the requirements specified in the plant list, but that do not possess a normal balance between height and spread will not be accepted. Plants for use when symmetry is required, or when planted in formal rows, shall be matched in form and size as nearly as possible. Do not prune prior to delivery.
- .9 All plants and all tree trunks shall be measured when the branches are in the normal position. Dimensions for height and spread as contained herein refer to the main body of the plant and not from branch-tip to branch-top. The height of tree trunks need not be as specified if the required height can be obtained by pruning the lower branches without leaving unsightly scars or otherwise damaging the trunk. Do not prune branches to obtain the required height, before the plants are delivered to the site unless so approved in writing by the UBCO Facilities Manager of Landscape and Building Services.
- .10 As per Canadian Standards for Nursery Stock: tree caliper must be the determining measurement when the caliper exceeds 40 mm (1.5 in.). It must be measured no less than 150 mm (6") above the ground level for trees with a caliper up to 100 mm (4"). Trees 100 mm (4in.) and larger caliper are to be measured 300 mm (12 in.) above the ground level.
- .11 All trees must have straight trunks with a single leader intact. Trees with multiple leaders, unless specified, shall be rejected. Trees with a damaged or crooked leader, bark abrasions, sunscald, disfiguring knots, insect or disease damage, girdling roots or cuts on limbs over 20mm (3/4") in diameter that are not completely closed should be rejected by UBCO Facilities Manager of Landscape and Building Services.
- .12 Take precautions during digging, handling and shipping of plant material to avoid injury to plants and root systems.

2.15 Related Materials:

- .1 Tree stakes: dressed 50mm (2") diameter treated fir stakes, lengths as detailed. Number per tree as required to keep tree plumb and true during one (1) year warranty period.
- .2 Guywires: Trees up to 65mm (2.5") calliper - 14 gauge galvanized, multi-strand, twisted wire. Trees 65mm (2.5") to 75mm (3") calliper – 12 gauge wire, covered with new black garden hose, 2-ply, reinforced and of at least 13 mm (1/2") diameter, around leader at branch crotch.
- .3 Deadmen: 100x150 mm (4"x6") pressure preservative treated construction grade lumber or approved equivalent. Lengths to be determined on site.

- .4 Plastic Strapping: DeepRoot, Arbortie or approved equivalent. Strapping to be to be 19mm (2") wide, flat, woven polypropylene or nylon; 900 lb. break strength.
- .5 Mulch: Shall be composted bark mulch with 50mm and minus Douglas Fir / Hemlock bark chips, dark brown in colour and free of cedar chips, soil, wood, stones, roots, plastic and other deleterious matter or pre-approved equal. Minimum compacted depth 7.5 cm (3").
- .6 Fasteners: All fasteners hot dipped galvanized.
- .7 Fertilizers: Agricultural fertilizer of a formula indicted by soil test results of site soils and/or planting media specified for the project. Fertilizers shall be organic, slow-release compositions incorporated into the planting media wherever applicable.
- .8 Anti-Desiccants: if specified, are to be applied to plants in full leaf immediately before digging or as required by the Project Landscape Architect. Anti-Desiccants are to be sprayed so that all leaves and branches are covered with a continuous protective film.
- .9 Biostimulants: shall contain soil conditioners, VAM, and ectomycorrhizal fungi spores and soil bacteria appropriate for existing soil conditions. Submit manufacturer's literature for approval.

2.16 Planting Hole Excavations – Trees, Shrubs and Groundcovers

- .1 Trees, shrub, and groundcover beds are to be excavated to the depth and widths indicated on the drawings. If the planting area under any tree is initially dug too deep, the soil added to bring it up to the correct level should be thoroughly tamped.
- .2 The sides of the excavation of all planting areas shall be sloped at a 45 degrees. The bottom of all beds shall slope parallel to the proposed grades or toward any subsurface drain lines within the planting bed. The bottom of the planting bed directly under any tree shall be horizontal and tamped such that the tree sits and remains plumb.
- .3 Maintain all required angles of repose of the adjacent materials as shown on the drawings. Do not excavate compacted subgrades of adjacent pavement or structures.
- .4 Subgrade soils shall be separated from the topsoil, removed from the area, and not used as backfill in any planted or lawn area. Excavations shall not be left uncovered or unprotected overnight.
- .5 On steep slopes, the depth of the excavation shall be measured at the center of the hole and the excavation dug as shown on the drawings.
- .6 Detrimental soil conditions: The landscape architect is to be notified, in writing, of soil conditions encountered, including poor drainage that the contractor considers detrimental to the growth of plant material. When detrimental conditions are uncovered, planting shall be discontinued until instructions to resolve the conditions are received from the UBCO Facilities Manager of Landscape and Building Services.
- .7 Obstructions: If rock, underground construction work, utilities, tree roots, or other obstructions are encountered in the excavation of planting areas, alternate locations for any planting shall be determined by the UBCO Facilities Manager of Landscape and Building Services.

2.17 Transplanting

- .1 Existing established trees, shrubs, and groundcovers designated to be relocated on site or from off-site locations, must be harvested, handled and transported according to recognized horticultural and arboricultural practices, and where applicable, within the guidelines and

specifications applied to nursery stock as per the Canadian Standards for Nursery Stock, Canadian Landscape Standard and ANSI A300. Refer to Section 32 93 05 Relocation of Existing Plant Material, for comprehensive transplanting guidelines.

2.18 Planting Season

- .1 Plant only during the season or seasons which are normal for such work determined by weather conditions and as approved by the UBCO Facilities Manager of Landscape and Building Services.
- .2 Do not plant during freezing and/or abnormally hot, dry weather.

2.19 Plant Layout

- .1 Plants should be located according to landscape planting plan, and according to locations determined by the UBCO Facilities Manager of Landscape and Building Services. Contractor to coordinate approval by UBCO Facilities Manager of Landscape and Building Services of planting layout prior to planting. Within reason, the Project Landscape Architect may make adjustments in plant location and orientation prior to, during and after planting.
- .2 Position of trees to be planted within structural cells should be determined prior to positioning and installing of structural cells.
- .3 Location of all major trees should be accurately staked on site. Call the UBCO Facilities Manager of Landscape and Building Services to be present during planting of major trees to ensure proper orientation and location.

2.20 Planting Procedures

- .1 All plants to be installed maintaining original grades of bases as they were in the Nursery.
- .2 Loosen bottom of planting hole to depth of 150-200mm (6 - 8") prior to placing growing medium.
- .3 Plant bare root trees vertically with roots placed straight out in hole. Orient plant material to give best appearance in relation to structure, roads and walks.
- .4 Place plant material to depths equal to the depth they were originally growing in nursery.
- .5 With balled and burlapped root balls, loosen burlap and cut away minimum top 1/3 without disturbing root ball. Do not remove burlap or rope from under root ball. Remove any excess soil on top of root ball such that root flare is at or slightly above finished grade.
- .6 With container stock, remove entire container without disturbing root ball. Non bio-degradable wrappings must be removed.
- .7 Tamp growing medium around root system in layers of 150mm (6") eliminating air voids. Frozen or saturated growing mediums unacceptable. When 2/3 of growing medium has been placed, fill hole with water. After water has completely penetrated into soil, complete backfilling.
- .8 Water thoroughly on the interior of the tree saucer until it is filled even if it is raining. A second watering may be necessary to ensure saturation of the root ball.
- .9 Prune out any dead or broken branches.
- .10 Remove all tags, labels strings, etc. from plant material.

2.21 Fertilizer Application and Soil Amendments

- .1 Make all amendments of lime and fertilizer indicated by soil test results at time of mixing and prior to placement of plant material. All mixing shall take place using appropriate equipment and methodology so as to ensure thorough mixing of all components within the planting media. (Refer to Section 32 91 00 Planting Preparation)
- .2 Pursuant to soil test recommendations and/or recommendations of the Project landscape Architect, add composted organic matter amendment as follows: After specified topsoil or planting mix is installed, and prior to fine grading and installation of plantings, spread 100 (4 in.) of composted organic matter over all beds and rototill into the top 100 mm (4 in.) of planting mix or topsoil. (Refer to Section 32 91 00 Planting Preparation).

2.22 Mulching

- .1 Mulch all tree, shrub and groundcover planting areas to a 7.5 cm (3") compacted depth with composted bark (see **2.15.5** above).
- .2 Ensure soil settlement has been corrected prior to mulching.

2.23 Guying and Staking

- .1 Guy and stake all trees immediately after planting according to current recommendations of the International Society of Arboriculture (ISA) and the ANSI A300 – Standards for Tree Care Operations. Plant material not guyed or staked immediately shall be replaced if damaged.
- .2 Stake or guy a tree only when necessary for the specific conditions encountered and as per ISA Tree Staking Details or project drawing details. Staking may be required in unusual circumstances such as sandy soils or in extremely windy conditions, Poor quality trees with cracked, wet, or loose root balls, poorly developed trunk-to-crown ratios, or undersized root balls shall be rejected if they require staking, unless written approval to permit staking or guying as remedial treatment is obtained from the UBCO Facilities Manager of Landscape and Building Services. Trees that settle out of plumb due to inadequate soil compaction either under or adjacent to the root ball shall be excavated and reset. In no case shall trees that have settled out of plumb be pulled upright using guy wires.
- .3 Stakes, anchors wires or plastic strapping shall be of sufficient strength to maintain the tree on an upright positions that overcomes the particular circumstances that initiated the need for staking or guying.
- .4 Guying: Fasten tree around leader at branch crotch to stake, pin or deadman in the ground, or laterally to upright tree stake with galvanized wire protected by hose where wire wraps around leader and crotch as per manufacture's or drawing detail specifications. Alternate to wire use Deeproot, Arbortie plastic strapping or approved equivalent.
- .5 Trees to stand plumb upon completion of this operation.
- .6 Stakes and guys shall be removed at end of first growing season. Any tree that is not stable at the end of this period shall be rejected.

2.24 Maintenance Prior to Substantial Performance

- .1 Maintain all plant material from date of planting until Certificate of Substantial Performance. Refer to Section 32 01 90 Operation and Maintenance of Planting.
- .2 Program timing of operations in accordance with growth, weather conditions and use of site.

- .3 Complete each operation within a reasonable time period prior to proceeding.
- .4 Collect and dispose of debris or excess material on a daily basis.
- .5 Water to maintain soil moisture conditions for optimum establishment, growth and health of plant material without causing erosion.
- .6 Supply equipment such as pumps, portable sprinklers systems, tanker trucks, hose and sprinklers required for watering operations.
- .7 The use of toxic chemical pesticides for cosmetic purposes is voluntarily suspended on UBC Campus. Plant only disease resistant and disease free stock. Remove and replace significantly infected plants. Combat pests, diseases and weeds according to IPM principles and within the limits of UBC Pest Control Policy #12. Cultivate to control weeds. Apply only organic, non-toxic pesticides as a last resort. Any use of pesticides on UBCO Campus must be approved and/or coordinated in consultation with UBCO Facilities Manager of Landscape and Building Services. Do not use pesticides prohibited by Agriculture Canada or the Pesticide Control Act Regulation.
- .8 Cultivate whenever required to keep top layer of soil loose, friable and free from weeds. Any operation must be continuous without interruption.
- .9 Replace or respread damaged, missing or disturbed mulch.
- .10 Clean, by hand, areas that are covered with mulch. Loosen top layer of mulch without mixing it with soil underneath.
- .11 Remove weeds including their roots.
- .12 Remove, dispose off Campus, and replace any plants and soil overwhelmed with persistent, noxious, invasive or perennial weeds.
- .13 Remove dead or broken branches from plant material. Prune in accordance with Division 32.
- .14 Keep trunk protection and guy wires in proper repair and adjustment.
- .15 Remove and replace dead plants and plants not in healthy growing condition. Make replacements in same manner as specified for original plantings.

2.25 Acceptance

- .1 Plant material will be accepted by Project Landscape Architect and UBCO Facilities Manager of Landscape and Building Services upon Substantial Performance of the Work and again at the end of the warranty period, provided that trees, plant material and plantings exhibit healthy growing conditions and are free from annual/perennial/invasive/noxious weeds, disease, insects and fungal organisms.
- .2 Acceptance will not be forthcoming if tree plants, plantings and/or soil show any evidence of invasive or perennial weeds such as morning glory, creeping vetch, horsetail or couch grass.
- .3 Plant material insufficiently hardened-off prior to onset of frost and freeze may be rejected and require replacement if signs of frost damage, poor root development or winter desiccation are evidenced.

2.26 Maintenance During Warranty Period

- .1 Refer to Section 32 01 90 Operation and Maintenance of Planting.

*****END OF SECTION*****

1.0 GENERAL

1.1 Scope

- .1 This guideline addresses the requirements for the transplanting of existing trees and plants, plus materials and equipment required to transplant and establish trees and plants in their new locations as shown on site development drawings.

1.2 References and Standards

- .1 Canadian Landscape Standard, current edition
- .2 International Society of Arboriculture (ISA), Planting Specification, Tree and Shrub Transplanting
- .3 International Society of Arboriculture (ISA), Best Management Practices - Tree Planting

1.3 Coordination

- .1 Coordinate as early as possible in the conceptual and design development phases with UBCO Facilities Manager of Landscape and Building Services.
- .2 Coordinate throughout construction phases with UBCO Facilities Manager of Landscape and Building Services regarding any site changes, potential damages or pruning required on relocated trees retained.

1.4 Related Work

- .1 Section 32 01 93.01 Tree and Shrub Preservation
- .2 Section 32 00 00 Irrigation Guidelines
- .3 Section 32 91 00 Plant Preparation
- .4 Section 32 93 00 Plants

2.0 MATERIALS AND DESIGN REQUIREMENTS

2.1 Tree Relocation and Protection Plans

- .1 For trees to be protected and/or retained on site, the Project Landscape Architect or UBCO Facilities Manager of Landscape and Building Services should provide Tree Protection/Relocation Plans indicating surveyed grades at base of trunks, DBH, extents of drip lines and location of Tree Protection Fencing. Specifications and cross-sectional details for applicable preservation strategies including, but not limited to, requirements covered in this general guideline must be included in construction documents.

2.2 Consulting Arborists and UBCO Facilities Manager of Landscape and Building Services

- .1 Where significant heritage trees, or complex tree preservation strategies are anticipated, UBC recommends that a project-specific, ASCA Registered Consulting Arborist be retained as an integral member of the design development team. The Consulting Arborist is to advise on specific pre- and post-development strategies or to provide expert analysis, details and/or specifications required to optimize tree retention and preservation.
- .2 The UBCO Facilities Manager of Landscape and Building Services will be UBCO's representative on Campus and will advise on related Campus tree issues with consultants, project managers and site supervisors as required.

2.3 Coordination, Inspection and Supervision

- .1 The UBCO Facilities Manager of Landscape and Building Services, Project Landscape Architect, Project Consulting Arborist shall coordinate as early as possible in the project to identify trees to be retained, protected, transplanted or removed and clearly establish tree relocation strategies for on-site or off-site locations.
- .2 Every effort should be made to coordinate transplanting to occur in the dormant season or otherwise optimize conditions for transplanting in conjunction with site development timing and priorities.
- .3 Qualified Landscape Contractor or authorized Tree Mover shall be responsible for transplanting of existing trees or shrubs to be relocated including preparation of site and coordination with Project Landscape Architect, Project Consulting Arborist and/or UBCO Facilities Manager of Landscape and Building Services.
- .4 The Contractor responsible must follow relocation instructions as per the Project Landscape Architect's directions in consultation with Project Consulting Arborist and/or UBCO Facilities Manager of Landscape and Building Services. Existing trees to be transplanted on-site shall be relocated as shown on the project drawings. Existing trees to be transplanted off-site shall be coordinated with the UBCO Facilities Manager of Landscape and Building Services.
- .5 The Project Landscape Architect, the Consulting Arborist and/or the UBCO Facilities Manager of Landscape and Building Services shall be on site to monitor the relocation operations as required. The Contractor will provide minimum 48 hours' notice prior to relocation operations.
- .6 During the construction phase, the Contractor responsible shall contact UBCO Facilities Manager of Landscape and Building Services immediately regarding any site changes impacting tree relocation and preservation.

2.4 Site Conditions and Preparation

- .1 Protect all existing trees, shrubs, properties, services and buildings from any potential damages from tree relocation work. (Refer to Section 32 01 93.01 Tree and Shrub Preservation).
- .2 Consult with UBCO Facilities Manager of Landscape and Building Services regarding any underground services prior to commencement of work. Ensure work area is free from overhead, above ground and below ground hazards or utilities. Consult with UBCO Facilities Manager of Landscape and Building Services regarding any unforeseen hazards, structures or services prior to moving trees or shrubs.
- .3 Check to see that sufficient access and room exist around the designated trees to achieve the specified root ball sizes with the stem centred on the root ball.
- .4 Check target locations for relocating plant material to ensure adequate access, soil quality and drainage.
- .5 Ensure that soil texture, fertility and drainage at the new planting site(s) is acceptable, and that new transplant site provides analogous cultural conditions to original site. (Refer to Section 32 91 00 Planting Preparation).

2.5 Maintenance

- .1 Maintenance of all relocated/transplanted trees and plant material at either on-site, or off-site heel-in/holding compounds will be the responsibility of the Contractor for the duration of the project and maintenance period.
- .2 Maintenance of all relocated/transplanted trees and plant materials to off-site, permanent planting locations, will be the responsibility of UBCO Facilities Management after project completion and turn-over unless otherwise specified.

2.6 Guaranty

- .1 Unless otherwise specified, the Contractor will not be required to guaranty transplanted trees and plant materials, but will be required to do all work as specified under the direction of the Project Landscape Architect in consultation with Project Consulting Arborist and/or UBCO Facilities Manager of Landscape and Building Services at the time of the plant moving.

2.7 Replacement

- .1 When specified in the contract drawings and documents, the Contractor shall be responsible to replace any damaged existing trees and plant material to be relocated in the same genus, species, size and character at no cost to UBC.

2.8 Existing Tree and Plant Material

- .1 Existing trees and plant materials designated for relocation shall be clearly tagged and indicated on demolition plans, site preparation plans and planting plans.
- .2 Trees and plant material designated as bareroot or collected transplants shall conform to the Canadian Standards for Nursery Stock. Those that cannot be planted right away shall be protected from sun or drying winds and kept in shade. Roots shall be well protected with soil, wet mulch and kept watered.
- .3 As far as practicable, transplanted B&B trees and plant material shall be properly dug with firm, natural balls of soil retaining as many fibrous roots as possible, in sizes and shapes as specified in the Canadian Standards for Nursery Stock.

2.9 Materials

- .1 Unless a tree or shrub is moved in one operation, directly to new site within a tree spade, rootballs shall be firmly wrapped with non-synthetic, rottable burlap secured with heavy non-synthetic, rottable twine.
- .2 Balls shall be firmly wrapped with non-synthetic, rottable burlap and secured with nails and/or heavy, non-synthetic rottable twine. The root collar shall be apparent at surface of ball. Trees and plant material with loose, broken root balls shall not be accepted.
- .3 Correctly sized wire baskets capable of accommodating the rootballs of trees and large shrubs may be used to facilitate movement, storage and rootball integrity.
- .4 Anti-desiccants are to be applied to plants in full leaf immediately before digging or as required by the Project Landscape Architect in consultation with Project Consulting Arborist and/or UBC Campus Arborist. Anti-desiccants are to be sprayed so that all leaves and branches are covered with a continuous protective film. Anti-desiccant shall be an emulsion

specifically for agricultural use, mixed and applied according to manufacturer's recommendations.

- .5 Anchors shall be Douglas Fir standard or better grade S4S lumber in the following size: 50 x 100 x 1200mm (2" x 4" x 48").
- .6 Tree wraps shall be 8 -10cm wide nylon strapping three (3) per tree, 0.75m in length, with galvanized metal eyes at either end.
- .7 Guy wire and safety sleeves shall be galvanized 11 gauge wire with brightly coloured survey plastic sleeves covering the bottom 1.5m of each section.
- .8 Turnbuckles shall be galvanized and a minimum body length of 150mm (6").

2.10 Fertilizer

- .1 Slow release fertilizer such as 18-6-12 Osmocote or approved equivalent.

2.11 Complete Chip Mulch

- .1 Tree mulch shall be complete tree chip mulch, including parts of the leaf, twig, bark and stem wood. This product may be obtained from local tree contractors or UBC Landscape Services, generally free of charge. The mulch should be free of pests or diseases and should not contain Western Red cedar or Black walnut.
- .2 Provide a sample of the proposed tree mulch and its source for approval by the Consulting Arborist and/or UBC Campus Arborist.

2.12 Planting Soil

- .1 Refer to Section 32 91 00 Planting Preparation for general specifications on use of native topsoils and commercial soil products.
- .2 Horticultural soil products may be mixed with existing soils to a maximum ration of 2:1 (new to old). The amended soil volume required for each tree will fill a void around the outside of the root ball 60cm in depth and equivalent to the radius of the root ball in width. [For example, a tree with a rootball 2m in diameter will require enough soil to fill a trench around the root ball 60cm in depth below existing grade and 1m wide. Additional soil will be required to raise the grade around the perimeter of root ball in its new location in order to form the watering saucers.

2.13 Period of Planting

- .1 Coordinate digging of plant material to be transplanted to ensure minimum time between digging and re-planting.
- .2 Trees and plant material designated for B&B, bareroot or as collected plants, shall not be dug or installed before dormancy or after bud break from late fall to early spring.
- .3 Transplanting outside of the dormant season may occur in special circumstances only in consultation with Project Consulting arborist and/or UBCO Facilities Manager of Landscape and Building Services.

2.14 Protection

- .1 Verify existence and location of any on-site utilities. Consult the UBCO Facilities Manager of Landscape and Building Services immediately for directions as to procedure should any piping or utilities be encountered during excavation.
- .2 Protect existing buildings, equipment, sidewalks, landscaping reference points, monuments and markers. Make good all damage incurred during this work.
- .3 Make every effort to protect all existing plants adjacent to any construction/tree relocation work.
- .4 Erect temporary continuous barriers where necessary to ensure safety of existing plants and trees. Refer to Section 32 01 93.01 Tree and Shrub Preservation for protection fencing specifications.
- .5 Replace, at no expense to UBCO, any trees and plant material damaged as a result of the work of this section.

2.15 Layout, Digging, Transportation, Planting and Securing

- .1 Stake out the exact location for each tree or shrub transplant as shown on the plan.
- .2 Review the staked locations with the UBCO Facilities Manager of Landscape and Building Services prior to digging tree pits.
- .3 In approved locations, dig tree pit holes that are deep enough to accommodate the depth of the root ball without settling beneath the existing grade. The diameter of the planting hole in the upper 60cm of soil should be approximately twice the diameter of the root ball selected for that location.
- .4 Ensure tree pits drain adequately. If drainage is poor, inform the Consulting Arborist.
- .5 Additional excavation of poorly drained material and addition of drainage material shall be carried out as authorized by the Landscape Architect at unit prices agreed to before excavation.
- .6 Dig each plant to the specified root ball diameter using appropriately sized Tree Spade equipment and employing the best trade practices. For trees with stem calipers less than 12cm, minimum root ball diameters will be calculated at 15 times the stem caliper, measured 30cm above grade. [For example, a 10cm. caliper tree will have a root ball no less than 1.5m in diameter.] For trees with stem calipers greater than 12cm, minimum root ball diameters will use a multiplier of 12. [For example, a 20cm caliper tree will have a root ball diameter of no less than 2.4m.] For trees with stem calipers greater than 25 cm, use a multiplier of 10.
- .7 Root balls will be dug, where possible, with the tree stem centered in the root ball. If circumstances preclude obtaining the minimum rootball size with the stem centered on the root ball, the contractor will consult with the Project Consulting Arborist or UBCO Facilities Manager of Landscape and Building Services before proceeding.
- .8 If, in the opinion of the contractor, the stability of the root ball or the tree will be compromised in the new planting site, the contractor is instructed to basket the root balls and ensure that the root balls are adequately strapped in burlap prior to transport. The contractor must ensure that the root plates of the relocated trees are stable and the trees are windfirm in their new sites. The contractor has the discretion to utilize wire baskets and or staking materials

and techniques (see below) as his judgment directs. Relocated trees must remain completely windfirm for the duration of the maintenance period (12 months).

- .9 Transport the plants immediately to the approved planting area and plant.
- .10 Tree Saucers:
 - .1 Make a saucer around each tree with a berm of soil approximately 150mm (6") higher than the top of the earth ball, 900-1200mm (36-48") from the base of the trunk of the tree to facilitate watering.
- .11 Tree Guying:
 - .1 Relocated trees must remain completely windfirm for the duration of the maintenance period (12 months). The contractor is directed to utilize whatever methods reflect the best trade practice of his industry to ensure the stability of the root ball. If, however, in the opinion of the contractor, guying of the tree is required, the following prescription is to be utilized.
 - .2 Equally space three anchors around the tree. Attach tree wraps approximately midway up the stem of the tree. Anchors should be placed at a sufficient distance to achieve a 45 degree angle on the guy. Anchors should be set at right angles to the guy wires and driven in to a depth sufficient to secure the guy (minimum of 80 centimeters).
 - .3 Secure the guy to the tree wrap rings and the anchor with a turnbuckle interposed between the two anchor points. Tension the guys once installed and position the protective sleeves. Provide three (3) guy wires per tree with a turnbuckle set in the centre of each wire.

2.16 Mulch and Fertilizer Application

- .1 Apply 12 – 14 centimeters of complete tree chip mulch to the area of the planting site [i.e. to an area twice the diameter of the root ball].
- .2 Apply fertilizer based on soil test results and incorporate into backfill soil or by surface application. In absence of soil test recommendations, apply approximately 250 grams (1/2 lb) of 18-6-12 Osmocote for each 5 centimetres of caliper per tree. Distribute the Osmocote over the top of the root ball area after mulching.

2.17 Watering

- .1 Immediately after mulching and fertilizing, apply approximately 181 liters (20 gallons) of water per tree at a moderate flow rate. Ensure that flow rate does not liquefy soils and destabilize tree.
- .2 In transplant locations irrigation must conform to UBCO Irrigation Technical Guidelines.

2.18 Pruning

- .1 Prune off any broken or damaged branches to the outer margin of the branch collar. All pruning work to be done by an ISA Certified Arborist in consultation with the Project Consulting Arborist, or UBCO Facilities Manager of Landscape and Building Services.

END OF SECTION