EXTERIOR IMPROVEMENTS

Trees, Shrubs, and Groundcover

Tree Care References and Reference Standards

This landscape section relies heavily on reference to established practices and procedures of the consensus of the industry, those primarily being the International Society of Arboriculture (ISA), American National Standards Institute (ANSI), and Tree Care Industry Association (TCIA), and others.

ANSI Documents*

To fully utilize the Tree Care section, one must also obtain the current revision of the following documents and the current revision of its companion Best Management Practices (BMP) document:

- ANSI A300 (Part 1)- Pruning
- ANSI A300 (Part 2)- Soil Management
- ANSI A300 (Part 3)- Supplemental Support Systems
- ANSI A300 (Part 4)- Lightning Protection Systems
- ANSI A300 (Part 5)- Management
- ANSI A300 (Part 6)- Planting and Transplanting
- ANSI A300 (Part 7)- Integrated Vegetation Management
- ANSI A300 (Part 8)- Root Management Standard
- ANSI A300 (Part 9)- Tree Risk Assessment
- ANSI A300 (Part 10)- Integrated Pest Management
- ANSI Z133.1 - American National Standard for Arboricultural Operations-Safety Requirements

*These publications are available, for a fee, at:

- ANSI http://ansi.org/
- ISA http://isa-arbor.com/
- TCIA http://tcia.org/

Site Planning, Site Development, and Construction

The phases of site planning, site development, and construction are the most crucial to the trees. Established trees are conserved during these phases. Considerations must be made and weighed with a variety of reasons, including economic, social, environmental, and cultural factors. SMU prefers to retain existing trees or accommodate them in ways which may include architectural changes and/or transplantation to make best use of their resources.

Management of Trees and Shrubs During Planning, Development and Construction

Objectives

Conserve the selected existing trees and shrubs on and adjacent to the construction site during the site planning, construction, and post-construction management establishment phases of development.

Requirements

Landscape Architect:

Verifies compliance with applicable ordinances, rules, regulations and standards.

SMU Office of Facilities Planning and Management:

- Provides direction for development of management plan and specifications
- In conjunction with the Landscape Architect, verifies compliance with applicable ordinances, rules, regulations and standards

Certified Arborist (retained by SMU):

A qualified ISA-Certified Arborist shall oversee and consult during all phases:

- Help interpret guidelines and regulations to insure conformity to standards
- Act as a quality and consistency gate
- Document these activities

The arborist shall be trained in current practices and, if possible, have experience in the practice of all arboriculture tasks required by the project (i.e. large transplants, removals, integration and pests).

Additional personnel as needed.

Planning Phase

A site survey shall be made available and include tree resource evaluation, including current tree inventory data:

- Existing tree identification and location
- Condition and Hazard management evaluation
- Soil examination (if indicated by tree health)
- Work history
- Longevity and life stage of tree
- Utility of tree specimen and species in project outcome
- Special designations (i.e. dedications, special usage and placards)

Tree Resource Evaluation Scope

The Certified Arborist shall complete and make available the tree resource evaluation for the project area, and surrounding area. It is important to include the surrounding area due to the extensive nature of trees and the sensitivity of some trees to disruption. If a condition is observed requiring attention beyond that affecting the project scope, the condition must be documented and reported. Corrective action shall be determined and may directly impact and preclude further proceedings with all or parts of the project. Usually this is not the case, but some cases exist.

Suitability for Conservation

Suitability ratings could be assigned [See Annex A, ANSI A300 (Part 5)]

Suitability specifications vary depending upon the species of tree; soil condition; construction/demolition activity; etc. Verify and conform to any agency or resource preservation ordinances.

Design Phase

Tree protection specifications and goals for the project shall be communicated during the design phase. The conserved trees shall not be compromised where health will be impacted either by the design or by implementation of the project. The arborist working with SMU and the architect prior to developing final site plans shall conduct the selection of trees to remain on the site. The existing conserved trees health shall not be compromised either by the design or by implementation of the project. The following items will be addressed when conducting the tree selection:

Tree Inventory

Inventory shall be conducted while building project is in early planning stages.

Tree Size

Only trees over a minimum size (6” DBH) shall be inventoried for preservation or removal. Small trees (e.g. 4-6” DBH) which are open grown and of suitable species and shape shall be inventoried for future relocation on site. The largest trees on the site may not be the most desirable to preserve if they are over mature and/ or declining.

Species

Identify genus and species when possible. Some species are inherently tolerant of root damage. This may be related to rooting habits or to the trees' inherent capacity to withstand stress. Preservation of short- lived species and those which have inherent insect, disease or structural problems shall be avoided.

Location

Trees to be preserved shall allow for access to the site by equipment. As a general rule, trees shall not be left within twelve feet of a structure and shall be removed. A minimum distance of twelve inches for each inch of trunk diameter (the Critical Root Zone) shall remain free of any construction activity around each tree. This includes cuts, fill, and infringement by equipment, materials storage, etc. Where this construction-free zone cannot be maintained, site plans shall be altered or and tree removal considered.

Age and Condition

Evaluate tree condition as Good, Fair, Poor, Dead/Dying or by ISA valuation formula percentage classes. There is a tendency to save the largest and oldest trees since these are most prominent and attractive to the property owner. However, mature, trees are much less adaptable to site changes occurring during construction. If adequate undisturbed space cannot be provided to these larger older trees, then establishing young, vigorously growing trees shall be favored. In any case, choose only healthy trees that are not suppressed or show evidence of trunk decay, structural deficiencies, bark injuries, disease or insect damage.

Exiting Trees to Conserve

Responsibilities to and scheduling of tree care such as pruning, maintenance, and irrigation within the Tree Protection Zone shall be established at this part of the project.

New Trees

The species selection is to be determined by the Landscape Architect and SMU Landscape Manager. The conceptual site plans shall be submitted to SMU for review and final approval. The site plans will need to include plant type, placement, location, accurate drip line of existing or proposed tree, irrigation needs, height, wind patterns, and sidewalk placement.

On-site Pre-Construction Preparation

Implementation of recommendations shall be communicated and tracked by the project arborist.

Building Site Preparation

Define areas for roads, construction path, structures and utilities as well as tree preservation zones (TPZs, see below). Locate specific sites for storage of building supplies and fill soil, worker and equipment parking areas and washout areas for concrete trucks. These areas shall not interfere with tree preservation areas zones. The decision of which trees are to be removed or preserved is addressed in the Design Phase. Designated green space areas that will endure construction activity such as parking or being driven over by any typical construction equipment, trailered, or have materials stored on them, shall be covered with coarse wood mulch (such as under composed wood chips) to a depth of 6 inches minimum. This depth shall be continuously

maintained and periodically refreshed (every 6 months, maximum) as the project progresses. Heavier equipment requires additional appropriate padding such as construction mats.

Worker Education

Pre-construction meetings shall be held to advise construction crews of tree preservation areas (TPZs) and procedures to avoid damage to remaining vegetation in these areas. Refer to ANSI A300 (Part 5)- Management. A system of fines shall be developed and imposed on workers, including subcontractors, who damage plants through negligence failure to use reasonable care, resulting in damage or injury. Most damage, visible and invisible is irreversible.

Pre-Construction Site Preparation (Site Clearing)

Trees which will not be preserved shall be removed from the site in a manner to avoid injury to remaining trees. Heavy equipment shall not encroach on the root systems of high value plants. If necessary, trees shall be removed manually with chain saws, and stumps shall be ground out instead of using heavy equipment.

Fell trees away from preservation areas whenever possible. Mitigation such as temporary bracing, root pruning, trunk flare exposure, soil amendments, etc. is preferred to be implemented before construction, except where the existing condition may protect the tree. When trenching or modification of the site encroaches heavily onto established trees, a root pruning method shall be employed where the roots are exposed and trimmed with proper pruning tools several inches to the side of the trench bordering the trunk of the affected tree. Tearing of roots is to be avoided. Supplemental irrigation shall start if needed. Any roots exposed by construction activity shall be pruned flush to the soil. Backfill root areas with good quality top soil as soon as possible (i.e. within the workday). If roots are not backfilled within this time, they shall be covered with organic material such as composted mulch to a depth of 4 inches which will reduce temperature and minimize water loss due to evaporation.

Delineating Protection Areas

Tree protection zone barrier(s) shall be installed prior to site work. Tree protection areas shall be delineated with chain-link fencing to prevent encroachment of equipment. Do not store materials or equipment within drip line. For forest trees, the protection zone shall extend 6 inches from the trunk for every foot of height. These are preferred areas for the tree protection zones. The minimum distance from the trunk of the tree protection zone shall never be less than twelve inches for every inch of trunk diameter. For old trees, declining trees and those sensitive to construction, a larger tree protection zone is required. Fences shall be erected at a minimum distance from the tree of twelve inches for every inch of trunk diameter. Signs, in English and Spanish shall be placed visible from all directions, along the fence to inform workers of the purpose of the boundary. Mulch shall be applied to protection areas to help reduce moisture stress. Area shall be restored to a safe work site if trees were removed:

- Stumps to be ‘ground’ or dug out

- Holes from manual or mechanical removal (such as tree spading) shall be back-filled
- Consideration shall be made to salvage wood created from removed trees.

Tree Protection Zone (TPZ)

Tree protection zones shall be established and maintained for all trees to be conserved on a construction site.

Specification: The Tree Protection Zone (TPZ) is part of the construction zone. A minimum TPZ is to be established at:

A. The drip line or horizontal extent of canopy
B. A diameter of 12 inches per diameter inch at breast height (DBH) measured at 4.5 feet from root flare whichever is greater.

This area may be adjusted for existing buildings, walkways, and roads by permission of SMU. Barricade shall be of 6-foot-high chain link fence, either of panels or permanent installation with top rail and 2 inch diameter galvanized post in an enclosure. If panel construction is used, no gate is required. Barricade is suggested to not be screened as to allow inspection of TPZ and increased visibility for security. Signs, in English and Spanish shall be placed visible from all directions, along the fence to inform workers of the purpose of the boundary. The barrier and proper signage shall be installed prior to any site preparation and shall be maintained throughout all phases of the construction project. Erosion and sediment control barriers shall be installed or maintained in a manner which does not result in soil buildup within tree drip line. Apply 4 inches of course mulch within protection areas to help reduce moisture stress and reduce maintenance.

Exceptions:

A. Where there is to be an approved grade change, impermeable paving surface, tree well, or other such site development, erect the fence 2 – 4 feet beyond the area to be disturbed.
B. Where permeable paving is to be installed within the tree’s drip line, erect the fence at the outer limits of the area to be paved, prior to grading so that the area is graded separately prior to paving installation to minimize root damage.
C. Where severe space constraints due to limits of construction location size or other special requirements, contact the SMU Arborist.

Where any of the above exceptions result in a fence being closer than 4 feet to a trunk, additionally protect the trunk with strapped on planking to a height of 8 feet (or the limits of lower branching) and install and maintain 8 inches of coarse mulch in addition to the reduced fencing provided.

On-site Construction Phase

The contracted arborist and the SMU Arborist, in coordination with the SMU Project Manager and/or the SMU Landscape Manager, shall be given access to and monitor implementation of recommendations. Tree health shall be monitored during the construction phase. Special care such as supplemental irrigation and bracing may need to be applied, and the party responsible shall be designated in the planning stage. In the event of damage to barriers and/or trees, corrective actions shall be implemented.

Excavations

Where excavations are performed within the root zone of trees, trenching shall be performed using a vibratory plow, directional borer or by air spading. Backhoes shall not be used to rip roots at considerable distances from the point of excavation.

Monitoring

The arborist shall inspect the project site weekly or more often on large projects. The arborist shall inspect fences, cuts and fills, as well as the general health and condition of the trees. Violations and tree problems shall be reported to the project coordinator in writing, and followed up on until corrective actions are applied.

Tree Maintenance During Construction

Trees that were previously irrigated shall be irrigated during construction. They shall receive a minimum of one inch of water per week from the combination of rainfall and irrigation. This is equivalent to 375 gallons of water per 1000 square feet within the TPZ. Trees with root injuries shall be irrigated during droughts, especially in summer. Root-pruned and root-damaged trees shall receive a minimum of one inch of water per week from the combination of rainfall and irrigation. This is equivalent to 750 gallon of water per 1000 square feet within the root zone (preservation area) of the plant. TPZ

Deadwood branches, storm damaged limbs and low limbs that interfere with construction, shall be pruned properly by an arborist in accordance to SMU pruning guidelines, on an as-needed basis.

Trees also shall be monitored for presence of damaging pests. Appropriate control procedures shall be implemented on an as-needed basis by the project arborist. Treatments such as fertilization and maintenance pruning generally shall be deferred until construction is complete, while treatments such as bark-tracing of wounds may need more immediate attention. Borer treatments may be necessary in summer in stressed, infected trees. Monitoring and treatment will be administered by SMU Maintenance and Grounds to all trees that are in a construction site or under one-year warranty.

Grade Changes

Grade changes shall be avoided around trees whenever possible. Site development shall utilize existing contours in order to preserve feature trees. If grade changes are unavoidable, then refer to ANSI A300 (Part 5)-2005 Management. When grade changes plan to exceed 6” above or below pre-construction level during construction or permanently, acceptance by SMU is required prior to implementing.

Post-Construction Phase

Landscape establishment may occur at any time but is usually performed after construction and during hardscape installation. Installation of irrigation shall avoid concentrations of established roots. AirSpade™ shall be employed for work in this area (within the drip line of established trees). Tree health shall continue to be monitored throughout all phases. Construction originated damage usually is not immediately apparent. Tree conservation recommendations shall be revised if the construction activity has significantly altered the tree health and maintenance needs. Protective devices such as fences and barricades may be removed but required the tree protection zone must still be observed. Long-term tree maintenance specifications shall proceed.

Transplanting objectives shall be established prior to beginning operations. Tree transplanting care is similar to its smaller woody and vegetative plant counterparts. Some practices may be extended towards their counterparts but only within the specifications of the respective material. Exceptions shall be discussed with the respective arborist or horticulturist before operations.

Irrigation Installation

Irrigation routing shall avoid concentrations of established roots. We prefer using trenchless methods such as the AirSpade™ or directional boring trenching while working inside the Critical Root Zone (within the drip line of established trees).

Compaction

Soil areas beneath roadways, paved areas, sidewalks and other features shall be compacted to specifications required. All other green space areas where turf, planting beds, and trees will reside shall avoid compaction and at least restored to 80 to 85% of maximum dry density as determined by the Proctor test. [Reference: ASTM D698-91]

Plant Material and Site Inspection

The contracted arborist and horticulturist can reject receiving incoming plants for, but not limited to, poor quality stock, disease, insect infestation, poor growth habits, disproportioned root to stem and canopy ratios, poor branching structure, wrong species or cultivar, unhealthy root system or root system structure. Inspection for girdling roots is as stated in section Post-Construction Tree Maintenance entitled “Root Pruning”. An initial 10% sampling of the delivery will be inspected. If more than two are found to exceed the limits by this guideline, the entire

delivery may be inspected. Results will be communicated to next higher management level as how to proceed. Refer to “Best Management Practices: Tree Planting”. Soil analysis and drainage considerations shall be assessed at this stage. Percolation test shall be administered. Water shall drain at the rate of 1 inch per hour and be completely drained below base of root ball in 24 hours. Report any condition beyond the original scope of transplanting work to the appropriate person authorizing the work. Work may need to stop and not proceed until the situation is rectified, in some cases.

Give the SMU Project Manager 24 hours’ notice prior to any plant delivery so that he can notify the Landscape Resource Manager. All plant material must be approved by SMU and the project landscape architect prior to being installed. A picture of the plants to be installed will not suffice.

The contracted arborist is to have access to and inspect incoming plant materials at earliest point, at delivery, before and after planting. The contracted arborist may issue adjustments to the installation at time of planting to insure proper handling and installation.

Tools and Equipment

Digging and pruning tools shall be sharp to cut without breaking, crushing, or tearing the intended target. Digging equipment shall be maintained to manufacturers’ recommendations to maintain safety and proper delivery with minimal damage. Lifting devices (e.g. cables, slings, chains) shall be inspected, certified rated, and used only within limits (see ANSI A300 (Part 6) Annex B). Devices showing wear or history of abuse shall be decommissioned (removed from usage and rendered unusable). Equipment and work practices that damage the plant beyond the scope of the work shall be avoided. (e.g. handling of the tree which causes fracture of the root ball) Root pruning tools shall be sharp to cut without breaking, crushing, or tearing roots.

Certified lifting devices shall be used according to manufacturer’s instructions and specifications within established safety standards.

Timing

Consideration shall be given to when the transplanting occurs and healthiness the plant is in during what season state the plant is in at that season (phenology). Adjustments shall be made, accordingly, e.g. watering, shading, frost protection.

If possible orient trees and shrubs to their original compass orientation before placing them in the ground. Opportunity to mark trees before digging is highly valuable.

If available, trees shall be marked as to original compass orientation. Opportunity to mark trees before digging is highly valuable.

Methods of Handling

Handling of trees intended for SMU projects shall incorporate any and all of the handling methods listed below at the earliest point of the transplant process. Continue following

throughout transportation chain, from off-site, through local storage (if required) to installation at project.

Lifting

Prior to lifting root balls, roots shall be separated from the surrounding soil. The system used for lifting shall prevent damage to the root ball, trunk and crown. Spreader bars shall be used to distribute forces away from the root ball and provide crown clearance.

Transporting

The system for transport shall minimize desiccation and other damage to crown, trunk, and root ball.

Storing Before Planting

Health and vigor of the materials shall be maintained during storage. Holding times shall be minimized through planning and just-in-time methods. Trees held on site before planting for more than 36 hours shall be protected as soon as possible from drying out, frost or heat, and sun. They need to be watered to prevent and reduce stress.

Digging the Hole

Follow established industry standards including those outlined in ANSI A300 (Part 6)-2005 Transplanting and its corresponding BMP.

The final depth of the planting hole is determined by the depth and firmness of the root ball and other characteristics of the site (e.g. grade, surround) and shall not exceed the depth of the root ball. The depth of the root ball shall be measured from the bottom of the trunk flare to the bottom of the root ball. The soil directly beneath the root ball shall be undisturbed or prepared to prevent settling. Planting hole width shall be a minimum of 1.5 times the diameter of the root ball. With the exception of tree spade and roundball methods, the sides of the planting hole shall be scarified. Use of augers and equipment such as backhoes may be employed to remove the central volume of the hole but the soil at the sides must not be compacted by their utilization and shall be hand dug. The sides of the planting holes must be roughed up to break up the glazing of the soil when planting all trees.

The planting hole shall be dug no deeper than the root ball when measured from the bottom of the root ball to the trunk flare. The hole shall be excavated to no less than 2 feet radius larger than the root ball, preferably, a slope sided hole that is three times as wide (diameter) as the root ball diameter. If the hole is augured, it must be then scarified to create rough star-shaped wall, removing at least 2 inches additional soil. Installation of a 4 inch “view tube”, to a depth of 24” below the bottom of the root ball is preferable. It is not required for every tree but in a regular interval not less than 33% of the trees in a planting section (approximately one irrigation zone), more with respect to varied soil and grade conditions.

Installation of Plant Material

Prior to lifting root balls, roots shall be separated from the surrounding soil. The system used for lifting shall prevent damage to the root ball, trunk and crown. Trees shall be lifted by the container or by supporting the bare root ball. Trees shall be placed in the same compass orientation from which they originated. If not marked, certain growth observations may be made to identify this orientation. The bottom of the trunk flare shall be 0-2” above finished grade. If the plant was accepted with objectionable roots, they may be removed before planting only if they do not disturb the integrity of the root ball. Removing objectionable roots shall then be done after planting by a qualified individual with appropriate tools and methods.

Once the tree is placed in planting hole, untreated burlap shall be cut away from the 1/3 of the root ball.

Balled and burlap (B&B) stock shall have covering removed from top and down 1/3 the sides of the ball, 12 inches or more, whichever is greater. Remove completely when possible. Treated or synthetic burlap shall be removed completely.

Metal baskets shall be removed from top and down 1/3 the sides of the ball to a depth of 12 inches or more, whichever is greater. Remove completely when possible.

Remove all rope, tags, and tree wrap from trunk and limbs.

Boxed containers shall have sides completely removed.

Backfill and Watering

Backfill shall be same or similar to the soil at the planting site. Backfill soil may not be amended to change texture (i.e. adding sand and/or loam to our primarily clay soils). Chemical amendments at planting shall only be applied if a soil analysis determines need to supplement to adjust for pH, micro-and/or macro-nutrients. In the first year nitrogen shall be withheld. Method shall be a slow-release formulation and shall be integrated evenly in the first 12-18 inches.

The back-fill soil shall be installed and settled in layered sections, with the use of water, to limit future settling and eliminate or prevent air pockets. Backfill soil shall not be compacted to a density that inhibits root growth. The goal is to restore to a similar density as the soil before the hole was dug. Water shall be added, at an appropriate rate, to the root ball and backfill to bring the root ball to field capacity.

Mulch shall be applied to an initial depth of 3 inches when lightly compacted. It shall be applied to within a 2 inch radius, and not touching the trunk or root flares. Mulch with same material as surrounding landscape, specified in the landscape section.

Staking

Staking is not required if the root ball is stable. Trees shall be guyed loosely enough to allow trunk to sway from the base. Opposing two-stake systems are preferred. Stakes and guying shall be installed to minimize hazards to people.

Wire or tubing encased wire is not to be used. Fabric and strapping specifically for staking shall be installed according to instructions. Staking shall remain for no longer that 1 year. Six months is preferred. Removal is the responsibility of the installer. (It's a good opportunity to check up on the tree's health).

Pruning

After planting, only dead, broken or damaged branches shall be pruned using proper techniques.

Post-Construction Tree Maintenance

Tree damaged by construction as well as new transplants generally require a high level of maintenance due to stress caused by root loss. Demands for water and mineral nutrients (fertilizer) are critical due to root loss.

Tree Structure Evaluation

A thorough inspection and evaluation of tree structure shall be performed before any maintenance in conducted. Careful inspection of the root zone and root flares shall be undertaken to assess hazardous conditions. Branch structure, wood decay and other defects also must be evaluated and remove if needed.

Final Grading

Final site grading shall provide drainage systems which divert ground water from tree preservation areas. Grading shall be avoided in preservation areas.

Whenever possible, maintain trees under a layer of mulch in natural areas rather than grading and establishing turf or other ground cover.

Root Collar Excavation

During construction, soil is frequently placed against root collars of trees due to grade changes. Ensure that root flares are visible on all trees during the initial inspection. Excavate soil to expose the root collar as necessary.

Mulching

SMU requires mulch around trees. The benefits of mulch on plant growth include conserving soil moisture, supplying nutrients and organic matter, eliminating competition from weeds and

ground cover plants and preventing erosion. Mulches shall be applied to a depth of two to four inches. Excessive mulch can encourage shallow rooting which can be detrimental during droughts. Avoid annually top dressing mulched areas where the mulch exceeds depths of four inches. Avoid placing mulches against the root collar. Maintain a mulch ring around each tree; 1foot of mulch for every inch of tree girth at the base of the tree.

Materials and Installation Specifications

General

Unless otherwise stated, it is expected that the Landscape Architect will specify the landscape subcontractor to furnish all labor, material and equipment required to complete the work described herein in strict accordance maintained in conformance with the drawings and specifications.

Protection of Existing Lawns to Remain

Do not store materials or equipment, permit burning, or operate or park equipment on existing lawn areas to remain except as actually required for construction on those areas.

Provide barricades, fences or other barriers as necessary to protect existing lawns to remain from damage during construction.

Notify Landscape Architect in any case where Contractor feels grading or other construction called for by Contract Documents may damage existing lawns to remain.

If existing lawn areas to remain are damaged during construction, Contractor shall replace such lawn areas of the same quality as those damaged at no cost to Owner. Determination of extent of damage and value of damaged lawns shall rest with Landscape Architect and SMU representative.

Clean Up

Keep all areas of work clean, neat, and orderly at all times. Keep all paved areas clean during lawn installation operations. Clean up and remove all deleterious materials and debris from the entire work area prior to Final Acceptance to the satisfaction of Landscape Architect and SMU representative. All existing landscapes that are not re-landscaped through the project and are behind a construction fence will be maintained by the project GC or their subcontractor during the life of the project. This maintenance includes proper irrigation, weeding, mowing of turfgrass, leaf and trash removal. The landscape shall be returned to SMU in the condition it was in the day the construction fence was installed.

Materials

Turfgrass Sod Composition: Turfgrass sod shall be Zorro Zoysia in all part-shade locations or Celebration Bermuda in all full-sun locations. Turfgrass will not be specified in any areas that receive less than 4 hours of sunlight per day.

Turfgrass Sod Quality: Turfgrass sod shall be of good quality, free of weeds, disease and insects and of good color and density.

Thickness of Cut: Turf shall be machine-cut at a minimum uniform soil thickness necessary for plant viability during the Harvest-Transport-Installation cycle.

Pad Size: Individual pieces of turfgrass sod shall be cut to the supplier's standard width and length.

Strength of Turfgrass Sod Sections: Standard size sections of turfgrass sod shall be strong enough to support their own weight and retain their size and shape when suspended vertically from a firm grasp on the upper 10 percent of the section.

Turfgrass shall be inspected and approved by SMU prior to installation. Sod cannot be kept on the pallet for more than 24 hours. Once delivered the sod must be laid, rolled, and irrigated immediately. This means the site must be prepped and ready for the sod to be laid before the sod delivery arrives.

Grading

Tilling: After the areas to be top soiled have been brought to grade, and immediately prior to dumping and spreading the topsoil, the sub-grade shall be loosened by disking or rototilling to a depth of at least 3 to 4 inches to permit bonding of the topsoil to the subsoil. This process must not be done under the drip line of any tree. To prepare the soil under the drip line of any tree, the soil must be air-spaded. There can be no tilling under the drip line of any tree. Place and spread any additional material that may be required. The Contractor shall be responsible for minor adjustments to the finished subgrade if such treatment is required in the opinion of the Owner's Representative. Hand-rake the surface, removing all of the clods and undesirable material greater than one-half (1/2") inch, from ground surface. Fill all low spots and cut irregularities to the acceptance of the Owner's Representative. Roll the entire surface evenly with a water ballast roller or other means acceptable.

During the finished grading operations, all swales and additional swales that may be required to drain areas where there are existing plant materials, shall be finished. In general, all grade adjustments shall be made so there are no areas that will have standing water. To prevent excessive weed growth in the lawn areas, the Contractor shall be prepared to immediately install the lawn upon the completed and acceptable finished grade.

Installation

Moistening the Soil: After all grading has been completed; the soil shall be irrigated within 12 to 24 hours prior to laying the turfgrass sod. Turfgrass sod shall not be laid on soil that is dry and powdery.

Starter Strip: The first row of turfgrass sod shall be laid in a straight line, with subsequent rows placed parallel to, and tightly against, each other. Lateral joints shall be staggered to promote more uniform growth and strength. Care shall be exercised to insure that the turf is not stretched or overlapped, and that all joints are butted tight in order to prevent voids, which would cause air-drying of the roots.

Sloping Surfaces: On sloping area where erosion may be a problem, turfgrass sod shall be laid with staggered joints and secured by pegging.

Mark all irrigation heads and cut turf around them. Roll Sod.

Fertilizers: All fertilizers shall be uniform in composition and free-flowing. Fertilizer shall be delivered to the job site fully labeled according to applicable state fertilizer laws. Fertilizer application rates shall be determined by soil tests. Fertilizer shall be distributed uniformly over the area to be sodded with turfgrass.

Watering: The landscape contractor shall be responsible for watering turfgrass sod immediately during and after installation to prevent drying. It shall then be thoroughly irrigated to a depth sufficient that the underside of the new turfgrass sod pad and soil immediately below the turfgrass sod are thoroughly wet (usually 1 inch of water is needed). The contractor shall be responsible for having adequate water available at the site prior to and during installation of the turfgrass sod.

Acceptance

Acceptance shall be given by the contractor, owner, architect or his/her agent upon satisfactory completion of each section or area as indicated on the drawings or as otherwise specified. Acceptance shall be recorded by the party responsible for the site preparation, and it shall be signed by the owner or agent. No Top-soiling or Turfgrass sod installation work shall precede until this requirement is met.

Guarantee

The landscape subcontractor shall guarantee work covered by this specification.

Contractor’s Responsibility

Unless otherwise specified, the Contractor shall be responsible for maintaining the accepted sodded turfgrass areas until the effective date for turf maintenance operations begins. The effective date shall be specified in a written notice from the Contractor.

Design Phase for Ornamental Plants

Selection of species is to be determined by the Landscape Architect. Conceptual or Design Development design plans shall be submitted to OFP&M for final approval. Plans shall contain: proposed plant type, container size, placement, irrigation needs, height of plant, shade, wind patterns, sidewalk placement. The Landscape Architect can obtain a plant list from OFP&M prior to preparation of the conceptual design. Plant materials must be drought tolerable/ low water usage, native or adapted to North Texas environment, and tolerable for existing soil conditions.

Soil Preparation and Planting Procedures for Ornamental Plants

Bed Preparation

Before planting, survey the site for potential hazards to plant growth. For instance, new construction sites are often littered with pieces of mortar, plaster or limestone, creating an alkaline soil condition and inhibiting a plant's ability to absorb nutrients. Chemical spills, such as motor oil or gasoline, can also impair plant growth. It may be necessary to remove the top six to eight inches of soil and replace it with a good grade of screened topsoil. Compacted soils also inhibit root growth.

Poor drainage of clay soils causes plant problems in central and north Texas. A water-logged soil will suffocate the root system and kill a plant if not corrected. Slope planting beds along the foundation away for the building and route water from drain spouts away from plant beds. Improve poorly-drained sites by deep tilling to break apart a layer of hard packed soil, or "hard-pan," several inches below the soil surface. After properly grading and removing all construction trash and debris, the areas that will be planted with groundcover, shrubs, herbaceous perennials, annuals, etc. must be tilled. Till all areas to be planted to a depth of 12". Then the areas must be amended with 12" of a high quality planting mix as specified by the Landscape Architect. Then incorporate an all-purpose, granular organic fertilizer. The planting mix and the fertilizer must then be tilled into the existing soil to a depth of 12". Grade the soil to ensure good drainage and to avoid standing water. There can be no tilling under the drip line of any tree. After planting apply 2" to 4" of mulch to the top of the soil surface to conserve moisture and prevent weeds. Keep mulch away from the base of each plant. There shall be no actual contact between the mulch and the plant itself. Areas to be planted under the drip line of any existing tree must be cultivated using an airspade. Before using the airspade the soil must be moistened to a depth of 12". If the soil is not adequately wet the airspade will not work. Add 2" of compost to the top of the soil and then airspade to a depth of 12".

Selecting and Planting Plants

Always purchase fresh, high quality plants. Container-grown plants shall have healthy, vigorous tops and white feeder roots on the outer edge of the root ball. Examine the plants for girdling and overgrown root systems. The roots shall be white. Dark roots can indicate problems. Container-grown plants generally transplant well throughout most of the year with minimum

shock, although fall and winter months are the best time to transplant. Because a large portion of the balled-and-burlapped plants root system is destroyed during digging, they transplant best during the cooler months of the year (October through April).

If plants cannot be planted right away, place them in a shaded area and keep the roots moist. If balled-and-burlapped or bare-root plants must be held several days before planting, cover their roots with soil to conserve moisture. Avoid placing the roots in buckets or water for long periods of time. Container plants may need daily watering. Plants must not be allowed to dry out before and/or after planting.

All plants must be approved on site by a representative from SMU's Project Manager. Therefore the contractor or sub must contact a SMU Project Manager every time plant material, turf, and/or trees are delivered, prior to installation. Photos of the plants will not suffice. SMU reserves the right to refuse plant material that we deem poor quality.

Plant Spacing

Groundcovers - All groundcovers (Asian jasmine, Liriope spp., Ophiopogon spp., Aspidistra, etc.) must be in 1 gallon containers or larger, no 4" pots. SMU reserves the right to refuse plant material based on container size and quality. One gallon groundcovers shall be spaced close enough to give the appearance of a mature landscape thus all groundcovers shall be spaced approximately 1' on center, no further.

Shrubs - All shrubs and roses must be in 3 gallon containers or larger. The shrubs must be spaced close enough to give the appearance of a mature landscape. The spacing for all shrubs shall be 4" from the outer edge of one plant to the outer edge of the next plant. SMU reserves the right to refuse plant material based on container size and quality.

In shrub beds, a minimum of 12" will be left open between the outer row of irrigation heads and the front of the shrubs to prevent the spray from being blocked.

Herbaceous Perennials- All herbaceous perennials must be in 1 gallon containers or larger. The perennials must be spaced close enough to give the appearance of a mature landscape. The spacing for all perennials shall be 3" from the outer edge of one plant to the outer edge of the next plant. SMU reserves the right to refuse plant material based on container size and quality.

Annuals - All annuals must be in 4", 1 gallon containers, or larger. The spacing for all 4" pots shall be 6" on center. The spacing of all 1 gallon annual plant material must be 8" to 12" on center. SMU reserves the right to refuse plant material based on container size and quality.

Planting in Individual Holes

When you are planting individual trees and shrubs, dig a large planting hole. Dig a hole twice as wide as the root ball to encourage rapid root growth and larger, stronger plants. Dig the planting hole to the depth of the root ball and no deeper. If the hole is dug deeper than needed, backfill the soil as necessary and tamp it firmly to prevent settling. Make certain the top of the root ball

is level with the soil surface. Prior to back filling, expose the root flair to make sure that it does not get planted below the soil level. Make any adjustments at this time such as raising the hole level and then backfill. Do not add any organic amendments, such as peat moss, pine bark and leaf mold, to the soil. Simply backfill with same soil removed from the hole after breaking apart any clods and removing stones or other debris.

Before planting balled-and-burlapped plants cut any wire or cord from around the trunk (remove from plant) and pull back the burlap from the top third of the root ball. This will allow newly formed feeder roots to grow into the new environment. When planting on poorly drained soils, remove the burlap completely. Make sure to remove the entire bag before planting when using ornamentals grown in fabric bags. As the backfill soil is placed in the hole, water to eliminate air pockets. Use your hand, not your foot, to gently firm the soil around the roots. Water the pants thoroughly when finished and water again several hours later. Do not add any type of fertilizer at this time.

Finally, shape a small ring of soil along the perimeter of the planting hole. This helps direct water to the roots and prevents runoff. Then apply a three-inch layer of mulch uniformly over the soil surface. Keep the mulch away from the root collar. Mulches promote rapid rooting by maintaining uniform moisture levels and temperatures in the soil and by preventing weed competition. Water the newly planted tree immediately and thoroughly.

Planting in Beds (Annuals and Herbaceous Perennials)

A group of ornamentals in one area of the landscape will grow more uniformly when planted in a well-prepared bed rather than in individual hole. Begin by deep tilling to a depth of 12 inches. At this time, elevate the bed 6 to 12 inches by adding soil amendments, compost or premium bedding mixes from Soil Building Systems, Vital Earth, or LETCO. A raised bed not only ensures good drainage, but also improves the visibility of the color display. After planting, apply about two inches of mulch on the soil surface to conserve moisture and prevent weeds.

Care of Newly Planted Ornamentals

Regular watering is critical during establishment. Keep the root system moist, but not too wet, for the first six to eight weeks after planting. The amount of water and frequency of application depends on the soil type, plant and time of year. Trees and shrubs may require watering twice a week when there is no rain. Annuals and ground covers may need daily watering during establishment. In the summer or dry periods or in the winter when there is a threat of freezing temperatures, plants may need to be hand watered to supplement the irrigation system. The contractor must monitor to know when hand watering is required. Let soil moisture be your guide for watering frequency.

If specifying general-purpose fertilizers, use light applications for newly-planted ornamentals during the first growing season. Broadcast fertilizers evenly over an area extending six inches from the trunk to one foot beyond the branch spread or canopy. When broadcasting fertilizers

over the tip of the foliage, be sure the foliage is dry, and water immediately after application. Mulch all newly planted beds with specified bark mulch.

Landscape Establishment Period

A quarterly walkthrough and inspection of all landscapes that are in the landscape establishment period will be set up by OFP&M and will include a SMU Project Manager, SMU Landscape Manager and SMU Sr. Irrigator, and the landscape contractor. The results of the inspection will be shared with all parties. Requirements for an LEP will be developed, revised and approved by SMU, (OFP&M, SMU and landscape architect), as part of the project specification.

The landscape contractor will communicate via email to SMU Sr. Irrigator when programming changes are needed. The contractor will provide the program schedule in the email.

Number of plants required per 100 Square Feet at Various Spacing:

Spacing (inches between plants)	Number of Plants Needed
4	900
6	400
8	225
9	178
10	144
12	100
16	56
18	45
24	25
30	16
36	11

LEED Building Landscapes

In all landscapes around LEED buildings the foundation plantings must be 12” – 18” away from the exterior wall of the building. Plants must be planted at such a distance to maintain this gap. Consider the size of the mature plant when establishing the proper distance to maintain this gap.

Landscape Irrigation Systems

The Design Team shall include in the Contract Documents that the Contractor shall provide/maintain irrigation (temporary or otherwise) to affected areas outside of the immediate construction contract limits. The Design Team shall also include in the Contract Documents that the Contractor to have an English-speaking person on site at all times. The Contractor shall notify SMU immediately of any damage to the irrigation system in order to prevent flooding, and loss of irrigation to plants. SMU Sr. Irrigator can make necessary adjustments and be knowledgeable of the situations. Adjacent areas shall be inspected by SMU Landscape Department for damaged wires, lines, heads, etc. at the end of the construction phase. SMU may elect to perform daily irrigation test to ensure systems are still functioning properly, and not leaking. The daily test will be conducted for one-minute per zone in the mid-afternoon. Damage that is located will be repaired on the same day by the SMU, and paid for by the Contractor.

Drip irrigation may be used in groundcover beds and shrub beds. For existing systems, SMU will perform a preconstruction walkthrough with the Contractor to inform of existing and adjacent irrigation systems. This walkthrough is to show: the system is functioning, locations of valves and heads, and piping layout. The SMU Sr. Irrigator will attend this preconstruction walkthrough to inform and answer all questions that the contractor may have about the irrigation system.

During the design phase, the Design Team shall develop an irrigation plan. This irrigation plan shall be reviewed by SMU Sr. Irrigator. SMU Sr. Irrigator shall inspect each phase of the Landscape irrigation system. This includes: excavation and pipe laying, wiring, valve placement, impact on and restoration of service to areas that have been impacted by construction areas. The designing of the irrigation system can either be a performance specification or designed by a Landscape Architect. SMU Sr. Irrigator will review the irrigation design, and CAD files will need to be provided to OFP&M for Project Record Documentation.

Gray water systems may be used. This system can be used for both LEED and non-LEED projects. Notation shall be on the sprinkler controller for identification of the gray water system. It is encouraged to use non-clog heads for this system. The non-clog heads will need to have a colored top cap in order to differentiate it from the regular heads. The Contractor will need to coordinate with OFP&M in regards to initial programming for the zones and clock timer settings for the irrigation system.

During Construction, there shall be no storage of materials on established landscape areas, as well as no on-site storage of materials within a close proximity of tree drip lines. Construction

team shall not bury construction material and debris. Sites shall be completely leveled-off, and graded, after tear down and deconstruction of projects.

Refer to Appendix 32-A - Irrigation.

Site Furnishing

Benches (Campus Standard)

- Wood, Cast Stone, or limestone.
- Location as determined by Design Team and OFP&M.
- Stone Benches: Refer to Appendix 32-B Cast Stone Bench.

Trash Receptacles (Campus Standard)

- Refer to Appendix 32-C - Trash Receptacles.
- There shall be a minimum of four trashcans per building. It is preferable that a trash receptacle be located next to or within approximately 30' of any entrance. In the landscape around any new building there shall be a trash receptacle at any cluster of seating. The exact locations will be determined by OFP&M.
- In a pedestrian mall there shall be a trash receptacle at any cluster of benches or seating area made up of more than one bench or one trash receptacle for every five benches. Pedestrian malls shall have at least 3 trash receptacles for each 13,500 square feet in addition to the ones placed at seating areas.
- Trash receptacles shall be ordered by the project's construction manager or general contractor.
- Trash receptacle liners must have a lip around the top to help hold the trash bag in place. Without it the bag will fall down. The liners come with the trash receptacle when ordered from Jackson Pottery. Refer to Appendix 32-C - Trash Receptacles.
- Trash receptacle lids are ordered separately. Refer to Appendix 32-C - Trash Receptacles.

Cigarette Urns (Campus Standard)

- There shall be a minimum of two ash urns per building. They will be placed in the landscape and must be at least 25' from any exterior entrance/exit door. The ash urns are best located next to a seating area. The exact locations will be determined by OFP&M.
- In a pedestrian mall there shall one ash urn for every five benches. The exact locations will be determined OFP&M.
- Ash urns will be ordered by the contractor and paid for by the project.
- Ash urns bowls shall be ordered for each ash urn by project/OFP&M.
- Ash urn bowls shall fit into ash urn properly.
- SMU will supply and fill the ash urn bowls with the black ash filler at the end of the project.
- Refer to Appendix 32-D - Cigarette Urn.

Bollards

- Shall be aluminum unless otherwise required for design.
- Location is to be determined on a case-by-case basis, and shall be confirmed with the applicable Fire Marshall.
- Knox padlocks, as well as campus locks will, be required.
- Refer to Appendix 32-E - Bollard.
- Location: as determined by Design Team and OFP&M.

Bicycle Racks

- Campus Standard: powder-coated steel pipe loops.
- Bike racks must be ordered by the contractor of the project and installed properly.
- Each bike rack must be embedded in the concrete, no above ground mounting.
- Must be on a concrete pad.
- Location: as determined by Design Team and Facilities.
- Refer to Appendix 32-F - Bicycle Racks.

Pavement Markings and Signage

Surface Parking Lot Pavement Markings

The Contractor shall perform all work in a first-class, professional manner in accordance with this contract, specifications, governing codes and instructions by SMU. Efforts by the Contractor to obtain a clear understanding of the scope of work for each assignment governed by this contract shall be requisite in contractor acceptance of this contract.

1. Application

   Provide qualified technician to supervise equipment and application of traffic paint. Layout markings using guide lines, templates and forms. Stencils and templates shall be professionally made to industry standards. Free hand painting of arrows, symbols, or wording shall not be permitted.
   a. Apply traffic paint per manufactures specifications.
   b. Apply traffic paint in dry weather and when weather will remain dry for 4 hours after application.
   c. Apply 1 coat of Sherwin Williams Set Fast (chlorinated rubber) Traffic Marking paint applied at 7.5 mills.
   d. Apply 1 coat of TxDot type 1 approved Thermoplastic at 90 mils.

2. Site Preparation

   Inspect existing pavement surface for conditions and defects that will adversely affect quality of work, and which cannot be put into acceptable condition through normal

preparatory work as specified. Contact SMU's General Services Manager for direction. At a minimum all areas must be prepared by:

a. All areas receiving traffic paint must be pressure washed. Thoroughly clean surface free of dirt, sand, gravel, oil and other foreign matter.
b. Existing thermoplastic pavement markings must be 100% removed by the best method considering the conditions of the surface. Removal method must be approved by SMU General Services Manager before start of removal process, if applicable. SMU General Services Manager will decide if Thermoplastic will be repainted or optioned out with Non-Thermoplastic Traffic paint.
c. Apply sealer to concrete surfaces before applying thermoplastic material.
d. Clean up and removal of all debris.
e. Surface must be clean and dry before painting.
f. Protect all areas and items not intended to receive traffic paint.
g. Protect work area from vehicle or pedestrian traffic with the use of traffic control devices such as barricades, traffic cones etc. as required or directed by SMU's General Services Manager.
h. Remove all traffic control devices once traffic paint is dry and area can be opened to vehicle and pedestrian traffic.

END OF SECTION