WORLD TRADE CENTER MEMORIAL
TREE ACQUISITION, INSTALLATION AND MAINTENANCE

ADDENDUM NO. 2

June 30, 2006

ADDENDUM CONTENTS

The following shall amend the bid documents for the above-mentioned contract:

Part I: Invitation To Bid

- Revised Bid Bond attached. Replaces prior issue. Typographical error on bid due date changed to **July 10, 2006**.

Part II: Technical Specification Sections

- Revised Specification Section 02931 - Trees, attached. Replaces prior issue.
- Deleted text reflected in ~~strikethrough~~ and new text reflected in **bold.**

Attachments as identified above.

End of Addendum.

WORLD TRADE CENTER MEMORIAL
TREE ACQUISITION, INSTALLATION AND MAINTENANCE

ADDENDUM NO. 2

June 30, 2006

Part I: Invitation to Bid

Revised Bid Bond

Bid Bond

(attach two originals)

BIDDER *(Name and Address)*: _____

SURETY *(Name and Address of Principal Place of Business)*: _____

OWNER *(Name and Address)*: Lower Manhattan Development Corporation
One Liberty Plaza, 20th Floor
New York, New York 10006

PROJECT TO BE BID: The selection, tagging, acquisition, digging, transfer, delivery, installation, and maintenance of the trees for the World Trade Center Memorial.

BID DUE DATE: **July 10**, 2006 at 5:00 p.m. EST

BOND

BOND NUMBER: _____
DATE: *(Not later than Bid Due Date)*: _____
PENAL SUM: (10% of Bid Amount) _____

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to pay to LMDC upon default of Bidder any difference between the total amount of Bidder's bid and the total amount of the bid of the next lowest, responsible and responsive bidder as determined by LMDC for the Work required by the Contract Documents, provided that:

   1.1 If there is no such next lowest, responsible bidder, then Bidder and Surety shall pay to LMDC the penal sum set forth on the face of this Bond, and

   1.2 In no event shall Bidder's and Surety's obligations hereunder exceed the penal sum set forth on the face of this Bond.

2. Default of Bidder shall occur upon the failure of Bidder to deliver within the time required by the Invitation to Bid (or any extension thereof agreed to in writing by LMDC) the executed contract required by the Invitation to Bid and any performance and payment bonds required by such contract.

3. This obligation shall be null and void if:

   3.1 LMDC accepts Bidder's bid and bidder delivers within the time required by the Invitation to Bid (or any extension thereof agreed to in writing by LMDC) the executed contract required by the Invitation to Bid and any performance and payment bonds required by such contract, or

   3.2 All bids are rejected by LMDC, or

   3.3 LMDC fails to issue a notice of award to Bidder within sixty (60) days after the last date for submissions of bids (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by paragraph 5 hereof).

4. Payment under this Bond will be due and payable upon default by Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from LMDC, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.

5. Surety waives notice of and any and all defenses based on or arising out of any time extension to issue notice of award agreed to in writing by LMDC and Bidder, provided that the total time for issuing notice of award including extensions shall not in the aggregate exceed 120 days from the date of the bid without Surety's written consent.

6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in paragraph 4 above is received by Bidder and Surety and in no case later than one year after due date for the bid as set forth in the Invitation to Bid.

7. Any suit or action shall be heard and determined only in a court of competent jurisdiction located in the City and County of New York.

8. Notices required hereunder shall be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier or by United States Registered or Certified Mail, Return Receipt Requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.

9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent or representative who executed this Bond on behalf of Surety to execute, seal and deliver such Bond and bind the Surety thereby.

10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable provision of any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

11. The term "bid" as used herein includes a bid, offer or proposal, as applicable.

IN WITNESS WHEREOF, Surety and Bidder, intending to be legally bound hereby, subject to the terms on the following page, do each cause this Bid Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

BIDDER

_____(Seal)
Bidder's Name and Corporate Seal

By: _____
Signature and Title

Attest: _____
Signature and Title

SURETY

_____(Seal)
Surety's Name and Corporate Seal

By: _____
Signature and Title
(Attach Power of Attorney)

Attest: _____
Signature and Title

Note:
(1) Above addresses are to be used for giving required notice.
(2) Any singular reference to Bidder, Surety, or other party shall be considered plural where applicable.

ACKNOWLEDGMENT OF PRINCIPAL, IF A CORPORATION

STATE OF)
) ss:
COUNTY OF)

On this _____ day of _____, 2006, before me personally came _____ , to me known, who, being by me duly sworn, did depose and say that he resides at _____ , that he is the _____ of _____, the corporation described in and which executed the foregoing instrument; that he signed his name thereto by order of the directors of said corporation.

Notary Public or Commissioner of Deeds

ACKNOWLEDGMENT OF PRINCIPAL, IF A PARTNERSHIP

STATE OF)
) ss:
COUNTY OF)

On this _____ day of _____, 2006, before me personally came _____ , to me known, who, being by me duly sworn, did depose and say that he resides at _____ , that he is the _____ of _____, the partnership described in and which executed the foregoing instrument; that he signed his name thereto by order of said partnership.

Notary Public or Commissioner of Deeds

ACKNOWLEDGMENT OF PRINCIPAL, IF AN INDIVIDUAL

STATE OF)
) ss:
COUNTY OF)

On this _____ day of _____, 2006, before me personally came _____ , to me known, who, being by me duly sworn, did depose and say that he resides at _____ , that he is the individual who executed the foregoing instrument, and that he signed his name thereto.

Notary Public or Commissioner of Deeds

AFFIX ACKNOWLEDGMENTS OF BID BOND, JUSTIFICATION OF SURETIES AND/OR COPIES

[Attached]

WORLD TRADE CENTER MEMORIAL
TREE ACQUISITION, INSTALLATION AND MAINTENANCE

ADDENDUM NO. 2
June 30, 2006

Part II: Technical Specification Sections

SECTION 02931

TREES

PART 1 — GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnishing of Trees.
2. Pre-installation Preparation and Pre-installation Maintenance of Trees at Tree Holding Facility.
3. Digging of Trees.
4. Delivery of Trees to Project Site.
5. Installation of Trees at Project Site.

B. Related Sections:

1. Section 02810, Irrigation (Not in Contract NIC –- for Reference Only).
2. Section 02910, Planting Soil Preparation (Not in Contract NIC –- for Reference Only).
3. Section 02930, Planting Materials (Not in Contract NIC –- for Reference Only).
4. Section 02935, Landscape Maintenance Period (Not in Contract NIC –- for Reference Only).
5. Section 02936, Landscape Maintenance Period for Trees.

C. Unit Prices:

1. Provide a unit price for each pesticide application indicated in the Preliminary Pesticide Application Schedule in Part 3 of this Section to establish a bid price.
2. Provide a unit price for each soil amendment application indicated in the Preliminary Soil Amendment Application Schedule in Part 3 in this Section to establish a bid price.
3. Unit prices shall be applicable for the cost of additional pesticide and soil amendment applications required beyond the quantity of applications included in the bid and shall be applicable for crediting the Owner for applications included in the bid price which are not required by the Arborist.
4. Credit Owner for any pesticide or soil amendment applications included in the bid price which are not required by the Arborist.

D. Alternates: Provide smaller trees as indicated in this Section for Alternate No. 1 and Alternate No. 2.

1.2 REFERENCES

A. ANSI — American National Standards Institute:

1. A300 — Tree, Shrub, and Other Woody Plant Maintenance — Standard Practices.
2. Z60.1 — American Standard for Nursery Stock.

3. Z133.1 — Pruning, Repairing, Maintaining, and Removing Trees, and Cutting Brush — Safety Requirements.

B. ASTM — ASTM International:
   1. C 881 — Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
   2. D1557 — Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

C. Hortus III — Hortus Third: A Concise Dictionary of Plants Cultivated in the United States and Canada.

D. USDA — United States Department of Agriculture:
   1. Soil Texture Triangle Classification.
   2. Handbook No. 60.

E. EPA — Environmental Protection Agency:
   1. Method 8015.
   2. Method 8020.

F. SSSA — Soil Science Society of America, Inc.
   1. Methods of Soil Analysis Part 1 — Physical and Mineralogical Methods, 1986.
   2. Methods of Soil Analysis Part 3 — Chemical Methods, 1996.

1.3 DEFINITIONS

A. Acceptance, Accepted, or Acceptable: Acceptance by the Architect or Arborist in writing.

B. Agronomist: Agronomist consultant employed by the Architect for Project.

C. Arborist: Arboricultural consultant employed by Architect for Project.

D. Architect: Landscape Architect employed by Owner to prepare Landscape Construction Documents for Project.

E. Caliper: Trunk diameter measured at a point 6 inches above natural ground surface for trees up to 4 inches caliper, and measured at a point 12 inches above natural ground surface for trees over 4 inches in caliper.

F. Drip Line: Line straight down from outermost limits of tree canopy branching.

G. Excessive Compaction of Soil or Soil Mix: Compaction greater than 75 percent dry density as determined by ASTM D 1557.

H. Extra Trees or Overstock Trees: Extra furnished trees to be used as replacement trees.

I. Injury: Any bruising, scarring, tearing, or breaking of roots, branches, or trunk.

J. Pest: Insects, mice and other animals, unwanted plants (weeds), fungi, or microorganisms like bacteria and viruses.

K. Pesticide: Any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest. Though often misunderstood to refer only to *insecticides*, the term pesticide also applies to herbicides, fungicides, and various other substances used to control pests. Under United States law, a

pesticide is also any substance or mixture of substances intended for use as a plant regulator, defoliant, or desiccant.

L. Plant Height: Measurement of main body height, not measurement to top branch.

M. Plant Spread: Measurement of main body diameter, not measurement from branch tip to tip.

N. Replacement Tree: Tree used as a replacement for dead tree or tree not in a vigorous, thriving condition, as determined by the Arborist.

O. Significant Pest: A pest that seriously threatens or has the potential to seriously threaten the plant health and appearance of the tree, as determined by the Arborist.

P. Swamp White Oak: A native tree species to the local climate meeting LEED requirements, known by the botanical name of Quercus bicolor.

Q. Sweetgum: A native tree species to the local climate meeting LEED requirements, known by the botanical name of Liquidambar styraciflua.

R. Tree Planting Zones: Zones of trees indicated on the Tree Planting Zone Plan.

S. Tree Protection Zone: The ground area and space above the paving area within the tree drip line, unless indicated otherwise on the Drawings.

T. Undue Stress: Stressed condition of tree's health caused by the Contractor's failure to meet requirements of this Section.

U. Significant Pest: A pest that seriously threatens or has the potential to seriously threaten the plant health and appearance of the tree, as determined by the Arborist.

V. Zone 1 Trees: Sweetgums and Swamp White Oaks within the Plaza area, as indicated on the Tree Planting Zone Plan.

W. Zone 2 Trees: Swamp White Oaks within the West Street Sidewalk area, as indicated on the Tree Planting Zone Plan.

X. Zone 3 Trees: Swamp White Oaks within the Liberty, Fulton, and Greenwich Sidewalk areas, as indicated on the Tree Planting Zone Plan.

Y. Zone 4 Trees: Swamp White Oaks at northeast corner area, as indicated on the Tree Planting Zone Plan.

1.4 ACTION SUBMITTALS

A. General Requirements: Refer to Section 01330.

B. Product Data:

1. Wood Chip Mulch.
2. Anti-desiccant.
3. Soil Amendments.
4. Pesticides.
5. Moisture Sensors and Related Materials and Equipment.
6. Back-up Drip Irrigation Bags.
7. Guy Straps.

8. Cable, Cable Tensioners, Eyebolts, Wire Rope Clips, and Wire Rope Thimbles.

C. Tree Holding Facility Shop Drawings:
   1. Submit Shop Drawings of holding facility site drawn to scale, dimensioned and with materials, equipment, and system components labeled.
   2. Include layout plan, with a "true north" arrow, showing perimeter security fence, fence gates, vehicular access routes, tree locations, equipment, irrigation lines, water supply, storage structure, and security camera layout.
   3. Include detailed sections and elevations showing fence, fence gates, irrigation, system components, guying system, drainage system, and surface paving materials.
   4. Include drainage plan showing surface slopes, drain locations, and swale locations.
   5. Include a site location map showing holding facility location relative to Project site, streets and highways adjacent to holding facility, and precise route for transporting trees to Project site.
   6. Submit Shop Drawings in digital PDF file format to the Owner's Representative, Architect, and Arborist via e-mail.

D. Samples:
   1. Wood Chip Mulch — 1/2-pound bag.
   2. Organic Amendment — 1-pound bag.
   3. Topsoil — 2-pound bag.
   4. Guy Straps — 3 straps.
   5. Tree Wrap — 3-foot length.

E. Test Reports:
   1. Laboratory soil test reports for composite soil samples taken from tree root balls, with test date less than 2 weeks old.
   2. Laboratory water test reports for representative irrigation water samples, with test date less than 2 weeks old.
   3. Laboratory soil test reports indicating specified characteristics of topsoil, with test date less than 2 weeks old.
   4. Laboratory test report for organic amendment indicating specified characteristics of organic amendment, with test date less than 2 weeks old.
   5. Laboratory test report for wood chip mulch, indicating specified physical and chemical characteristics, with test date less than 2 weeks old.

1.5 INFORMATIONAL SUBMITTALS

A. General Requirements: Refer to Section 01330.

B. Plant Material Photographs:

1. At least 14 days prior to submittal of plant material location data, submit color photographs of representative plants of each type and plant material.
2. Submit 4 photos of each representative tree taken from positions approximately 90 degrees on center around tree.
3. Indicate height of tree in each photograph via a telescoping measuring rod that has 12-inch increment marks which are clearly visible in the photograph.

C. Plant Material Location Data:
1. Quantities of each plant material type at each nursery or other place of growth.
2. Address, phone number, location map, and contact person for each nursery or other place of growth.

D. Product Purchase and Delivery Documentation: Within 5 working days of each soil application of soil amendment and pesticide, submit purchase orders, invoices, and receipts showing supplier name and address, person who sold product, date of purchase, specific product purchased, quantity purchased, and delivery date.

E. Maintenance Log:
1. Using a tree inventory database, maintain a daily record of observations and Work performed on an individual tree basis.
2. Record precipitation from on-site rain gauge; time and duration of each water application; chemical and fertilizer applications; irrigation problems; drainage problems; soil temperatures; visual observations of plants; tests performed; moisture sensor readings; annual twig elongation rate; height growth progress; and fall color.
3. Make log available for review at any time by the Owner, the Arborist, and the Architect.
4. Submit weekly a digital copy via e-mail to the Owner's Representative, Arborist, and Architect by the Tuesday following the week of the observations and Work.

F. Stressed Plant Condition Inspection Reports: Plant inspection report documenting damage and signs of stress, pests, and disease, submitted via e-mail to the Owner's Representative, the Architect, and the Arborist within 48 hours of observation.

G. Fall Color Photo Log:
1. Develop, maintain, and submit, at times indicated in this Section, a photo log of the fall color of each sweetgum tree for the purpose of selecting suitable, well-matched specimens for planting at the Project site.
2. Include 2 photos of each tree taken from opposite sides of the crown for each year the sweetgum trees are in the Tree Holding Facility so that

consistency in coloration from year to year can be evaluated by the Architect.

3. Take photos at the peak of fall coloration.
4. Take photos with a digital camera with at least 5.0 megapixels of resolution and ensure that the natural color of the foliage is depicted as accurately as possible.

H. Certificates:
1. Arborist Certifications.
2. Pesticide Applicator Certifications indicating pesticide applicator is currently certified by the State in which the application will take place.

I. Selected Trees for Installation:
1. Preliminary Recommendations.
2. Final Recommendations.

J. Manufacturer's Installation Instructions:
1. Current Printed Application Instructions for Root Growth Regulator.
2. Current Printed Installation Instructions for Moisture Sensor Access Tubes.

K. Documentation of Owner Accepted Conditions: Within 7 working days after the Owner's acceptance of maintenance, submit color photographs and a written report documenting the Owner's accepted conditions of the plant material.

1.6 QUALITY ASSURANCE

A. Qualifications of Contractor Providing and Maintaining Trees:
1. Established history of specializing in the large tree transplanting of at least 15 years operating under the same company name and management.
2. Able to demonstrate proficiency in tree transplanting using hydraulic tree spades and shall submit documentation of experience with project name, customer and customer contact information of at least 3 projects with in the last 5 years utilizing tree spade transplanting technology.
3. Able to demonstrate proficiency in tree transplanting using tree-boxing techniques and shall submit documentation of experience with project name, customer and customer contact information of at least 3 projects with in the last 5 years utilizing tree-boxing technologies.
4. Able to demonstrate proficiency in managing a boxed tree nursery started from field-collected trees and shall submit documentation of experience with project name, customer and customer contact information of at least 3 box-tree nurseries from harvested tree stock that the bidder managed with in the last 5 years.
5. Able to demonstrate the ability to execute large-scale tree transplanting jobs and shall submit documentation of experience with project name, customer, and customer contact information of at least 3 tree transplanting projects completed with in the last 5 years.

6. Arborist on staff with current ISA certification.
7. Implemented OSHA approved safety program that meets OSHA and ANSI Z133.1 requirements.
8. Director of safety on staff who is trained and approved to OSHA standards.
9. On-site Work supervisor shall have current arborist certification from the ISA and shall have demonstrated skill and experience in the particular tasks being performed.

B. Pesticide Applicator Qualifications: Pesticide treatments shall be performed by an acceptable, qualified, and experienced plant health care technician that is currently state-certified to be a commercial pesticide applicator in the state where the application takes place.

C. Regulatory Requirements:
1. Meet requirements of applicable OSHA regulations, laws, codes, and other regulations required by authorities having jurisdiction over Work.
2. Provide for inspections and permits required by Federal, State and local authorities in furnishing, transporting, and installing materials.

D. Pre-Tree Tagging Meeting: Prior to commencement of Work under this Section, schedule and conduct a meeting with the Owner's Representative, Architect and Arborist to review the requirements of this Section and to review the schedule for periodic reviews by the Architect and Arborist.

E. Root Ball Anchor System Mock-ups:
1. Install one complete root ball anchor system on an installed Zone 1 tree, and install one complete root ball anchor system on a Zone 2 or Zone 3 tree.
2. Accepted mock-up shall become Project standard by which work will be judged.
3. Accepted mock-up may remain in place as part of permanent installation.

1.7 LIFTING, HANDLING, TRANSPORT, AND DELIVERY OF TREES TO PROJECT SITE

A. Deteriorated Box Materials:
1. Prior to lifting boxed trees, carefully inspect box materials.
2. Remove materials that have deteriorated and are not capable of holding root balls solid and firm during lifting, handling, and transport of trees.
3. Replace removed materials with new materials prior to moving trees.

B. Lifting and Handling Trees:
1. Lift boxes with adequate support to avoid damage to boxes and root balls, to prevent injury to trees and roots, and to prevent displacement of soil from the boxes..
2. Do not lift trees by trunks.
3. Do not bind or handle trees with wire or wire rope.

4. Pad trunks and branches wherever hoisting cables or straps contact.

C. Protection of Trees during Transport:
   1. Treat trees with anti-desiccant spray applied to the trunk, branches, and twigs, no more than 72 hours and no less than 24 hours prior to transport, as directed by the Arborist.
   2. Wrap trunk of each tree with tree wrap, if directed by the Arborist.
   3. Tie branches with rope or twine in such a manner that no injury will occur to the bark or branches.
   4. Exercise care to prevent injury and drying out of the trees and root balls.
   5. Protect plants from sun and drying winds.
   6. Once loaded and secured onto the transport vehicle, cover trees with a securely fastened, open-weave shade tarp that minimizes desiccation while permitting sufficient cool air flow.
   7. Remove the shade tarp immediately upon arrival at the Project Site.

D. Transport of Trees:
   1. To the extent that schedules permit, transport trees from the Tree Holding Facility to the Project Site, while dormant and before spring bud swell.
   2. If construction schedule dictates that the trees must be transported and planted while in leaf, transport trees during the night or early morning hours to minimize desiccation.
   3. Transport no more trees from the Tree Holding Facility to the Project Site than can be installed within 48 hours, unless accepted otherwise by the Arborist.

E. Temporary Storage of Trees at Project Site Prior to Installation:
   1. Protect plant root balls from sun and drying winds.
   2. Keep root balls moist.
   3. Keep sun-sensitive plants shaded.
   4. Anchor plants to prevent injury from strong winds.

F. Owner-Supplied Sweetgum Trees:
   1. Prior to submitting bid, review plant materials at the source to verify that plants are undamaged, healthy, accessible for digging, and satisfactory for which to provide the Warranty requirements of this Section.
   2. Notify Owner in writing, prior to submitting bid, if unsatisfactory conditions are found that will not allow the plants to be warranted as described in this Section.
   3. The Contractor, by performing pre-installation preparation Work and pre-installation maintenance Work on plant material and without providing written notification of unsatisfactory conditions, assumes Warranty responsibilities for the plant material as described in this Section.

1.8 SEQUENCING AND SCHEDULING

A. Commencement of Pre-installation Preparation and Maintenance Work:

1. Start Work sequence for Zone 1, 2, and 3 trees in fall, 2006.
2. Start Work sequence for Zone 4 trees in fall, 2007.
3. Start Work sequence for 7 extra sweetgums in fall, 2006.
4. Start Work sequence for 3 extra sweetgums in fall, 2007.
5. Start Work sequence for 33 extra swamp white oaks in fall, 2006.
6. Start Work sequence for 18 extra swamp white oaks in fall, 2007.
7. Start Work sequence for 3 extra swamp white oaks in fall, 2008.

B. Installation of Trees at Project Site Relative to Other Work at Project Site: Transport trees to Project site and install trees after paving support structure, stone slab pavers, soil mixes, deadman assemblies, and irrigation system are installed, and after irrigation system has been tested, adjusted, and is operating correctly.

C. Installation of Trees at Project Site:
1. Install Zone 1 trees during March, 2009.
2. Install Zone 2 trees between October 15 and November 15, 2008.
3. Install Zone 3 trees during June, 2009.
4. Install Zone 4 trees during July, 2010.

1.9 SITE CONDITIONS

A. Environmental Requirements: Do not apply materials to tree foliage during windy conditions, when ambient air temperatures are above 80 degrees Fahrenheit or below 45 degrees Fahrenheit, or when precipitation is expected within 12 hours.

1.10 WARRANTY

A. Warranty Period:
1. For each tree planting zone, warrant that trees, including Owner-supplied trees, will be healthy and in a vigorous, flourishing condition of active growth for 2 full calendar years from date of acceptance of tree installation Work in the respective tree planting zone.
2. Replace trees as many times as required to provide trees meeting these Warranty requirements.

B. Delays: Delays in commencement of tree installation operations shall extend the Warranty Period correspondingly.

C. Condition of Trees: Trees shall be free of dead or dying, injured, or diseased branches and branch tips, with foliage of a normal density, size and color.

D. Incorrect Materials:
1. During Warranty Period, replace at no additional cost to the Owner, trees revealed as being untrue name, as determined by its form, leaf, flower, and/or fruiting characteristics, in accordance with Hortus III.
2. Provide replacement trees of a size and quality to match the installed trees at the time the mistake is discovered.

E. Replacement Trees:

1. As soon as weather and seasonal conditions permit, replace at no additional cost to the Owner, dead trees and trees not in a vigorous, thriving condition, as determined by the Arborist during and at the end of Warranty Period.
2. Apply requirements of this Section to replacements, except length of Warranty Period.
3. Warranty period for replacement trees shall apply from the time of replacement until the end of the 2-year warranty period for respective tree planting zone.
4. At the end of the 2-year warranty period, Contractor shall relocate and plant any remaining overstock trees Owner, not more than 50 miles from the Tree Holding Facility.

1.11 MAINTENANCE

A. Maintenance of Trees after Installation: Refer to Section 02936.

B. Maintenance of Extra Trees: Refer to Section 02936.

PART 2 — PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS AND SUPPLIERS

A. Anti-desiccant: Miller Chemical & Fertilizer Corporation, Hanover, PA, (717) 632-8921, www.millerchemical.com or accepted substitute.

B. Soil Amendments:

1. Plant Health Care Inc., Pittsburgh, PA, (800) 421-9051, www.planthealthcare.com; or accepted substitute.
2. Mycorrhizal Applications, Inc., Grants Pass, OR; (514) 476-3985; www.mycorrhizae.com; or accepted substitute.
3. Bio-Plex, Manheim, PA, (800) 441-3573, www.bio-plex.com; or accepted substitute.
4. The Doggett Corporation, Lebanon, NJ; (908) 236-6335, www.doggettcorp.com; or accepted substitute.
5. LimeCrest Corp., Sparta, NJ; (973) 383-2000; or accepted substitute.
6. Vermi Technology Unlimited, Orange Lake, Fla.; (352) 591-1111; www.vermitechnology.com; or accepted substitute.

C. Pesticides:

1. Insecticide for Control of Borers (Merit 75 WSP): Bayer CropScience Research, Triangle Park, NC; (800) 842-8020, www.bayercropscienceus.com; or accepted substitute.
2. Insecticide (Astro) for Control of Leaf Chewing Caterpillars And Aphids: FMC Corp, Philadelphia, PA; (215) 299-6000, www.fmc.com; or accepted substitute.
3. Insecticide (Horticultural Oil) for Control of Scale Insects: Lesco, Inc., Cleveland, OH; (216) 706-9250, www.lesco.com; or accepted substitute.

4. Miticide (Avid) For Control of Spider Mites: Syngenta Professional Products, Greensboro, NC; (866) 796-4368, www.syngentaprofessionalproducts.com; or accepted substitute.
5. Fungicide (Banner Maxx) for Treatment of Anthracnose: Ciba-Geigy Corp., Greensboro, NC; or accepted substitute.
6. Spreader Sticker (Nu-Film) Spray Adjuvant: Miller Chemical and Fertilizer Corp., Hanover, PA; (717) 632-8921, www.millerchemical.com; or accepted substitute.
7. Herbicide for Weed Control (RoundUp): Monsanto Co., St. Louis, MO; (314) 694-1000, www.monsanto.com; or accepted substitute.
8. Root Growth Regulator: SePRO Corporation, Carmel, IN; (317) 580-8282; www.sepro.com or accepted substitute.

D. Back-up Drip Irrigation Bags: Spectrum Products, Inc., Youngsville, NC, (866) 873-3428, www.treegator.com or accepted substitute.

E. Moisture Sensors and Related Materials and Equipment: Dynamax Inc., Houston, TX; (800) 896-7108; www.dynamax.com or accepted substitute.

F. Guy Straps for Boxed Trees: Straps specifically designed for guying trees, without damaging the bark, and strong enough to hold trees upright during high winds.

G. Cable Tensioners Root Ball Anchor Systems: Foresight Products, Commerce City, CO; (303) 286-8955; www.earthanchor.com; or accepted substitute.

H. Eyebolts, Anchor Cable, Wire Rope Clips, and Wire Rope Thimbles for Root Ball Anchor Systems: McMaster-Carr, Los Angeles, CA; (562) 692-5911; www.mcmaster.com; or accepted substitute.

2.2 MATERIALS

A. Requirements for Trees at Time of Tagging:

1. Sweetgum Source: Nursery-grown or field-collected, meeting climatic growing condition requirements.
2. Swamp White Oak Source: Nursery-grown from locations meeting the climatic growing condition requirements.
3. Quantity of Sweetgums for Zone 1: 44 trees. Five of the 44 trees will be supplied by the Owner.
4. Quantity of Swamp White Oaks for Zone 1: 239 trees.
5. Quantity of Swamp White Oaks for Zone 2: 33 trees.
6. Quantity of Swamp White Oaks for Zone 3: 51.
7. Quantity of Swamp White Oaks for Zone 4: 34 trees.
8. Extra Sweetgums: 10 trees.
9. Extra Swamp White Oaks: 54 trees.
10. Base Bid Size for Swamp White Oaks: 6.5 to 7.5-inch minimum caliper, 22 to 26 feet height, with trees from northern sources in upper half of height range to account for slower growth rate, lowest branch a minimum

6 feet from top of root ball, matched spread plus or minus 24 inches measured when plants are in normal, upright position.

11. Alternate No. 1 Size for Swamp White Oaks: 4 to 5-inch caliper, 16 to 19 feet height with trees from northern sources in upper half of height range to account for slower growth rate, lowest branch a minimum 6 feet from top of root ball, matched spread plus or minus 18 inches measured when plants are in normal, upright position.
12. Base Bid Size for Sweetgums: 7 to 7.5-inch minimum caliper, 24 to 26 feet height, with trees from northern sources in upper half of height range to account for slower growth rate, lowest branch a minimum 6 feet from top of root ball, matched spread plus or minus 24 inches measured when plants are in normal, upright position.
13. Alternate No. 2 Size for Sweetgums: 4.5 to 5-inch caliper, 18 to 19 feet height with trees from northern sources in upper half of height range to account for slower growth rate, lowest branch a minimum 6 feet from top of root ball, matched spread plus or minus 18 inches measured when plants are in normal, upright position.
14. Nomenclature: Plant nomenclature shall meet requirements of Hortus III.
15. Climatic Growing Conditions: Grown in USDA Hardiness Zone 6b or colder, for at least two years, immediately prior to tagging, unless accepted otherwise by the Arborist.
16. Root Ball Size: 90-inch diameter.
17. Trunk: Single leader to at least 66 percent of height, structurally strong, able to stand upright without stakes or guys on a windless day.
18. Branching: Well-spaced and well-formed with strong attachments, symmetrical, tightly knit, so trained or favored in development and appearance as to be superior in form, number of branches, compactness and symmetry.
19. Vigor: Healthy, vigorous, and densely foliated when in leaf, with at least 12 inches average annual twig elongation in top 30 percent of crown over past 3 years, and with good leaf size and good leaf color.
20. Disease and Pests: Free of significant pests, eggs, or larvae.
21. Root System: Root collar even with or near ground surface at site where trees are tagged, healthy, well-developed root density and distribution, free of kinked roots, circling roots, girdling roots, root-bound condition, cracked root balls, or broken root balls.
22. Pruning: Do not prune, thin or shape plants before delivery without acceptance by the Arborist.
23. Unacceptable Conditions: Multiple leaders, unless specified, damaged or crooked leaders, bark abrasions, sunscald, disfiguring knots, or fresh cuts of limbs over 3/4-inch diameter which have not completely callused.

24. Root Ball Top Slope: Within 1 inch of level straight edge laid across top of root ball.

B. Owner-Supplied Sweetgum Trees for Zone 1:
   1. Five of 44 Sweetgum trees have been tagged by the Architect and will be supplied by the Owner.
   2. Prior to submitting bid, review trees at the source to verify trees are healthy, free of injury, accessible for digging, and satisfactory for which to provide the Warranty of this Section.
   3. Along with bid, notify the Owner in writing of unsatisfactory conditions observed that do not allow the trees to be warranted as indicated in this Section.
   4. The installer, by performing pre-installation preparation and maintenance Work on the trees, and without written notification of unsatisfactory conditions, assumes the Warranty responsibilities for the trees, as described in this Section.

C. Requirements for Trees at Time of Installation:
   1. Base Bid Tree Lowest Branch Height: 10 to 13 feet.
   2. Alternate No. 1 and Alternate No. 2 Tree Lowest Branch Height: 8.5 to 10 feet.
   3. Base Bid Tree Height: 25 to 29 feet.
   4. Alternate No. 1 and Alternate No. 2 Tree Height: 19 to 23 feet.
   5. Base Bid Tree Caliper: 7.5 to 9 inches.
   6. Alternate No. 1 and Alternate No. 2 Tree Caliper: 5.5 to 6.5 inches.
   7. Trunk: Single, well-developed, well-formed, straight leader to top of canopy.
   8. Branching: Well-spaced and well-formed with strong attachments, symmetrical, tightly knit, so trained or favored in development and appearance as to be superior in form, number of branches, compactness and symmetry, with matched lower branch height, canopy height, and crown form.
   9. Vigor: Free of significant insects and diseases, at least 12 inches average annual twig elongation in top 30 percent of crown for 2 growing seasons prior to installation, and with good leaf size and good leaf color.
   10. Root System: Root collar even, with healthy, well-developed root density and distribution, free of kinked roots, circling roots, girdling roots, root-bound condition, cracked root balls, or broken root balls.
   11. Root Collar: Exposed root collar above root ball surface.
   12. Climatic Adaptation: Grown under similar climatic conditions as Project site for a minimum 2 years prior to installation.
   13. Root Ball Top Slope: Within 1/2- inch of level straight edge laid across top of root ball.

D. Topsoil for Backfill Soil Mix:

1. General: Topsoil shall be friable and have sufficient structure in order to give good tilth and aeration to the soil. When amended, fertilized, and conditioned, the soil must be friable, be well drained, and be supportive of vigorous plant growth. It must contain low concentrations of inhibitory constituents. Plant growth of dicots and monocots must be at least 80 percent of a known reference soil, free of inhibitory constituents. A soil containing inhibitory constituents will be deemed to be suitable if the inhibitory constituents can be properly counteracted. The soil must have sufficient moisture retention and nutrient retention to avoid excessive frequency of irrigation and frequency of fertilizer application. The soil must be clean and free of excessive gravel, rock, and physical impurities.
2. Deleterious Materials: Free of roots, clods, stones larger than 1 inch in the greatest dimension, pockets of coarse sand, noxious weeds, sticks, lumber, brush, and other debris.
3. Disease-causing Organisms: Free of infestation of nematodes or other undesirable disease-causing organisms such as insects and plant pathogens.
4. Gradation: Sandy loam as classified by the USDA Soil Texture Triangle classification method.
5. Permeability Rate: Hydraulic conductivity rate shall be not less than 1 inch per hour, nor more than 20 inches per hour when tested in accordance with the USDA Handbook, No. 60, Method 34B or other approved methods.
6. Fertility: The range of the essential elemental concentration in soil shall be as follows:

Ammonium Bicarbonate / DTPA Extraction *Parts per million (mg/kg dry-weight basis)*	
Phosphorus:	20.0 – 40.0
Potassium:	40.0 – 220.0
Iron:	2.0 – 35.0
Manganese:	0.3 – 6.0
Zinc:	0.6 – 8.0
Copper:	0.1 – 5.0
Boron:	0.2 – 1.0
Magnesium:	50.0 – 150.0
Sodium:	0 – 100.0
Sulfur:	25.0 – 500.0
Molybdenum:	0.1 – 30.0

7. Acidity: 6.0 – 7.0 soil pH range measured in the saturation extract (Method 21a, USDA Handbook No. 60).
8. Salinity: 0.5 – 2.0 dS/m salinity range measured in the saturation extract (Method 3a, USDA Handbook No. 60). If calcium and if sulfate ions both exceed 20 milliequivalents per liter in the saturation extract, the maximum salinity shall be 4.0 dS/m.
9. Chloride: 150 mg/liter (parts per million) maximum concentration of soluble chloride in the saturation extract (Method 3a, USDA Handbook No. 60).
10. Boron: 1-mg/liter (parts per million) maximum concentration of soluble boron in the saturation extract (Method 3a, USDA Handbook No. 60).
11. Sodium Adsorption Ratio (SAR): Maximum of 3 measured per Method 20b, USDA Handbook No. 60.
12. Soil Organic Matter Content: Sufficient soil organic matter present to impart good physical soil properties, but not be excessive to cause toxicity or cause excessive reduction in the volume of soil due to decomposition or organic matter.
13. Calcium Carbonate Content: No free calcium carbonate (limestone) present.
14. Available Aluminum: Less than 5 parts per million measured with the Ammonium Bicarbonate/DPTA Extraction.
15. Heavy Metals: The maximum permissible elemental concentration in the soil shall not exceed the following:

Ammonium Bicarbonate / DTPA Extraction Parts per million (mg/kg dry-weight basis)	
Arsenic	2.0
Cadmium	2.0
Chromium	10.0
Cobalt	2.0
Lead	30.0
Mercury	1.0
Nickel	5.0
Selenium	3.0
Silver	0.5
Vanadium	3.0

If the soil pH is between 6.0 and 7.0, the maximum permissible elemental concentration shall be reduced 50 percent. If the soil pH is less than 6.0,

the maximum permissible elemental concentration shall be reduced 75 percent. No more than three metals shall be present at 50 percent or more of the above values.

16. Phytotoxic Constituent, Herbicides, Hydrocarbons, etc.: Total petroleum hydrocarbons shall not exceed 50 mg/kg dry soil measured per the modified EPA Method No. 8015. Total aromatic volatile organic hydrocarbons (benzene, toluene, xylene and ethylbenzene) shall not exceed 2 mg/kg dry soil measured per EPA Method No. 8020.

E. Organic Amendment: Organic material is to be well-composted humus with the following properties:

1. Humus material shall have an acid-soluble ash content of no less than 5 percent and no more than 20 percent.
2. The pH of the material shall be between 6 and 7.5.
3. The salt content shall be less than 10 millimho/cm at 25 degrees C on a saturated paste extract.
4. Boron content of the saturated extract shall be less than 1.0 part per million
5. Silicon content (acid-insoluble ash) shall be less than 50 percent.
6. Calcium carbonate shall not be present if the amendment is to be applied on alkaline soils.
7. Types of acceptable products are composts, manures, mushroom composts, straw, alfalfa, sludge, peat mosses, etc., low in salts, low in heavy metals, free from weed seeds, free of pathogens and other deleterious materials.
8. Composted wood products are conditionally acceptable (stable humus must be present). Wood-based products are not acceptable which are based on redwood or cedar.
9. Sludge-based materials are not acceptable if the soil already has a high level (toxic level) of zinc, copper, or other heavy metals based on soil analysis.
10. Carbon-nitrogen ratio shall be less than 25:1.
11. The compost shall be aerobic without malodorous presence of decomposition products.
12. The maximum particle size shall be 0.5-inch and 80 percent or more shall pass a No. 4 screen for mixing with soil. The maximum particle size for applying via hydroseeding machine shall be 0.25-inch.
13. Maximum total permissible pollutant concentrations in organic amendment in parts per million on a dry-weight basis:

Arsenic: 20

Cadmium:	15
Chromium:	300
Cobalt:	50
Copper:	150
Lead:	200
Mercury:	10
Molybdenum:	60
Nickel:	100
Selenium:	50
Silver:	10
Vanadium:	200
Zinc:	300

14. From 45- to 65-percent moisture measured via wet-weight basis.
15. Free of stones and debris.
16. Tests 5 to 8 on Solvita Test.

F. Irrigation Water: Clean, fresh, free of substances toxic to plant growth, with the following chemical properties:

Acceptable pH:	6.5 to 8.4
Total Dissolved Solids:	< 600 mg/l
Electrical Conductivity:	< 0.8 millimho/cm
Boron:	< 0.5 mg/l
Chloride:	< 100 mg/l
Sodium:	< 70 mg/l
Adjusted SAR (sodium absorption ratio):	< 3.0
Bicarbonate:	< 100 mg/l
Redox:	300 millivolts or higher
Dissolved Oxygen:	2 mg/l or higher
Total Hydrocarbons:	< 20 ppm
BTEX:	< 0.5 ppm
Iron:	< 1.0 mg/l
Manganese:	< 0.2 mg/l
Zinc:	< 2.0 mg/l
Copper:	< 0.2 mg/l
Molybdenum:	< 0.01 mg/l
Aluminum:	< 5.0 mg/l
Arsenic:	< 0.1 mg/l
Cadmium:	< 0.01 mg/l
Chromium:	< 0.1 mg/l
Cobalt:	< 0.01 mg/l

Lead:	< 5.0 mg/l
Lithium:	< 2.5 mg/l
Nickel:	< 0.2 mg/l
Selenium:	< 0.02 mg/l
Vanadium:	< 0.1 mg/l

G. Wood Chip Mulch: Course shredded hardwood mulch derived from tree pruning and removal waste with at least 70 percent of the particles by mass at least 1 inch and no more than 3 inches in their largest dimension, free of non-organic materials and contaminants, and properly composted at least 6 months in a manner to sufficiently suppress disease organisms and weed seeds.

H. Anti-desiccant: Vapor Gard.

I. Pesticides:

1. Insecticide for Control of Flat-Headed Borers: Merit 75 WSP (Imidacloprid); or accepted substitute.
2. Insecticide for Control of Leaf Feeding Caterpillars and Aphids: Astro (Permethrin); or accepted substitute.
3. Insecticide for Control of Scale Insects: Horticultural Oil, (superior horticultural oil); or accepted substitute.
4. Miticide for Control of Spider Mites: Avid 0.15 EC, (Abamectin) ; or accepted substitute.
5. Fungicide for Control of Oak Anthracnose: Banner Maxx, (Propiconazole); or accepted substitute.
6. Herbicide for Control of Invasive Weeds: Round-Up (Glyphosate); or accepted substitute.
7. "Spreader-Sticker" Spray Adjuvant to be Mixed with Certain Pesticides: Nu-Film; or accepted substitute.
8. Root Growth Regulator: Spin Out; or accepted substitute.

J. Potential Soil Amendments to be Required by Soil Amendment Program Determined by the Arborist and Agronomist:

1. Doggett Injecto Feed 32-7-7; or accepted substitute.
2. Doggett Injecto Feed 12-24-24; or accepted substitute.
3. AgriPlex Micro-Mix micronutrient supplement; or accepted substitute.
4. PHC BioPak Plus 3-0-20 micronutrient biofertilizer; or accepted substitute.
5. Soluble Mycorrhizal Drench; or accepted substitute.
6. Bio-Plex Technical Concentrate and Plant Enhancer biostimulant; or accepted substitute.
7. Doggett Nutri-Sul 90 Elemental Sulfur 90%; or accepted substitute.
8. Pulverized limestone, dolomitic or non-dolomitic; or accepted substitute.
9. Other soil amendments that may be required, subject to acceptance of the Arborist; or accepted substitute.

K. Soil Amendment for Backfill Soil Mix in Wood Tree Boxes: Vermi Technology Pure Black Castings.

L. Tree Wrap: Burlap, untreated, 4 inches wide.

M. Moisture Sensors and Related Materials and Equipment: One PR2/6 100 cm probe, one HH2 portable data logger, one SM200 single sensor, one hundred 1 meter long access tubes, one ATL1-CLMP access tube clamp, one PR-AUG2 tube auger and one AT-ROD1 insertion rod.

N. Back-up Drip Irrigation Bags: 20-gallon TreeGator Original; or accepted substitute.

O. Tree Protection Fencing for Perimeter of Tree Protection Zones: Galvanized steel, 2-inch by 2-inch chain link mesh by 6-foot minimum height with 2-inch diameter galvanized steel posts.

P. Snow Fencing to Protect Tree Trunk: Wooden slat and wire type.

Q. Plastic Construction Barrier Fencing to Protect Tree Branches: Orange, plastic, 4-foot high barrier fencing.

R. Boards for Root Ball Anchor Systems: Wood, pressure-treated with .40 PCF ACQ, sizes indicated on the Drawings.

S. Eyebolts for Deadman Assemblies: Forged steel, hot-dip galvanized, plain pattern, 5/8-inch diameter, 1.25-inch minimum inside diameter hole, 8 inches long, 3,500–pound working load limit.

T. Eyebolts for Root Ball Stabilizer Boards: Forged steel, hot-dip galvanized, shoulder pattern, 5/16-inch diameter, 0.63 inside diameter hole, 2.25 inches long, 800-pound work load limit.

U. Eyebolts in Reinforced Concrete Slab: Forged steel, hot-dip galvanized, shoulder pattern, 5/8-inch diameter, 1.25 inside diameter hole, 4 inches long, 3,500-pound work load limit.

V. Nuts for Eyebolts: Heavy hex, hot-dip galvanized, size to fit eyebolt.

W. Flat Washers for Eyebolts: Steel, hot-dip galvanized, size to fit eyebolt.

X. Cable Tensioners for Root Ball Anchor Systems: Manta Ray 1-RT-10 ratchet tensioner; or accepted substitute.

Y. Anchor Cables for Root Ball Anchor Systems: Galvanized steel, 5/16-inch diameter, 7X9 strand core wire rope, 9,800 pounds breaking strength.

Z. Wire Rope Clips and Thimbles for Anchor Cables of Root Ball Anchor Systems: Crosby forged steel clips, size to fit wire rope; and hot-dip galvanized steel thimbles, size to fit rope.

AA. Adhesive for Anchoring Eyebolts into Concrete: ASTM C 881, 2 component, chemical-resistant, structural epoxy bonding system, formulated for exterior use in anchoring threaded rods, bolts, reinforcing bars, and smooth dowels into solid material.

2.3 MIXES

A. Anti-desiccant Water Mix: Mix anti-desiccant with water at rates determined by Arborist, based on time of year anti-desiccant will be used.

B. Backfill Soil Mix for Boxes: 85 percent topsoil by volume, 15 percent organic amendment by volume, 100 pounds of Pure Black Castings per ton of mix, mixed uniformly.

C. Plant Pit Backfill Mix: Soil excavated from plant pit.

2.4 TREE HOLDING FACILITY

A. General Requirements:

1. A site within a 50 mile radius of Project Site.
2. A site with public street access suitable for the ingress and egress of tractor trailer trucks and other heavy equipment.
3. A site with an unobstructed delivery route to the Project site for tractor trailers with potentially wide loads.
4. A site with sun and wind exposure conditions similar to the Project site so that the trees may acclimate during the pre-installation period.
5. A site without exposure to significant amounts of dust.
6. An area of sufficient size that allows trees to be spaced apart at a distance of 40 feet on center in a triangular spacing to provide enough sun exposure to permit the trees to meet the growth, development, and branching requirements of this Section; that allows storage of ancillary equipment and supplies; and that allows access and maneuverability of necessary vehicles and equipment.
7. Security against theft and vandalism, including a security camera system capable of monitoring the entire facility.
8. A chain-link security fence around the perimeter of the site with lockable gates.
9. A sufficiently flat and firm ground surface to permit access and maneuverability of necessary equipment and vehicles.
10. Sufficient surface drainage to ensure that water does not stand and the soil does not remain muddy for prolonged periods of time.
11. A secure building structure suitable for housing irrigation control equipment and other equipment and supplies.
12. An acceptable water source.
13. An installed irrigation system.
14. Back-up irrigation system, including water stored on site.
15. Operable webcam to allow Owner, Architect, and Arborist to monitor Work progress.

B. Primary and Back-up Irrigation System Water Sources: Flow rate adequate to irrigate trees and with water of acceptable quality.

C. Primary Irrigation System: Piped, automatically controlled, and able to withstand year-round weather exposure until trees are transported to Project site.

D. Back-up Irrigation System:

1. Water source different from water source for primary irrigation system with acceptable water quality, based on water test results.
2. Tank truck capable of preserving the accepted water quality, transporting the water to the holding facility at a rate sufficient to adequately irrigate the trees, and efficiently transferring the water to the drip irrigation bags installed on each tree.
3. A sufficient quantity of drip irrigation bags to install two 20-gallon bags on each 5 to 7-inch caliper tree, three 20-gallon bags on each 7 to 9-inch caliper tree, and four 20-gallon bags on each 9 to 11-inch caliper tree at any time.

2.5 GENERAL PRE-INSTALLATION PREPARATION AND MAINTENANCE REQUIREMENTS

A. Work Period: Perform Work on trees starting at time of purchase until installation, as described below in this Section.

B. Work Objectives: Perform Work on trees with the objectives of: Maximizing height growth; maximizing lower branch height; maximizing root mass within root ball area, in order to maximize speed of post-planting recovery and growth, and in order to minimize plant mortality; maintaining and improving branching structure and appearance; improving uniformity in height, spread, and canopy bottom height, and maintaining plants in a healthy, vigorous condition.

2.6 SCHEDULE AND SEQUENCE OF PRE-INSTALLATION PREPARATION AND PRE-INSTALLATION MAINTENANCE WORK

A. Fall and Winter of Year No. 1 Before Trees are Dug from Ground at Nursery or Other Place of Growth:

1. Collect soil samples from tree root balls, have samples tested, and submit soil test report.
2. The Arborist and Agronomist will develop a custom soil amendment program based on the soil test results with the primary objectives of maximizing height growth, starch accumulation, fibrous root development, and transplantability during the pre-installation period prior to installation at the Project site.
3. Excavate excess soil from the root collars and the top of the root ball area via Air-Spading and prune adventitious, malformed and misdirected roots.
4. Chemically treat competing weeds within the drip line of each tree.
5. If directed by the Arborist, aerate and incorporate organic matter and/or other soil amendments into the soil via Air-Spading to a depth of 24-inches and a distance of 36-inches from the trunk as directed by the

Arborist, to encourage increased root mass within the root ball area in lieu of root pruning.

6. Apply fertilizer, biostimulant, mycorrhiza and other soil treatments in early October in accordance with the soil amendment program determined by the Arborist and Agronomist.
7. The Arborist will determine the need for mulching in the nursery or place of growth based on the existing site and growing conditions. If directed, install a 3-inch depth continuous layer of hardwood mulch around trees from 6 inches from the base of the trunk to the drip line.
8. In the late winter, prior to spring bud-swell, prune the trees with the specific objectives of:
    a. Raising the crowns of Base Bid trees to 10 feet clear at trunk or raising the crowns of Alternate No. 1 and Alternate No. 2 trees to 8 feet clear at trunk, or as otherwise directed by the Arborist.
    b. Reducing foliage by 50 percent on branches from 10 feet to 12 feet for Base Bid trees or 8 feet to 9 feet for Alternate No. 1 and Alternate No. 2 trees, or as otherwise directed by the Arborist.
    c. Removing dead, damaged, diseased, or otherwise objectionable branches in a manner that minimizes the loss of foliage in the remaining crown.
    d. Subordinating or removing codominant or otherwise undesirable branches, as directed by the Arborist.
9. Photographically document the fall color of each sweetgum at peak of fall color to aid in final selection of individual trees to be installed at the Project site.

B. Spring of Year No. 2:
1. Dig and box the trees prior to bud break in late winter/early spring.
2. Wrap the trunk of each tree with burlap tree wrap, if directed by the Arborist.
3. Immediately transport, assemble and secure the trees at the holding facility, as specified, for continued treatment and evaluation for the remaining pre-installation period.
4. Continually monitor soil moisture and immediately provide irrigation, whenever trees need it.
5. Perform plant health care monitoring inspections at least once per month and complete pest and disease control, cultural, and other treatments necessary to ensure that the trees are healthy and maintained in accordance with the Work objectives.
6. Maintain continuous control over weeds within the boxes.

7. Remain prepared to immediately implement a plan to protect the boxed trees from severe weather (e.g. excessively high soil temperatures, tipping during severe wind, etc.).
8. Apply fertilizer, biostimulant, mycorrhiza and other soil treatments in March in accordance with the soil amendment program determined by the Arborist and Agronomist.
9. Install wood chip mulch as necessary to maintain a continuous, loose depth of 3 inches from the box edges to 6 inches away from the root collar.

C. Summer of Year No. 2:
1. Continually monitor soil moisture and immediately provide irrigation, whenever trees need it.
2. Perform plant health care monitoring inspections at least once per month and complete pest and disease control, cultural, and other treatments necessary to ensure that the trees are healthy and maintained in accordance with the Work objectives.
3. Maintain continuous control over weeds within the boxes.
4. Remain prepared to immediately implement a plan to protect the boxed trees from severe weather (e.g. excessively high soil temperatures, tipping during severe wind, etc.).
5. If directed by the Arborist, apply anti-desiccant to the trees' foliage in accordance with label rate for "summer transplants", or as otherwise directed by the Arborist.
6. Collect soil samples from tree root balls in August, have samples tested, and submit soil test report.
7. The Arborist and Agronomist will develop a custom soil amendment program based on the soil test results with the primary objectives of maximizing height growth, starch accumulation, fibrous root development, and transplantability during the pre-installation period prior to installation at the Project site.
8. In the late summer, evaluate, rank and document the comparative size, form, structure, and health of trees for the purpose of making preliminary selections for installation at the Project site and submit preliminary proposed selections to the Architect and Arborist.

D. Fall and Winter of Year No. 2:
1. Continually monitor soil moisture and immediately provide irrigation, whenever trees need it.
2. Perform plant health care monitoring inspections at least once per month and complete pest and disease control, cultural, and other treatments necessary to ensure that the trees are healthy and maintained in accordance with the Work objectives.

3. Maintain continuous control over weeds within the boxes.
4. Remain prepared to immediately implement a plan to protect the boxed trees from severe weather (e.g. freeze and thaw damage to the root balls, tipping during severe wind).
5. Photographically document the fall color of each sweetgum at peak of fall color to aid in final selection of individual trees to be installed at the Project site.
6. Apply fertilizer, biostimulant, mycorrhiza and other soil treatments in early October in accordance with the soil amendment program determined by the Arborist and Agronomist.
7. Implement applicable winterization measures.
8. In the late winter, prior to spring bud-swell, prune the trees with the specific objectives of:
    a. Raising crowns of Base Bid trees to 10 to 13 feet clear at trunk, or raising crowns of Alternate No. 1 and Alternate No. 2 trees to 8.5 to 10 feet clear at trunk, or as otherwise directed by the Arborist (Arborist will require crowns to be raised higher if rate of growth permits).
    b. Removing dead, damaged, diseased, crossing and conflicting, poorly spaced, or otherwise objectionable branches in a manner that minimizes the loss of foliage in the remaining crown.
    c. Removing or continuing to subordinate codominant or otherwise undesirable branches, as directed by the Arborist.

E. Spring of Year No. 3:
1. Continually monitor soil moisture and immediately provide irrigation, whenever trees need it.
2. Perform plant health care monitoring inspections at least once per month and complete pest and disease control, cultural, and other treatments necessary to ensure that the trees are healthy and maintained in accordance with the Work objectives.
3. Maintain continuous control over weeds within the boxes.
4. Remain prepared to immediately implement a plan to protect the boxed trees from severe weather (e.g. excessively high soil temperatures, tipping during severe wind, etc.).
5. Remove excess soil from the root collars and the top of the root balls via Air-Spading and prune adventitious, malformed and misdirected roots, as necessary.
6. Apply fertilizer, biostimulant, mycorrhiza and other soil treatments in March in accordance with the soil amendment program determined by the Arborist and Agronomist.

7. Install wood chip mulch as necessary to maintain a continuous, loose depth of 3-inches from the box edges to 6-inches away from the root collar.
8. Turn boxed trees in place 90 degrees clockwise, if required by the Arborist, to facilitate symmetrical growth and acclimation.
9. Re-tension guy straps on the trees as directed by the Arborist.

F. Summer of Year No. 3:
1. Continually monitor soil moisture and immediately provide irrigation, whenever trees need it.
2. Perform plant health care monitoring inspections at least once per month and complete pest and disease control, cultural, and other treatments necessary to ensure that the trees are healthy and maintained in accordance with the Work objectives.
3. Maintain continuous control over weeds within the boxes.
4. Remain prepared to immediately implement a plan to protect the boxed trees from severe weather (e.g. excessively high soil temperatures, tipping during severe wind, etc.).
5. Collect soil samples from tree root balls in August, have samples tested, and submit soil test report.
6. The Arborist and Agronomist will develop a custom soil amendment program based on the soil test results with the primary objectives of maximizing height growth, starch accumulation, fibrous root development, and transplantability during the pre-installation period prior to installation at the Project site.
7. In the late summer, reevaluate and rank the size, form, structure, and health of trees and submit final proposed selections for installation at the Project site.

G. Fall and Winter of Year No. 3:
1. Continually monitor soil moisture and immediately provide irrigation, whenever trees need it.
2. Perform plant health care monitoring inspections at least once per month and complete pest and disease control, cultural, and other treatments necessary to ensure that the trees are healthy and maintained in accordance with the Work objectives.
3. Maintain continuous control over weeds within the boxes.
4. Remain prepared to immediately implement a plan to protect the boxed trees from severe weather (e.g. freeze and thaw damage to the root balls, tipping during severe wind).
5. Photographically document the fall color of each sweetgum at peak of fall color to aid in final selection of individual trees to be installed at the project site.

6. Apply fertilizer, biostimulant, mycorrhiza and other soil treatments in early October in accordance with the soil amendment program determined by the Arborist and Agronomist.
7. Implement applicable winterization measures.

H. Spring of Year No. 4 of Extra Trees Only:
1. Continually monitor soil moisture and immediately provide irrigation, whenever trees need it.
2. Perform plant health care monitoring inspections at least once per month and complete pest and disease control, cultural, and other treatments necessary to ensure that the trees are healthy and maintained in accordance with the Work objectives.
3. Maintain continuous control over weeds within the boxes.
4. Remain prepared to immediately implement a plan to protect the boxed trees from severe weather (e.g. excessively high soil temperatures, tipping during severe wind, etc.).
5. Apply fertilizer, biostimulant, mycorrhiza and other soil treatments in March in accordance with the soil amendment program determined by the Arborist and Agronomist.
6. Install wood chip mulch as necessary to maintain a continuous, loose depth of 3 inches from the box edges to 6 inches away from the root collar.
7. Turn boxed trees in place 90 degrees clockwise, if required by the Arborist, to facilitate symmetrical growth and acclimation.
8. Re-tension guy straps on the trees as directed by the Arborist.

I. Summer of Year No. 4 of Extra Trees Only:
1. Continually monitor soil moisture and immediately provide irrigation, whenever trees need it.
2. Perform plant health care monitoring inspections at least once per month and complete pest and disease control, cultural, and other treatments necessary to ensure that the trees are healthy and maintained in accordance with the Work objectives.
3. Maintain continuous control over weeds within the boxes.
4. Remain prepared to immediately implement a plan to protect the boxed trees from severe weather (e.g. excessively high soil temperatures, tipping during severe wind, etc.).
5. Collect soil samples from tree root balls in August, have samples tested, and submit soil test report.
6. The Arborist and Agronomist will develop a custom soil amendment program based on the soil test results with the primary objectives of maximizing height growth, starch accumulation, fibrous root development,

and transplantability during the pre-installation period prior to installation at the Project site.

J. Fall and Winter of Year No. 4 of Extra Trees Only:

1. Continually monitor soil moisture and immediately provide irrigation, whenever trees need it.
2. Perform plant health care monitoring inspections at least once per month and complete pest and disease control, cultural, and other treatments necessary to ensure that the trees are healthy and maintained in accordance with the Work objectives.
3. Maintain continuous control over weeds within the boxes.
4. Remain prepared to immediately implement a plan to protect the boxed trees from severe weather (e.g. freeze and thaw damage to the root balls, tipping during severe wind).
5. Photographically document the fall color of each sweetgum at peak of fall color to aid in final selection of individual trees to be installed at the project site.
6. Apply fertilizer, biostimulant, mycorrhiza and other soil treatments in early October in accordance with the soil amendment program determined by the Arborist and Agronomist.
7. Implement applicable winterization measures.

2.7 PEST AND DISEASE CONTROL

A. General:

1. Employ principles of IPM in the selection of preventative and control measures for plant pests and diseases.
2. Insignificant pests will be tolerated providing they do not seriously threaten planting health and appearance unless directed otherwise by the Arborist.
3. Monitor the site closely and take timely action to address problems identified.
4. Employ a certified commercial pesticide applicator to apply pesticides.
5. Use pesticides approved by the EPA that conform to applicable laws, codes and regulations.
6. When necessary apply the least toxic pesticide required for the existing problem, unless directed otherwise by the Arborist.
7. Apply pesticide only if a pest or disease is a serious threat and cease application after problem is under control, unless directed otherwise by the Arborist.
8. Spray with extreme care to avoid hazards to any person, animal, automobile, or sensitive environment in the area or adjacent areas.
9. Meet requirements of pesticide manufacturer's current printed label and application instructions.

10. The Contractor shall be held liable for plant damage due to the use of pesticides.

B. Plant Condition Inspection:
   1. Inspect plant material weekly for damage and signs of stress, pests, and disease.
   2. Submit a written and photographic inspection report of observed damage, and signs of stress, pests, or disease via e-mail to the Owner, the Architect, and Arborist within 48 hours of observations.
   3. Use a digital camera with at least 5.0 megapixels of resolution to document observations.

C. Pesticide Application:
   1. When necessary apply the least toxic pesticide required for the existing problem.
   2. Meet requirements of manufacturer's current printed instructions.
   3. Apply sprays only if a pest or disease is a serious threat and cease application after problem is under control.
   4. Make spray applications in early morning hours, prior to 7:00 A.M., unless approved otherwise by Owner and Arborist.

2.8 REQUIREMENTS FOR SPECIFIC PRE-INSTALLATION PREPARATION AND PRE-INSTALLATION MAINTENANCE WORK

A. Soil Moisture Monitoring:
   1. Monitor and record soil moisture levels of root balls and surrounding soil or backfill soil mix at least once per week or as often as required to provide optimum moisture to the root balls.
   2. Monitor soil moisture with a soil sampling tube and properly calibrated and maintained soil moisture sensor probes inserted into access tubes.
   3. Check moisture at representative trees at 6-inch, 18-inch, and 30-inch depths.
   4. Record readings at each depth and weekly submit readings as part of the maintenance log required in this Section.

B. Root Collar Excavation:
   1. Excavate excess soil, mulch and other debris from the root collars and the top of the root balls of all trees via air-spading in fall of Year No. 1 and again in spring of Year No. 3.
   2. Air-excavate and remove soil to the extent that the root collar is exposed at and above-grade level and the first primary roots are within 1 inch of the root ball surface.
   3. Remove any adventitious, malformed and misdirected roots at this time.

C. Mulching: For boxed trees, apply and maintain a continuous layer of wood chip mulch at a loose depth of 3-inches from the box edges to 6 inches away from the root collar.

D. Irrigation:
   1. Apply accepted irrigation water on an as-needed (versus automatic timed) basis, as determined by continual soil moisture monitoring.
   2. When necessary, unless otherwise directed by the Arborist, apply irrigation water so that the equivalent of 1 inch of water is evenly distributed over the area under the drip line in a single application.
   3. Make subsequent applications only after excess free water has sufficiently drained to permit re-oxygenation of the soil and to avoid excessive wetness.

E. Soil Amendment Applications:
   1. To establish a bid price, assume fertilizer, biostimulant, mycorrhiza treatments, and other soil treatments indicated in the Preliminary Pesticide Application Schedule in Part 3 of this Section.
   2. For actual application, apply the specific products as specified in the soil amendment program determined by the Arborist and Agronomist.

F. Tree Pruning:
   1. Perform pruning under the direct supervision of the Arborist.
   2. Perform pruning in strict accordance with ANSI A300, Part 1, Article 5.7.1 Young Trees, unless directed otherwise by the Arborist.
   3. Perform the following pruning only when directed by the Arborist:
      a. Removal of dead, broken, conflicting, interfering, or otherwise objectionable branches.
      b. Removal of basal suckers and excessive water sprouts.
      c. Crown reduction to improve consistency in height between the trees.
      d. Shaping to improve consistency in form between the trees.

G. Anti-Desiccant Treatments:
   1. Treat trees with an anti-desiccant spray to reduce moisture stress at the time of digging and boxing and following installation on site.
   2. Make additional anti-desiccant applications if required by the Arborist.

H. Root Drench Borer Treatment:
   1. Treat swamp white oaks with Imidacioprid in October, prior to digging and boxing trees the following spring, and at time of planting at the Project site, to help protect against stress-related infestations of flat-headed borers.
   2. Make additional applications if required by the Arborist.
   3. Make applications via soil drench in the root ball area in strict accordance with label instructions and per-caliper-inch dosage rates.

I. Weed Control:
   1. Control weeds within the drip line of trees growing in the ground and the entire soil surface of boxed trees as frequently as necessary.

2. Acceptable methods of weed control shall include mowing, hand-pulling and/or applications of Round-Up in strict accordance with label instructions and in a manner that will avoid damage or stress to the trees.
3. Do not apply other pre-emergent or post-emergent herbicides.
4. Do not use invasive methods of mechanical control that may be injurious to tree roots, such as tilling, without the Arborist's acceptance.

J. Winterization of Boxed Trees:
1. After the first hard frost, insulate the tree boxes against rapid freeze and thaw cycles by stacking bales of straw or salt hay on all four sides of the box, from the ground to the top of the box, and secure the bales in place with baling wire or metal straps.x
2. Maintain and replace the bales as necessary throughout the winter.
3. Remove and dispose of the bales between March 10 and March 21, or unless directed otherwise by the Arborist.

K. Tree Wrapping:
1. Wrap trees only when required by the Arborist to prevent desiccation and sun scald injury.
2. Install tree wrap in a spiral fashion around the trunk from base to above the first prominent branches with a 1-inch overlap and secure the loose ends at the top and bottom with weather-proof tape or stitching.
3. Do not use fasteners that penetrate the bark.
4. Maintain or replace the tree wrap as necessary to ensure its effectiveness.
5. Remove tree wrap materials when directed by the Arborist.

L. Tree Digging and Options for Transport to Holding Facility:
1. Dig trees from the place of growth while still dormant in early to mid March.
2. Tie up the trees' crowns with sisal twine prior to digging to minimize interference and injury and to permit transportation.
3. Tie the crowns no more than two days prior to digging.
4. Take extreme care to prevent over-bending the branches to the point of injury or permanent bending.
5. Protect the branches with wraps of burlap under the twine to prevent injury to bark.
6. If soil moisture levels warrant, thoroughly irrigate the trees two days prior to digging.
7. Prior to digging, mark the north side of the trunk with a small paint dot approximately 24 inches from the base.
8. Dig by hand or with a truck-mounted tree spade trees with 90-inch diameter root balls.
9. Dig trees so that the trunks are well centered within the root ball.

10. Transfer trees directly to wooden boxes, or transport trees dug with a tree spade via tree spade to holding facility and box immediately upon arrival at the holding facility, or transfer trees from the tree spade to burlap-lined wire baskets and box immediately upon arrival at the tree holding facility.
11. Drum-lace root balls placed in wire baskets to hold the soil in a firm, stable condition prior to loading and transport to the holding facility.
12. At the time of boxing, remove burlap, twine, wire baskets, and other materials used in the balling and burlapping process.

M. Tree Boxing Procedures:
1. Construct heavy-duty boxes from wood boards and steel strapping, in accordance with current industry standards.
2. Construct boxes with inside dimensions of 120 inches long by 90 inches wide by 48 inches deep, except for Owner-supplied trees.
3. For Owner-supplied trees, construct boxes with inside dimensions of 120 inches by 120 inches by 48 inches deep.
4. Prior to installing backfill mix or trees, uniformly coat the inside vertical surfaces and bottom surfaces of the boxes with root growth regulator, in accordance with the manufacturer's current printed instructions.
5. Set sweetgum trees and 357 swamp white oak trees in boxes with top of root balls 42 inches above bottom of box after settlement, with trunk centered in box.
6. Set 54 swamp white oaks in boxes with top of root balls 36 inches above bottom of box after settlement, with trunk centered in box.
7. Immediately after setting each root ball into box, backfill around root ball to top of root ball, without covering root ball with backfill soil mix.
8. Secure the trees in the boxes with four guy straps looped around the trunk and over strong branch crotches in the lower one-third of the crown and secure straps to eyebolts firmly mounted in the corner frames of the boxes.
9. Gradually and alternately tension the guy straps in a manner that ensures that the trees are plumb within the boxes.
10. Immediately after backfilling and guying the trees in the boxes, fully saturate the soil with water and add additional backfill soil mix, if necessary, to compensate for settling.
11. Upon completion of box installation, make a larger paint mark on the side of each box corresponding to the north side of each tree.
12. In 100 of the boxes, install one moisture sensor probe access tube half way between trunk and box end, in accordance with the manufacturer's current printed installation instructions.

N. Preparation of Trees for Transport, Transport, and Delivery of Trees from the Place of Growth to Tree Holding Facility:

1. Prior to transport, securely cap boxes with wood sheathing in a manner that ensures the soil mix and root balls are held firmly in place during transport.
2. Utilize methods of lifting, handling, loading, transport, and unloading that prevent injury to the trees, damage to the boxes, and disruption or loss of soil from the boxes.
3. Transport trees from the place of growth to the holding facility as soon after digging as possible and before spring bud swell.
4. Treat trees with an anti-desiccant spray applied to the trunk, branches and twigs no more than 72 hours and no less than 24 hours prior to transport.
5. Thoroughly irrigate trees no more than 12 hours prior to shipping.
6. Once loaded onto the transport vehicle, cover trees with a securely fastened, open-weave shade tarp that minimizes desiccation while permitting sufficient cool air flow.
7. If trees must be transported while in leaf, make shipments during the night or early morning hours to minimize desiccation, unless otherwise accepted by the Arborist.
8. Off load the trees immediately upon arrival at the holding facility and place at the designated locations.
9. Remove the wood box caps and irrigate the trees again immediately upon being placed at the designated locations, or sooner in the event of a delay in placing the trees at designated locations.
10. Install wood chip mulch over surface of soil in boxes within 72 hours of delivery.

O. Preparation of Trees for Transport to Project Site:
1. Treat trees with an anti-desiccant spray applied to the trunk, branches and twigs no more than 72 hours and no less than 24 hours prior to transport.
2. Thoroughly irrigate trees no more than 12 hours prior to shipping.

P. Lifting, Handling, Transport, and Delivery of Trees to Site: Meet requirements in Part 1of this Section.

Q. Root Pruning in Box at Holding Facility:
1. If directed by the Arborist, prune roots of each tree while trees are in boxes at the holding facility.
2. Remove steel banding from box of each tree immediately prior to pruning roots and securely brace box sides to prevent the box sides from moving away from root ball.
3. Remove one box side at a time, perform cutting of roots, replace box side and re-brace box side before removing next box side for root pruning.
4. Perform root pruning by using sharp loppers or a sharp blade to make a vertical cut at the center of each root ball side, from the top of the root ball to the bottom of the root ball.

5. Make each cut 2 inches deep into the side of the root ball.
6. Do not make cuts deeper than 2 inches into the root ball unless directed to do so by the Arborist.
7. Prune other individual circling roots if directed by the Arborist.
8. Re-install steel banding immediately after root pruning of each root ball has been completed.

2.9 MAINTENANCE OF PRIMARY IRRIGATION SYSTEM AT HOLDING AREA

A. Damages: Perform repairs before next irrigation cycle commences.

B. Cleaning and Monitoring the System:

1. Continually monitor the irrigation systems to verify that they are functioning properly as designed.
2. Clean filters and strainers at least once a month and as often as necessary to keep the irrigation systems free of sand and other debris.
3. Set and continuously adjust and program automatic controller for changing water requirements.
4. Make program adjustments as required by changing weather and soil conditions.
5. Record in writing the daily watering times set for each remote control valve and weekly submit times as part of the maintenance log required by this Section.

C. Winterization: Prior to first freeze, drain irrigation system in the fall of the first year after installation and restart system in the following spring.

2.10 SOURCE QUALITY CONTROL

A. Plant Material Review and Tagging by Architect and Arborist:

1. Architect and Arborist will review, photograph, and tag at the nursery, or other place of growth prior to root pruning, using metal lock-seal tags with serial numbers.
2. Tagging of plant material at the nursery or place of growth does not affect the right of the Architect or Arborist to reject plant material at the Project site, if damage or unacceptable conditions are found that were not detected at the places of growth and maintenance or if damage occurs during transport.

B. Irrigation Water Source Testing:

1. Collect a 1-quart size water sample in a clean, glass container from the proposed water sources for primary irrigation system and for back-up irrigation system.
2. Send water samples to A&L Eastern Agricultural Laboratories in Richmond, VA, and employ laboratory to perform the A&L Basic Test No. W2 for sodium, calcium, magnesium, chloride, conductivity, sulfate, nitrate, pH, carbonate, bicarbonate, phosphorous, potassium, boron, total dissolved solids and sodium absorption rate.

3. Within 14 days of award of contract, submit to the Owner's Representative, Architect, Arborist, and Agronomist the laboratory's written test report for their evaluation and formulation of corrective treatments that may be necessary if the water does not meet the specified requirements.
4. Collect samples and have water tested from each source once per month in April, May, June, July, and August of each year.

C. Procedure for Sampling ~~and Testing of~~ Soil at Tree Places of Growth and Holding Area **for Testing**:
1. Collect soil with clean, stainless steel implements and place it in clean plastic bags or soil sampling bags to prevent contamination.
2. Collect soil samples from places of growth and holding area in a manner and in whatever quantity necessary to ensure that the samples are representative of "average" growing conditions at each location.
3. Within each location, identify different areas based on site conditions, such as visible differences in soil, slope, drainage, differences in tree growth rates, differences in groundcover vegetation, and prepare a separate composite sample for each area.
4. Collect soil at a depth of 6 to 12 inches from various points between the trunk and two-feet beyond the drip line from several trees within the area.
5. Blend the soil to create a composite sample that represents average conditions within the area.
6. Send soil samples to ~~A&L Eastern Agricultural Laboratories in Richmond, VA and employ laboratory to perform the: 1) A&L Standard Test 1A for organic matter, estimated nitrogen release, phosphorous P1 and P2, potassium, magnesium, calcium, pH, buffer pH, hydrogen, exchange capacity, and percent base saturation; 2) A&L Test 2 for soluble salts, excess lime and sodium; and 3) the A&L Test 3 for sulfur, boron, zinc, manganese, iron, and copper~~ **laboratory for testing, as indicated in Paragraph E below**.
7. At least 21 days prior to each scheduled amendment application, submit to the Architect, Agronomist, and Arborist the laboratory's written soil test report, including the laboratory's soil test data; the laboratory's interpretation of nutritional deficiencies, excesses, and potential toxicities; the laboratory's amendment recommendations; and the laboratory's maintenance recommendations.
8. The Architect, the Agronomist, and the Arborist will determine the soil amendment programs based on the soil test report which may differ from the soil test report recommendations.

D. **Procedure for Sampling** ~~Soil Tests~~ **Topsoil at Source for Testing** to Verify Chemical and Physical Characteristics ~~of Topsoil~~:

1. Take representative samples from at least 5 locations at topsoil source.
2. Collect soil with clean, stainless steel implements and place it in clean plastic bags or soil sampling bags to prevent contamination.
3. Collect soil samples in a manner and in whatever quantity necessary to ensure that the samples are representative of topsoil.
4. Send **soil** samples to ~~A&L Easter Agricultural Laboratories in Richmond, VA~~ **laboratory for testing, as indicated in Paragraph E below**.
5. **Submit to the Architect, Agronomist, and Arborist the laboratory's written soil test report, including the laboratory's soil test data; the laboratory's interpretation of nutritional deficiencies, excesses, and potential toxicities; and the laboratory's amendment recommendations.**

E. Soil Sample Testing:

1. **Send samples to Wallace Laboratories in El Segundo, CA.**
2. Employ the laboratory to ~~test the soil samples for the following~~ **perform the following tests**:
   a. pH measurement in the saturation extract per USDA Handbook No. 60, Method 21.
   b. Electrical conductivity of the saturation extract per USDA Handbook No. 60, Method 2.
   c. Sodium absorption ratio of the saturation extract per USDA Handbook No. 60, Method 20b.
   d. Determination of boron, calcium, copper, iron, magnesium, manganese, molybdenum, phosphorous, potassium, sodium, sulfur, and zinc, via the ~~following test methods: Mehlich Number 3, Bray P1, Bray P2, Olsen P, DTPA, ammonium acetate,~~ ammonium bicarbonate DTPA **test method**~~, and hot water extract from boron~~.
   e. Analysis of saturation extract for calcium, magnesium, sodium, boron, chloride, phosphorous, nitrate, and sulfate **per USDA Handbook No. 60, Method 2**.
   f. Measurement of following trace metals by the **ammonium bicarbonate** DTPA extract **test method**: aluminum, arsenic, cadmium, chromium, cobalt, lead, lithium, nickel, selenium, silver, strontium, tin, and vanadium **per SSSA Methods of Soil Analysis Part 3**.
   g. Presence of calcium carbonate and magnesium carbonate.
   h. ~~Estimate of~~ **Determine** soil texture ~~per commonly used methods~~ **per SSSA Methods of Soil Analysis Part 1**.
   i. ~~Estimate~~ **Measurement** of organic matter content ~~per commonly used methods~~ **by organic carbon and total nitrogen per SSSA Methods of Soil Analysis Part 3**.

j. **Measurement of** exchangeable Ammonium cation **per SSSA Methods of Soil Analysis Part 3**.

k. **Determine** base Saturation **per SSSA Methods of Soil Analysis Part 3**.

l. **Determine** cation Exchange Capacity **per SSSA Methods of Soil Analysis Part 3**.

~~m. Carbonates Determination.~~

~~n. Soil Bulk Density.~~

m. Water Infiltration Rate per USDA Handbook No. 60, Method 34b.

3. Employ the laboratory to perform tests in accordance with commonly used methods if a specific method is not indicated.

~~4. Submit laboratory's test report to the Architect, Agronomist, and Arborist.~~

F. Testing to Verify Organic Amendment Properties:

1. Send representative sample to A~~&L Easter Agricultural~~ **Wallace** Laboratories in ~~Richmond, VA~~ **El Segundo, CA**.
2. Employ the laboratory to test for the specified properties.
3. Submit laboratory's test report to Architect, Agronomist, and Arborist.

G. Reviews of Pre-installation Preparation Work and Maintenance Work by Architect and Arborist:

1. Have supervising personnel be present during reviews by the Architect and Arborist.
2. Architect will periodically review trees with the Arborist at least 3 times per year, once in Spring, after trees have fully leafed out, once in Fall at the height of Fall color, and once after the leaves have dropped.
3. Prior to the loading and transport of trees to the Project site, the Landscape Architect will review trees with the Arborist to make final selection of trees to be installed at the Project site.

H. Reviews of Pre-installation Preparation Work and Maintenance Work by Arborist:

1. Have supervisory personnel present during reviews by the Arborist.
2. Keep Arborist updated on precise schedule for root-pruning and canopy pruning Work and coordinate this Work with the Arborist's availability.
3. In addition to the reviews with the Architect, the Arborist will review trees twice monthly to review progress of growth and to check for signs of stress.
4. The Arborist will also be present to provide instruction for root-pruning and canopy pruning Work, and to monitor root-pruning and canopy pruning Work.

PART 3 — EXECUTION

3.1 EXAMINATION

A. Verification of Site Conditions:

1. Verify soil mixes have been installed.
2. Verify that the structural planting soil mix under the root ball has been installed to the correct elevations.
3. Verify that the deadman assemblies, eyebolts, and anchor cables for the root ball anchor systems have been installed before installing trees.
4. Verify that stone slab pavers have been installed.
5. Verify that irrigation system has been installed and has been tested, adjusted, and is operating correctly.

3.2 PREPARATION

A. Protection of Existing Conditions:

1. Use every possible precaution to prevent damage to existing conditions to remain such as structures, utilities, plant materials and paving on or adjacent to the site of the Work.
2. Provide protective mats, barricades, fences or other barriers to protect existing conditions to remain from damage during construction.
3. Use every possible precaution to prevent excessive compaction of planting area soil and soil mixes within or adjacent to the areas of Work.
4. Do not store materials or equipment, permit burning, or operate or park equipment under the branches of existing plants to remain.
5. Submit written notification of damaged existing conditions the Owner's Representative immediately.

3.3 TREE INSTALLATION

A. Plant Pit Excavation:

1. Excavate plant pits to a depth equal to the root ball height minus the amount needed to allow for settlement and to install the root balls at the elevation indicated on the Drawings.
2. Excavate pits to size indicated on the Drawings.
3. At lawn and ground cover areas, install top of plant root balls 1 inch above adjacent finished grade, or higher, if required to allow for settlement, except where indicated otherwise.

B. Protection of Trees On-site Prior to Installation:

1. Protect tree root balls from sun or drying winds.
2. Keep root balls of plants that cannot be planted immediately upon delivery in the shade, well-protected and well-watered.

C. Tree Placement:

1. Handling tree carefully, set box on top of structural planting soil mix cone at pit bottom.
2. Where tree root balls will be covered by paving, install box vertically so that top of root ball is at the elevation indicated on the Drawings.

3. At lawn and ground cover areas, install top of plant root balls 1 inch above adjacent finished grade, or higher, if required to allow for settlement, except where indicated otherwise.
4. Adjust bottom of pit elevation as required by adding or removing structural planting soil mix.

D. Removal of Box Materials:
1. Remove and dispose of box sides, burlap, nylon cord, wire, twine, and other materials prior to backfilling.
2. Do not remove box bottom.

E. Root Ball Scarification:
1. After removing box sides, scarify sides of root ball to prevent root-bound condition.
2. Loosen root ball soil surface to depth of 1/8-inch to 1/4-inch without damaging roots or breaking root ball.

F. Circling Roots:
1. Progressively comb-out and position circling roots.
2. If circling roots are encountered at root ball sides that cannot be combed out, notify the Arborist for field review.
3. If acceptable to the Arborist, cut roots on 4 sides of root ball 90 degrees apart at no additional cost to the Owner.
4. Use a 4-inch wide sharp straight blade.
5. Cut roots by pushing spade or knife down sides of root ball 90 degrees to root ball surface and 2 inches into root ball.
6. Keep spade or knife sharp to cut roots cleanly.

G. Root Biostimulant: Apply mychoriza to root ball and surrounding backfill mix.

H. Backfill Mix Placement:
1. Place mix carefully as not to damage the plant root ball, trunk, branches, or foliage.
2. Fill pit until top of backfill mix is even with top of root ball.
3. Uniformly spread excess planter soil mix excavated from the plant pits, that is not needed for backfill, over the surface of the planter in which the tree is installed.

I. Backfill Mix Settlement:
1. Settle backfill mix by watering evenly.
2. Fill settled backfill mix areas with additional backfill mix as required to bring it even with top of root ball, drench added backfill mix with water.
3. Continue filling settled areas and drenching with water until settlement stops.

J. Root Ball Anchor Systems at Zone 1 and 4 Trees:
1. Install eyebolts in reinforced concrete slab where indicated on the Drawings, before the structural planting soil is installed.

2. Drill holes in concrete to diameter recommended by the adhesive manufacturer and to a 4-inch depth.
3. Do not drill holes deeper than 4 inches, so that waterproof membrane below is not damaged.
4. Anchor eyebolts in drilled holes with adhesive.
5. After adhesive has cured, thread one anchor cable segment halfway through each eyebolt and temporarily attach ends of anchor cables to edge of tree well opening in paving above, so that cables extend vertically from eyebolts to edge of tree well opening above, and are accessible to install on top of the root balls after the trees are installed.
6. Attach cable ends securely enough to edge of tree well openings, so that they are not easily displaced during installation of soil mixes and trees.
7. After trees are installed, install root ball stabilizer boards, anchor cables, and cable tensioners on top of root balls, as indicated on the Drawings.
8. Where indicated on Drawings, connect cable segment ends together using four wire rope clips and two thimbles.
9. At cable tensioners, connect one cable end to hole in the end of the cable tensioner opposite the drum using two wire rope clips and one thimble, and connect one cable end to tensioner drum, in accordance with the tensioner manufacturer's current printed instructions.
10. After root ball anchor system materials are installed, apply enough tension to cables to keep the root balls from moving during high winds, and mark ratchet position for future reference.

K. Root Ball Anchor Systems at Zone 2 and 3 Trees:
1. Install deadman assemblies and anchor cables before structural planting soil mix is installed.
2. After each deadman assembly is installed, thread one anchor cable segment halfway through each deadman assembly eyebolt.
3. Lay cable ends toward the center of the deadman assembly, to dig up later, for use when tree pit is excavated.
4. After trees are installed, install root ball stabilizer boards, anchor cables, and cable tensioners on top of root balls, as indicated above for Zone 1 and 4 trees.

L. Cable End Connections with Wire Rope Clips and Thimbles for Root Ball Anchor Systems:
1. Install each cable end around a thimble with 6 inches of turnback.
2. Install two clips on each turnback, one clip as close as possible to thimble, and the other clip 1-inch clear from the cable turnback end.
3. Install U-bolt part of each clip on turnback part of cable and install the saddle part of each clip on long end of cable.

4. Apply the amount of torque to tighten nuts, as designated by the clip manufacturer's current printed instructions.
5. When tensioning cables, do not exceed maximum wrench torque recommended by tensioner manufacturer.

M. Anti-desiccant: Apply anti-desiccant to foliage of each tree after backfilling of each root ball is complete, as directed by the Arborist.

N. Borer Protection: Apply Imidacloprid drench to each root ball after backfilling of each root ball is complete.

3.4 WATERING BASINS

A. Dikes: Using soil excavated from plant pit, form a 4-inch high continuous soil dike ring at outside perimeter of each root ball to form a watering basin.

B. Wood Chip Mulch:
1. Install a 3-inch deep layer of mulch over ground surface and root ball surface, inside each dike ring.
2. Rake mulch surface smooth.
3. Hold and slope mulch away from trunks so that mulch does not touch trunks.

3.5 FIELD QUALITY CONTROL

A. Field Reviews by the Architect:
1. Have supervisory personnel present during entire walkthrough by the Architect, when requested by the Architect.
2. Keep the Architect updated on precise Work schedule.
3. The Architect will review installation Work frequently to check for compliance with the Contract Documents.

B. Field Reviews by the Arborist:
1. Have supervisory personnel present during reviews.
2. Keep the Arborist updated on precise Work schedule.
3. The Arborist will review installation Work weekly or more frequently to check stress, damage, and for compliance with the Contract Documents.

3.6 PROTECTION

A. Excessive Compaction of Soil Mixes and Root Balls:
1. Protect planting soil mix, plant pit backfill soil mix, and tree root balls from excessive compaction.
2. Do not allow pedestrian, vehicular, or equipment traffic on planting soil mixes and root balls.
3. Do not allow storage of materials on planting soil mix, plant pit backfill soil mix, and root balls.

B. Protection Fencing for Trees:
1. Install chain-link fencing at the perimeter of tree protection zones if required to keep construction traffic out of the protection zones, so that trunks are protected from the ground to the lowest limbs.

2. Install posts at minimum 8 feet on-center.
3. Attach chain-link mesh to post with wire clips located at 12 inches on-center.
4. Do not remove or modify protection fence without acceptance from the Architect or Arborist.
5. Do not allow people or equipment within tree protection zones without acceptance from the Architect or Arborist.

C. Interim Removal and Replacement of Protection Fence to Facilitate Work within the Tree Protection Zones:
1. Wrap snow fence 3 to 4 times around tree trunks located within tree-protection zones where Work is to occur within tree protection zones.
2. Wrap plastic barrier fencing around branches overhanging areas where Work is to occur within tree-protection zones.
3. Remove snow fence and plastic barrier fencing and replace protection fence as soon as Work is complete.

D. Restrictions: Do not allow the following operations within the tree-protection zones:
1. Parking of vehicles or equipment.
2. Storage of materials, signs, tools, refuse.
3. Use of trees as support posts, power poles, sign posts or other functions.
4. Dumping of toxic materials such as paint, petroleum products, non-potable water, and other deleterious materials.
5. Excessive water or heat from construction equipment or burning of trash under or near trees.
6. Excessive water, exhausts or drying resulting from dewatering or other operations.
7. Branch pruning.
8. Foot, vehicle, and equipment traffic.

E. Dust Control:
1. Maintain dust control to keep dust occurrence at a bare minimum.
2. Remove dust from the surfaces of foliage existing plants to remain within the project area and adjacent to it via spraying with water as often as is required by the Arborist.

3.7 SCHEDULES

A. Preliminary Pesticide Application Schedule to Establish Bid Price:

Pesticide:	*Tree Type:*	*Total Applications Per Tree:*	
		Zone 1, 2, 3, 4:	*Extra Trees:*
Imidacloprid Soil Drench:	Swamp White Oak	2	2
	Sweetgum	0	0

Pesticide:	*Tree Type:*	*Total Applications Per Tree:*	
		Zone 1, 2, 3, 4:	*Extra Trees:*
Anti-desiccant:	Swamp White Oak Sweetgum	4 4	4 4
Horticultural Oil:	Swamp White Oak Sweetgum	2 0	2 0
Fungicide:	Swamp White Oak Sweetgum	6 0	9 0
Miticide:	Swamp White Oak Sweetgum	2 0	3 0
Insecticide (general foliar spray):	Swamp White Oak Sweetgum	2 2	3 3
Insecticide (contact for scale):	Swamp White Oak Sweetgum	2 0	3 0
Herbicide on Ground at Place of Growth, Prior to Boxing:	Swamp White Oak Sweetgum	1 1	1 1
Herbicide on Surface of Backfill Mix and Root Balls in Boxes:	Swamp White Oak Sweetgum	2 years on ongoing basis 2 years on ongoing basis	3 years on ongoing basis 3 years on ongoing basis

B. Preliminary Soil Amendment Application Schedule to Establish Bid Price:

Soil Amendment:	*Tree Type:*	*Total Applications Per Tree:*	
		Zone 1, 2, 3, 4:	*Extra Trees:*
N-P-K plus Micronutrients:	Swamp White Oak Sweetgum	5 5	7 7
Mycorrhizae:	Swamp White Oak Sweetgum	3 3	4 4
Biostimulant:	Swamp White Oak Sweetgum	3 3	4 4

C. Preliminary Schedule of Other Treatments to Establish Bid Price:

Treatment:	*Tree Type:*		*Total Treatments Per Tree:*	
			Zone 1, 2, 3, 4:	*Extra Trees:*
Air Spade Root Collar Excavation:	Swamp	White	2	2
	Oak		2	2
	Sweetgum			
Air Spade Root Zone Aeration	Swamp	White	1	1
	Oak		1	1
	Sweetgum			
Mulching in Boxes:	Swamp	White	2	3
	Oak		2	3
	Sweetgum			
Initial Pruning in Year 1:	Swamp	White	1	1
	Oak		1	1
	Sweetgum			
Second Pruning in Year 2:	Swamp	White	1	1
	Oak		1	1
	Sweetgum			
Winterization of Boxed Trees:	Swamp	White	2	3
	Oak		2	3
	Sweetgum			
Tree Wrap:	Swamp	White	2	2
	Oak		2	2
	Sweetgum			
Root Pruning in the Box at the Holding Facility:	Swamp	White	1	1
	Oak		1	1
	Sweetgum			

END OF SECTION