

9-14 Erosion Control and Roadside Planting

9-14.1 Soil

9-14.1(1) Topsoil Type A

Topsoil Type A shall be as specified in the Special Provisions.

9-14.1(2) Topsoil Type B

Topsoil Type B shall be native topsoil taken from within the project limits either from the area where roadway excavation is to be performed or from strippings from borrow, pit, or quarry sites, or from other designated sources. The general limits of the material to be utilized for topsoil will be indicated in the Plans or in the Special Provisions. The Engineer will make the final determination of the areas where the most suitable material exists within these general limits. The Contractor shall reserve this material for the specified use. Material for Topsoil Type B shall not be taken from a depth greater than 1 foot from the existing ground unless otherwise designated by the Engineer.

In the production of Topsoil Type B, all vegetative matter, less than 4 feet in height, shall become a part of the topsoil. Prior to topsoil removal, the Contractor shall reduce the native vegetation to a height not exceeding 1 foot. Noxious weeds, as designated by authorized State and County officials, shall not be incorporated in the topsoil, and shall be removed and disposed of as designated elsewhere or as approved by the Engineer.

9-14.1(3) Topsoil Type C

Topsoil Type C shall be native topsoil meeting the requirements of Topsoil Type B but obtained from a source provided by the Contractor outside of the Contracting Agency owned right of way.

9-14.2 Seed

Grasses, legumes, or cover crop seed of the type specified shall conform to the standards for "Certified" grade seed or better as outlined by the State of Washington Department of Agriculture "Rules for Seed Certification", latest edition. Seed shall be furnished in standard containers on which shall be shown the following information:

- (1) Common and botanical names of seed,
- (2) Lot number,
- (3) Net weight,
- (4) Pure live seed.

All seed vendors must have a business license issued by the Washington State Department of Licensing with a "seed dealer" endorsement. Upon request, the Contractor shall furnish the Engineer with copies of the applicable licenses and endorsements.

Upon request, the Contractor shall furnish to the Engineer duplicate copies of a statement signed by the vendor certifying that each lot of seed has been tested by a recognized seed testing laboratory within six months before the date of delivery on the project. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.

9-14.3 Fertilizer

Fertilizer shall be a standard commercial grade of organic or inorganic fertilizer of the kind and quality specified. It may be separate or in a mixture containing the percentage of total nitrogen, available phosphoric acid, and water-soluble potash or sulfur in the amounts specified. All fertilizers shall be furnished in standard unopened containers with weight, name of plant nutrients, and manufacturer's guaranteed statement of analysis clearly marked, all in accordance with State and Federal laws.

Fertilizer shall be supplied in one of the following forms:

- (1) A dry free-flowing granular fertilizer, suitable for application by agricultural fertilizer spreader.
- (2) A soluble form that will permit complete suspension of insoluble particles in water, suitable for application by power sprayer.
- (3) A homogeneous pellet, suitable for application through a ferti-blast gun.
- (4) A tablet or other form of controlled release with a minimum of a 6 month release period.
- (5) A liquid suitable for application by a power sprayer or hydroseeder.

9-14.4 Mulch and Amendments

All amendments shall be delivered to the site in the original, unopened containers bearing the manufacturer's guaranteed chemical analysis and name. In lieu of containers, amendments may be furnished in bulk. A Manufacturer's Certificate of Compliance shall accompany each delivery. Compost and other organic amendments shall be accompanied with all applicable health certificates and permits.

9-14.4(1) Straw

Straw shall be in an air-dried condition, free of noxious weeds, seeds, and other materials detrimental to plant life. Hay is not acceptable.

All straw material shall be Certified Weed-Free Straw using North American Weed Management Association (NAWMA) standards or the Washington Wilderness Hay and Mulch (WWHAM) program run by the Washington State Noxious Weed Control Board. Information can be found at www.nwcb.wa.gov.

In lieu of Certified Weed-Free Straw, the Contractor shall provide documentation that the material is steam or heat treated to kill seeds, or shall provide U.S., Washington State, or other states' Department of Agriculture laboratory test reports, dated within 90 days prior to the date of application, showing that there are no viable seeds in the straw.

Straw mulch shall be suitable for spreading with mulch blower equipment.

9-14.4(2) Hydraulically Applied Erosion Control Products (HECPs)

All HECPs shall be biodegradable and in a dry condition, free of noxious weeds, seeds, chemical printing ink, germination inhibitors, herbicide residue, chlorine bleach, rock, metal, plastic, and other materials detrimental to plant life. Up to 5 percent by weight may be photodegradable material.

The HECP shall be suitable for spreading with a hydroseeder.

All HECPs shall be furnished premixed by the manufacturer with Type A or Type B Tackifier as specified in [Section 9-14.4\(7\)](#). Under no circumstances will field mixing of additives or components be acceptable.

The Contractor shall provide test results, dated within 3 years prior to the date of application, from an independent, accredited laboratory, as approved by the Engineer, showing that the product meets the following table requirements:

**Table 1
HECP Requirements**

Properties	Test Method	Requirements
Acute Toxicity	EPA-821-R-02-012 Methods for Measuring Acute Toxicity of Effluents. Test leachate from recommended application rate receiving 2 inches of rainfall per hour using static test for No-Observed-Adverse-Effect-Concentration (NOEC).	Four replicates are required with no statistically significant reduction in survival in 100 percent leachate for a Daphnid at 48 hours and <i>Oncorhynchus mykiss</i> (rainbow trout) at 96 hours.
Solvents	EPA 8260B	Benzene – < 0.03 mg/kg Methylene chloride – < 0.02 mg/kg Naphthalene – < 5 mg/kg Tetrachloroethylene – < 0.05 mg/kg Toluene – < 7 mg/kg Trichloroethylene – < 0.03 mg/kg Xylenes – < 9 mg/kg
Heavy Metals	EPA 6020A Total Metals	Antimony – < 4 mg/kg Arsenic – < 6 mg/kg Barium – < 80 mg/kg Boron – < 160 mg/kg Cadmium – < 2 mg/kg Total Chromium – < 4 mg/kg Copper – < 10 mg/kg Lead – < 5 mg/kg Mercury – < 2 mg/kg Nickel – < 2 mg/kg Selenium – < 10 mg/kg Strontium – < 30 mg/kg Zinc – < 305 mg/kg
Water Holding Capacity	ASTM D 7367	900 percent minimum
Organic Matter Content	ASTM D 586	90 percent minimum
Moisture Content	ASTM D 644	15 percent maximum
Seed Germination Enhancement	ASTM D 7322	Long-Term 420 percent minimum Moderate-Term 400 percent minimum Short-Term 200 percent minimum

If the HECP contains cotton or straw, the Contractor shall provide documentation that the material has been steam or heat treated to kill seeds, or shall provide U.S., Washington State, or other states' Department of Agriculture laboratory test reports, dated within 90 days prior to the date of application, showing that there are no viable seeds in the mulch.

The HECP shall be manufactured in such a manner that, when agitated in slurry tanks with water, the fibers will become uniformly suspended, without clumping, to form a homogeneous slurry. When hydraulically applied, the material shall form a strong moisture-holding mat that allows the continuous absorption and infiltration of water.

The HECP shall contain a dye to facilitate placement and inspection of the material. Dye shall be nontoxic to plants, animals, and aquatic life and shall not stain concrete or painted surfaces.

The HECP shall be furnished with a Material Safety Data Sheet (MSDS) that demonstrates that the product is not harmful to plants, animals, and aquatic life.

9-14.4(2)A Long-Term Mulch

Long-Term Mulch shall demonstrate the ability to adhere to the soil and create a blanket-like mass and shall bond with the soil surface to create a continuous, porous, absorbent, and flexible erosion-resistant blanket that allows for seed germination and plant growth and conforms to the requirements in [Table 2](#), Long-Term Mulch Test Requirements.

The Contractor shall provide test results documenting that the mulch meets the requirements in [Table 2](#), Long-Term Mulch Test Requirements. Effective January 1, 2012, the Contractor shall supply independent test results from the National Transportation Product Evaluation Program (NTPEP).

**Table 2
Long-Term Mulch Test Requirements**

Properties	Test Method	Requirements
Performance in Protecting Slopes from Rainfall-Induced Erosion	ASTM D 6459. Test in one soil type. Soil tested shall be sandy loam as defined by the NRCS Soil Texture Triangle.	C Factor = 0.01 maximum using Revised Universal Soil Loss Equation (RUSLE)

9-14.4(2)B Moderate-Term Mulch

Within 48 hours of application, the Moderate-Term Mulch shall bond with the soil surface to create a continuous, absorbent, flexible, erosion-resistant blanket that allows for seed germination and plant growth and conforms to the requirements in [Table 3](#), Moderate-Term Mulch Test Requirements.

The Contractor shall provide test results documenting that the mulch meets the requirements in [Table 3](#), Moderate-Term Mulch Test Requirements.

Effective January 1, 2012, the Contractor shall supply independent test results from the National Transportation Product Evaluation Program (NTPEP).

**Table 3
Moderate-Term Mulch Test Requirements**

Properties	Test Method	Requirements
Performance in Protecting Slopes from Rainfall-Induced Erosion	ASTM D 6459. Test in one soil type. Soil tested shall be sandy loam as defined by the NRCS Soil Texture Triangle.	C Factor = 0.05 maximum using Revised Universal Soil Loss Equation (RUSLE)

9-14.4(2)C Short-Term Mulch

The Contractor shall provide test results documenting that the mulch meets the requirements in [Table 4](#), Short-Term Mulch Test Requirements.

Effective January 1, 2012, the Contractor shall supply independent test results from the National Transportation Product Evaluation Program (NTPEP).

**Table 4
Short-Term Mulch Test Requirements**

Properties	Test Method	Requirements
Performance in Protecting Slopes from Rainfall-Induced Erosion	ASTM D 6459. Test in one soil type. Soil tested shall be sandy loam as defined by the National Resources Conservation Service (NRCS) Soil Texture Triangle.	C Factor = 0.15 maximum using Revised Universal Soil Loss Equation (RUSLE)

9-14.4(3) Bark or Wood Chips

Bark or wood chip mulch shall be derived from Douglas fir, pine, or hemlock species. It shall not contain resin, tannin, or other compounds in quantities that would be detrimental to plant life. Sawdust shall not be used as mulch.

Bark or wood chips when tested shall be according to WSDOT Test Method T 123 prior to placement and shall meet the following loose volume gradation:

Sieve Size	Percent Passing	
	Minimum	Maximum
2"	95	100
No. 4	0	30

9-14.4(4) Wood Strand Mulch

Wood strand mulch shall be a blend of angular, loose, long, thin wood pieces that are frayed, with a high length-to-width ratio, and it shall be derived from native conifer or deciduous trees. A minimum of 95 percent of the wood strand shall have lengths between 2 and 10 inches. At least 50 percent of the length of each strand shall have a width and thickness between 1/16 and 1/2 inch. No single strand shall have a width or thickness greater than 1/2 inch.

The mulch shall not contain salt, preservatives, glue, resin, tannin, or other compounds in quantities that would be detrimental to plant life. Sawdust or wood chips or shavings will not be acceptable.

The Contractor shall provide Material Safety Data Sheet (MSDS) that demonstrates that the product is not harmful to plant life and a test report performed in accordance with WSDOT Test Method 125 demonstrating compliance to this specification prior to acceptance.

9-14.4(5) Lime

Agriculture lime shall be of standard manufacture, flour grade or in pelletized form, meeting the requirements of ASTM C 602.

9-14.4(6) Gypsum

Gypsum shall consist of Calcium Sulfate (CaSO42H2O) in a pelletized or granular form. 100 percent shall pass through a No. 8 sieve.

9-14.4(7) Tackifier

Tackifiers are used as a tie-down for soil, compost, seed, and/or mulch. Tackifiers shall contain no growth or germination-inhibiting materials and shall not reduce infiltration rates. Tackifiers shall hydrate in water and readily blend with other slurry materials, and shall conform to the requirements in Table 5, Tackifier Test Requirements.

The Contractor shall provide test results documenting the tackifier meets the requirements in Table 5, Tackifier Test Requirements.

**Table 5
Tackifier Test Requirements**

Properties	Test Method	Requirements
Heavy Metals Solvents Acute Toxicity	See Table 1 in Section 9-14.4(2). Test at manufacturer's recommended application rate.	See Table 1 in Section 9-14.4(2)
Viscosity	ASTM D 2364. Testing shall be performed by an accredited, independent laboratory.	4000 cPs minimum

9-14.4(7)A Organic Tackifier

Organic tackifiers shall be derived from natural plant sources and shall have an MSDS that demonstrates to the satisfaction of the Engineer that the product is not harmful to plants, animals, and aquatic life.

9-14.4(7)B Synthetic Tackifier

Synthetic tackifiers shall have an MSDS that demonstrates to the satisfaction of the Engineer that the product is not harmful to plants, animals, and aquatic life.

9-14.4(8) Compost

Compost products shall be the result of the biological degradation and transformation of organic materials under controlled conditions designed to promote aerobic decomposition. Compost shall be stable with regard to oxygen consumption and carbon dioxide generation. Compost shall be mature with regard to its suitability for serving as a soil amendment or an erosion control BMP as defined below. The compost shall have a moisture content that has no visible free water or dust produced when handling the material.

Compost production and quality shall comply with [WAC 173-350 and for biosolids composts, WAC 173-308](#).

Compost products shall meet the following physical criteria:

1. Compost material shall be tested in accordance with U.S. Composting Council Testing Methods for the Examination of Compost and Composting (TMECC) 02.02-B, "Sample Sieving for Aggregate Size Classification".

Fine compost shall meet the following gradation:

Sieve Size	Percent Passing	
	Minimum	Maximum
1"	100	
5/8"	90	100
1/4"	75	100

Note: Maximum particle length of 4 inches.

Medium compost shall meet the following gradation:

Sieve Size	Percent Passing	
	Minimum	Maximum
1"	100	
5/8"	85	100
1/4"	70	85

Note: Maximum particle length of 4 inches. Medium compost shall have a carbon to nitrogen ratio (C:N) between 18:1 and 35:1. The carbon to nitrogen ratio shall be calculated using the dry weight of "Organic Carbon" using TMECC 04.01A divided by the dry weight of "Total N" using TMECC 04.02D.

Coarse compost shall meet the following gradation:

Sieve Size	Percent Passing	
	Minimum	Maximum
2"	100	
1"	90	100
3/4"	70	100
1/4"	40	60

Note: Maximum particle length of 6 inches. Coarse compost shall have a carbon to nitrogen ratio (C:N) between 25:1 and 35:1. The carbon to nitrogen ratio shall be calculated using the dry weight of "Organic Carbon" using TMECC 04.01A divided by the dry weight of "Total N" using TMECC 04.02D.

2. The pH shall be between 6.0 and 8.5 when tested in accordance with U.S. Composting Council TMECC 04.11-A, "1:5 Slurry pH".
3. Manufactured inert material (plastic, concrete, ceramics, metal, etc.) shall be less than 1 percent by weight as determined by U.S. Composting Council TMECC 03.08-A "Classification of Inerts by Sieve Size".
4. Minimum organic matter shall be 40 percent by dry weight basis as determined by U.S. Composting Council TMECC 05.07A "Loss-On-Ignition Organic Matter Method (LOI)".
5. Soluble salt contents shall be less than 4.0 mmhos/cm when tested in accordance with U.S. Composting Council TMECC 04.10 "Electrical Conductivity".
6. Maturity shall be greater than 80 percent in accordance with U.S. Composting Council TMECC 05.05-A, "Germination and Root Elongation".
7. Stability shall be 7-mg CO₂-C/g OM/day or below in accordance with U.S. Composting Council TMECC 05.08-B "Carbon Dioxide Evolution Rate".
8. The compost product shall originate from organic waste as defined in [WAC 173-350](#) as "Type 1 Feedstocks", "Type 2 Feedstocks", and/or "Type 3 Feedstocks". The Contractor shall provide a list of feedstock sources by percentage in the final compost product.
9. The Engineer may also evaluate compost for maturity using U.S. Composting Council TMECC 05.08-E "Solvita® Maturity Index". Fine compost shall score a number 6 or above on the Solvita® Compost Maturity Test. Medium and coarse compost shall score a 5 or above on the Solvita® Compost Maturity Test.

9-14.4(8)A Compost Submittal Approval

The Contractor shall submit the following information to the Engineer for approval:

1. The Qualified Products List printed page or a Request for Approval of Material (WSDOT [Form 350-071](#)).
2. A copy of the Solid Waste Handling Permit issued to the manufacturer by the Jurisdictional Health Department in accordance with [WAC 173-350](#) (Minimum Functional Standards for Solid Waste Handling) or for biosolid composts a copy of the Coverage Under the General Permit for Biosolids Management issued to the manufacturer by the Department of Ecology in accordance with [WAC 173-308](#) (Biosolids Management)..
3. The Contractor shall verify in writing and provide lab analyses that the material complies with the processes, testing, and standards specified in [WAC 173-350](#) and these Specifications. An independent Seal of Testing Assurance (STA) Program certified laboratory shall perform the analyses.
4. A copy of the manufacturer's Seal of Testing Assurance STA certification as issued by the U.S. Composting Council.

9-14.4(8)B Compost Acceptance

Fourteen days prior to application, the Contractor shall submit a sample of the compost approved for use, an STA test report dated within 90 calendar days of the application, and the list of feed stocks by volume for each compost type to the Engineer for review.

The Contractor shall use only compost that has been tested within 90 calendar days of application and meets the requirements in [Section 9-14.4\(8\)](#). Compost not conforming to the above requirements or taken from a source other than those tested and accepted shall not be used.

9-14.4(9) Vacant

9-14.4(10) Vacant

9-14.5 Erosion Control Devices

9-14.5(1) Polyacrylamide (PAM)

PAM is used as a tie-down for soil, compost, or seed, and is also used as a flocculent. PAM products shall meet ANSI/NSF Standard 60 for drinking water treatment with an AMD content not to exceed 0.05 percent. PAM shall be anionic and shall be linear, and not cross-linked. The minimum average molecular weight shall be greater than 5-mg/mole and minimum 30 percent charge density. The product shall contain at least 80 percent active ingredients and have a moisture content not exceeding 10 percent by weight. PAM shall be delivered in a dry granular or powder form.

9-14.5(2) Erosion Control Blanket

Temporary erosion control blankets shall be made of natural plant fibers. The Contractor shall supply independent test results from the National Transportation Product Evaluation Program (NTPEP) meeting the following requirements in [Tables 6 and 7](#):

**Table 6
Temporary Erosion Control Blanket Test Requirements**

Properties	ASTM Test Method	Requirements
Protecting Slopes from Rainfall-Induced Erosion	D 6459. Test in one soil type. Soil tested shall be sandy loam as defined by the NRCS Soil Texture Triangle.	Maximum C factor of 0.15 using Revised Universal Soil Loss Equation (RUSLE)
Dry Weight per Unit Area	D 6475	0.36-lb/sq. yd. minimum
Performance in Protecting Earthen Channels from Stormwater-Induced Erosion	D 6460. Test in one soil type. Soil tested shall be loam as defined by the NRCS Soil Texture Triangle.	1.0-lb/sq. ft. minimum
Seed Germination Enhancement	D 7322	200 percent minimum
Note: Netting, if present, shall be biodegradable with a life span not to exceed 2 years.		

Permanent erosion control blanket/turf reinforcement mats shall meet the following requirements in [Table 7](#):

**Table 7
Permanent Erosion Control Blanket Requirements**

Properties	ASTM Test Method	Requirements
UV Stability	D 4355	Minimum 80 percent strength retained after 500 hours in a xenon arc device
Protecting Slopes	D 6459 with 0.12 inch average	Maximum C factor of 0.15 using

from Rainfall-Induced Erosion	raindrop size. Test in one soil type. Soil tested shall be loam as defined by the NRCS Soil Texture Triangle.	Revised Universal Soil Loss Equation (RUSLE)
Dry Weight per Unit Area	D 6566	0.50 lb/sq. yd. minimum
Performance in Protecting Earthen Channels from Stormwater-Induced Erosion	D 6460. Test in one soil type. Soil tested shall be loam as defined by the NRCS Soil Texture Triangle.	2.0 lb/sq. ft. minimum
Seed Germination Enhancement	D 7322	200 percent minimum

9-14.5(2)A Erosion Control Blanket Approval

The Contractor shall select erosion control blanket products that bear the Quality and Data Oversight and Review (QDOR) seal from the Erosion Control and Technology Council (ECTC). All materials selected shall be currently listed on the QDOR products list available at www.ectc.org/qdor.

9-14.5(3) Clear Plastic Covering

Clear plastic covering shall meet the requirements of ASTM D 4397 for polyethylene sheeting having a minimum thickness of 6 mils.

9-14.5(4) Check Dams

All materials used for check dams shall be non-toxic and not pose a threat to wildlife when installed.

9-14.5(4)A Biodegradable Check Dams

Biodegradable check dams shall meet the following requirements:

- Wattle Check Dam Section 9-14.5(5)
- Compost Sock Check Dam Section 9-14.5(6)
- Coir Log Check Dam Section 9-14.5(7)

The Contractor may substitute a different biodegradable check dam as long as it complies with the following and is approved by the Engineer:

1. Made of natural plant fiber.
2. Netting if present shall be biodegradable.

9-14.5(4)B Non-biodegradable Check Dams

1. Geotextile materials shall conform to Section 9-33 for silt fence.
2. Other such devices that fulfill the requirements of Section 9-14.5(4) and shall be approved by the Engineer prior to installation.

9-14.5(5) Wattles

Wattles shall consist of cylinders of biodegradable plant material such as weed-free straw, coir, compost, wood chips, excelsior, or wood fiber or shavings encased within biodegradable netting. Wattles shall be a minimum of 5 inches in diameter. Netting material shall be clean, evenly woven, and free of encrusted concrete or other contaminating materials such as preservatives. Netting material shall be free from cuts, tears, or weak places and shall have a minimum lifespan of 6 months and a maximum lifespan of not more than 24 months.

Compost filler shall be coarse compost and shall meet the material requirements as specified in [Section 9-14.4\(8\)](#). If wood chips are used, they shall meet the material requirements as specified in [Section 9-14.4\(3\)](#). If wood shavings are used, 80 percent of the fibers shall have a minimum length of 6 inches between 0.030 and 0.50 inches wide and between 0.017 and 0.13 inches thick.

Wood stakes for wattles shall be made from untreated Douglas fir, hemlock, or pine species. Wood stakes shall be 2 by 2-inch nominal dimension and 36 inches in length.

9-14.5(6) Compost Socks

Compost socks shall consist of extra heavy-weight biodegradable fabric, with a minimum strand thickness of 5 mils. The fabric shall be filled with Coarse Compost. Compost socks shall be at least 8 inches in diameter. The fabric shall be clean, evenly woven; free of encrusted concrete or other contaminating materials; free from cuts, tears, broken or missing yarns; free of thin, open, or weak areas; and free of any type of preservative. Netting material shall have a minimum lifespan of 6 months and a maximum lifespan of not more than 24 months.

Coarse Compost filler shall meet the material requirements as specified in [Section 9-14.4\(8\)](#).

Wood stakes for compost socks shall be made from untreated Douglas fir, hemlock, or pine species. Wood stakes shall be 2 by 2-inch nominal dimension and 36 inches in length,

9-14.5(7) Coir Log

Coir logs shall be made of 100 percent durable coconut (coir) fiber uniformly compacted within woven netting made of bristle coir twine with a minimum tensile strength of 80 lbs. The netting shall have nominal 2 by 2-inch openings. Log segments shall have a maximum length of 20 feet, with a minimum diameter as shown in the Plans. Logs shall have a minimum density of 7 lbs/cf.

Stakes shall be untreated Douglas fir, hemlock, or pine species. Wood stakes shall have a notch to secure the rope ties. Rope ties shall be made of ¼-inch diameter commercially available hemp rope.

9-14.5(8) High Visibility Fencing

High visibility fence shall be UV stabilized, orange, high-density polyethylene or polypropylene mesh, and shall be at least 4 feet in height.

Support posts shall be wood or steel in accordance with Standard Plan I-10.10. The posts shall have sufficient strength and durability to support the fence through the life of the project.

9-14.6 Plant Materials

9-14.6(1) Description

Bareroot plants are grown in the ground and harvested without soil or growing medium around their roots.

Container plants are grown in pots or flats that prevent root growth beyond the sides and bottom of the container.

Balled and burlapped plants are grown in the ground and harvested with soil around a core of undisturbed roots. This rootball is wrapped in burlap and tied or placed in a wire basket or other supportive structure.

Cuttings are live plant material without a previously developed root system. Source plants for cuttings shall be dormant when cuttings are taken and all cuts shall be made with a sharp instrument. Cuttings may be collected. If cuttings are collected, the requirement to be nursery grown or held in nursery conditions does not apply. Written permission shall be obtained from property owners and provided to the Engineer before cuttings are collected. The Contractor shall collect cuttings in accordance with applicable sensitive area ordinances. Cuttings shall meet the following requirements:

- A. Live branch cuttings shall have flexible top growth with terminal buds and may have side branches. The rooting end shall be cut at an approximate 45-degree angle.
- B. Live stake cuttings shall have a straight top cut immediately above a bud. The lower, rooting end shall be cut at an approximate 45-degree angle. Live stakes are cut from one to two year old wood. Live stake cuttings shall be cut and installed with the bark intact with no branches or stems attached, and be ½ to 1½ inch in diameter.
- C. Live pole cuttings shall have a minimum 2-inch diameter and no more than three branches which shall be pruned back to the first bud from the main stem.

Rhizomes shall be a prostrate or subterranean stem, usually rooting at the nodes and becoming erect at the apex. Rhizomes shall have a minimum of two growth points. Tubers shall be a thickened and short subterranean branch having numerous buds or eyes.

9-14.6(2) Quality

At the time of delivery, all plant material furnished shall meet the grades established by the latest edition of the American Standard for Nursery Stock, (ASNS) ANSI Z60.1 and shall conform to the size and acceptable conditions as listed in the Contract, and shall be free of all foreign plant material.

All plant material shall comply with State and Federal laws with respect to inspection for plant diseases and insect infestation.

All plant material shall be purchased from a nursery licensed to sell plants in Washington State.

Live woody or herbaceous plant material, except cuttings, rhizomes, and tubers, shall be vigorous, well formed, with well developed fibrous root systems, free from dead branches, and from damage caused by an absence or an excess of heat or moisture, insects, disease, mechanical or other causes detrimental to good plant development. Evergreen plants shall be well foliated and of good color. Deciduous trees that have solitary leaders shall have only the lateral branches thinned by pruning. All conifer trees shall have only one leader (growing apex) and one terminal bud, and shall not be sheared or shaped. Trees having a damaged or missing leader, multiple leaders, or Y-crotches shall be rejected.

Root balls of plant materials shall be solidly held together by a fibrous root system and shall be composed only of the soil in which the plant has been actually growing. Balled and burlapped rootballs shall be securely wrapped with jute burlap or other packing material not injurious to the plant life. Root balls shall be free of weed or foreign plant growth.

Plant materials shall be nursery grown stock. Plant material, with the exception of cuttings, gathered from native stands shall be held under nursery conditions for a minimum of one full growing season, shall be free of all foreign plant material, and meet all of the requirements of these Specifications, the Plans, and the Special Provisions.

Container grown plants shall be plants transplanted into a container and grown in that container sufficiently long for new fibrous roots to have developed so that the root mass will retain its shape and hold together when removed from the container, without having roots that circle the pot. Plant material which is root bound, as determined by the Engineer, shall be rejected. Container plants shall be free of weed or foreign plant growth.

Container sizes for plant material of a larger grade than provided for in the container grown Specifications of the ASNS shall be determined by the volume of the root ball specified in the ASNS for the same size plant material.

All bare root plant materials shall have a heavy fibrous root system and be dormant at the time of planting.

Average height to spread proportions and branching shall be in accordance with the applicable sections, illustrations, and accompanying notes of the ASNS.

Plants specified or identified as "Street Tree Grade" shall be trees with straight trunks, full and symmetrical branching, central leader, and be developed, grown, and propagated with a full branching crown. A "Street Tree Grade" designation requires the highest grade of nursery shade or ornamental tree production which shall be supplied.

Street trees with improperly pruned, broken, or damaged branches, trunk, or root structure shall be rejected. In all cases, whether supplied balled and burlapped or in a container, the root crown (top of root structure) of the tree shall be at the top of the finish soil level. Trees supplied and delivered in a nursery fabric bag will not be accepted.

Plants which have been determined by the Engineer to have suffered damage for the following reasons will be rejected:

1. Girdling of the roots, stem, or a major branch.
2. Deformities of the stem or major branches.
3. Lack of symmetry.
4. Dead or defoliated tops or branches.
5. Defects, injury, and condition which renders the plant unsuitable for its intended use.

Plants that are grafted shall have roots of the same genus as the specified plant.

9-14.6(3) Handling and Shipping

Handling and shipping shall be done in a manner that is not detrimental to the plants.

The nursery shall furnish a notice of shipment in triplicate at the time of shipment of each truck load or other lot of plant material. The original copy shall be delivered to the Project Engineer, the duplicate to the consignee and the triplicate shall accompany the shipment to be furnished to the Inspector at the job site. The notice shall contain the following information:

1. Name of shipper.
2. Date of shipment.
3. Name of commodity (including all names as specified in the Contract).
4. Consignee and delivery point.
5. State Contract number.
6. Point from which shipped.
7. Quantity contained.
8. Size (height, runner length, caliper, etc., as required).
9. Signature of shipper by authorized representative.

To acclimate plant materials to Northwest conditions, all plant materials used on a project shall be grown continuously outdoors north of the 42nd Latitude (Oregon-California border) from not later than August 1 of the year prior to the time of planting.

All container grown plants shall be handled by the container.

All balled and burlapped plants shall be handled by the ball.

Plant material shall be packed for shipment in accordance with prevailing practice for the type of plant being shipped, and shall be protected at all times against drying, sun, wind, heat, freezing, and similar detrimental conditions both during shipment and during related handling. Where necessary, plant material shall be temporarily heeled in. When transported in closed vehicles, plants shall receive adequate ventilation to prevent sweating. When transported in open vehicles, plants shall be protected by tarpaulins or other suitable cover material.

9-14.6(4) Tagging

Plants delivered as a single unit of 25 or less of the same size, species, and variety, shall be clearly marked and tagged. Plants delivered in large quantities of more than 25 must be segregated as to variety, grade, and size; and one plant in each 25, or fraction thereof, of each variety, grade, and size shall be tagged.

9-14.6(5) Inspection

The Contracting Agency will make an inspection of plant material at the source when requested by the Engineer. However, such preliminary approval shall not be considered as final acceptance for payment. Final inspection and approval (or rejection) will only occur when the plant material has been delivered to the Contract site. The Contractor shall notify the Engineer, not less than 48 hours in advance, of plant material delivery to the project.

9-14.6(6) Substitution of Plants

No substitution of plant material, species or variety, will be permitted unless evidence is submitted in writing to the Engineer that a specified plant cannot be obtained and has been unobtainable since the Award of the Contract. If substitution is permitted, it can be made only with written approval by the Engineer. The nearest variety, size, and grade, as approved by the Engineer, shall then be furnished.

Container or balled and burlapped plant material may be substituted for bare root plant material. Container grown plant material may be substituted for balled and burlapped plant materials. When substitution is allowed, use current ASNS standards to determine the correct rootball volume (container or balled and burlapped) of the substituted material that corresponds to that of the specified material. These substitutions shall be approved by the Engineer and be at no cost to the Contracting Agency.

9-14.6(7) Temporary Storage

Plants stored under temporary conditions prior to installation shall be the responsibility of the Contractor.

Plants stored on the project shall be protected at all times from extreme weather conditions by insulating the roots, root balls, or containers with sawdust, soil, compost, bark or wood chips, or other approved material and shall be kept moist at all times prior to planting.

Cuttings shall continually be shaded and protected from wind. Cuttings shall be protected from drying at all times and shall be heeled into moist soil or other insulating material or placed in water if not installed within 8 hours of cutting. Cuttings to be stored for later installation shall be bundled, laid horizontally, and completely buried under 6 inches of water, moist soil or placed in cold storage at a temperature of 34°F and 90 percent humidity. Cuttings that are not planted within 24 hours of cutting shall be soaked in water for 24 hours prior to planting. Cuttings taken when the temperature is higher than 50°F shall not be stored for later use. Cuttings that already have developed roots shall not be used.

9-14.6(8) Sod

The available grass mixtures on the current market shall be submitted to the Engineer for selection and approval.

The sod shall be field grown one calendar year or older, have a well developed root structure, and be free of all weeds, disease, and insect damage.

Prior to cutting, the sod shall be green, in an active and vigorous state of growth, and mowed to a height not exceeding 1 inch.

The sod shall be cut with a minimum of 1 inch of soil adhering.

9-14.7 Stakes, Guys, and Wrapping

Stakes shall be installed as shown in the Plans.

Commercial plant ties may be used in lieu of hose and wire guying upon approval of the Engineer. The minimum size of wire used for guying shall be 12-gauge, soft drawn.

Hose for guying shall be nylon, rubber, or reinforced plastic and shall have an inside diameter of at least 1 inch.

Tree wrap shall be a crinkled waterproof paper weighing not less than 4 pounds per 100 square feet and shall be made up of two sheets cemented together with asphalt.