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SECTION 20 LANDSCAPING

20-1 GENERAL

Landscaping work shall consist of performing roadway planting, park landscaping, irrigation installation, and other work necessary for improving the appearance of the roadside and park facilities, as shown on the Plans and in accordance with these Specifications.

20-2 MATERIALS

Landscaping materials shall conform to the requirements in Section 50-43, "Landscaping Materials", and these Specifications.

20-2.01 Root Control Barrier

Root control barrier shall be installed prior to topsoil placement or by means of trenching against existing surfaces. Panels shall be installed slightly higher than finish grade [one inch (1")], flush against edge of pavement, and joined with locking strips or integral male/female sliding locks. Locking mechanism shall have a close tolerance to restrict any slippage between panels. Barrier shall be installed with root deflectors facing inward and shall provide a continuous barrier around the perimeter of each median, tree well, sidewalk or other hardscape surface.

20-2.02 Topsoil

Topsoil shall be placed and spread to the line and grade as shown on the Plans or as directed by the Agency. Topsoil shall be compacted to approximately eighty percent (80%) relative compaction. Topsoil in tree or shrub pits shall be lightly tamped by hand so as to form a firm setting for the plant, but not hinder growth. Mechanical tamping will not be permitted.

After spreading the topsoil, any extraneous or unacceptable material not previously removed shall be raked off and removed from the topsoil area. Spreading and compacting shall be completed in such a manner that seeding, sodding, or planting can proceed without additional grading.

Immediately before planting, the topsoil shall be cultivated and raked to provide a uniformly smooth, firm, friable, fine textured finished surface. No grading equipment will be permitted on the topsoil after the area has been finish graded and prepared for planting.

20-2.03 Soil Amendment

Soil amendment shall be uniformly spread at the rate specified and incorporated with a rotary cultivator to obtain a homogeneously blended soil six inches (6") in depth, unless specified otherwise in the Special Provisions.

20-2.04 Liquid Green Dye

Liquid green dye used in erosion control and hydroseeding work shall be forty-eight- (48-) hour colorfast, applied at the rate of two (2) quarts per acre, unless otherwise specified in the Special Provisions.

20-2.05 Mulch

Mulch shall be top dressed, where specified, to a minimum depth of three inches (3") over soil level. Taper mulch away from the crowns of all newly planted and existing trees.

20-3 EROSION CONTROL

Erosion control materials shall conform to Section 50-43, "Landscaping Materials", the Special Provisions, and these Specifications.

20-3.01 Seeding and Fertilizing

Seeding and fertilizing shall conform to the Special Provisions and these Specifications.

If the Contractor elects to hydroseed, a minimum of fifteen hundred (1,500) pounds of fiber per acre shall be mixed and applied with the seed, and fertilizer (if required) may be mixed with the seed and fiber and applied in the hydroseeding operation.

The Contractor shall scarify to a depth of six inches (6") and uniformly fine grade so that proper drainage of the entire ground cover is assured. All rocks, soil lumps, and other deleterious materials larger than one inch (1") shall be removed and the area raked smooth.

The Contractor shall avoid any compaction of the soils after treatment, and shall not permit traffic over such areas. In case of such compaction, the areas shall be recultivated by the Contractor, at the Contractor's expense.

Areas to be treated for weed control shall be treated as shown or specified in the Contract .

Equipment for hydroseeding application shall have a built-in agitation system with an operating capacity sufficient to agitate, suspend, and homogeneously mix a slurry of fiber, fertilizer, seed, and water. The discharge line shall provide even distribution of the slurry on the slopes to be seeded. The slurry tank shall have a minimum capacity of one thousand (1,000) gallons.

The slurry preparation shall begin by adding water to the tank. When the water level has reached the height of the agitator shaft, the stabilizing agent shall be added. Seed and fertilizer shall then be added, followed by the fiber mulch. The combined materials shall then be uniformly blended prior to application. Spraying shall commence within two (2) hours after the tank is full.

The Contractor shall perform hydroseeding during calm wind conditions. The operator shall spray the slopes with a uniform, visible coat, using the color of the mulch as a guide. The slurry shall be applied in a sweeping motion to allow the fibers to build on each other, until a good coat is achieved. Unless otherwise specified in the Special Provisions, the application rates shall be:

Material	Application Rate per Acre
Mulch	1,500 pounds
6-20-20 fertilizer	400 pounds
Seed Mix	See Plans or Special Provisions
Liquid Green Dye	2 quarts
Stabilizing Emulsion	As approved by the Agency

20-3.02 Measurement and Payment

The quantity of erosion control to be paid for by the square foot, square yard, acre or as designated in the Contract will be calculated on the basis of actual or computed slope measurements.

The price paid per square foot, square yard, or acre includes compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all the work involved in performing erosion control work and hydroseeding, complete in place, including site preparation, hydroseeding application, and clean-up as shown on or specified in the Contract, as specified in these Specifications, and as directed by the Agency.

20-4 PLANTING

This work shall consist of furnishing and installing planting materials, clearing planting areas, preparing planting areas, planting plants and establishing plants as shown on the Plans and as specified in these Specifications and the Special Provisions.

Planting materials shall be as specified in Section 50-43, "Landscaping Materials", and these Specifications, and shall be installed in accordance with Standard Drawings L-1 and L-2.

20-4.01 Pesticides

The Contractor shall obtain recommendations for the use of pesticides from a licensed Pest Control Adviser in accordance with the requirements of the California Food and Agricultural Code. At least twenty-four (24) hours prior to using any pesticides, a copy of such recommendations shall be submitted to the Agency for approval. The recommendations shall include, but not be limited to, the pesticides to be used, rates of application, methods of application and areas to which pesticides are to be applied.

Pesticides for weed control shall be applied with a photosensitive dye which will produce a contrasting color when sprayed upon the ground. The color shall disappear between two (2) and three (3) days after being applied. The dye shall not stain any surfaces nor injure plant or animal life when applied at the manufacturer's recommended application rate.

Pesticides shall not be applied when weather conditions, including wind conditions, are unsuitable for such work.

Any new or existing plants which, in the opinion of the Agency, have been damaged by the application of pesticides shall be replaced by the Contractor at his expense.

20-4.02 Preparing Planting Areas

The Agency shall approve the ground locations of plants by inspecting the placement of the plants, stakes, or other suitable markers. The Contractor shall furnish all labor, materials, and transportation required to adequately mark the various plant locations.

In areas to be planted, all rocks and other debris greater than one inch (1") in diameter shall be removed and disposed of.

In areas to be planted, the grade shall be one (1") to two inches (2") below the planned finish grade prior to conditioning the soil. In all other areas, the grades shall be as indicated at the grading plane for the type of facility to be constructed thereon.

The formation and compaction of embankments shall conform to the provisions as specified in Section 18, "Earthwork", of these Specifications and as modified herein. In areas to be planted, compaction of the fill shall be not more than eighty-five percent (85%) for the upper one foot (1') of such fill.

Cultivation shall be performed with as many passes with the cultivator as necessary, as determined by the Agency, to produce a friable, uniformly mixed soil, free of pockets of unmixed soil, amendments, or fertilizers if such are specified.

Areas adjacent to walks, structures, or other such facilities that are inaccessible or difficult to reach by mechanical rotary cultivators shall be cultivated by hand.

After cultivation, the surface shall be raked, rolled, or otherwise smoothed to remove ridges and fill depressions. The finished surface shall be uniform, evenly graded, and reasonably firm. The grades of the finished surface shall be approximately two inches (2") below the top of adjacent curbs or pavement, unless otherwise shown on the plans and except for those areas designated to receive topsoil, where the grade shall be six inches (6") below planned finish grade.

Soil preparation and planting operations shall be conducted under favorable weather conditions only. Soil shall not be worked when excessively dry or wet and the Agency has the right to stop any work taking place during a period when conditions are considered detrimental to soil structure or plant growth.

The work involved in preparing planting areas shall be so conducted that the existing flow line in drainage ditches will be maintained. Material displaced by the Contractor's operations that interferes with drainage shall be removed and dispersed of as directed by the Agency.

Cultivation shall be performed until the soil is in a loose condition to a minimum depth of six inches (6"). Soil clods shall not be larger than two inches (2") in any dimension after cultivation.

Planting areas that have been cultivated and become compacted for any reason shall be recultivated by the Contractor at his expense.

20-4.03 Header Boards

Header boards shall conform to Section 50-43.11, "Lumber", of these Specifications and shall be installed in accordance with Standard Drawing L-27.

Header board stakes shall be of the size and shape shown on the Plans. Each stake shall be driven flush with the top edge of the header board and the stake top shall be beveled away from the header board on a forty-five-degree (45°) angle. Stakes shall be at four feet (4') on center along the length of the header board. Stakes shall be attached to header boards with a minimum of two (2) 12-penny hot-dip galvanized common nails per stake.

Where asphalt concrete or portland cement concrete surfacing must be removed to permit the installation of header boards, and no joint exists between the surfacing to be removed and surfacing to remain in place, the surfacing shall be cut in a neat line to a minimum depth of 0.17-foot with a power driven saw before the surfacing is removed.

20-4.04 Planting

Plant material shall conform to Section 50-43.14, "Plants", of these Specifications and shall be installed in accordance with Standard Drawings L-1 and L-2.

No planting shall be done in any area until the area concerned has been prepared in accordance with these Specifications and the Special Provisions and presents a neat and uniform appearance satisfactory to the Agency. When an irrigation system is required, the irrigation system shall be installed and checked for coverage to the satisfaction of the Agency prior to planting plants.

Planting will not be allowed in any area that in the opinion of the Landscape Architect is too wet or too dry or that is in any other way unacceptable for planting.

Where vines are to be planted against walls or fences, the vines shall be planted as close as possible to the wall or fence as shown on the Plans.

Plants shall be removed from the containers in such a manner that the ball of earth surrounding the roots remains intact, and they shall be planted and watered as hereinafter specified immediately after removal from the containers. Containers shall not be cut prior to delivery to the planting site.

Roots of plants not in containers shall be kept moist and covered until such plants are planted.

Before planting in holes or trenches, water shall be applied to the backfill with a pipe or tube inserted to the bottom of the hole until the backfill material is saturated for the full depth. Backfill for planting holes and trenches shall be placed in two (2) lifts. Water shall be applied to the backfill between lifts with a hose and allowed to fill and percolate. Additional backfill shall not be placed until the water has percolated and saturated the planting hole to its full depth.

Each tree and shrub location shall be as shown on the Plans, or as approved by the Agency. Plants shall be spaced as indicated on the Plans or in the Special Provisions. Plants in adjacent rows shall be staggered. Tree and shrub locations shall not conflict with any existing utilities, utility boxes, or other improvements. Plants improperly located shall be replanted by the Contractor in the proper location at no additional cost to the Agency.

Planting shall be performed in accordance with the details shown on the Plans and Standard Drawings. Each plant shall be placed in the planting excavation in an upright position in the center of the hole, and the space around it backfilled with planting mix so that amended soil of a thickness equal to at least half the diameter of the root ball is around the sides of the root ball. Organic matter shall not be placed beneath the plant's root ball. Plants shall be set in the backfill material in flat bottomed holes to such depth that after the soil has settled, the top of the plant ball will be one inch (1") above the bottom of the basin or even with surrounding soil where there is no basin. Plants shall be planted in such a manner that the roots will not be restricted

or distorted. Soil shall not be compacted around the roots or ball of the plant during or after planting operations. The plant shall be set so that the root crown is one-half inch (1/2") or three-quarter-inch (3/4") higher than average surrounding grade. The ground around the plant shall be shaped to drain water away from the root crown or trunk of plant. Any plants that have settled deeper or stand higher than specified shall either be raised back to the required level or replaced, at the option of the Contractor.

After planting operations have been completed, the Contractor shall remove all trash, empty plant containers, tools, and equipment used in this work, and any other marks in the area caused by this work shall be repaired at the Contractor's expense, and the ground left in a neat and orderly condition.

20-4.04.A Preparation for Ground Covers

Areas to be planted with ground cover shall receive fertilizer and soil amendment, uniformly distributed and thoroughly cultivated into the top six inches of soil (6"). The rate of application for fertilizer and soil amendment shall be as shown or specified in the Contract.

The Contractor shall fine grade the planting area so that proper drainage of the entire ground cover is assured.

The Contractor shall avoid any compaction of the soils after treatment, and shall not permit traffic over such areas. In the event of such compaction, the areas shall be recultivated by the Contractor, at the Contractor's expense.

Areas to receive a pre-emergent weed control shall be treated prior to planting as shown in the Plans or specified in the Special Provisions.

Ground covers shall be planted in the prepared soil, which shall be moist and friable, never dry or wet and soggy. The moist condition shall extend to the full depth of cultivation.

Ground cover plants shall be planted in neat, straight rows parallel to the nearest pavement or fence.

The spacing of ground cover plants shall be as shown on the Plans and in the Plant List. Plants shall be planted in neat, evenly spaced rows with staggered triangular spacing. Ground cover shall be planted around shrubs to within one foot (1'), and around trees to within eighteen inches (18"). Ground cover in one (1) gallon containers shall not be planted closer than two feet (2') to curbs, dikes, paved areas, walls, and fences, unless otherwise shown on the Plans or specified in the Special Provisions. Ground cover from flats shall not be planted closer than six inches (6") to curbs, dikes, paved areas, walls, and fences, unless otherwise shown or specified in the Contract.

20-4.04.B Preparation for Trees and Shrubs

Trees, shrubs, and vines in ground cover areas shall be planted before ground cover plants or cuttings are planted. Holes for trees and shrubs shall be excavated by auger unless otherwise indicated on the Plans or specified in the Special Provisions. Before an augured hole is made, the top six inches (6") of soil amendment treated soil shall be removed and stockpiled at one side of hole.

A twelve-inch (12") diameter by ten feet (10') deep tree pit shall be bored prior to planting all trees fifteen (15) gallons or larger, unless otherwise specified in the Special Provisions. Boring shall take place prior to placement of topsoil. Backfill for bored pit shall be excavated bored material. Backfill shall be jetted and settled a minimum of four (4) days prior to planting trees.

When the backfill around the plant is approximately two-thirds (2/3) completed, the plant shall be thoroughly watered, after which the backfill shall be completed to the grade of the surrounding area.

Planting tablets conforming to Section 50-43.02, "Commercial Fertilizer", of these Specifications shall be installed according to the following schedule:

Plant Container Size	Planting Tablets
One gallon	2 tablets, 21 gram
2 or 5 gallon	3 tablets, 21 gram
15 gallon	6 tablets, 21 gram
24-inch box stock or larger	10 tablets, 21 gram

No boxed, balled, or canned trees shall be planted if the rootball is broken or cracked, either before or during the process of planting.

All trees shall be provided with two (2) tree stakes. Tree ties shall be placed in one place just below the main fork or branches. Tree ties shall be nailed or tacked through knot to the tree stake with an appropriate length fastener. Tree stakes shall not be driven into the root ball.

Except in turf areas, each plant shall have a soil berm constructed around it to retain water. The soil berm shall be at least four inches (4") high and shall have a minimum inside diameter of two feet (2') for shrubs and three feet (3') for trees.

Each tree in a turf area shall have the turf removed in a ring around the tree base. For five-(5) gallon trees, the ring shall be twenty-four inches (24") in diameter; for fifteen-(15) gallon and larger trees, the ring shall be thirty inches (30") in diameter.

20-4.04.C Preparation for Turf

All areas to be turfed shall receive fertilizer and soil amendment, uniformly distributed at the following minimum rates per one thousand (1,000) square feet and thoroughly cultivated into the top six inches (6") of soil, unless otherwise specified in the Special Provisions:

Material	Distribution Rate per 1,000 Square Feet
Fertilizer	18 pounds
Soil Amendment	4 cubic yards

After application of fertilizer and preparation of soil has been completed, the areas to be sodded or seeded in lawn shall be brought to a smooth, uncompacted grade.

The Contractor shall fine grade so proper drainage of the entire area is assured. Rocks, soil lumps, and other deleterious materials larger than one inch (1") shall be removed and the area raked smooth.

The Contractor shall avoid any compaction of the soils after treatment, and shall not permit traffic over such areas. In case of such compaction, the areas shall be recultivated by the Contractor, at the Contractor's expense.

The soil on which the turf sod is to be placed shall be moist at the time of planting. The Contractor shall install the turf sod in conformance with the supplier's recommendations.

The sod shall be installed to the smooth finish grade with tight edges and no gaps. Sod pieces shall be placed with ends staggered. Sod shall not be stretched.

After the sod has been placed, it shall be rolled with a roller to ensure no air pockets are between the roots and the soil. Sod shall be watered immediately after installation.

Turf to be seeded shall be sown in prepared soil at the rate of twelve (12) pounds per one thousand (1,000) square feet or as shown on the Plans or specified in the Special Provisions. Seed shall be raked in lightly and rolled.

20-4.05 Watering

Water from facilities within the limits of the project may be obtained free of charge.

Trees, shrubs, and vines shall be watered immediately after planting. Water shall be applied until the backfill soil around and below the roots or ball of earth around the roots of each plant is thoroughly saturated.

Where watering is done with a hose, a water disbursement device or pressure-reducing device shall be used. Under no circumstances shall the full force of the water from the open end of a hose be allowed to fall within the basin around any plant.

Sprinklers shall water ground cover plants in areas provided with an irrigation system. Several consecutive waterings may be necessary to thoroughly saturate the soil around each plant.

Water shall be applied to plants as often and in sufficient amount to keep the plants in a healthy, growing condition during the life of the Contract.

Precautions shall be taken to prevent water from wetting vehicles, pedestrians, and pavement. The Contractor, at the Contractor's expense, shall repair any erosion or slippage of the soil caused by watering.

Compliance with the provisions in this Section does not relieve the Contractor of responsibility for the replacement of plants. The Contractor, at the Contractor's expense, shall furnish any additional watering required to maintain the plants in a growing condition.

20-4.06 Plant Replacement

Plants that show signs of failure to grow at any time during the warranty period, or which have been injured, damaged, vandalized, or stolen as to render them unsuitable for the purpose intended, as determined by the Agency, shall be removed and replaced. Replacement plants shall be furnished and planted by the Contractor at the Contractor's expense. The Contractor and Landscape Architect may agree to the substitution of alternative species of plants to be used as replacements. Any damage to the finish grading caused by replanting operations and/or vandalism shall be repaired and replanted by the Contractor at the Contractor's expense.

Turf damage caused by vandalism or premature use shall be repaired and reseeded before final inspection but will not cause extension of the maintenance period. Turf failure caused by improper maintenance practices and/or weather shall be replanted and the maintenance period extended to thirty (30) Calendar Days after the replanting or as required by the Agency.

Unless otherwise permitted by the Agency, the Contractor shall complete replacement of unsuitable plants within one (1) week after the Agency marks or otherwise indicates that such plants shall be replaced.

20-4.07 Plant Establishment Work

The plant establishment period shall begin after all landscape work has been completed and shall continue until final acceptance of the Work. The number of Calendar Days for the plant establishment period shall be designated in the Special Provisions.

Plant establishment work shall include, but is not limited to, all watering, weeding, fertilizing, cultivation, spraying, cutting, and pruning necessary to keep the plant material in a healthy, growing condition, and to keep the planted areas neat and attractive throughout the plant establishment period. Vines next to walls and fences shall be kept staked and tied.

During the plant establishment period, electric automatic irrigation systems shall be operated in the automatic mode, unless otherwise permitted by the Agency. Plants shall be watered to provide optimum growth conditions. The Contractor shall provide equipment and means for the proper applications of water to planted areas not provided with an irrigation system.

The project site shall be kept free of trash and debris during the plant establishment period.

Commercial fertilizer shall be applied to trees, shrubs, vines, and ground cover areas as specified in the Special Provisions and shall be watered into the soil after each application. The Contractor shall notify the Agency at least forty-eight (48) hours prior to applying each application of commercial fertilizer.

As part of the plant establishment work, five (5) Working Days prior to completion of the plant establishment period instructions shall be given to designated Agency maintenance personnel by a qualified person from the Contractor's personnel on the use and adjustment of the irrigation controllers installed.

During the plant establishment period, trees, shrubs, vines, and ground cover plants, planted as part of the Contract, shall be pruned by the Contractor at the Contractor's expense, as directed by the Agency.

Trees and shrubs shall be watered, cultivated, and sprayed as required to assure a vigorous, thriving condition from day of planting to end of plant establishment period. Weeds shall be removed during this period. During the plant establishment period, the Contractor shall not water between the hours of 7:00 a.m. and 7:00 p.m.

Should the Contractor fail, be neglectful, or negligent in this work, the Agency may elect to perform plant establishment work. The Agency will charge the Contractor the cost for performing the required work by deducting this cost from the payments due the Contractor.

Turf shall be watered, reseeded, edged, weeded, and mowed as required to assure a neat appearance and a healthy and vigorous growth from the day of seeding to the end of plant establishment period. The first mowing shall not be done until the grass is generally at least two inches (2") but less than three inches (3") high. For the first mowing and all subsequent mowing, the mower shall be set to cut at a height of one and one-half inches (1-1/2"). Subsequent mowings, as required, shall be done before the grass is three inches (3") high. Grass clippings for all mowings shall not be allowed to lie after mowing. A catcher shall be used on the mower, and grass clippings shall be removed and discarded off site. Immediately following the first mowing of the turf, turf areas shall be fertilized at the rate of eight (8) lbs. per one thousand (1,000) square feet or as otherwise specified in the Special Provisions. Reapplication of fertilizer shall take place as directed by the Agency during the plant establishment period.

Just prior to the end of the plant establishment period, the Contractor shall cut all grass, weed all planting areas, and leave the work area in a neat and attractive condition. Prior to final inspection, all trash and debris shall be removed and disposed of off site.

At the end of the plant establishment period, all plant material shall be in a healthy, growing condition.

The Contractor shall guarantee a weed free, even stand of the lawn grass, with ninety-five percent (95%) coverage, of the varieties specified. If such stand does not develop as a result of the first seeding, the Contractor shall reseed and care for thin spots until an even stand with ninety-five percent (95%) coverage is produced.

Weed control herbicides, in addition to that which is specifically required elsewhere, may be applied to planted areas at no expense to the Agency, if the Contractor deems it necessary. The type of herbicide to be used and method of application shall be approved by the Agency.

Following the plant establishment period, the Contractor shall provide a warranty that guarantees all trees for one (1) year from date of Final Acceptance. The Contractor shall replace any tree that dies during the warranty period and the replacement shall be the same size container as originally designated on the Plans.

20-4.08 Inspection for Plant Establishment Work

Upon completion of the planting work and irrigation installation, the Contractor shall notify the Agency that the project is ready for maintenance. The Agency will then schedule a pre-maintenance walk-through inspection and will notify the Contractor and the Landscape Architect of the time and date. Upon inspection, if the Agency and the Landscape Architect find the irrigation, turf, and planting work complete and in compliance with the Contract, the Agency will authorize the start of the plant establishment period. Written notice will be given to the Contractor by the Agency as to the starting date of the plant establishment period.

20-4.09 Measurement and Payment

Planting work will be paid for at a single lump sum price or at unit prices for separate items of planting work, as designated in the Contract. Full compensation for providing planting work is included in the prices paid for the various items and no additional compensation will be paid.

20-5 IRRIGATION SYSTEMS

Irrigation system materials shall be as specified in Section 50-43, "Landscaping Materials" of these Specifications.

20-5.01 Maintain Existing Water Supply

The Contractor shall notify the Agency and the property owner, manager, or tenant at least forty-eight (48) hours prior to shutting off the water supply to any portion of an existing irrigation system. The Agency and the property owner, manager, or tenant shall also be notified when the water supply is returned to said portion of the irrigation system.

Where work is performed on an existing irrigation system, the system shall be checked by the Contractor for proper operation after the work is completed and any malfunctions resulting from the Contractor's operations shall be corrected at the Contractor's expense. If the work will interrupt the water supply for more than twenty-four (24) hours, the Contractor shall water existing landscaping, including that being maintained by Agency landscape maintenance forces, in the area irrigated from that water supply as often as necessary to maintain healthy plant growth. The watering will be at the Contractor's expense. At the option of the Contractor, temporary connections to an operational existing irrigation system may be made as approved by the Agency until the interrupted water supply has been restored.

20-5.02 Remove Existing Plants for Trenching

Where trenching for new irrigation facilities is performed in areas planted with existing trees or shrubs, the trenching alignment shall be adjusted as necessary to avoid damage to such trees or shrubs and their root systems.

Where trenching for new irrigation facilities is performed in existing ground cover or turf, sufficient plant material shall be removed to permit the proper installation of such facilities, but in no case shall the removal width exceed five feet (5'). All turf repair or ground cover replacement planting shall be performed before the start of the plant establishment period, or at least fourteen (14) Calendar Days prior to the acceptance of the Contract if there is no plant establishment period.

20-5.03 Electrical Service for Electric Automatic Irrigation Systems

Electrical service for electric automatic irrigation systems shall conform to Section 49, "Signals, Lighting and Electrical Systems", of these Specifications and Standard Drawing 5-8, "Signal, Lighting and Electrical Systems Metered Service Can", of the County Improvement Standards.

20-5.03.A Components

Electrical components for electric automatic irrigation systems shall include irrigation controllers with weatherproof enclosures; remote control valves; valve boxes; pull boxes; conductors between controllers, pumps and valves; moisture sensors; rain switches; and all appurtenances, incidentals, and accessories required for proper installation and operation of the electrical portions of such systems.

Electrical components requiring modifications to conform to the specified requirements shall have such modifications made by the manufacturer before shipment to the project. Components shall also include the electric service pedestal for the irrigation controller.

20-5.03.B Controllers

Controllers shall conform to Section 50-43.20, "Automatic Irrigation Controllers", of these Specifications and shall be installed in accordance with Standard Drawing L-17.

Controllers shall be the type and model specified in the Plans and Special Provisions.

All wiring to and from the controller shall be through color-coded plugs and sockets.

All controller locations are essentially diagrammatic and shall be specifically located by the owner, or his representative.

Remote control valves shall be connected to the controller as shown on the Plans, unless otherwise directed by the Agency.

A complete maintenance and operations manual for each type of controller installed shall be submitted to the Agency.

The controller housing enclosure shall house the irrigation controller and moisture sensor control panel (if specified) and shall be installed according to the Standard Drawings.

20-5.03.C Control Wire, Electrical Conduit and Pull Boxes

Control wire shall conform to Section 50-43.33, "Irrigation Control Wires", of these Specifications. Pull boxes shall conform to Section 50-43.34, "Pull Boxes", of these Specifications.

Where control wires are installed in the same trench or opening as irrigation pipe, such control wires shall be placed at the same depth or below the pipe.

Sharp bends or kinks in the control wires will not be permitted. Control wires shall be unreeled in place alongside or in the trench and shall be carefully placed along the bottom of the trench and installed in conduit when under pavement. Under no condition shall the cable be unreeled and pulled into the trench from one end.

Not less than one foot (1') of cable slack shall be left on each side of all splices at all points where cable is connected to field equipment. The slack cable shall be placed in the trench in a series of "S" curves.

Conductors shall be run continuous without splices from controller enclosure to the valve boxes. Splices shall be made only in pull boxes or valve boxes. Splices shall be clamped and sealed with waterproof connectors. When splices are necessary, the wire color shall not change along the wire run. Conductors from controllers to valves shall be wrapped together with electrical tape at ten-foot (10') intervals. An eighteen-inch (18") wire loop shall be provided at each valve.

Pullboxes shall be installed at the following locations:

1. At all control wire splices, except splices made in valve boxes.
2. At intervals not to exceed two hundred fifty feet (250') along any low voltage, neutral and control wire runs. Valve boxes installed along a control wire run shall not be considered as pull boxes in determining the spacing.
3. Within five feet (5') of irrigation controllers or within five feet (5') of cabinets housing one (1) or more controllers.
4. At ends of electrical conduits.
5. At other locations shown on the Plans.

When approved by the Agency, the Contractor may install additional pull boxes to facilitate the work. Additional pull boxes installed for the Contractor's convenience will be at the Contractor's expense.

The tops of all pull boxes shall be flush with the surrounding finished grade.

20-5.03.D Testing

Field tests shall be performed by the Contractor to demonstrate that electrical components of the irrigation systems function as specified and the system is operational.

A field test shall be satisfactorily completed prior to the start of planting, the plant establishment period, and Final Acceptance, unless otherwise authorized by the Agency. Field

test shall be done to determine that all sprinklers function according to manufacturer's data. The Contractor shall replace any sprinklers/emitters not functioning as specified; otherwise correct system to provide satisfactory performance and retest.

The controller shall be tested in the automatic, semi-automatic, and manual operation modes.

20-5.04 Installation

20-5.04.A General

Foreign material shall be prevented from entering the irrigation system during installation. Immediately prior to assembling, all pipes, valves, and fittings shall be cleaned. All unattached ends of pipe, fittings, and valves shall be plugged or capped pending attachment of additional pipe or fittings. All lines shall be thoroughly flushed out prior to attachment of sprinklers, emitters, and other terminal fittings. Repair of irrigation systems shall be made within one (1) Calendar Day after a malfunction or damage to any portion of the system has occurred, unless otherwise directed by the Agency.

The system shall completely, efficiently and evenly irrigate all areas, and shall be left ready for operation to the satisfaction of the Agency.

The Contractor shall install the specified pipe, valves fittings, wiring, switches, controls and appurtenances at the locations shown on the Plans. The irrigation system as shown on the Plans, except for sprinkler locations, is diagrammatic. The Agency will, or direct the Contractor to, determine specific locations.

The Contractor shall provide, at the work site, temporary facilities required for the safe and proper storage of materials, tools, etc. These facilities shall be constructed only in locations approved by the Agency or as designated on the Plans, and must not interfere with the work of any other contractor. At such times as the Contractor's facilities interfere with the proper installation and completion of the Work, they shall be removed by the Contractor, at the Contractor's expense, within three (3) Calendar Days after having been notified by the Agency that such removal is necessary.

20-5.04.B Irrigation Sleeving

Sleeving for water line crossovers and sprinkler control crossovers shall conform to Section 50-43.18, "Irrigation Sleeving Conduit", of these Specifications.

Control wire, water supply line or lateral line pipe crossovers shall be installed in conduits or as shown on the Plans. After completing conduit backfill and prior to performing the pressure test on a water line crossover, the Contractor shall demonstrate that the water line crossover can be moved longitudinally within the conduit. Where water line crossovers are installed for future use, the ends of such crossovers shall be capped immediately after testing. Conduits shall extend twelve inches (12") beyond edge of paving unless otherwise noted on the Plans.

The location of each conduit shall be designated by cementing a Type A pavement marker to the paved shoulder near each end and over the centerline of the conduit using a standard set type adhesive. Type A pavement markers and adhesive shall conform to the provisions in Section 85, "Pavement Markers", of the State Specifications and shall not conflict with existing markers within the project site.

20-5.04.C Water Line Crossovers

Water line crossovers are supply line or lateral line pipes installed in conduits.

Water line crossovers shall be polyvinyl chloride (PVC) plastic pipe, Class 315 or Schedule 40, with a minimum pressure rating of three hundred fifteen (315) pounds per square inch, and shall be sized as shown or specified in the Contract .

After completing conduit backfill and prior to performing the pressure test on a water line crossover, the Contractor shall demonstrate that the water line crossover can be moved

longitudinally within the conduit. The water line crossover shall then be positioned to extend at least one (1) foot beyond each end of the conduit.

Where water line crossovers are installed for future use, the ends of such crossovers shall be capped immediately after testing.

20-5.04.D Trenching and Backfilling

Trenching and backfilling shall be in accordance with Standard Drawing L-18. Trenches shall be excavated only as far in advance of pipe laying as is permitted by the Agency. Excavated material shall be piled in a manner that will not endanger the Work and will avoid obstructing sidewalks and driveways. Open trenches and piles of dirt shall be marked and lighted as to provide safety to all pedestrians and to vehicular traffic.

Rock, pavement, and other debris encountered during trenching operation shall be removed and disposed of outside of the project limits at the Contractor's expense. The size and quantity of material to be disposed of will be determined by the Agency.

Trenches for plastic pipe shall be smooth and free of jagged rubble or sharp objects which will cause bending stress and uneven weight distribution to pipes, conduits and conductors during backfilling operations. Trenches for solvent-cemented plastic pipe supply lines shall be of sufficient width to permit snaking of the pipe. Other trenches shall not be excavated wider than necessary for the proper installation of pipe supply lines.

Except as otherwise specified in this Section, backfill material shall be material excavated from the trenches, compacted by an Agency-approved method other than ponding or jetting with water until the backfill material, after settlement, is level with the surrounding soil. When any backfilled area has settled excessively, said area shall be refilled and compacted by the Contractor at the Contractor's expense, including furnishing, placing, and compacting the fill material.

Trenches for pipe and electrical conductors may be excavated manually or with mechanical trenching equipment. Trenching equipment shall be essentially vertical so that a minimum of surface is disturbed. Blades of road graders shall not be used to excavate trenches. Trenches for pipe shall be excavated to the depths shown on the Plans.

Pipe shall have a firm, uniform bearing for the entire length of each pipe line. Wedging or blocking of pipe will not be permitted.

Trenches shall not be excessively wet and shall not contain pools of water during backfilling operations.

Extreme care shall be exercised by the Contractor while backfilling. Any materials or equipment damaged while backfilling shall be repaired or replaced by the Contractor as directed by the Agency, at no cost to the Agency.

Rock saw trenching within asphalt pavement shall be repaired in accordance with Section 14, "Restoration of Surfaces", of these Specifications.

20-5.05 Pipe

Plastic pipe supply lines, plastic pipe irrigation lines, and fittings shall be installed in accordance with the pipe and fitting manufacturers' printed instructions and these Specifications.

PVC pipe one and one-half inches (1-1/2") or less in diameter shall be cut with "PVC cutters", not by sawing. Pipe greater than one and one-half inches (1-1/2") in diameter shall be cut with a fine-toothed hacksaw and any burrs shall be removed. All pipe shall be cut straight and true.

The outside surface of the pipe and the inside surface of the fittings shall be wiped with a clean cloth to remove all dirt and moisture before the solvent cement solution is applied. Solvent cement welding shall be done in accordance with the printed instructions of the solvent manufacturer.

The male portion of each threaded plastic pipe and fitting connection shall be wrapped with at least two (2) layers of approved pipe thread sealant tape. Pipe from the service connection through a backflow preventer assembly to plastic pipe supply lines shall be copper, bronze, or as shown on the Plans, and shall be wrapped with six (6) mil plastic tape.

Plastic pipe supply lines shall be installed not less than twenty-four inches (24") below the finished grade, measured from the top of pipe, unless otherwise shown or specified in the Contract.

Valves and fittings shall be designed for and shall meet the requirements for service at an operating pressure of one hundred fifty pounds per square inch (150 psi), unless otherwise specified.

Valves and fittings shall have connections compatible with the type of pipe joint selected by the Contractor. If mechanical joints or slip-type joints are used, the Contractor shall furnish and install necessary portland cement concrete thrust blocks as specified by the Agency.

Guarantee shall cover workmanship of materials from the plastic pipe manufacturer for all plastic pipe and fittings. Main irrigation lines shall be Schedule 40 for lines one and one-half inches (1-1/2") and smaller and Class 315 PVC for lines two inches (2") and larger. Lateral irrigation lines shall be Class 200 PVC. PVC pipe shall conform to CS 256 and ASTM Designation: D 2241.

Pipe fittings shall be of the same material as pipe where applicable and recommended by the pipe manufacturer for the particular type of pipe to which they are to be connected, and shall conform to the following specifications.

All slip-joint PVC fittings shall be Schedule 40. All Schedule 40 PVC couplings four inches (4") in diameter or larger shall be a minimum of seven inches (7") in length.

The Contractor shall use only the solvent supplied and recommended by the manufacturer to attach PVC pipe and pipe joints. The pipe and fittings shall be thoroughly cleaned of dirt, dust, and moisture before applying solvent.

The Contractor shall make solvent weld joints with nonsynthetic bristle brush in the following sequence:

1. Apply a liberal, even coat of purple PVC primer to the pipe and fitting immediately before applying the solvent.
2. Apply a liberal even coat of solvent to the inside of the fitting and then to the outside of the pipe, making sure that the coated area is equal to the depth of the fitting socket.
3. Insert the pipe quickly into the fitting and turn the pipe approximately one-quarter (1/4) turn to distribute the solvent and remove air bubbles. Hold the joint for approximately fifteen (15) seconds so the fitting does not push off the pipe.
4. Use a clean rag and wipe off all excess solvent.
5. To prevent disturbing the last completed joint, the pipe shall not be twisted when making subsequent joints.

Allow at least fifteen (15) minutes setup time for each welded joint before moving.

On plastic to steel connections, the Contractor shall work the steel connections first. For all PVC threaded connections use thread sealing paste with virgin Teflon. In no event shall an oil base joint compound be used on a PVC joint.

The Contractor shall exercise care in handling, loading, unloading, and storing plastic pipe and fittings. All plastic pipe and fittings shall be stored under cover before using, and shall be transported in a vehicle that can support the entire length of pipe. The Agency will inspect all pipe before it is laid and will reject any section that is damaged or is found to be defective to a degree which will materially affect function and service of pipe. Any section of pipe that has been bent, dented, or damaged shall be discarded until said section of pipe is cut out and rejoined with a coupling.

The Contractor shall install the pipe to line and grade, as staked by the Agency. The Contractor's facilities for lowering the pipe into the trench shall be such that neither the pipe nor the trench will be damaged.

All pipes shall be assembled free from dirt, pipe scale, and burrs. Each section of lateral pipe shall be flushed out before sprinkler heads or emitters are attached.

Plastic pipe shall not be laid when there is water in the trench.

20-5.05.A Subsurface Dripperline

Subsurface dripperline shall conform to Section 50-43.17, "Subsurface Dripperline", of these Specifications and shall be installed in accordance with Standard Drawings L-13, L-14, and L-15.

Dripperlines shall be installed four inches (4") below finish grade unless otherwise specified on the Plans or in the Special Provisions. Dripperlines shall be installed at the spacing distance specified on the Plans or in the Special Provisions. Install dripperlines with orifices facing down and as shown on the Plans.

Dripperlines shall be installed using barbed fittings only. Subsurface dripperline systems shall be installed with flush valves and air vacuum relief valves.

20-5.05.B Valves and Valve Boxes

Irrigation control valves and valve boxes shall be of the type shown on the Plans or specified in the Special Provisions and shall conform to Sections 50-43.22, "Control Valves," and 50-43.24, "Valve Boxes", of these Specifications. Irrigation control valves shall be installed in accordance with Standard Drawings L-3 and L-4.

The Contractor shall provide and install valves as shown on the Plans and as required for the proper control of the piping systems in which they are incorporated. Main shut-off valves shall be gate valves.

Where a remote control valve is shown on the Plans as located at the edge of turf and shrub areas, it shall be placed in the shrub area.

Valves shall be placed in groupings for ease of maintenance.

Valve boxes that contain remote control valves shall be identified on the top surface of the valve box covers by the appropriate letters and numbers for controller and station numbers as shown on the Plans.

Valve boxes shall be identified by labels attached to the covers that contain the appropriate abbreviations. Remote control valves shall be labeled with the controller station. Quick coupling valves shall be labeled "QCV." Gate valves shall be labeled "GV." Labels for valve boxes shall consist of engraved letters and numbers on a two-layer white over black, exterior-sign-plate plastic. The dimensions of the labels shall be a minimum of two inches by three inches by one-eighth inch thick (2" x 3" x 1/8" thick). The letters and numbers shall be a minimum of one and one-eighth inches (1-1/8") in height. Labels shall be attached to the valve box covers with commercial quality brass or stainless steel machine screws, nuts, and washers.

Valve boxes shall be provided with valve box extensions when required.

20-5.05.C Quick Coupling Valve

Quick coupling valves shall conform to Section 50-43.21, "Quick Coupling Valves", of these Specifications and shall be installed in accordance with Standard Drawing L-5. Quick coupling valves shall be installed with Sch. 80 PVC fittings and swing joint assemblies.

Valve box for the quick coupling valve shall be ten-inch (10") diameter and installed two inches (2") above finished grade.

20-5.05.D Backflow Preventers

Backflow preventers shall conform to Section 50-43.25, "Backflow Preventers", of these Specifications and shall be installed in accordance with Standard Drawing 8-8A or 8-8B, unless otherwise specified. Backflow preventer assemblies shall consist of backflow preventer, wye

strainer, gate valves, pipe fittings, portland cement concrete supports, and portland cement concrete pad for the assembly, and shall conform to the details shown on the Plans, these Specifications, and the Special Provisions. Components of the backflow preventer assembly shall be of the type shown on the Plans or specified in the Special Provisions and shall conform to Section 50-43.25, "Backflow Preventers", of these Specifications. Backflow preventer assemblies shall be from the approved list issued by the Sacramento County Environmental Health Division.

Installation of backflow preventer assemblies shall conform to Agency codes and ordinances regarding cross connection control installation, shall be UL listed and approved by the Research Foundation for Cross Connection Control, University of Southern California. Special attention shall be given to the minimum and maximum heights of assemblies.

The bottom of backflow preventers shall be installed twelve inches (12") above finished grade or concrete pad. Exposed top surfaces of concrete foundations and pads shall have a medium broom-finish applied parallel to the long dimension of foundations and pads. Backflow preventer assembly shall be tested by a certified backflow device tester prior to initial usage and operation of the system.

Backflow preventer installations shall include a backflow device protection blanket.

20-5.05.E Master Valve/Flow Meter Assembly

Assembly shall conform to Section 50-43.23, "Master Control Valve/Flow Sensor Assembly", of these Specifications and be installed in accordance with Standard Drawing L-6. Assembly shall be installed after the water meter and the backflow preventer at the irrigation point of connection. Assembly shall be as shown or specified in the Contract, and shall conform to Section 50-43.23, "Master Control Valve/Flow Sensor Assembly", of these Specifications.

Installation shall include providing five (5) #14 control wires, unless otherwise specified, from the master valve/flow meter assembly to the irrigation controller. Wiring shall include a hot and a common conductor for both the master valve and the flow meter and one (1) spare conductor.

20-5.05.F Air Vacuum Relief Valve

Air vacuum relief valve shall conform to Section 50-43.30, "Air Vacuum Relief Valve", of these Specifications and shall be installed in accordance with Standard Drawing L-8.

Air vacuum relief valve shall be installed in-line with a subsurface dripperline at the highest point of the system. Valve box for the air vacuum relief valve shall be ten inches (10") diameter with a two-inch (2") layer of pea gravel and installed two inches (2") above finished grade.

20-5.05.G Flush Valve

Flush valve shall conform to Section 50-43.31, "Flush Valve Assembly", of these Specifications and shall be installed in accordance with Standard Drawing L-7.

Flush valve shall be installed at the end of a subsurface dripperline system as shown on the Plans. Valve box for the flush valve shall be ten inch (10") diameter with a two-inch (2") layer of pea gravel and installed two inches (2") above finished grade.

Installation shall include providing a plastic ball valve before the flush valve with an eighteen-inch (18") minimum length of flexible hosing or blank dripperline for the purpose of periodic system maintenance.

20-5.05.H Sprinklers and Emitters

Sprinklers and emitters shall conform to Section 50-43.19, "Sprinklers and Emitters", of these Specifications and shall be installed in accordance with Standard Drawings L-9, L-10, L-11, and L-12.

20-5.05.I Pressure Testing

Except for nonrigid pipelines and lateral irrigation lines, pressure testing for leakage shall be performed on all supply lines installed by the Contractor. Pipelines shall be tested in place and all open ends of the pipeline and fittings shall be plugged or capped prior to testing.

The Contractor shall notify the Agency at least twenty-four (24) hours prior to performing any pressure test. Pressure tests shall be performed only between the hours of 8:00 a.m. and 5:00 p.m. except that no pressure tests shall be made on Saturdays, Sundays, or legal holidays, unless otherwise approved in writing by the Agency. Each pressure test shall be observed by the Agency.

Pipelines to be tested shall be filled with water, and a pressure gauge shall be connected to the pipeline. The pipe shall then be placed under a pressure of one hundred twenty-five pounds per square inch (125 psi) (except as otherwise specified below) by air or water pressure, after which the source of pressure shall be cut off, leaving the line under the required pressure.

The pressure gauge shall be calibrated from zero (0) to two hundred (200) pounds per square inch (psi) in five-(5-) pound increments and shall be accurate within a tolerance of two (2) pounds.

The Contractor shall provide the necessary pump and equipment required for this test.

The pipeline shall be tested under the required pressure for a period of one (1) hour. The pressure gauge shall remain in place until each test period has been completed. Leaks that develop in the tested portion of the system shall be located and repaired after each test period when a drop of more than two (2) pounds is indicated by the pressure gauge when testing pipe over one hundred feet (100') in length. There shall be no pressure drop permitted when testing pipe from one foot (1') to one hundred feet (100') in length. After such leaks have been repaired, the one- (1) hour pressure test shall be repeated and additional repairs made until there is no drop in pressure for pipe lengths up to one hundred feet (100'), or the drop in pressure is two pounds per square inch (2 psi) or less for pipe lengths over one hundred feet (100'). If testing by means of water pressure, air shall be expelled from the pipe prior to testing.

Tests on pressure lines shall be completed prior to backfilling; however, sufficient backfill shall be placed in trenches between fittings to insure the stability of the line under pressure. In all cases, fittings and couplings must be open to visual inspection for the full period of the test.

No testing shall be done until the last solvent welded joint has had twenty-four (24) hours to cure.

Where any section of the pipe system is provided with a concrete thrust block, the test shall not be made until at least five (5) Calendar Days have passed after the concrete thrust block was installed. If higher early-strength cement is used in the concrete thrust block, the test shall not be made until at least two (2) Calendar Days have elapsed.

Contractor shall disinfect potable water lines according to AWWA standards.

20-5.05.J Repairs and Coverage

All leaks that develop and all defective material in any portion of the irrigation system installed by the Contractor shall be repaired or replaced by the Contractor.

The entire system shall be checked and, if necessary, adjusted for uniform and complete coverage after installing the sprinklers. All emitters shall be checked for proper operation and, if necessary, cleaned and replaced.

The risers for sprinklers on slopes shall be set approximately perpendicular to the slope. Each series of sprinklers shall be installed and test operated. Nozzles of all sprinklers and bubblers shall be adjusted for proper rate of flow and coverage. Sprinklers and/or bubblers shall be relocated as required to produce uniform coverage.

Any revision of the proposed irrigation systems ordered by the Agency and necessary to achieve complete and adequate coverage and operation of the system, which is not within the

scope of work, shall be paid for as extra work as provided in Section 9, "Changes and Claims", of these Specifications.

20-5.06 Measurement and Payment

Except as otherwise provided in these Specifications or the Special Provisions, full compensation for conforming to the requirements in this Section (Section 20) is included in the prices paid for the various items of work and no additional compensation will be paid.

20-6 RECORD DRAWINGS AND CONTROLLER CHARTS

The Contractor shall maintain record drawings and controller drawings in conformance with the requirements in Section 11, "Preconstruction Photographs and Record Drawings", of these Specifications and this Section (Section 20).

Prior to the final inspection, the Contractor shall submit to the Agency, for review and comment by the Landscape Architect, one (1) set of Record Drawings. The work will not be formally accepted until the Record Drawings are accepted by the Landscape Architect. Upon approval by the Landscape Architect, these records shall be delivered to the Agency, in reproducible form, and in good and acceptable condition prior to final acceptance of the Work.

The Contractor shall provide two (2) reduced (original 11" x 17") charts for each controller. One copy shall be placed on the inside of the controller enclosure door. The second copy shall be provided to Agency maintenance personnel. Record Drawings shall be approved by the Landscape Architect prior to preparing the charts.

Each controller chart shall show the as-built condition of the area controlled by the automatic controller. All symbols shall be readable at the final reduced size. The controller chart shall include:

1. Connections to existing water lines.
2. Routing of pressure lines.
3. Routing of control valves.
4. Locations of remote control valves, gate valves, and quick coupling valves.
5. Other items as directed by the Agency.

The chart shall be a black line or blue line print and shall be colored or otherwise coded to indicate the area of coverage for each station.

When completed and approved, the chart shall be hermetically sealed between two (2) pieces of 10 mil plastic, minimum.

Each chart shall be completed and approved prior to final inspection of the irrigation system.