SECTION 16

CLEARING AND GRUBBING

Clearing and grubbing shall conform to Section 16 of the Caltrans Standard Specifications and these City Standard Specifications.

16-1.01 Description. - Areas subject to the provisions of this section shall include any portions of the project site identified in the project plans or special provisions to be cleared and grubbed. This work shall include, but not be restricted to, removal of structures, trees, stumps, logs, brush, other vegetation, debris and rubbish of any nature. This work shall also consist of protecting and maintaining existing trees not to be removed from the project site.

16-1.03 Construction. - Within the limits of clearing, all objectional material including masonry and concrete rubble shall be removed 3 feet below the existing ground surface or 6 feet below finished grade, whichever is deeper.

Tree branches extending over the roadway within 13.5 feet of the finished grade shall be cut off close to the trunk by a reputable arborist or tree surgeon.

16-1.04 Removal and Disposal of Materials. - All materials removed shall be disposed of at locations outside the project site unless otherwise shown on the plans or specified in the special provisions. The Contractor shall make his own arrangements for disposal and shall pay all costs involved.

Combustible material, including chips, shall be disposed of as directed by the Engineer.

16-1.06 Payment. - The price paid for clearing and grubbing shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals required for maintenance and protection of existing trees as specified in this section.

SECTION 17

WATERING

Watering shall conform to Section 17 of the Caltrans Standard Specifications and these City Standard Specifications.

17-1.01 Description. - This work shall also consist of: (1) application and payment of fees for drawing water through meters from fire hydrants and (2) constructing or installing portable tank reservoirs and installing pumping plants and pipeline systems.

Any system chosen by the Contractor shall be adequate for the supply of water for periods of maximum demand and shall be in operation for the life of the project.

Water used for whatever purpose in construction shall be considered as included in the prices paid for the various items of work involved and no additional compensation will be allowed therefor.

17-1.02A Application. - The application of water shall be under the control of the Engineer at all times.

At the option of the Contractor, excavation areas and borrow sources may be watered prior to excavating the material.

17-1.03 Materials. - Water, wetting agents, and chemical additives shall conform to the following:

(a) **Water.** - Water used for whatever purpose in construction shall be free from oils, heavy concentrations of salts, minerals, or other deleterious substances.

(b) **Wetting Agents.** - Type of material shall be as specified in the special provisions or on the project plans. In any case, the chemical additive to be used as a wetting agent shall be capable of readily mixing with water and of distributing moisture evenly in soil, leaving no dry pockets or voids.

The wetting agent shall be a non-ionic, non-organic, non-detergent, non-toxic, non-flammable liquid having a neutral pH which, when applied to soils shall not be harmful to vegetation.

The proportion of wetting agent to water shall be as recommended by manufacturer unless otherwise directed by the Engineer.

The manufacturer shall establish the necessary quality control and inspection practice to assure compliance with these specifications. The Contractor shall furnish a certificate of compliance, in accordance with the requirements of Section 6-1.07, "Certificate of Compliance", that the product furnished complies with the requirements of these specifications.

17-1.04 Payment. - Delete Section 17-1.04 of the Caltrans Standard Specifications.

SECTION 18

DUST PALLIATIVE

Dust palliative shall conform to Section 18 of the Caltrans Standard Specifications.

SECTION 19

EARTHWORK

19-1 GENERAL

Earthwork shall conform to Section 19 of the Caltrans Standard Specifications and these City Standard Specifications.

19-1.01 Description. - Earthwork for drainage and sewer facilities is specified in Section 1301 of these City Standard Specifications. Subgrade preparation shall conform to Section 21 of these City Standard Specifications. Delete all subgrade preparation provisions in Section 19 of the Caltrans Standard Specifications.

Earthwork shall include all excavation, compaction, and other earthwork performed on the project site, as indicated in the plans or special provisions. In general, references to the "roadway prism" or "roadway facilities" or "roadway" or "highway" shall be construed as references to the project or project site, as applicable and except as otherwise indicated in these specifications.

19-2 ROADWAY EXCAVATION

19-2.01 Description. - This work shall conform to Section 19-2 of the Caltrans Standard Specifications, except that all references to "roadway" shall be construed as references to roadways and other pavement facilities.

Excavation shall be performed as indicated on the plans to the lines, grades, and elevations shown. All deleterious materials encountered within the limits indicated shall be removed and disposed of.

The rough excavation shall be carried to a depth necessary to allow for compacting the basement material to the requirements as specified and to the planned cross section of the grading plane.

The Contractor may use any type of earth-moving equipment or any type of compaction equipment, provided the equipment is in satisfactory condition and is capable of performing the work within the time schedule of the project.

During the process of excavation, the grade shall be maintained so that it will be well drained at all times. When so directed, Contractor shall install temporary drains and drainage ditches to intercept or divert surface water which may affect the work.

19-2.05 Slopes. - When completed, slopes and shoulders shall present a neat and uniform appearance.

19-2.07 Selected Material. - Topsoil excavated within the limits of the project shall be stockpiled for use in areas to be planted or landscaped, and shall not be used for any other purpose until no further topsoil is required for landscape purposes. Any remaining topsoil may then be used as specified for selected material.

Selected material designated for use as backfill for areas to be landscaped shall conform to Section 20-2.01, "Soil," except the soil need not be surface soil.

19-3 STRUCTURE EXCAVATION AND BACKFILL

19-3.01 Description. - Trenches or foundation pits for structures or structure footings shall be excavated to the lines and grades or elevations shown on the plans or as staked by the Engineer. Trenches or pits shall be of sufficient size to permit the placing of structures or structure footing of the width and length shown on the plans. Any elevation, as shown on the plans, of the bottoms of footings shall be considered as approximate only and the Engineer may order in writing such changes in dimensions or elevations of footings as may be necessary to secure a satisfactory foundation.

19-3.03 Cofferdams. - Cofferdams shall be used whenever water-bearing strata are encountered above the elevation of the bottom of the excavation.

Cross struts or bracing used in cofferdam construction which extend through foundation concrete both above and below low water shall be removed upon completion of footing pouring or when cofferdam is no longer necessary, and the resulting space filled with concrete of the same mix as that specified for the surrounding concrete.

19-3.04 Water Control and Foundation Treatment. - All loose and displaced material resulting from the driving of piles shall be removed.

19-3.06 Structure Backfill. - Material for structure backfill shall be soil selected from structural excavation insofar as such material is readily compactible and conforms to the requirements of this section.

Structure backfill shall be free from stones and lumps exceeding 3 inches in greatest dimension, vegetable matter, or other unsatisfactory material. If satisfactory material for use as structure backfill cannot be obtained from excavation, suitable imported material, approved by the Engineer, shall be furnished by the Contractor, at his expense.

Material from excavation that is determined by the Engineer to be unsuitable for use as backfill shall be disposed of.

19-3.065 Pervious Backfill Material. - Sieve analysis of mineral aggregate to be used as pervious backfill will be tested in accordance with California Test 202.

That portion of pervious backfill material passing the No. 4 sieve shall have a sand equivalent of not less than 60, as determined in accordance with California Test 217.

Filter material for wall drain outlets shall consist of burlap sacks, each containing approximately one cubic foot of specified material. One sack shall be placed behind each wall drain outlet, along with the pervious material backfill.

19-3.066 Permeable Backfill Material. - Where shown on the plans, areas to receive permeable material blankets shall be graded to the lines and grades as shown on the plans.

Minimum durability index shall be 40, when tested in accordance with California Test No. 229. Minimum Sand Equivalent of permeable materials shall be 75 when tested in accordance with California Test 217. Original has no test value.

19-5 COMPACTION

19-5.02 General. - For areas greater than 100 square feet on fill, the provisions of Section 19-6, "Embankment Construction," shall apply. In addition to the density required, the subgrade shall be stable and unyielding.

Any portion of the area which is not accessible to standard compacting equipment shall be compacted to the required density by approved mechanical tamper.

All irregularities or depressions that develop under compacting or rolling equipment shall be corrected by adding, removing, or replacing material until the surface is smooth, uniform and unyielding.

All soft and yielding material and material which will not compact readily when rolled or tamped shall be removed as directed by the Engineer and replaced with suitable material.

19-5.03 Relative Compaction (95 Percent). - On areas to be paved, the finished subgrade (basement grade) shall be compacted to a density of not less than 95 percent for a depth of 0.5 foot in accordance with California Test No. 231.

The required relative compaction for paved areas of 95 percent to a minimum depth of 2.5 feet below finished grade applies to embankment fills in excess of 3 feet from the original ground surface. For embankment fills less than 3 feet in height, the relative compaction of not less than 95 percent shall be obtained for the complete depth of the embankment, including 0.5 foot below the original ground surface.

All embankment lifts not otherwise specified in this Section, and composed of noncohesive (granular) soils, shall have a relative compaction of not less than 95 percent.

19-5.04 Relative Compaction (90 Percent). - If a portion of an area to be paved is on a local filled area, the material shall be compacted to a density of 90 percent to within 0.5 foot of the subgrade and 95 percent thereafter to finished subgrade.

19-5.05 Foundation Preparation. - No payment will be made for suitable materials removed, manipulated, and replaced in order to obtain density. Any removal, manipulation, aeration, replacement, or recompaction of suitable materials necessary to obtain the required density shall be considered as incidental to the excavation.

19-6 EMBANKMENT CONSTRUCTION

19-6.01 Placing. - Before placing fill material upon any area, clearing and grubbing shall have been accomplished in accordance with the provisions of Section 16, "Clearing and Grubbing." All depressions or holes below the ground surface, whether caused by grubbing or otherwise, shall be backfilled with suitable material and compacted prior to the construction of embankments. Objectionable material shall not be allowed in or under the embankment.

The entire area upon which the embankment is to be placed shall be scarified, plowed, or broken up in such manner that the fill material will blend with the existing surface. Any objectionable material that would cause interference with the compaction of the fill shall be removed and disposed of.

When embankments are to be constructed upon an existing paved surface, the pavement shall be scarified to its full depth and broken up so that no piece larger than 1 foot in greatest dimension shall remain. The broken pieces shall be thoroughly mixed with fill material so that no pockets of broken pavement exist.

The loose thickness of each layer of embankment fill material shall not exceed 0.67 foot for the full width of cross section.

Clods or hard lumps of earth over 0.5 foot in greatest dimension shall be broken up before compacting the embankment material, except as otherwise provided in Section 19-6.01 of the Caltrans Standard Specifications.

When embankment construction requires cutting a minimum 6-foot horizontal bench into existing slopes, as specified in Section 19-6.01 of the Caltrans Standard Specifications, a new bench shall be started where the vertical cut for the next lower bench intersects the existing ground.

19-6.025 Settlement Period. - Any embankment for which a settlement period is provided in the special provisions, shall remain in place for the required settlement period before excavating for any designated improvements.

Where an embankment settlement period is specified, the embankment fill shall be constructed to the lines, grades and to the limits shown on the plans or specified in the special provisions.

Settlement platforms and instruments connected therewith shall be protected by the Contractor for the length of the settlement period.

SECTION 20

LANDSCAPING

20-1 GENERAL

This work shall consist of performing roadway planting, park landscaping, and other work necessary for improving the appearance of the roadside and park facilities.

20-2 SOIL

20-2.01 Description. - Topsoil shall be Sandy loam of an even texture and shall pass through a 1/2-inch screen.

The topsoil shall be free from insects, animal life, or any toxic substances that may be detrimental to the growth of vegetation.

Soil sterilizers or weed killers, if required, shall be of a type which will permit growth of nursery stock planted 3 weeks after application. Compounds containing cyanide or arsenic will not be accepted.

Topsoil shall have a neutral soil reaction and shall have a PH of not less than 6.6 nor greater than 8.0. The topsoil shall have a low saline alkali content-saturation extract and shall have a conductivity of not more than 4 million per centimeter at 25 degrees centigrade and an exchangeable sodium or sodium cation content of not more than 10 percent of the total metallic cation content.

After notification of source of supply by the Contractor, the Engineer shall inspect the topsoil site and have the soil tested for compliance to these specifications.

Sandy loam of low fertility, even though mixed with leaf mold, manure, or other fertilizers, will not be acceptable unless prior approval has been granted by the Engineer. Contractor shall attach soil and plant Lab Report for the Engineer's approval.

20-2.02 Soil Amendment. - Organic soil amendment shall be specified by Engineer based on soil and plant laboratory test results. Soil amendment shall be free of weed seed, dust, and other objectionable materials.

In addition to selected organic soil amendment, where specified, commercial grade agricultural gypsum shall be used as soil amendment.

The materials shall be uniformly spread and incorporated with a rotary cultivator to obtain a homogeneously blended soil 6 inches in depth, unless stated otherwise in special provisions.

20-2.03 Mulch. - Mulch shall be ground, screened fir bark. Mulch size shall be 3/8-inch to 1/2-inch. Mulch shall be top dressed, where specified, to a minimum depth of 3 inches over soil level.

20-2.04 Planting Mix. - Planting mix for backfilling planting holes shall consist of 2 parts of soil excavated from the planting holes (free of rocks over 1/2-inch in diameter) and one part soil amendment. The materials shall be thoroughly mixed until they lose their individual identities.

20-2.05 Certificate of Compliance. - The Contractor shall be responsible for the establishment of the necessary quality control and inspection practice as necessary to assure compliance with these specifications. The Contractor shall furnish certificates of compliance for materials so designated in accordance with the requirements of Section 6-1.07, that all of the required tests have been made and the results comply with the requirements of these specifications.

20-2.06 Topsoil Placement and Treatment. - Topsoil shall be delivered reasonably dry and in a workable condition. It shall be placed and spread to the line and grade as shown on the plans or as directed by the Engineer. Topsoil shall be compacted to approximately 80 percent 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 allowed.

After spreading of 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, if and as specified on the plans, can proceed after completion of this work without additional grading.

When specified in the special provisions or shown on the plans, the placed topsoil shall be sterilized or treated with an approved weed killer and left 3 or 4 weeks prior to planting.

Immediately before planting, the topsoil shall be cultivated, rolled with a 200-pound roller and raked to provide a uniformly smooth, firm, friable, fine textured finished surface. No grading equipment will be allowed on the topsoil after the area has been treated and prepared for planting.

20-3 FERTILIZING

20-3.01 Fertilizer. - Planting tablets for planting trees and shrubs shall be tightly compressed, non-burning, long lasting fertilizer of the following guaranteed analysis.

Nitrogen, water soluble	7.00%
Nitrogen, water insoluble	13.00%
Phosphoric Acid, available	10.00%
Potash, soluble	5.00%
Calcium combined	2.60%
Sulfur, combined	1.60%
Iron, expressed as Fe	0.35%

Fertilizer used for planting maintenance shall have a minimum guaranteed chemical analysis of 21 percent nitrogen, 0 percent phosphoric acid, and 0 percent soluble potash.

Fertilizer for tree, turf, and shrub plantings shall be in granular or pelleted form, shall conform to the standards of the Association of Official Agricultural Chemists, and shall provide the minimum percentage of available nutrients as specified in the plans or special provisions. A liquid fertilizer may be used if and when specified.

20-4 SEEDS

20-4.01 Seed. - Seed shall be furnished separately or in mixtures in standard sealed containers labeled with the seed name, lot number, net weight, percentage of purity, germination and hard seed, and percentage of maximum wildflower/grass seed content.

The Contractor shall furnish the Engineer duplicate signed copies of a certificate of compliance by the vendor certifying that each lot of seed has been tested by a recognized laboratory for seed testing within 6 months of date of delivery. The testing shall be in conformance with test procedure standards of the Association of Official Seed Analysts and the provisions of the Agricultural Code of the State of California. The certificate of compliance shall include name and address of laboratory, date of test, lot number for each kind of seed, and results of tests as to name, percentages of purity and of germination. and percentage of wildflower/grass content for each kind of seed furnished and, in case of a mixture, the proportions of each kind of seed.

20-4.01A Hydroseeding. - Seeds used for hydroseeding shall conform to the following provisions:

Mulch shall be virgin wood cellulose fiber and shall be of such character that it will disperse uniformly into a slurry when mixed with water. The slurry, when hydraulically applied to the ground, shall form an absorptive mat of mulch uniformly impregnated with seed and other ingredients. No materials which inhibit growth or germination shall be present in the mixture.

Fertilizer shall have a guaranteed analysis of 6 percent nitrogen, 20 percent phosphoric acid, and 20 percent soluble potash and shall be in a form which readily disperse into the slurry.

Seed shall be labeled in accordance with California Department of Agriculture State Seed Law requirement effective on the date of invitation for bids. Seeds that become wet, moldy, or otherwise damaged in transit or in storage will be subject to retest at the discretion of the Landscape Architect. The seed shall be supplied in unopened containers from a commercial seed dealer and may be either mixed or in separate container for each lot. Tags shall be given to inspector or site superintendent. Job will not be considered complete unless all tags are produced and verified.

20-4.01A Turf Seed. - Turf seed or mixtures of seed are classified by type according to species or variety of grass. Types of seed or seed mixtures shall be as shown on the plans or specified in the special provisions.

Lawn seed shall be true to species or variety for the type as specified and shall conform to the Agricultural Code of the State of California and the standards of the Association of Official Seed Analysts.

20-4.01B Wildflower Seed for Hydroseeding. - Wildflower seed type to be used for hydroseeding shall be as indicated in the plans or special provisions.

Seed shall be labeled in accordance with the California Department of Agriculture, State Seed Law requirements, effective on the date of invitation for bids. Seeds that become wet moldy, or otherwise damaged in transit or in storage will be subject to retest at the discretion of the Landscape Architect. The seed shall be supplied in unopened containers from a commercial seed dealer and may either be mixed or in separate containers for each lot. Tags shall be given to the inspector

or site superintendent. Job will not be considered complete unless all tags are produced and verified.

20-5 EROSION CONTROL

20-5.01 Description. - This work shall include all erosion control and planting work performed on any portion of the project site (not limited to highways), as indicated in the plans or special provisions. Similarly, all references to "roadway" or "highway" or "right-of-way" shall be construed as references to the project site.

20-5.02 Liquid Green Dye. - Liquid green dye used in erosion control work shall be 48-hour colorfast, applied at the rate of 2 quarts per acre.

20-5.03 Fiber. - Fiber used for erosion control hydroseeding shall be virgin wood cellulose fiber of such character that it will disperse uniformly into a slurry when mixed with water. The slurry, when hydraulicly applied to the ground, shall form an absorptive mat of mulch uniformly impregnated with seed and other ingredients. No materials which inhibit growth or germination shall be present in the mixture.

20-5.04 Hydroseeding. - The Contractor shall scarify to a depth of 6 inches 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 1 inch shall be removed and the area raked smooth.

The Contractor shall avoid any compaction of the soils after treatment, and shall not permit vehicular or equipment traffic over such areas. In the event of such compaction, the Contractor shall be required to recultivate any areas thus compacted, at his own expense.

All areas to be treated for weed control shall be treated as indicated in the plans or special provisions.

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 1,000 gallons.

The slurry preparation should 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 than be added, followed by the fiber mulch. The engine throttle shall be opened to full speed when the tank is half-filled with water. All the mulch shall be added by the time the tank is 2/3 to 3/4 full. All material then shall be uniformly blended prior to application. Spraying shall commence within 2 hours after tank is full.

Contractor shall perform hydroseeding when there is no wind. 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 and the material is spread at the following rates per acre:

1) 1,800 lbs. mulch
2) 400 lbs. 6-20-20 fertilizer

3) seed mix as specified in the plans or special provisions.
4) 2 quarts liquid green dye

Fertilizer used for erosion control work shall be in a form which will readily disperse into the slurry, and shall have a minimum guaranteed chemical analysis of 6 percent nitrogen, 20 percent phosphoric acid, and 20 percent soluble potash.

20-5.05 Preparing Soil for Planting Areas. - In areas to be planted, all rocks and other debris greater than one inch in diameter shall be removed and disposed of.

In areas to be planted, the grade shall be one to 2 inches 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 19, "Earthwork," and as modified herein. In areas to be planted, compaction of the fill shall be not more than 85 percent for the upper one foot of such fill.

Cultivation shall be performed with as many passes with the cultivator as necessary, as determined by the Engineer, 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.

All rocks or other debris greater than one inch in diameter brought to the surface during cultivation shall be removed and disposed of.

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 2 inches 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 6 inches below planned finish grade.

Grading of plants shall conform to the "American Standard for Nursery Stock," ANSI Standard Z60.1, and as may be specified in the special provisions.

20-6 PLANTS AND PLANTING PREPARATION

20-6.01 Plants. - Plants shall be vigorous, first class representations of the species and cultivars specified, shall conform to all State and local laws governing the sale and transportation of plant materials. Only plants of the size and type indicated, and only plants with normal plant and root structures, will be acceptable. All plants shall be nursery grown in containers, unless otherwise indicated in the plans or special provisions, shall have been grown in the specified containers for not less than 6 months, and shall be accompanied by certification of same. They shall have straight, single trunks, unless otherwise specified on the plans. No pruning shall be undertaken before planting. Plants specified to be multi-trunk shall have at least 3 main leaders from the base. Any and all plants that have any encircling roots (not rootbound) shall have root balls lightly slashed on a minimum of 3 sides to stop encircling root growth. All plants shall be free from disfiguring

knots and sunscald injuries abrasions, or other objectionable disfigurements. Tree trunks shall be sturdy and well "hardened off."

Any plants delivered to the job site which are found to be not true to name or unsuitable in growth or conditions shall be removed from the site and replaced with acceptable plants. All plants shall be of the species, variety, size, age, and condition a specified herein or as shown on the plans. Under no condition will there be any substitution of plants or sizes for those listed on the accompanying plans, except with the written consent of the Landscape Architect.

One plant of each bundle or lot shall be tagged with the name and size of the plant, in accordance with the standards of practice recommended by the American Association of Nurserymen.

All plant materials shall meet the specifications of Federal, State, and County laws requiring inspection for plant diseases and insect infestations. Inspection certifications required by law shall accompany each shipment, invoice, or order for stock, and when such plants arrive at the site of the work the certificate of inspection shall be filed with the Engineer.

Inspection of all plant material for acceptance shall be made at the project site at time of delivery. All plant material shall be approved by the Landscape Architect prior to installation. Any and all rejected plant material shall be marked as such and removed from the project site immediately.

The Contractor shall notify the Section of Landscape Architecture at least 2 days prior to the delivery of each shipment of plant materials. Plant materials shall be protected and maintained in good condition. Bare root and balled materials shall be watered regularly and placed in a cool area protected from sun and wind.

Plants shall be classified by type as to species, variety and genus and will be specified by scientific name conforming to the publication "Standard Plant Names" as adopted by the American Joint Committee on Horticultural Nomenclature. The plant materials to be planted will be shown on the plans or specified in the special provisions.

20-6.02 Turf. - Grass sod shall be will established mown lawn grass turf and shall be free of weeds and any other harmful or deleterious matter.

At least 80 percent of the grass plants in the cut sod shall be composed of the species or varieties specified in the special provisions.

Grass sod shall be grown, inspected, and shipped in accordance with the provisions of the Agricultural Code of the State of California.

Sod shall be machine stripped or cut of a uniform soil thickness of one inch plus or minus 1/4 inch. The measurement for thickness shall exclude top growth and thatch and shall be determined at the time of cutting in the field.

Sod shall be rolled or folded prior to lifting. Handling of sod shall be done in a manner that will prevent tearing, breaking, drying, or any other damage.

Sod shall be transplanted within 24 hours from the time it is stripped, unless circumstances beyond the Contractor's control make storing necessary. In such case, sod shall be stacked, kept moist, and protected from exposure to the air and sun. The stored sod shall be installed in place not more than 48 hours after cutting.

20-6.03 Trees. - Trees are classified by type as to genus, species, and variety as well as common name. The tree varieties to be planted shall be as indicated in the plans or special provisions.

Tree species for planting in the City of San Jose are identified by size, either caliper size of trunk or height of tree stock. Table 1 indicates the height relationship to caliper of trunk. The size of tree shall be as indicated on the plans either by caliper or height. If the tree size is specified by caliper of trunk, the height indicated in the table will be considered a minimum; if height is specified on the plans, then caliper of trunk will be considered a minimum. For shade trees of recognized slower growth, as identified by the Engineer, the height shall be not less than 2/3 the height as indicated in Table 1 for specified caliper of trunk.

In size grading of container grown trees, caliper measurement shall take precedence over height measurement, unless otherwise specified in the special provisions.

Caliper measurement shall be taken 4 to 5 inches above soil level. If the tree is budded or grafted to a root system, the measurement shall be taken 2 inches above the bud or graft union.

Trees to be planted as street trees shall be free of branches for approximately the lower half of their height. Trees shall have reasonably straight stems and shall be well branched and symmetrical in accordance with their natural habits of growth. The branch system shall be free from dead or dry wood or broken terminal growth.

Container grown trees shall be capable of standing upright without staking and shall have been grown in the container sufficiently long for the fibrous roots to have developed so that the root mass will retain its shape and hold together when removed from the container. Trees not meeting this requirement will be rejected.

The container shall be sufficiently rigid to protect the root mass during shipping.

At least one tree of each species or variety delivered to the job site shall be identified by scientific name and size on a legible waterproof label securely attached to the tree.

All trees shall be subject to inspection by the Engineer at any time during the duration of the project, at the place of growth, upon delivery, or during planting operations; however, such inspection shall not be construed as final acceptance or even conditional acceptance of such trees until completion of the project.

The Contractor shall establish the necessary quality control and inspection practice to assure compliance with these specifications. The Contractor shall furnish a California Nursery Stock Certificate for each shipment of trees.

Table 1
TREE CALIPER-HEIGHT RATIO

Caliper of Trunk (inches)	Average Height Range (feet)	Container Size (gallons)
3/8 to 1/2	4 to 5	5
1/2 to 5/8	5 to 6	5
5/8 to 3/4	6 to 7	7
3/4 to 1	7 to 8	7
1 to 1 1/4	8 to 9	7
1-1/4 to 1-1/2	9 to 10	15
1-1/2 to 1-3/4	10 to 12	15
1-3/4 to 2	12 to 14	15

20-6.03A Stakes and Ties. - Stakes for support of trees shall be lodge-pole pine. Stakes for 15-gallon trees or smaller shall be 2 inches diameter x 10 feet long and 6 feet above ground. Stakes for 24 inch box trees or larger shall be 2 inches diameter x 12 feet long and 8 feet above ground, with 3 one-inch x 4-inch wood cross ties.

The tree ties shall be pieces of corded rubber placed in one place just below the main fork or branches.

20-6.04 Planting. - Each tree and shrub location shall be indicated on the plans and shall not be in conflict with any existing utilities, utility boxes, etc. Any and all plants improperly located shall be replanted in their proper location at no additional cost to the City.

After all planting operations have been completed, the Contractor shall remove all trash, empty plant containers, tools, and equipment used in this work, or 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 throughout the work site.

Planting shall be performed in accordance with the standard plan details and these specifications. 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. Do not place organic matter beneath the plant's root ball. The plant shall be set so that the root crown is 1/2 or 3/4-inch higher than average surrounding grade. Dispose of balance of borings around plant in a manner that water is shed away from the crown or trunk of plant.

20-6.05 Preparation for Ground Covers. - All areas to be planted with ground cover shall receive fertilizers and soil amendment, uniformly distributed at the following rate per 1,000 square feet and thoroughly rototilled into the top 6 inches of soil. The rate of application for fertilizer and soil amendment shall be as determined by the Engineer.

The Contractor shall fine grade 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 vehicular or equipment traffic over such areas. In the event of such compaction, the Contractor shall be required to recultivate any areas thus compacted, at his own expense.

All areas to receive a pre-emergent weed control shall be treated prior to planting as indicated in the plans or 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.

The spacing of all ground cover plants shall be as indicated on the plans and in the plant list. Plants shall be planted in evenly spaced rows with staggered triangular spacing, around shrubs to within one foot, and around trees to within 18 inches.

20-6.06 Preparation for Trees and Shrubs. - Excavate holes by auger unless otherwise specified for particular situations. Before an augered hole is made, the top 6 inches of amended soil shall be removed and stockpiled at one side of hole.

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

Install planting tablets according to the following schedule:

one gal. stock:	2 tablets, 21 gram
2 or 5 gal. stock:	3 tablets, 21 gram
15 gal. stock:	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 ball is broken or cracked, either before or during the process of planting.

All trees shall be provided with 2 lodge pole pine stakes. Tree stakes shall not be driven into the rootball.

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

Each tree in a turf area shall have the turf removed in a ring around the tree base. For 5-gallon trees, the ring shall be 24 inches in diameter; for 15-gallon and larger trees, the ring shall be 30 inches in diameter.

Pruning shall be limited to a minimum necessary for removal of injured twigs and branches, with cuts over 1/2-inch in diameter painted with a tree wound compound.

"Deep Root" planters, as approved by the Engineer, shall be installed for all trees located in tree wells with tree grates. Deep root planter shall totally encase tree ball. Outside the deep root planter, 3/4 inch to 1-1/2 inches gravel shall be placed to the full depth of the deep root planter. Imported amended topsoil shall be placed a minimum of 12 inches below the bottom of the deep root planter.

20-6.07 Preparation for Turf. - All areas to be turfed shall receive fertilizers and soil amendment, uniformly distributed at the following rates per 1,000 square feet and thoroughly rototilled into the top 6 inches of soil unless otherwise stated in the special provisions:

160 lbs. agricultural gypsum
18 lbs. fertilizer
5 cubic yards soil amendment

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

The Contractor shall fine grade so that proper drainage of the entire area is assured. All rocks, soil lumps, and other deleterious materials larger than one inch shall be removed and the area raked smooth.

The Contractor shall avoid any compaction of the soils after treatment, and shall not permit vehicular or equipment traffic over such areas. In the event of such compaction, the Contractor shall be required to recultivate any areas thus compacted, at his own expense.

All 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 Engineer reserves the right to stop any work taking place during a period when conditions are considered detrimental to soil structure or plant growth.

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 all manufacturer'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. There shall be no stretching

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 10 pounds per 1,000 square feet, raked in lightly, and rolled.

20-7 MAINTENANCE

20-7.01 Plant Establishment Work. - 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 in appearance throughout the plant establishment period. This work shall also include any additional watering by hand which may be necessary. All plants shall be watered not less than twice a week and in any event shall be such as 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.

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 10:00 a.m. and 4:00 p.m.

Should the Contractor fail, be neglectful, or negligent in this work, the City may choose to perform said work. The City shall charge the Contractor the cost for performing the required work by deducting this cost from the partial payments due the Contractor as these costs are incurred by the City.

Turf shall be watered, reseeded, edged, and mowed as required to assure a neat appearance and a healthy and vigorous growth from day of seeding to end of plant establishment period. The first mowing shall not be done until the grass is generally at least 2 inches but less than 3 inches high. For the first mowing and all subsequent mowings, the mower shall be set to cut at a height of 1-1/2 inches. Subsequent mowings, as required, shall be done before the grass is 3 inches 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 8 lbs. per 1,000 square feet or as specified in the special provisions. Reapplication of fertilizer shall take place as directed by the Engineer during the plant establishment period.

Just prior to the end of plant establishment period, Contractor shall cut all grass, weed all beds, and generally put the whole work in first-class condition.

Prior to and during the plant establishment period, should the appearance of any plant material indicate weakness and probability of dying, in the Engineer's opinion, that plant shall be replaced immediately be the Contractor, at his own

expense. Replacements shall be made in the same manner as specified for the original planting. At the end of the plant establishment period, all plant material shall be in a healthy growing condition. Any plant material replaced within the last 30 days of the plant establishment period must be maintained by the Contractor for 30 days from the date of replacement.

The Contractor shall guarantee a weed free, even stand of the lawn grass, with 95 percent 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 95 percent 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 City if the Contractor deems it necessary. Type of herbicide to be used and method of application shall be approved by the Engineer.

Following the plant establishment period, the Contractor shall provide a warranty which guarantees all trees for one year from date of final acceptance of the contract. The Contractor shall replace any tree which has died and the tree replacement shall be the same size container as originally designated in the plans.

20-7.02 Inspection for Start of Plant Establishment Period. - Upon completion of the turf and planting work and when a stand of turf between 2 and 3 inches has been established and has undergone the first cutting, the Contractor shall notify the Inspector that the project is ready for maintenance. The Inspector shall then schedule a pre-maintenance walk-through inspection for the project and shall notify the Contractor and the Landscape Architect as to the time and date. Upon inspection, if the Inspector and the Landscape Architect find the irrigation, turf, and planting work complete and in compliance with the plans and specifications, the City shall authorize the start of the plant establishment period. Written notice shall be given the Contractor as to the starting date of the maintenance period.

20-8 IRRIGATION MATERIALS

20-8.01 Pipe. - Water transmission pipe and fittings for service mains, branch mains, and laterals shall be as indicated on the plans and shall conform to the applicable provisions of Section 101, "Pipe and Fittings."

All valves and fittings shall be designed for and shall meet the requirements for service at an operating pressure of 150 pounds per square inch, unless otherwise specified.

All 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 Engineer.

20-8.01A Steel pipe. - Pipe shall conform to AWWA Standard C200 and ASTM A53.

20-8.01B Plastic Pipe Supply Line. - All plastic pipe shall be continuously and permanently marked with the following information: Manufacturer's name, kind of pipe, material, size, NSF approved, and schedule or type.

The manufacturer shall also mark the date of extrusion on pipe. This dating shall be done in conjunction with records to be held by the manufacturer for 2 years, covering quality control tests, raw material batch numbers, and any other information deemed necessary by the manufacturer.

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 1-1/2 inches and smaller and Class 315 PVC for lines 2 inches and larger. Lateral irrigation lines shall be Class 200 PVC. PVC pipe shall conform to CS 256 and ASTM Designation: D 2241.

20-8.01C Pipe Fittings. - 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.

Standard galvanized pipe fittings shall conform to the requirements of the AWWA Committee 8620D report, "Collected Standards for Service Line Materials." Galvanized pipe shall be joined by means of couplings. Couplings, elbows, tees, and other fittings shall be galvanized conforming to the above requirements.

Cast iron pipe fittings shall conform to the AWWA Standard C110, "Short Body Cast Iron Fittings, 3 to 12 inches for 250 psi Water Pressure Plus Water Hammer." Cast iron pipe joints shall be the "push-in" type, sealed by means of rubber gaskets. Cast iron fittings shall be used on existing AC mains and shall be approved by Engineer.

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

20-8.02 Anti-Siphon and Vacuum Breaker Control Valves. - Anti-siphon and vacuum breaker control valves shall be of brass construction for body and vacuum collar with I.P.S. female pipe connections. The valve body shall be of 2- piece construction with O-ring stem seal.

20-8.03 Anti-Drainage Valves. - Anti-drainage valves, for prevention of water drainage of lines through low sprinklers, shall be spring loaded diaphragm devices designed to open valve seat at 16 psi. The body of the valve shall be of brass construction.

20-8.04 Quick Coupling Valves. - Quick coupling valves shall be 2-piece brass construction, one inch, angle slot type with locking rubber or vinyl cover, capable of withstanding working pressure of 150 psi without leakage. Quick coupling valves shall be installed on swing joint assembly (same as rotary pop-ups). Valves shall have IPS female pipe connection. Valve key shall be of bronze construction with a replaceable stainless steel lug.

20-8.05 Automatic Control Valves. - Automatic control valves shall be electrically operated, normally closed, 24 volts, 60 cycle, 3.5 watt, angled or globe pattern valves. The automatic control valves shall be compatible for operation with the automatic controller.

Automatic control valves shall include housing, cover, and other appurtenances, each of which shall conform to the requirements of the following specifications:

(1) Automatic valves shall have a cast iron body with bronze seat with globe pattern. Valves shall be completely serviceable from the top without removing the valve body from the system and with a wheel or nut type manual adjustment with packing gland feature to regulate flow from fully open to closed. The adjustment shall remain in set position when the valve is operated manually or automatically. The adjustment feature shall regulate automatic closing time to not less than 4 seconds.

(2) Included as part of this item will be Christy 3B box or Brooks No. 3 box or approved equal, gravel bed, spicing to control wires and common ground, tee or saddle and all other fittings for connection to main, and all other appurtenances necessary to complete this item as shown on the plans, as well as a one-inch quick coupling valve.

20-8.06 Valve Boxes. - Valve boxes and covers shall be constructed of high-density portland cement concrete with a minimum compressive strength at 28 days of 4000 psi.

Reinforcement shall be cold-drawn steel wire conforming to the provisions of ASTM Designation: A#2 or deformed billet-steel bars conforming to the provisions of ASTM Designation: A615.

20-8.07 Reduced Pressure Backflow Preventers (RPP). - A backflow prevention assembly shall consist of 2 detector check valves connected in series with 2 non-rising stem gate consist of 2 detector check valves connected in series with 2 non-rising stem gate valves. Backflow prevention assemblies shall be the same size as the pipe main in which they are installed. Standard bronze service stops shall be included with each assembly. The materials for the check and gate valves shall be black iron body, bronze trimmed. The assembly shall be UL listed and approved by the Research Foundation for Cross Connection Control, University of Southern California.

20-8.08 Gate Valves. - Gate valves 3 inches and smaller shall be bronze or brass. Gate valves 4 inches and larger shall be cast iron. All valves and sizes shall be as indicated on the plans. Gates valves shall conform to Section 20-2.28 of the Caltrans Standard Specifications and Section 102-2.02, "Resilient Seated Gate Valves" of these City Standard Specifications.

20-8.09 Wye Strainers. - Strainers shall be self-cleaning, of the size of service main, with a split wedge gate valve on the strainer end. The gate valve shall be compatible with the size of the assembly. The strainer assembly body shall be black iron.

20-8.10A Irrigation Controllers. - Irrigation controllers shall meet one of the following specifications.

20-8.10A(1) Type I Controllers. - Automatic irrigation controllers shall be electrically operated, fully automatic, with all solid state electronic components. The controller shall be rated for 117 volt, 60 cycle AC input and 26.5 volt, 2.2 amp output for continuous operation of 24 volt valves, and shall have 12 independent

timing stations unless otherwise shown on the plans, with 14-day programming capability. The controller shall have a 24-hour clock dial with one-hour increment starts. Each station shall have an "Off" switch for zero watering time and individual infinitely variable timing control for 2 to 60 minute station timing as well as an "On-Off-Repeat" switch for eliminating one or more stations from the timing sequence without changing timing dial setting. The 14-day clock shall provide maximum programming versatility and all timer pins shall be of the captive type to prevent loss.

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

The controller shall be constructed of heavy gauge steel with corrosion resistant enamel finish inside and out.

Automatic irrigation controllers shall conform to NEC Class 2 requirements.

20-8.10A(2) Type 2 Controllers. - Automatic irrigation controllers shall be the MIR-5000F Multi-Wire Field Unit by Motorola, Inc., or approved equal . The field unit shall be a computerized irrigation controller capable of fully automatic or manual operation of the irrigation system. The unit shall be a stand-alone controller which is capable of being programmed by a central computer, such as the IBM PC. The unit shall comprise a microprocessor that can handle an input unit (for field sensors), an output unit (to activate irrigation valves), and a keyboard and display. The keyboard shall consist of dedicated functional keys for easy operation. The display shall consist of a liquid crystal display with 2 lines of 40 characters each. The controller shall operate on 115 volts ac, 60Hz, up to 2 amps, and shall be provided with a transformer which will supply a 24 volt current for operating the electric remote control valves. In addition, the controller shall be equipped with or shall be capable of the following:

a) 60 multi-independent programs
b) Simple manual operation from keyboard
c) Program by volume and/or by time
d) Increments of gallons, hours-minutes, or minute-seconds
e) Evapotranspiration water budgeting in 1 percent increments, 0-999 percent
f) Programming up to 8 individual water sources for simultaneous and independent operation
g) Programming auxiliary operations (in addition to the irrigation programs) for lights, fountains, pumps, gates, etc.
h) Programming the injection of fertilizer on either a proportional or a direct feed basis
Programming the automatic flushing of filter(s) based on the elapsed time/quantity of irrigation and/or pressure differential input
j) Programming in cycles (unlimited per day) to match application rate to the soil's infiltration rate
k) Programming on the basic unit (18 or 26 stations) which will allow up to 4 water sources, each operating as many as 6 stations at once

l) Programming on the expanded unit (52 stations) which will allow up to 8 water sources, each operating as many as 6 stations at once
m) Programming which will allow the selective entry of a stop time to prevent irrigation during "sensitive" times of the day -- this halts the irrigation even if it is not finished and notifies the operator of the incomplete status of that program
n) Programming by volume which will permit application of water in gallons, measured and regulated by a flow meter
o) When irrigation is performed on volume basis, monitoring the flow rate of the water for high flow, low flow, no flow, as a means of detecting burst pipes, low pressure, and malfunctioning (closed) valves
p) When using a flow meter, detection of water flow in the main line and shutoff of the main valve in case of water flow if no command was given (by the operator) to operate the valve.

The controller housing enclosure shall be LeMeur Model "AK" or approved equal and shall be installed according to plans. The controller housing enclosure shall be primed and painted dark brown with industrial grade, rust inhibiting primer and paint by Ameron, Benjamin Moore, or approved equal, as indicated in the plans or special provisions.

20-8.10B Conductors. - The wire conductors for automatic control devices shall be of the size and color as shown on the plans and shall be UL rated for direct burial. Conductors shall be able to withstand a crush test of 5000 psi. Common or neutral conductors shall be white. The control wires to the automatic control valves shall be red. The spare wires used, when necessary, shall be black.

20-8.10C Wire Connectors. - Wire connectors shall be specifically designed to insure waterproof underground wire connection, and shall be UL listed "Water Resistant Wire Connector Rated 60c, 600v for PVC insulated copper wires." Each connector shall consist of a crimp sleeve, base socket, sealing plug, and inert sealer.

20-9 IRRIGATION INSTALLATION

20-9.01 Conductors, Electrical Conduit and Pull Boxes. - Conductors may be installed in the same trench as the water pipe. All Clearances between conductors, pipes, and trench walls shall be as specified herein and in the standard details or as indicated in the plans or special provisions.

Sharp bends or kinks in the conductor shall not be permitted. Conductors shall be unreeled in place alongside or in the trench and shall be carefully placed along the bottom of the trench. Under no condition shall the cable be unreeled and pulled into the trench from one end.

Not less than one foot 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.

20-9.02 Installation. - Before proceeding with any work, the Contractor shall carefully check and verify all dimensions and shall report any variations to the Engineer.

The system shall efficiently and evenly irrigate all areas and shall be complete in every respect, and shall be left ready for operation to the satisfaction of the Engineer.

The Contractor shall install the specified pipe, valves fittings, wiring, switches, controls and appurtenances at the approximate locations indicated on the plans. The Engineer shall indicate specific locations.

The Contractor shall provide all temporary storerooms and shops that he may require at the site for the safe and proper storage of his materials, tools, etc. These rooms shall be constructed only in locations approved by the Engineer as designated on the location map, and must in no way interfere with the work of any other contractor. At such times as these structures interfere with the proper installation and completion of the work, they shall be removed by this Contractor, at his expense, within 3 days after having been notified by the Engineer that such removal is necessary.

20-9.02B Trenching and Backfilling. - Trenches for pipe and electrical conductors may be excavated manually or with mechanical trenching equipment. Mechanical trench diggers used on the site shall be essentially vertical so that a minimum of surface is disturbed. Road patrols or graders shall not be used to excavate the trench with their blades. Trenches for pipe shall be excavated to the depths shown on the plans.

The procedure for backfilling shall be the same for all trenches. All lumber, rubbish, and large rocks shall be removed from the trenches. Pipe shall have a firm, uniform bearing for the entire length of each pipe line. Wedging or blocking of pipe will not be permitted.

The procedure for backfilling shall be the same for all trenches. All lumber, rubbish, and large rocks shall be removed from the trenches. 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.

Trenches shall be backfilled with sand to a level not less than 8 inches below the finish grade. Sand shall be jetted lightly. The remainder of the backfill shall be topsoil not less than 8 inches deep.

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 Engineer, at no cost to the City.

20-9.02C Pipe. - Contractor shall use only the solvent supplied and recommended by the manufacturer to make plastic 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 1/4 turn to distribute the solvent and remove air bubbles. Hold the joint for approximately 15 seconds so the fitting does not push off the pipe.
(4) Use a clean rag and wipe off all excess solvent.
(5) Be sure in going to the next joint that the pipe is not twisted, disturbing the last completed joint.

Allow at least 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 with a bed long enough to allow the length of pipe to lie flat so as not to be subject to undue bending or concentrated external load at any point. Any section of pipe that has been dented or damaged will be discarded until said section of pipe is cut out and rejoined with a coupling.

The Contractor shall provide the necessary mason's lines and supports to insure installation of the pipe to line and grade, as staked by the Engineer. The Contractor's facilities for lowering the pipe into the trench shall be such that neither the pipe not the trench will be damaged or disturbed.

All pipes shall be assembled free from dirt, pipe scale, and burrs. The main line supply shall be flushed out and tested for leaks before backfilling and with control valves in place and before lateral pipes are connected to valves. Each section of lateral pipes shall be flushed out before sprinkler heads are attached.

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

The Engineer shall inspect all pipe before it is laid and reject any section that is damaged by handling or is found to be defective to a degree which will materially affect function and service of pipe.

Except as may be noted in other parts of this specification or on the drawings, installation of pipe and connecting fittings shall be as outlined in manuals furnished by the pipe manufacturer, or as set forth by the by the Johns-Manville Co. Manual #7720601 or any later manual. This information shall be deemed part of this specification.

Piping shall be installed a minimum of 36 inches below the top of paved surfaces. Where irrigation mains or laterals are to be installed under paving, a Schedule 40 PVC sleeve shall be installed. The inside diameter of the sleeve shall be a minimum of 2 inches larger that the outside diameter of the pipe.

A separate sleeve shall be installed for irrigation control wires. The minimum diameter shall be 2 inches.

20-9.02D Valves and Valve Boxes. - The Contractor shall provide and install all valves as indicated on the drawings and as required for the proper control of the piping systems in which they are incorporated. All main shut-off valves shall be gate valves.

Where a remote control valve is shown 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.

20-9.02E Pressure Testing. - Before testing by either method, all air shall be expelled from the pipe.

All tests on pressure lines shall be completed prior to backfilling; however, sufficient sand 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 24 hours to cure.

Where any section of the pipe system is provided with concrete thrust block, the test shall not be made until at least 5 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 2 days have elapsed.

20-9.02F Sprinkler Heads. - Turf sprinkler heads in open areas shall be installed at least 4 inches above finished grade at the time of installation. Within 5 days of notification by the Engineer, Contractor shall make whatever adjustments of pipe, fittings, valves, or sprinkler heads are necessary to bring the system to the proper level of the permanent grade. At this time, heads shall be made completely firm with sand.

Turf sprinkler heads along walks and driveway, where the finished grade level is established, shall be set flush at the time of installation.

20-9.02G Disinfection. Contractor shall disinfect potable water lines according to AWWA standards.

20-9.02H Records. - The Contractor shall maintain reasonably clear and detailed records of all underground installations. These records shall be available to the Engineer at all times for verification while the work is in progress. These records shall be delivered to the Engineer in good and acceptable condition prior to final acceptance of the work.

The Contractor shall provide a chart for each controller, which shall be placed on the inside of the controller enclosure door. Record drawings from which the charts are to be made shall be approved by the Landscape Architect prior to preparing the charts.

Each chart shall show the area controlled by the automatic controller and shall be the maximum size which the controller door will allow. The controller chart shall include:

Connection to existing water lines
Routing of pressure lines
Routing of control valves
Locations of remote control valves, gate valves, and quick valves
Other items as directed by the Engineer

The chart shall be reduced drawing of the actual as-built system. All symbols shall be readable at the final reduced size.

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 2 pieces of 10 mil plastic, minimum.

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

20-9.02I Training. - After the system has been completed, the Contractor shall instruct the Engineer in the operation and maintenance of the system and shall furnish a complete set of operating instructions prior to final acceptance.

20-10 MEASUREMENT AND PAYMENT

Measurement and payment shall be as specified in the project special provisions.

SECTION 21

SUBGRADE PREPARATION

21-1.01 Description. - This work consists of preparing subgrades for the placement of subsequent construction such as pavements, bases, subbases, curbs, gutters, sidewalks, driveways, and other structures, which are not specifically provided for under other sections of these specifications.

The preparation of the subgrade may be required at various elevations, depending upon the number of layers of material specified to be placed thereon or type of structure to be constructed and as required in Section 19 "Earthwork".

21-1.02 Classes. - Subgrade preparation is classified according to the plane or layer of material placed thereon as follows:

Class A. - Preparation of the native or imported material at the basement grade (grading plane).

Class B. - Preparation of any layer of new material above the basement grade (grading plane), on which a succeeding layer of material is to be placed.

Class C. - Rehabilitation of an existing surface upon which a layer of subbase, base, pavement, surfacing, or other specified material is to be placed.

21-1.03 Preparation. - Material shall not be placed upon the prepared subgrade until it has been inspected and approved by the Engineer.

21-1.03A Class A. - The preparation of Class A subgrade shall consist of grading and compacting native or imported soil material at the basement grade. Scarifying and cultivating will be required, prior to grading and compacting for dry soils which are impervious to the penetration of water, or for soils which contain excessive amounts of moisture which may result in unstable foundations, or for soils which are non-uniform in character which may result in non-uniform compaction and subsequent differential settlements of finished surfaces, or when a pavement material is to be placed directly on native soil.

After rough grading has been completed, when scarifying and cultivating is required, the basement material shall be loosened to a depth of at least 0.5 foot. The loosened material shall then be worked to a finely divided condition and all rocks larger than 0.25 foot in dimension shall be removed. The moisture content shall be brought to optimum by the addition of water, or by the addition and blending of dry suitable material or by the drying of existing material as the case may be. The material shall then be compacted by approved compacting equipment.

Uniform pervious soils, that allow the immediate penetration of water or uniform impervious soils which allow the penetration of water to a depth of at least 0.5 foot, after the addition of an approved wetting agent to the water, will not require scarifying and cultivating unless a condition previously set forth in this section requires such processing. When scarifying and cultivating are not required, the moisture content of the top 0.5 foot of the material shall be brought to optimum

by addition of water at the surface, and the material shall be compacted by approved equipment.

21-1.03B Class B. - The preparation of Class B subgrade shall consist of finishing the surface of any layer of material above the grading plane in accordance with the provisions of the sections for such material, as described below.

Type of Material	Section
Lime Treatment	24
Aggregate subbase	25
Aggregate base	26
Cement treated base	27
Lean Concrete Base	28
Treated Permeable Base	29
Deep Lift Asphalt Base	30
Asphalt Concrete	39
Portland Cement Concrete Pavement	40

Portions of the subbase, base, or other material which have become damaged or destroyed since completion shall be repaired or reconstructed to the specified tolerance requirements for grade and cross section immediately prior to placing any new material thereon, or immediately prior to the application of a curing seal, prime coat or tack coat.

21-1.03C Class C. - In advance of spreading any new material on an existing surface to be rehabilitated, surface shall be cleaned of all dirt and loose material.

Broken, failed or otherwise unsatisfactory portions of the existing surface and sections interfering with new construction shall be removed and disposed of. The areas and depths to be removed shall be as shown on the plans and as directed by the Engineer. The basement grade area in the exposed spaces shall be watered and compacted, after which the space shall be filled with subbase, base, or pavement material as shown on the plans or as directed by the Engineer.

Where shown on the plans or specified in the special provisions or directed by the Engineer, the existing surface shall be scarified, watered and rolled in advance of placing any new material thereon.

Where shown on the plans or specified in the special provisions, a leveling course shall be spread upon the existing surface in accordance with the specifications for the type of material being placed, and no compensation other than the contract price or prices being paid for the material will be made for such work, unless otherwise designated.

21-1.04 Conform Areas. - Roadway or other areas where "grade only" or "conform" is called for on the plans, shall be graded to meet the tolerances for a base material grade. The finished surface shall be a straight grade from the finished pavement or curb elevations shown on the plans to the elevation of the existing ground at the extremities of the area graded.

21-1.05 Compaction. - The finished subgrade immediately prior to placing subsequent layers of material thereon shall have a relative compaction of

not less than 95 percent for a depth of 0.5-foot, or to a depth of 3 ft. below finished grade for engineered fill area. The subgrade for sidewalks, driveways, aprons and similar structures below the aggregate or sand cushion shall be compacted to a relative compaction of 95 percent for a depth of 0.5 foot. After compaction and trimming, the subgrade shall be firm, hard, and unyielding.

Relative compaction will be determined in accordance with California Tests 216, Part II and 231.

The Engineer will perform one initial compaction test and a second compaction retest for failure of the material to meet specification requirements on initial testing. The above 2 tests will be performed in each completed area without charge to the Contractor. In those areas where more than the 2 tests specified above are required for failure of the material to meet the specified compaction requirements, the Contractor will be assessed $100.00 for each additional test required until the material meets the specified compaction requirements. The Contractor agrees to pay said amounts to the City as liquidated damages, not as a penalty, and further agrees that the City may deduct the amounts from monies due or that may become due the Contractor under the Contract.

21-1.06 Tolerances. - The finished subgrade for pavements, sidewalks, curb and gutters, driveways, aprons and other roadway structures shall be uniform and shall not vary more that 0.02-foot from the specified grade and cross section. The finished subgrade for subbase or base material shall not vary more than 0.05-foot from the specified grade and cross section, except as otherwise specified in the appropriate sections of these City Standard Specifications for the material being placed.

21.107 Measurement. - Where a separate pay item for Class A subgrade is designated in the Engineer's Estimate, the area of subgrade preparation to be paid for will be measured by the square foot to the dimensions shown on the plans. No allowance will be made for subgrade preparation outside such dimension unless ordered by the Engineer.

21-1.08 Payment. - The area of Class A subgrade will be paid for at the contract price per square foot. The above price shall include full compensation for furnishing all labor, materials, tools, equipment and incidentals, and for doing all work in preparing the subgrade complete, as shown on the plans, as specified in these specifications and as directed by the Engineer.

Where a contract item is not provided for Class A subgrade and for all other subgrade preparation, no separate payment will be made for such work. Full compensation for such subgrade preparation shall be considered as included in the various contract items of work involved.

SECTION 22

FINISHING ROADWAY

Finishing roadway shall conform to Section 22 of the Caltrans Standard Specifications and these City Standard Specifications.

22-1.01 Description. - References to "highway" or "right-of-way" shall be construed as references to any project facilities for which grading operations have been performed.

This work shall also include removal and disposal of all weeds and other objectionable growths from areas which were previously cleared and grubbed by the Contractor.

All sewers, drains, culverts, and their appurtenant structures constructed under the contract, as well as existing drainage facilities within the project shall be cleaned out.

Earth conforms for back of sidewalks shall be formed to produce a smooth and uniform slope.

All storage facilities, sheds, yards, equipment, tools, and devices used as temporary installations during construction (e.g., fences, barricades, signs, guard rails, and A. C. berms) shall be removed from the project area and disposed of.