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## SECTION 50 – CONSTRUCTION MATERIALS

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This Section indicates the requirements for various classes and types of materials used in construction. Materials not included in this Section shall be as described and specified in other Sections of these Specifications or in the Special Provisions.

### **50-1 PORTLAND CEMENT**

Unless otherwise specified in the Special Provisions, all cement used in concrete shall conform to ASTM Designation: C 150, Type II.

Type III portland cement may be substituted for Type II when Special Provisions require high early strength.

All portland cements shall be "low alkali", containing not more than zero point six percent (0.60) by weight of alkalis, calculated as the percentage of Na<sub>2</sub>O plus zero point six hundred fifty eight (0.658) times the percentage of K<sub>2</sub>O.

Unless otherwise specified in the Special Provisions, calcium chloride shall not be used in any concrete containing steel reinforcement or other embedded metals.

When directed by the City, the Contractor shall furnish certificates of compliance stating that the cement delivered to the work complies with these Specifications.

### **50-2 CONCRETE AGGREGATES**

Unless otherwise specified in the Special Provisions, concrete aggregates shall conform to ASTM Designation: C 33

### **50-3 WATER FOR CONCRETE**

Water used for mixing and curing concrete shall be clean, free from oil, acid, alkalis, vegetable matter, or other deleterious matter. No water containing excessive amounts of salts, sulfates, or chlorides shall be used.

### **50-4 PREMOLDED EXPANSION JOINT FILLER**

Unless otherwise specified in the Special Provisions, premolded expansion joint filler material shall conform to ASTM Designation: D 1751.

### **50-5 PORTLAND CEMENT CONCRETE**

#### **50-5.01 Composition**

Portland cement concrete shall be composed of portland cement, fine aggregate, coarse aggregate, admixtures (if used) and water; and shall be designated as one of the following classes:

**Class "A-1" Concrete**—Shall be 4,000 psi and contain six (6) sacks (564 pounds) of portland cement per cubic yard and shall have a maximum size of coarse aggregate of either one inch (1") or one and one-half inches (1-1/2").

**Class "A-2" Concrete**—Shall be 4,000 psi and contain six (6) sacks (564 pounds) of portland cement per cubic yard and shall have a maximum size of coarse aggregate of three quarters inch (3/4").

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**Class "B-1" Concrete**—Shall be 3,500 psi and contain five (5) sacks (470 pounds) of portland cement per cubic yard and shall have a maximum size of coarse aggregate of either one inch (1") or one and one-half inches (1-1/2").

**Class "B-2" Concrete**—Shall be 3,000 psi and contain five (5) sacks (470 pounds) of portland cement per cubic yard and shall have a maximum size of coarse aggregate of three-quarters inch (3/4").

**Class "C" Concrete**—Shall be 2,500 psi and contain four (4) sacks (376 pounds) of portland cement per cubic yard and shall have a maximum size of coarse aggregate of either one inch (1") or one and one-half inches (1-1/2").

Should the quantity of ingredients designed to produce a cubic yard of finished concrete result in a yield greater than one (1) cubic yard, the relative proportions of fine and coarse aggregates shall be adjusted as necessary to maintain a consistent quantity of portland cement in each cubic yard of concrete. Fly ash contents not to exceed 20% by weight of cementitious material.

A mix design for each class of portland cement concrete used in the Work shall be submitted to the City for approval at least seven (7) days prior to the proposed portland cement concrete being incorporated into the Work.

### **50-5.02 Proportioning**

The Contractor shall determine the mix proportions for all portland cement concrete to be used in the Work. The coarse and fine aggregates shall be combined in such proportions that the percentage composition by weight of the individual and primary aggregate sizes, as determined by laboratory screens and sieves, conforms to Section 90-1.02C, "Aggregates", of the State Specifications.

Exact proportions of primary aggregate sizes used in the concrete mix shall be as designated or approved by the City. The City may adjust the mix to accommodate changes in aggregate and moisture contents, to improve mixing and placing characteristics and to secure maximum quality of the finished concrete.

### **50-5.03 Mixing**

Concrete shall be from an approved plant. All concrete mixing shall be done in machine batch mixers of an approved type, having a capacity of not less than that which utilizes a full sack of cement, unless, in the opinion of the City, the quantity to be mixed is too small to justify the use of a batch mixer. Sacks of cement shall be completely emptied by dumping directly upon other materials previously measured into the mixer. No splitting of sacks of cement will be allowed. The cement may be weighed into the batch from bulk storage if the Contractor provides suitable equipment approved by the City.

Mixing shall continue for a minimum of one (1) minute. In mixers larger than one (1) cubic yard capacity, the mixing time shall be increased so minimum mixing time is not less than one (1) minute for each cubic yard, or part thereof, of the mixer capacity.

The total volume of material mixed per batch shall not exceed the rated capacity of the mixer as determined by the standard requirements of the Associated General Contractors of America. Mixing equipment not indicated in this Section shall be operated at the speeds recommended by the manufacturer. Revolving drum mixers, except on transit mixers, shall

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not make less than fourteen (14) nor more than eighteen (18) revolutions per minute. The rotation rate of transit mixers shall produce a peripheral speed of approximately two hundred (200) feet per minute.

Each paving mixer or stationary mixer shall be equipped with an acceptable timing device. Should the Contractor elect to utilize transit-mixing equipment, the Contractor shall make adequate advance arrangements for preventing delays in delivery and placing of the concrete. If there is an interval of more than forty-five (45) minutes between any two (2) consecutive batches or loads, or a delivery and placing rate of less than eight (8) cubic yards of concrete per hour, a construction joint be installed and a twelve foot (12') gap left in the work, and the work continued wherever practical for the remainder of the day. If the work is shut down, the Contractor, at the Contractor's expense, shall make a construction joint in the concrete already placed at the location and of the type directed by the City.

Transit-mixed concrete shall be delivered to the site of the Work and discharge shall be completed within ninety (90) minutes after the addition of the cement to the aggregates or before the drum has been revolved two hundred fifty (250) revolutions, whichever comes first. In hot weather or under conditions contributing to quick set up of the concrete or when the temperature of the concrete is eighty-five degrees (85°) F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed forty-five (45) minutes.

Batch or transit-mixed concrete delivered to the Work shall be accompanied by a batch ticket and the weight ticket showing all of the ingredients in pounds. The batch ticket shall also show the time of day the materials were batched. Trucks arriving at the work site without both tickets will be rejected.

The City may stop concrete pouring if the placing of the concrete is causing separation of constituent materials of the concrete.

Transporting of concrete in non-mixing trucks or trailers will not be permitted.

### **50-5.04 Water Control**

Within the limits hereinafter specified, the amount of water required for the proper consistency of concrete shall be determined by the slump test, in accordance with ASTM Designation: C 143.

The Allowance for slump, unless otherwise directed by the City, shall be as follows:

1. Concrete paving and reinforced structures - Not more than three inches (3").
2. Reinforced structures and columns -Not more than four inches (4").
3. Concrete placed under water - Not less than six inches (6") nor more than eight inches (8").
4. Water shall conform to Section 50-3, "Water for Concrete", in this Section of these Specifications.

The Contractor shall furnish, without charge, such materials as may be required for making tests of concrete during the progress of the Work. Such tests will be made at the City's expense.

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### **50-6 CURING COMPOUNDS FOR CONCRETE**

Concrete curing compounds shall be used where specified in these Specifications and the Special Provisions.

The compounds shall meet the requirements of Section 90-1.03B(3), “Curing Compound Method”, of the State Specifications.

### **50-7 AGGREGATE BASES**

Aggregate bases shall conform to the requirements of Section 26, “Aggregate Bases”, of the State Specifications, and these Specifications.

The combined aggregate shall conform to the gradation requirements specified for the three quarter ( $\frac{3}{4}$ ) inch maximum aggregate for Class 2 aggregate base, unless otherwise specified in the Special Provisions.

### **50-8 PIT RUN BASE (GRADED)**

Pit run base is a processed pit run material from local sources which may be specified on the Plans or in the Special Provisions for work where ordinary earth fill may not be satisfactory.

Pit run material shall have a minimum sand equivalent of twenty-five (25), as determined by California Test Method 217.

Pit run base shall have the following limits of gradation:

<b>Sieve Size</b>	<b>Percentage Passing</b>
2-1/2"	100
2"	75-100
1"	50-75
No.4	20-50
No. 200	0-10

### **50-9 COBBLES**

Cobbles shall measure a minimum four inches (4”) in the least dimension and a maximum of ten inches (10”) in the greatest dimension.

### **50-10 GEOTEXTILE FABRIC**

The geotextile shall be of nonwoven construction and consist of long-chain polymeric fibers composed of polypropylene, polyethylene, or polyamide. The fibers shall be oriented into a random web and stabilized so they retain their relative positions. The geotextile shall be free of any chemical treatment or coating which reduces permeability and shall be inert to chemicals commonly found in soil.

The geotextile shall conform to the physical property requirements listed in the table below:

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<b>TABLE 50-1 REQUIRED GEOTEXTILE PROPERTIES</b>		
<b>Physical Property</b>	<b>Test Method</b>	<b>Acceptable Minimum Test Results</b>
Tensile strength, lb	ASTM D 1682	120
Elongation, %	ASTM D 1682	60
Coefficient of water permeability, cm/sec	ASTM D 4491	0.10
Puncture strength, lb	ASTM D 7511	65
Mullen Burst strength, psi	ASTM D 3786	215
Note: Tension testing machine with ring clamp, steel ball replaced with a 5/16-inch-diameter solid steel cylinder, with flat tip and beveled edges, centered within the ring clamp.		

Supac 4NP as manufactured by Phillips Fibers Corporation meets these specifications.

**50-11 CEMENT-TREATED BASES**

Road-mixed and plant-mixed cement treated base shall comply with Section 27, “Cement Treated Bases”, of the State Specifications.

**50-12 LIME TREATED BASE**

Lime treated base shall comply with 24-2 “LIME STABILIZED SOIL” of the State specification.

**50-13 SAND**

Sand bedding shall be free from clay or organic material. Ninety (90) percent to one hundred (100) percent shall pass a No. 4 sieve and not more than five (5) percent shall pass a No. 200 sieve.

**50-13.01 River Sand**

River sand shall be free from vegetable matter, lumps, balls of clay, or adherent films of clay. The material shall not have more than twenty (20) percent passing a two hundred (200) mesh screen.

**50-13.02 Graded Sand**

Graded sand shall be free from vegetable matter, lumps, balls of clay, or adherent films of clay.

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The percentage composition by weight of graded sand shall conform to the following gradations:

<b>Sieve Size</b>	<b>Percentage Passing by Weight</b>
9.5 mm (3/8")	100
4.75 mm (#4)	95-100
2.36 mm (#8)	90-100
1.18 mm (#16)	80-100
600 µm (#30)	65-100
300 µm (#50)	40-70
150 µm (#100)	0-30
75 µm (#200)	0-12

**50-14 RESERVED**

**50-15 CONTROLLED DENSITY FILL/CONTROLLED LOW STRENGTH MATERIAL**

**50-15.01 Controlled Density Fill (CDF)**

Control density backfill material shall consist of a workable mixture of aggregate, cementitious materials, and water.

Prior to excavation, the Contractor shall submit to the City for approval a mix design, and test data that demonstrate that the mix design complies with the following:

- Portland cement shall be Type II conforming to the requirements in Section 50-1, "Portland Cement", in this Section of these Specifications.
- Admixtures, including mineral admixtures, may be used in conformance with Section 90-1.02E, "Admixtures", of the State Specifications. Chemical admixtures containing chlorides such as Cl in excess of one percent (1%) by mass of admixture, as determined by California Test Method 415, shall not be used. The amount of air-entraining admixture added shall be a maximum of twenty percent (20%).
- Coarse aggregate shall consist of a well-graded mixture of crushed rock with a maximum size aggregate of three-eighths inch (3/8"). One hundred percent (100%) shall pass the one-half-inch (1/2") sieve. Not more than thirty percent (30%) shall be retained by the three-eighths inch (3/8") sieve and not more than twelve percent (12%) shall pass the No. 200 sieve. All material shall be free from organic matter and not contain more alkali, sulfates, or salts than the native materials at the site of work.
- The minimum twenty-eight-day (28-day) compressive strength shall be between 100 and 200 psi.

Water shall conform to Section 50-3, "Water for Concrete", in this Section of these Specifications.

Materials for controlled density backfill shall be thoroughly machine-mixed in a pugmill, rotary drum, or other approved mixer. Mixing shall continue until the cementitious

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material and water are thoroughly mixed. Controlled density backfill shall be placed within ninety (90) minutes after introduction of the cement to the aggregates.

Control density backfill shall be placed in a uniform manner that will prevent voids in, or segregation of, the backfill. Foreign material that falls into the trench prior to or during placing of the control density backfill shall be immediately removed.

When control density backfill is to be placed within the traveled way or otherwise to be covered by paving, the material shall achieve a maximum indentation diameter of three inches (3") prior to covering and opening to traffic. Penetration resistance shall be as measured by ASTM Designation: C 6024.

### **50-15.02 Controlled Low Strength Material (CLSM)**

All CLSM must conform to ACI report 229R-99 and have a twenty-eight day (28-day) unconfined compressive strength of between 50 and 125 psi. Cement must be Type I or Type II portland cement conforming to ASTM C150. Blended cements conforming to ASTM C595 may be used with the written approval of the Agency after submittal of test results. Fly Ash must be Class F per ASTM C618. Air-entraining admixtures and foaming agents are permitted. Water-quality must conform to ASTM C94. Aggregates must comply with ASTM C33. Aggregates must be sand with no more than ten percent (10%) passing a No. 200 sieve. If Fly Ash is not used in the mix design, the amount passing the No. 200 sieve can be increased to 20 percent. Soils with clay fines are prohibited. The Contractor must submit a mix design and test results to the Agency for approval prior to commencing excavation

#### **50-15.02.A Properties**

Flowability: High flowability: Between 8 and 10 inches per ASTM C143 (slump cone) method. Segregation: The separation of constituents in the mixture during fluid movement is not permitted.

#### **50-15.02.B Mixing, Transporting and Placing**

The mixing, transporting, and placing of CLSM must be in accordance with the methods and procedures given in ACI 304 and ACI 304.6R. Prior to placement of the CLSM:

- The trench must be free of loose soil
- The trench bottom must be stable and non-yielding
- There must be no excess moisture present
- The pipe bells must be supported so they maintain a minimum three inch (3") separation from the bedding material

All bedding material must be removed from the pipe haunches. The CLSM must be placed the full width and length of the trench and must cover the top of the pipe bell. The CLSM must be placed on both sides of the pipe simultaneously to minimize the potential for lateral displacement of the pipe.

The pipe sections may need to be secured against floatation during CLSM placement. The CLSM may be placed in lifts to reduce the potential for floatation to occur.

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**50-15.02.C Backfill**

Backfill above the CLSM can commence only when placement and compaction of the backfill will not cause deformation of the CLSM, or at the direction of the Agency.

**50-15.02.D Quality Control**

Sampling must be in accordance with ASTM D 5971. The testing of CLSM cylinders must be per ASTM D 4832, "Preparation and testing of soil-cement slurry test cylinders." Protect the area where the CLSM has been placed. The liquid CLSM will have characteristics similar to quick sand, until solidification occurs.

**50-16 CLEAN CRUSHED ROCK**

Clean crushed rock of the type shown or specified in the Contract shall be the product of crushing rock or gravel. The percentage composition by weight of clean crushed rock shall conform to the following gradations for the Type specified:

<b>Sieve Size</b>	<b>1/2" crushed</b>	<b>3/4" crushed</b>	<b>1" crushed</b>
2"	--	--	--
1-1/2"	--	--	100
1"		100	90-100
3/4"	100	70-100	30-60
1/2"	70-100	5-55	0-20
3/8"	0-10	0-15	--
No. 4	0-15	0-5	0-5
No. 200	0-5	0-2	--

Clean crushed rock shall have a minimum Cleanliness Value of 60 as determined by California Test Method 227. At least 75 percent of the crushed rock particles must have 2 or more fractured faces.

**50-17 ASPHALT BINDERS AND EMULSION**

Asphalt, liquid asphalt, and asphaltic emulsion, as required by these Specifications or by the Special Provisions, shall be as specified in Section 92, "Asphalt Binders", of the State Specifications, and asphaltic emulsions as specified in Section 94, "Asphaltic Emulsions", of the State Specifications.

**50-18 VITRIFIED CLAY PIPE (VCP)**

Vitrified clay pipe shall conform to the specifications of the specifying agency. The City does not currently own any facilities using VCP.

**50-19 SUBSURFACE DRAINS**

Subsurface drains shall comply with Section 68, "Subsurface Drains", of the State Specifications.

**50-20 NONREINFORCED CONCRETE PIPE (CP)**

Nonreinforced concrete pipe shall conform to ASTM Designation: C 14.

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### **50-21 REINFORCED CONCRETE PIPE, DRAINAGE (RCPD)**

Reinforced concrete pipe shall conform to ASTM Designation: C 76 for Class I, II, III, IV, or V. The class of pipe will be shown on the Plans or specified in the Special Provisions.

Sections of circular pipe with elliptical reinforcing shall have the location of the minor axis of the reinforcing indicated by three-inch (3”) wide, waterproof, painted stripes on the inside and outside of the pipe at the top and bottom, at least twelve inches (12”) long at each end of the pipe section.

Unless otherwise indicated on the Plans or in the Special Provisions, joints for concrete pipe shall be bell and spigot and shall be of a design that, when properly laid, shall have a smooth and uniform interior surface. Each joint shall be sealed to prevent leakage. Unless otherwise indicated on the Plans or in the Special Provisions, joints shall be sealed with a rubber O-ring gasket conforming to ASTM C443. Compression couplings capable of the same performance are also allowed where splices are needed.

Protect O-ring gaskets from exposure to weather, heat, ozone, oil, grease, and sunlight for any time period exceeding 48 hours. Do not store gaskets near electrical or exhaust heat sources.

### **50-22 REINFORCED CONCRETE PIPE, SEWER (RCPS)**

Concrete cylinder pipe shall conform to Federal Specifications SS-P-381a and cement mortar lined and coated steel pipe shall conform to Federal Specifications SS-P-385a, each subject to the following modifications:

- a. Minimum steel cylinder thickness shall be one hundred and nine thousandths (0.109) of an inch.
- b. Mortar coating shall provide a minimum of three-quarters inch (3/4) cover over all structural steel
- c. Cement mortar lining shall be of Type II portland cement and shall be centrifugally applied. Minimum lining thickness shall be one-half inch (1/2”). The finished inside diameter of the lined pipe shall be the diameter shown on the plans and shall match the inside diameter of the adjoining pipe sections to within one percent (1%), or one-quarter inch (1/4”), whichever is greater.
- d. Pipe shall be Class 100, unless otherwise shown or specified in the Contract
- e. Deflection of the pipe cross section shall be limited to one percent (1%) of the inside diameter when the pipe is placed under full external design load.
- f. Pipe sections of less than standard length may only be used with approval of the City.

Joints for concrete cylinder pipe and cement mortar lined and coated steel pipe shall be O-ring rubber gasket type with grout “diaper” finish, bolted flange type, “Dresser” or “Victaulic” couplings.

Protect gaskets from exposure to weather, heat, ozone, oil, grease, and sunlight for any time period exceeding 48 hours. Do not store gaskets near electrical or exhaust heat sources.

### **50-23 DUCTILE IRON PIPE (DIP), AND CAST IRON PIPE AND DUCTILE IRON FITTINGS**

Ductile iron pipe shall conform to ANSI A21.51 (AWWA C151) for a minimum working pressure of one hundred fifty (150) psi unless otherwise specified. Ductile iron casting shall conform to and be tested in accordance with ASTM Designation: A 536. Casting grade for pipe shall be 60-42-10.

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Laying length shall be the manufacturer's standard length, normally eighteen feet (18'). Shorter lengths may be used for closures and proper location of special sections.

Except for gravity sanitary sewer, the interior surface of all ductile iron pipe shall be cement-mortar lined and seal coated in conformance with AWWA C104 and the exterior surface shall have a bituminous coating of either coal tar or asphalt base, approximately 1 mil thick or as directed by the City or specified in the Special Provisions.

For gravity sanitary sewers, coat interior of ductile iron pipe with 40 mil (minimum) of two-component polyisocyanate, polyol-cured urethane coating equivalent to Corropipe II manufactured by Madison Chemical Industries. Wrap ductile iron pipe with two wraps of 8-mil HDPE wrapping sleeve. Secure sleeve with 3 wraps of 10 mil HDPE tape, overlapping each wrap one-half tape width.

Fittings shall have push-on, mechanical joints or flanged ends. Four-inch (4") through twelve-inch (12") fittings shall be ductile iron, fittings larger than twelve inches (12") shall be cast iron or ductile iron. All fittings shall conform to ANSI 21.10 (AWWA C110), ANSI 21.11 (AWWA C111), or AWWA C153 designed for a working pressure of two hundred fifty (250) or three hundred fifty (350) pounds per square inch (psi). Coating and lining requirements shall be the same as specified for the pipe.

Joints shall be push-on or mechanical type and shall conform to ANSI 21.11 (AWWA C111) with rubber gaskets unless otherwise specified. Gasket lubricant shall be minimum required plus ten percent (10%).

### **50-24 RESERVED**

### **50-25 RESERVED**

### **50-26 RESERVED**

### **50-27 RESERVED**

### **50-28 FIELD ASSEMBLED PLATE CULVERT**

Field assembled plate culverts shall conform to Section 67, "Structural Plate Culverts", of the State Specifications.

### **50-29 PLASTIC PIPE**

Section 50-29 includes specifications for fabricating and installing plastic pipe.

Plastic pipe delivered to the project shall have a Certification of Compliance, including the average pipe stiffness, resin material cell classification and date of manufacture. Plastic pipe shall not be installed until the Engineer has received the Certification of Compliance.

Installing plastic pipe includes excavation, backfill, connection of new pipe to new or existing facilities, reinforcement, concrete collars or tees, and other connecting devices.

Plastic pipe must be Type S corrugated polyethylene pipe, polypropylene dual wall pipe or corrugated PVC pipe with smooth interior unless specified otherwise.

The residue from the ignition of polyethylene, PVC, and polypropylene compounds must not exceed 30 percent as determined under ASTM D2584 except the muffle furnace temperature must

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be 840 ± 45 degrees F.

Pipes and fittings must be homogenous throughout and uniform in color, opacity, density, and other properties. The inside and outside surfaces must be semi-matte or glossy in appearance and free of chalky, sticky, or tacky material. The pipe walls must be free of cracks, holes, blisters, voids, foreign inclusions, or other defects affecting the pipe wall integrity or visible to the naked eye. Do not use pipes or fittings with abrasions or scratches deeper than 10 percent of the wall thickness. The joint surfaces where the gaskets bear must be smooth and free of imperfections, ridges, fractures, or cracks that could adversely affect the joint seal.

Store pipes in unit packages and protect the bell end of the pipes from damage. Support unit packages with racks or dunnage to prevent damage and bending. If unit packages are stacked, do not allow the weight of the upper units to cause deformation to the pipes in the lower units. Do not store pipes adjacent to heat sources. Do not allow pipes to overhang vehicles or storage areas unsupported by more than 3 feet.

Pipe, fittings, and gaskets must be covered or wrapped if exposed to sunlight during storage to provide sun block protection. Provide adequate air circulation around the covered pipes to reduce excessive heat accumulation. Protect gaskets from exposure to weather, heat, ozone, oil, grease, and sunlight for any time period exceeding 48 hours. Do not store gaskets near electrical or exhaust heat sources. Provide adequate blocking to prevent pipe sagging and deflection. Pipe must be kept clean and fully drained during storage.

The City rejects pipes with cracked or split gaskets.

The Contractor shall:

1. Protect pipes and fittings from damage when handling and installing.
2. Lay plastic pipe to line and grade with sections closely jointed
3. Not let the pipe trench flood before backfilling,

Excavation and backfill shall conform to these Standard Construction Specification, Section 19 “Trench Excavation, Bedding and Backfill” and Standard Drawings SD-6.0, SD-6.1 and SD-6.2.

Plastic pipe is to be placed in a trench excavated to the established lines and grades. Grade and prepare the bottom of the trench throughout the entire length of the pipe as specified in these specifications and Standard Drawings.

Backfill materials for plastic pipe, including crushed rock, Portland Cement Concrete, Controlled Density Fill, and Controlled Low-Strength Material, must comply with Standard Construction Specification, Section 50 “Construction Materials”.

### **50-29.01 Polyvinyl Chloride (PVC) Pipe for Sewers and Drainage**

#### **50-29.01A PVC Pipe for Drainage**

Polyvinyl Chloride Pipe for drainage shall conform to one of the following Standards:

<b>Diameter (inches)</b>	<b>Standard Designation</b>
12	ASTM D3034, SDR 35, AWWA C900, DR 18
14	AWWA, C905, DR 18
15	, AWWA C905, DR 18
16	AWWA C905, DR 18

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18	ASTM D2241, SDR 51, AWWA C905, DR 18
20	AWWA C905, DR 18
21	ASTM D2241, SDR 51
24	ASTM D2241, SDR 51; AWWA C905, DR 18
27	ASTM D2241, SDR 51
30	AWWA C905, DR18

Joints of PVC pipe shall consist of either an elastomeric gasket coupling or an integral bell and spigot with an elastomeric gasket. The assembly of joints shall be in accordance with the pipe manufacturer's recommendations and the requirements of ASTM Designation: D 3212.

The quality of material and installation of all PVC pipe shall meet or exceed the requirements of Section 38-9, "Testing of Pipe", of these Specifications.

Use of PVC pipe downstream of the last manhole or junction structure to an open channel, detention facilities or a daylight condition is not allowed.

Excavation and backfill shall conform to Section 19, "Trench Excavation, Bedding and Backfill" of the Standard Construction Specifications.

**50-29.01B BPVC Pipe for Sewer – RESERVED**

**50-29.02 Corrugated Polyethylene Pipe**

Corrugated polyethylene pipe must be Type S and be sixty inches (60") or less in nominal diameter. Corrugated polyethylene pipe with inside diameters of twelve inches (12") to sixty inches (60") shall conform to AASHTO M294 and AASHTO M294R.

Compounds used in the manufacture of corrugated polyethylene pipe and fittings must comply with AASHTO M 294 and AASHTO M294R, except the mix must contain from two percent to four percent (2% to 4%) well dispersed carbon black. If Corrugated polyethylene pipe is manufactured with recycled resins, the final blend shall adhere to AASHTO M294R requiring a 100 year service life.

If recycled resin is used for corrugated polyethylene pipe, the Contractor shall submit the percentage of recycled resin used to the Engineer.

The corrugated polyethylene pipe manufacture must:

1. Participate in the National Transportation Product Evaluation Program (NTPEP) for each plant supplying corrugated polyethylene pipe and fittings for the project,
2. Conduct and maintain a quality control program under National Transportation Product Evaluation Program

All pipes and fitting must be clearly marked with:

1. Manufacturer's name or trademark
2. Nominal size
3. Specification designation
4. Plant location or designation code
5. Date of manufacture

Pipe must be marked at intervals of not more than twelve (12) feet.

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Pipe joints shall be bell and spigot or welded type, certified capable of watertight performance, with O-ring gaskets meeting ASTM Designation: F 477. The assembly of joints shall be in accordance with the pipe manufacturer's recommendations and the requirements of ASTM Designation: D 3212. The quality of the material and installation shall meet or exceed the requirements of Section 38-9, "Testing of Pipe", of these Specifications. Pipe dimensions are nominal inside diameters. The average inside diameter shall not vary more than the following:

Pipe Diameter	Maximum
12" through 18"	1/4 inch
21" through 24"	3/8 inch
Over 24"	1/2 inch

The corrugated polyethylene pipe compounds shall conform to cell classifications as provided in ASTM Designation: D 3350.

Wall thickness of Type S corrugated polyethylene pipe shall be the thickness of the inner liner measured between corrugation valleys. The wall thickness of the corrugated polyethylene pipe, measured as specified above, shall equal, or exceed the minimum wall thickness values in Table 50-6.

The pipe stiffness shall be determined in accordance with ASTM Designation: D 2412 at five percent (5%) deflection. The Contractor shall verify compliance of pipe stiffness and testing from the NTPEP in accordance with AASHTO 294, AASHTO 294R and ASTM D2412.

Excavation and backfill shall conform to Section 19, "Trench Excavation, Bedding and Backfill" of the Standard Construction Specifications.

Backfill for polyethylene pipe forty-two inches (42") or greater in nominal diameter shall conform to these specifications and Standard Drawing SD-6.0 and SD-6.2.

Corrugated Polyethylene pipe shall not be used in existing or future roadways or for driveway culverts. It may only be used for trunk lines outside roadways.

### **50-29.03 Polypropylene Dual Wall Pipe**

Polypropylene dual wall pipe and fitting must have a smooth interior wall and annular exterior corrugation complying with ASTM F2881. Polypropylene dual wall pipe must not exceed sixty-inch (60") in nominal diameter.

Polypropylene compound for pipe and fitting production must be impact modified copolymer materials and meet the requirements of ASTM F2881.

Pipe and fittings must be manufactured from virgin compounds. Reworked plastic may be used if it meets the requirements for rework plastic conforming to ASTM F2881.

Pipe must be colored or black. Carbon black content must be from 2 to 3 percent by weight for black pipe. Add UV stabilizers for colored pipe under the manufacturer's instructions.

Gaskets must be elastomeric and comply with ASTM F477. No reworked material will be allowed in the manufacture of the gasket. Gaskets must be covered with a removable,

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protective wrap to ensure the gasket is free from debris.

All pipes and fittings must be clearly marked with:

1. Manufacturer's name or trademark
2. Nominal size
3. Specification designation
4. Plant location or designation code
5. Date of manufacture

Pipe must be marked at intervals of not more than 12 feet.

For Polypropylene Dual Wall pipe:

1. Joint must be watertight unless otherwise specified.
2. Joints must comply with ASTM D3212 and be bell and spigot type unless alternative connections are shown.
3. Gaskets must be installed at all joints.
4. The lubricate used for the assembly of the gasketed joint must be as recommended by the pipe manufacturer with no detrimental effect on the gasket or pipe.
5. Install joints so that the elastomeric gasket will be compressed radially between the pipe bell and the spigot to form a tight seal when assembled.

Excavation and backfill shall conform to Section 19, "Trench Excavation, Bedding and Backfill" of the Standard Construction Specifications.

Backfill for polypropylene pipe forty-two inches (42") or greater in nominal diameter shall conform to these specifications and Standard Drawing SD-6.0 and SD-6.2.

### **50-30 REINFORCING STEEL, CURB DOWELS AND TIE BARS**

Reinforcing steel shall conform to Section 52, "Reinforcement", of the State Specifications. Unless shown or specified in the Contract, bar reinforcement shall be deformed Grade 60 conforming to ASTM Designation: A 615.

Welded steel wire fabric for concrete reinforcement shall conform to ASTM Designation: A 1064. The gauge of the wire and the dimensions of the mesh will be as shown or specified in the Contract.

### **50-31 STORM DRAIN CASTINGS**

Castings for manhole frames and covers, drop inlet frames, gutter drain frames, open-back hoods, flushing branch frames and covers, or other purposes shall be tough gray iron, shall have a coating of black bituminous material or hot dip galvanized, per the Standard Drawing SD section per corresponding detail notes. free from cracks, holes, swells, and cold sheets, and be of workmanlike finish. A "Certificate of Compliance" signed by an authorized agent of the manufacturer or supplier shall be required and shall be delivered to the City. Each certificate so furnished shall be accompanied by a copy of test results stating that the material has been sampled, tested, and inspected in accordance with the provisions of ASTM Designation: A 48, Gray Iron Castings Class 35B.

Test bars shall be cast and tested for the first lot of casting and every four (4) months thereafter. If production is interrupted for any period longer than four (4) months, test bars shall

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be cast and tested from the initial lot after production is resumed and every four (4) months thereafter. The first lot is defined as the first castings produced after January 1 every year. The tension tests specified shall be performed and the results certified by an independent testing laboratory.

The cast iron shall meet the requirements of ASTM Designation: A 48, Class 35. The seating faces of manhole covers and frames shall be machined as shown on the Standard Drawings or Plans to assure a tight fit and prevent rocking. The name of the manufacturer shall be cast on the manhole cover and frame. In addition, the day, month, and year of manufacture shall be cast on the frame and cover adjacent to the name of the manufacturer.

Twenty-four inch (24") diameter manhole frames and covers shall conform to Standard Drawings SD-9 and SD-11 for storm drain, unless otherwise shown on the Plans or specified in the Special Provisions.

Thirty-six inch (36") diameter manhole frames and covers shall conform to Standard Drawings SD-10.1 & 10.2 for storm drain, unless otherwise shown on the Plans or in the Special Provisions.

The CSD-1 logo covers are required on all County Sanitation District 1 sewer line manholes; the SRCSD logo covers are required on all Sacramento Regional County Sanitation District sewer line manholes.

When required by the City, proof-load tests shall be performed on manhole frames and covers in accordance with Section 3.3 of Federal Specification A-A-60005.

Exposed edges of castings shall be chamfered or rounded, and all exposed surfaces shall be smooth unless otherwise shown.

Manhole frames and covers shall be clearly marked with the country of origin as specified in the Trade of Tariff Act of 1984.

At the Contractor's option, drop inlet frames and open back hoods may be fabricated from steel plate as structural shapes in lieu of cast iron. If the Contractor elects to use fabricated steel drop inlet frames or open back hoods, the Contractor shall submit Working Drawings to the City for approval prior to fabrication. This submittal requirement does not apply to the drop inlet frame shown on Standard Drawing SD-14.

### **50-32 JOINT MATERIALS FOR MANHOLES**

Joint materials for precast reinforced concrete manhole sections shall conform to one of the following:

1. Mortar proportioned as one (1) cubic foot of portland cement to two (2) cubic feet of concrete sand. All mortar shall be used within thirty (30) minutes after the mixing water has been added.
2. Preformed plastic sealing compound shall conform to Type 1 - Rope Form, one and one-half inch (1-1/2") diameter, Federal Specification SS-S-210A.
3. Gulf States Pre-Extruded concrete joint sealant.

### **50-33 FENCING - CHAIN LINK**

Chain link fence and gate materials shall conform to Section 80, "Fences", of the State

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Specifications, and these Specifications.

The carbon content of steel posts shall not exceed 0.82 percent.

Chain link fence fabric shall meet the requirements of zinc-coated steel chain link fence fabric, ASTM Designation: A 392 with Class 1 zinc coating. Unless otherwise shown on the Plans or specified in the Special Provisions, the fabric shall be a two-inch (2”) mesh of nine (9) gauge wire, with a minimum breaking strength of one thousand two hundred ninety (1,290) pounds.

Vinyl coated chain link fence fabric, when shown on the Plans or specified in the Special Provisions, shall be black polyvinyl chloride coated steel link fabric and fittings. Polyvinyl chloride shall be applied by the thermal extrusion process.

Slats shall be as specified in the Special Provisions.

Base material for the manufacture of steel pipe used for posts, braces, rails, and gate frames shall be commercial quality, or better, weldable steel, conforming to the specifications of ASTM Designation: A 120. At the option of the Contractor, and upon approval of the City; high-strength tubing fabricated by cold rolling and radio frequency welding from steel conforming to ASTM Designation: A 446, Grade D, may be used provided that the product of the yield strength and the section modulus shall not be less than that of pipe conforming to ASTM Designation: A 120.

The base material for the manufacture of other steel sections used for posts and braces shall conform to ASTM Designation: A 572, Grade 45, with a minimum yield strength of forty thousand (40,000) pounds per square inch. All posts, braces, rails, and gate frames shall be hot dipped galvanized in accordance with ASTM Designation: A 123, or ASTM Designation: A 525, Coating Designation G235 plus chromate conversion coating and 0.4 mils minimum thickness finish coat of clear, cross-linked acrylic.

Posts and rails for vinyl coated chain link fence shall be hot dipped galvanized and covered with two (2) coats of black metal paint applied over a metal primer.

Posts and rails shall be as specified in the following Table 50-7, unless otherwise shown or specified in the Contract. The Contractor shall have the option of section types to be used with the condition that the option exercised shall be uniform throughout the Work.

<b>TABLE 50-7 CHAIN LINK FENCING</b>			
<b>Fence Member</b>	<b>Section Type</b>	<b>Dimension O.D. (Inches)</b>	<b>Minimum Weight (LBS/FT)</b>
Line Posts	C-Section	1.875	2.15
	Sch. 40 pipe	2.375	3.65
	Hi-strength tubing	2.375	3.12
Terminal, Corner & Latch Posts	Sch. 40 pipe'	2.875	5.79
	Hi-Strength tubing	2.875	4.64
Horizontal & Diagonal Braces, Top Rails	C-Section	1.825	1.35
	Sch. 40 pipe	1.660	2.27
	Hi-Strength tubing	1.660	1.82

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Gate Frames		Sch. 40 pipe	2.375	3.65
		Hi-Strength tubing	2.375	3.12
Gate Post	Gate width up through 6'	Sch. 40 pipe	2.875	5.79
	Gate width over 6'	Sch. 40 pipe	4.500	10.79
	Gate width over 12'	Sch. 40 pipe	5.563	14.62
	Gate width over 18' (24'Max gate width)	Sch. 40 pipe	6.625	18.97

Fittings shall be hot-dip galvanized and shall be of malleable, cast iron, or pressed steel. A Certificate of Compliance in accordance with the provisions of Section 6-1.07, "Certificates of Compliance", of the State Specifications, shall be furnished to the City prior to the installation of any chain link fencing, gates or components

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**50-34.01 Topsoil**

Topsoil shall be sandy loam of an even texture and shall pass through a one-half inch (1/2") screen.

The topsoil shall be free from insects, animal life, or any toxic substances that may be detrimental to the growth of vegetation. Topsoil shall be capable of sustaining healthy plant life. Soil sterilizers or weed killers shall permit growth of nursery stock planted three (3) weeks after application. Compounds containing cyanide or arsenic will not be allowed.

The Contractor shall provide a soils report to the City for approval prior to placement of topsoil. The report shall indicate conformance with these Specifications and the following:

<b>SOIL ELEMENTS</b>	<b>ACCEPTABLE RANGE</b>
pH	6.6 - 8.0
CEC (Cation Exchange Capacity)	12.00 - 35.00 meg/100g
SAR (Sodium Absorption Ratio)	less than 5.00
ESP (Exchangeable Sodium Percentage)	less than 5.00
EC (Electronic Conductivity)	2.0 - 2.5 mmho/cm
SP (Sodium Percentage)	less than 45%
Percentage Organic Matter	2% - 5%

Topsoil shall be delivered reasonably dry and in a workable condition.

Sandy loam of low fertility, even though mixed with leaf mold, manure, or other

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fertilizers, will not be acceptable unless prior approval has been granted by the City. The Contractor shall attach soil and plant Lab Report for the City's approval.

### **50-34.02 Commercial Fertilizer**

Planting tablets for planting trees and shrubs shall be tightly compressed, non-burning, long lasting fertilizer, weighing between five (5) and twelve and a half (12.5) grams 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%

Quantity of planting tablets per plant shall be based on the manufacturer's recommendation unless otherwise specified in the Special Provisions.

Fertilizer used for planting maintenance shall have a minimum guaranteed chemical analysis of twenty-one percent (21%) nitrogen, zero percent (0%) phosphoric acid, and zero percent (0%) soluble potash.

Fertilizer for turf installation, unless otherwise specified, shall have a minimum guaranteed chemical analysis of twenty-one percent (21%) nitrogen, ten percent (10%) phosphoric acid and ten percent (10%) 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 when specified in the Special Provisions.

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 six percent (6%) nitrogen, twenty percent (20%) phosphoric acid, and twenty percent (20%) soluble potash.

### **50-34.03 Soil Amendment**

Soil amendment shall be a ground wood product such as bark or redwood fortified with nitrogen and treated to absorb water quickly, or a relatively dry organic compost derived from sewage sludge. Soil amendment shall be friable and shall be free of weed seed, dust, and other objectionable materials. Soil amendment shall pass a one-inch (1") sieve and shall comply with the requirements in the California Food and Agricultural Code.

### **50-34.04 Iron Sulfate**

Iron sulfate shall be ferrous sulfate in pelleted or granular form containing not less than 18.5 percent iron expressed as metallic iron. Iron sulfate shall conform to the requirements of the California Food and Agricultural Code.

### **50-34.05 Straw**

Straw shall be derived from wheat, rice, or barley. The Contractor shall furnish to the

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City evidence that clearance has been obtained from the Sacramento County Agricultural Commissioner, as required by law, before straw obtained from outside the County is delivered to the site of the Work. Straw that has been used for stable bedding shall not be used.

### **50-34.06 Fiber**

Fiber used for hydroseeding shall be produced from natural or recycled (pulp) fiber, such as wood chips or similar wood materials or from newsprint, chipboard, corrugated cardboard, or a combination of these processed materials, and shall be free of synthetic or plastic materials. Fiber shall disperse uniformly into a slurry when mixed with water. Fiber shall be colored to contrast with the area on which the fiber is to be applied and shall not stain concrete or painted surfaces. The slurry, when hydraulically applied to the ground, shall form an absorptive mat of mulch uniformly impregnated with seed and other ingredients. No materials that inhibit growth or germination shall be present in the mixture.

### **50-34.07 Mulch**

Unless otherwise specified in the Special Provisions or shown on the Plans, mulch shall consist of wood chips, tree bark, or shredded bark, or any combination thereof, at the Contractor's option. Shredded redwood bark ("gorilla hair") shall not be used. Materials deemed highly flammable or a potential fire hazard by the City shall not be used.

Wood chips shall be manufactured from clean wood. The particle size of the chips shall be between one-half inch (1/2") and three inches (3") in length, and not less than three-eighths inch (3/8") in width and one-sixteenth inch (1/16") in thickness. At least 85 percent, by volume, of wood chips shall conform to the sizes specified.

Tree bark shall have a particle size between one-half inch (1/2") and one-and-one-half inches (1-1/2") and shall be free of salt and foreign materials such as clods, coarse objects, sticks, rocks, weeds or weed seeds.

Shredded bark shall be a mixture of shredded bark and wood; shall have a particle size between one-eighth inch (1/8") and one-and-one-half inches (1-1/2") in thickness and one inch (1") to eight inches (8") in length; and shall be free of salt and deleterious materials such as clods, coarse objects, and rocks. At least seventy-five percent (75%), by volume, of shredded bark shall conform to the sizes specified.

### **50-34.08 Planting Mix**

Planting mix for backfilling planting holes shall consist of two (2) parts of soil excavated from the planting holes free of rocks over one-half inch (1/2") in diameter and one part soil amendment per Section 50-34.03. The materials shall be thoroughly mixed.

### **50-34.09 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 or grass seed content for each kind of seed furnished and, in the case of a mixture, the proportions of each kind of seed. Types of seed or seed mixtures shall be as shown on the Plans or specified in the Contract Special

Provisions.

The Contractor shall furnish the City 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 six (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 or grass content for each kind of seed furnished and, in case of a mixture, the proportions of each kind of seed.

Seed with less than the specified purity or germination may be used under the following conditions:

- a. The application rate for such seed shall be increased to compensate for the less than specified purity or germination.
- b. Prior to using such seed, the Contractor shall submit to the City the purity and germination percentages, and the proposed increased application rate for such seed.
- c. No such seed shall be used before the City has approved, in writing, the use of such seed and the increased application rate.
- d. The additional seed required because of the increased application rate shall be furnished and applied at the Contractor's expense.

Seed specified without a purity or germination requirement shall be labeled to include the name, date (month and year) collected and name and address of the supplier. Said seed shall be, at the time of sowing, from the previous or current year's harvest.

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.

**50-34.09.A 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.

**50-34.09.B Wildflower Seed for Hydroseeding**

Wildflower seed type to be used for hydroseeding shall be as indicated in the Plans or Contract 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. 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 City. Final acceptance will not be considered unless all tags are produced and verified.

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### **50-34.10 Stabilizing Emulsion**

Stabilizing emulsion (tackier or binder) shall be a concentrated liquid chemical that forms a plastic film upon drying and allows water and air to penetrate. The film shall be nonflammable and shall have an effective life of at least one year.

Stabilizing emulsion shall be nontoxic to plant or animal life and non-staining to concrete or painted surfaces. In the cured state, the stabilizing emulsion shall not be re-emulsifiable. Stabilizing emulsion shall be miscible with water at the time of mixing and application.

### **50-34.11 Lumber**

Lumber shall be construction grade cedar, pressure treated Douglas fir, or heart redwood, rough cut, from sound timber. It shall be straight and free from loose or unsound knots, shakes in excess of 1/3 the thickness of the lumber, splits longer than the thickness of the lumber, or other defect which would render the lumber unfit structurally for the purpose intended. Knots in all lumber shall be sound, tight, well spaced, and shall not exceed two inches (2") in size on any face. Sweep shall not exceed 0.08 foot in six feet (6').

### **50-34.12 Tree Stakes and Ties**

Stakes for support of trees shall be lodge-pole pine, unless otherwise specified in the Special Provisions. Stakes for fifteen- (15) gallon trees or smaller shall be two-inch (2") diameter x ten feet (10') long. Stakes for twenty-four inch (24") box trees or larger shall be two-inch (2") diameter x twelve feet (12') long. The tree ties shall be black rubber cinch ties, unless otherwise specified in the Special Provisions.

### **50-34.13 Root Control Barrier**

Root control barrier shall be an injection molded or extruded modular component made of high-density polypropylene or polyethylene plastic. Panels shall have a minimum thickness of 0.080 inch (2.032 mm). Each panel shall have molded vertical ribs (four minimum) and locking strips or integral male/female sliding locks. Vertical root deflecting ribs or channels shall be one-half inch (1/2") high, perpendicular to the panel, and between six (6) and eight (8) inches apart. Panel shall be twenty-four inch x twenty-four inch (24" x 24") size unless otherwise specified in the Special Provisions.

### **50-34.14 Plants**

Plants shall be of the variety and size shown on the Plans or specified in the Special Provisions and shall conform to the requirements of these Specifications.

Plants shall be vigorous, first class representations of the species and cultivars specified, and shall conform to State and local laws governing the sale and transportation of plant materials. Only plants of the size and type shown on the Plans or designated in these Specifications or the Special Provisions, and only plants with normal plant and root structures will be acceptable.

All plants shall be nursery grown in containers, unless otherwise shown on the Plans or designated in the Special Provisions, and shall have been grown in the specified containers for not less than six (6) months. They shall have straight, single trunks, unless otherwise specified on the Plans. No pruning shall be undertaken before planting. Plants specified as

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multi-trunk shall have at least three (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 three (3) sides to stop encircling root growth. Plants shall have well developed root systems and not be rootbound or show sunscald, injuries, abrasions or other objectionable disfigurements. Plants shall be free of disease, insects, pests, eggs, or larvae. Tree trunks shall be sturdy and well "hardened off". Plants not meeting these specifications shall be rejected.

Any plants delivered to the work 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 as specified herein or as shown on the Plans or described in the Special Provisions. Under no condition shall there be any substitution of plants or sizes for those listed on the Plans, except with the written consent of the Landscape Architect.

No plant shall be transported to the planting area that is not thoroughly wet throughout the root ball. Any plant that, in the opinion of the City, has a damaged root ball or is dry or in a wilted condition when delivered to the planting area will not be accepted, and shall be replaced by the Contractor at the Contractor's expense. Trucks used for transporting plants shall be equipped with covers to protect plants from windburn.

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, County and City laws requiring inspection for plant disease 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 City.

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

The Contractor shall notify the City at least two (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.

### **50-34.14.A Turf**

Grass sod shall be well established mown lawn grass turf and shall be free of weeds and any other harmful or deleterious matter.

At least eighty percent (80%) of the grass plants in the cut sod shall be composed of the species or varieties specified in the Special Provisions.

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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 one-quarter inch ( $1" \pm 1/4"$ ). 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 twenty-four (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 forty-eight (48) hours after cutting.

**50-34.14.B 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 shown on the Plans or described in the Special Provisions.

Tree species shall meet minimum size requirements for caliper size of trunk and height of tree stock or they shall be rejected. Table 50-8 below indicates the height to caliper of trunk relationship. Trees shall be specified by container size in the Contract, and shall meet the minimum height and caliper of trunk indicated in the table. For shade trees of recognized slower growth, as identified by the City, the height and caliper shall be not less than two-thirds ( $2/3$ ) the height and caliper indicated below:

<b>TABLE 50-8 TREE CALIPER-HEIGHT RATIO</b>		
<b>Container Size (gallons)</b>	<b>Caliper of Trunk (inches)</b>	<b>Average Height Range (feet)</b>
5	$3/8$ to $1/2$	4 to 5
5	$1/2$ to $5/8$	5 to 6
7	$5/8$ to $3/4$	6 to 7
7	$3/4$ to 1	7 to 8
7	1 to $1-1/4$	8 to 9
15	$1-1/4$ 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

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 five inches (5") above soil level. If the tree is budded or grafted to a root system, the measurement shall be taken two inches (2") 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.

If possible, 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 shall not be rootbound or show evidence of girdling or kinked root systems. Trees shall not exhibit co-dominant trunks or branching with included bark. Trees shall not be severely topped or headed. Trees shall not have surface roots larger than one-quarter-inch (¼”) diameter. Trees shall not exhibit evidence of sunscald or pest infestation. Upon inspection, trees not meeting these requirements 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 work 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 City at any time during 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.

**50-34.15 Water**

Water shall be of such quality that it will promote germination of seeds and growth of plants. Should recycled (or reclaimed) water be used, please refer to the Sacramento County Standard Construction Specifications Section 41-22 – “Recycled Water” for the unique requirements of using recycled water.

**50-34.16 Irrigation Pipe**

Pipe and fittings for irrigation systems shall be as specified in these Specifications and the Special Provisions.

Unless otherwise shown on the Plans, risers and threaded nipples for irrigation systems shall be Schedule 80, PVC 1120 or PVC 1220, or PVC pipe conforming to the requirements of ASTM Designation: D 1785.

**50-34.16.A Steel Pipe**

For installation of backflow preventers, steel pipe and couplings and wrought iron couplings shall conform to AWWA standard C200 and the specifications of ASTM Designation: A 53, standard weight, galvanized, except that the weight of zinc coating shall be not less than ninety percent (90%) of the weight specified in said ASTM Designation. Fittings, except couplings, shall be galvanized malleable iron, banded and threaded, conforming to ANSI Standard: B16.3, one hundred fifty (150) pound class.

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Steel pipe below grade shall be wrapped with six (6) mil plastic tape.

### **50-34.16.B Plastic Pipe**

Plastic pipe for irrigation systems will be shown on the Plans as main line and lateral line (non-pressure).

Solvent cement and primer for PVC plastic pipe and fittings shall be of commercial quality specifically manufactured for use with rigid PVC plastic pipe and fittings. The solvent cement and primer used shall be made by the same manufacturer. The color of the primer shall contrast with the color of the pipe and fittings.

The pipe shall be furnished in minimum standard lengths of twenty feet (20’).

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 two (2) years, covering quality control tests, raw material batch numbers, and any other information deemed necessary by the manufacturer.

### **50-34.16.B.(1) Main Line**

Main line shall be PVC of the types and classifications shown or specified in the Contract. Main line shall be approved by the National Sanitation Foundation, and shall conform to the requirements of either ASTM Designation: D 2241 or D 2672, except that main line with a bell socket formed as an integral part of the pipe for use with rubber ring gaskets shall conform to the requirements of ASTM Designation: D 2241. The belled portion of said pipe for use with rubber ring gaskets shall conform to the requirements of ASTM Designation: D 3139 (except for the dimensional ratio), shall be formed to maintain uniformity in alignment and roundness and shall be free of irregularities and defects.

The wall thickness of the bell shall not be less than the specified minimum wall thickness of the pipe.

The wall thickness of the bell end of the pipe may exceed maximum allowable wall thickness of the pipe for a length not to exceed twenty-four inches (24”) from the end of the pipe.

Main line pipe and fittings on the pressure side of control valves that are two inches (2”) or larger in diameter shall be either the rubber ring gasket type or the solvent cemented type, except that all pipe and fittings installed in conduits or sleeves shall be the solvent cemented type.

Threaded fittings and fittings to be solvent cemented to main line shall be injection molded PVC, Schedule 40. Fittings equipped with rubber ring gaskets for main line shall be either injection molded PVC plastic pipe fittings or machined pipe stock fittings.

### **50-34.16.B.(2) Lateral Line**

Lateral line shall be PVC of the type and classification shown on the Plans or specified in the Special Provisions. Lateral line shall be approved by the National Sanitation

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Foundation, and shall conform to the requirements of ASTM Designation: D 2241. PVC pipe shall be solvent weld, minimum Class 200, and shall be manufactured of Type 1, Grade I or II, 2000 psi design stress compound designated as PVC 1120 or 1220, and shall conform to ASTM Designation: D 1784 for rigid PVC compounds.

Fittings shall be molded fittings manufactured of the same material as the pipe and shall be suitable for either solvent weld or screwed connections. Solvent weld fittings shall be of a pressure rating equal to or greater than that of the pipe.

### **50-34.17 Subsurface Dripper line**

Subsurface dripper line shall conform to Section 20-5.05A, "Subsurface Dripper line", of these Specifications and the Special Provisions. The dripper line shall consist of one-half inch (1/2") low density linear polyethylene tubing, housing internal, pressure compensating, self-cleaning, integral drip emitters.

The dripper line shall be available with two different emitter discharge rates. Low flow discharge rates shall range from .53 to .61 GPH. High flow discharge rates shall range from .92 to 1.02 GPH. Dripper line shall be available with twelve-inch (12"), eighteen-inch (18") and twenty-four inch (24") emitter spacing.

### **50-34.18 Irrigation Sleeving Conduit**

Irrigation sleeving for irrigation line crossovers or control wire shall conform to Section 20-5.04B, "Irrigation Sleeving", of these Specifications and the Special Provisions.

Conduit shall be Schedule 40 PVC pipe. Conduit shall extend a minimum of twelve inches (12") beyond the back of all pavement.

### **50-34.19 Sprinklers and Emitters**

Sprinklers and emitters shall be the type and model as noted on the Plans or as specified in the Special Provisions.

### **50-34.20 Automatic Irrigation Controllers**

Automatic irrigation controllers shall be the type and model noted on the Plans or specified in the Special Provisions. Automatic irrigation controllers shall be 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, with 14-day programming capability.

The controller shall be capable of manual station selection and operation. 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 two- to sixty- (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 fourteen (14) day clock shall provide maximum programming versatility.

The controller shall have the following standard features: an electrical circuit to operate a master valve, a reset circuit breaker to protect the controller from damage due to excessive voltage surges and a master "on-off" switch for turning controller "off" during rainy weather while allowing day and hour clocks to continue operation.

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Irrigation controllers shall be housed in pedestal or wall-mounted enclosures as specified in the Contract.

Irrigation controllers shall conform to NEC Class 2 requirements. The controller output shall be less than 110 volt-amperes to qualify for direct burial of output wires.

The irrigation controller enclosure shall be constructed of stainless steel and shall be a minimum of thirty-six inches (36") high and twenty-four inches (24") wide and deep enough to house the components. Enclosure shall have a vented door and/or sides and shall be lockable. The enclosure shall be mounted on a concrete pad with a minimum dimension of thirty-six inches x thirty-six inches x six inches (36" x 36" x 6").

### **50-34.21 Quick Coupling Valves**

Quick coupling valves shall be of brass or bronze construction with one-inch (1") IPS female pipe connections. The valve body shall be of two-piece construction, consisting of an upper and a lower piece body. The upper valve body shall be easily removable for replacement.

All quick coupling valves shall be the type used on non-potable systems marked with special "Do Not Drink" warnings. Quick coupling valve shall have a durable locking rubber or vinyl cover, yellow in color. Purple covers shall only be used on systems using non-potable water.

All quick coupling valve keys shall be of the same manufacturer as the quick coupling valve, and shall be the proper size to fit the valves as specified. Valve key shall be of brass or bronze construction with a replaceable stainless-steel lug.

### **50-34.22 Control Valves**

Control valves shall be the electric remote control, battery-operated remote control or manual type straight or angle pattern globe valves, and shall be of glass filled nylon, plastic, brass, bronze, or cast iron construction as shown on the Plans or specified in the Special Provisions. All metal parts of glass filled nylon valves shall be stainless steel or brass. Valves shall be of the same size as the pipeline that said valves serve, unless otherwise shown on the Plans. Control valves shall be capable of withstanding a cold water working pressure of one hundred fifty (150) pounds per square inch.

Automatic valves shall have a manual flow control adjustment with shut-off provisions. The valves shall also have an external "bleed" to enable manual operation. Automatic actuation shall be by means of an encapsulated type solenoid with a minimum rating of 24 volts, 60 cycle and 2 to 5 watts.

### **50-34.23 Master Control Valve/Flow Sensor Assembly**

Master Control Valve/Flow Sensor Assembly shall combine a turbine type (vertical impeller) water meter and a diaphragm actuated solenoid controlled valve mounted in a single globe style valve body. Master control valve shall be an electric normally open valve with a 24V solenoid. The main valve shall fully open and close drip tight in response to an electrical signal. The meter shall power a gear mechanism that activates a reed switch that transmits a pulse at a pre-determined amount of flow. Pulse transmitter shall be one pulse per ten (10) gallons through the master valve and flow sensor unit. The unit should include integral flow guides to eliminate the need for straight pipe allowances before and after the

valve.

Maintenance operations on the valve and meter shall be feasible without removing the valve body from the line.

**50-34.24 Valve Boxes**

Valve boxes and valve box lids shall be precast portland cement concrete when installed in concrete or other paving. Valve boxes and valve box lids shall be reinforced plastic when installed in turf or planter areas. Concrete valve box lids shall be marked "IRRIGATION" in cast-in letters not less than one inch (1") high.

Valve boxes for control valves shall be 17" x 11-3/4" x 12" depth (minimum size) with 3" x 4" knock outs and installed two inches (2") above finished grade.

**50-34.25 Backflow Preventers**

Backflow preventers shall be reduced-pressure type as approved by the Sacramento County Environmental Health Division.

Backflow preventers shall have a bronze main valve body and relief valve body. Backflow preventers shall be factory-assembled and shall consist of two independently operating, center-guided, spring-loaded, "Y" pattern check valves, one hydraulically dependent differential relief valve, two (2) shut-off valves and four (4) test cocks. Pressure loss shall not exceed ten pounds per square inch (10 psi) at twenty (20) gpm.

Backflow preventers shall be the same size as the service line in which they are installed, unless otherwise shown on the Plans.

Protection blanket shall be provided for each device, and it shall be the appropriate size to fit the backflow prevention assembly specified. Fabric shall be a heavy-duty resin or vinyl coated 100% polyester plain weave. Fabric shall be water, mildew and flame resistant. Insulation shall be a layer of Radiant Barrier Foil (BF) consisting of a layer of polyethylene bubbles bonded to and sandwiched between two industrial strength foil sheets with a minimum R-value of R-9. This material is impervious to moisture and is unsuitable for rodent nesting material. Blanket shall have a water repellent lining of nylon fabric to resist tearing from backflow parts. Blanket shall be machine stitched with metal grommet reinforcement for installation of an individual lock. Blanket shall be forest green in color and have a manufacturer's five-year warranty.

**50-34.26 Concrete**

Unless otherwise specified in the Special Provisions, concrete for irrigation facilities shall be Class "B-2" concrete as specified in Section 50-5, "Portland Cement Concrete", in this Section of these Specifications. Hand mixing of the concrete will be permitted.

**50-34.27 Filter Assembly Units**

Filter assembly units shall be as specified in the Special Provisions.

**50-34.28 IPS Flexible PVC Hose**

IPS flexible PVC hose shall be nonrigid polyvinyl chloride (nonrigid PVC) hose conforming to the specifications of ASTM Designation: D 2287, Cell-type 66404006.

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The hose shall provide leak-free, non-separating connections suitable for the purpose intended when connected to the fittings specified herein. Flexible hose shall be algae resistant. Fittings for flexible hose shall be injection molded PVC, Schedule 40, conforming to the specifications of ASTM Designation: D 2466. Fittings shall be solvent cemented type.

Solvent cement and primer for flexible hose and fittings shall be of commercial quality as specified for use with rigid PVC pipe and plastic pipe fittings.

### **50-34.29 Gate Valves**

Gate valves shall be either flanged, threaded or ring type, iron or bronze body, bronze trimmed valves with rising (internally threaded) or non-rising stem, and shall withstand a cold water working pressure of one hundred fifty (150) pounds per square inch (psi). Gate valves shall be of the same size as the pipeline that the valves serve, unless otherwise shown on the Plans.

Gate valves three inches (3") and smaller shall be bronze or brass. Gate valves four inches (4") and larger shall be cast iron.

Ball valves at control valve assemblies shall be plastic.

Valve boxes for gate valves shall be ten-inch (10") diameter with a bolt down lid and installed two inches (2") above finished grade.

### **50-34.30 Air Vacuum Relief Valve**

Air vacuum relief valve shall be non-corrosive plastic with one-half inch (1/2") MPT threads. Maximum operating pressure of air vacuum relief valve shall be 140 psi. Valve shall eliminate negative pressure and vacuum within subsurface dripper line systems that may draw contaminants into the system.

### **50-34.31 Flush Valve Assembly**

Flush valve shall be non-corrosive plastic with one-half inch (1/2") MPT threads. Maximum operating pressure of flush valve at ends of dripper line shall be fifty-seven (57) pounds per square inch (psi). Valve shall flush approximately one (1) gallon per cycle. Valve shall reduce sediment build-up within the dripper line system.

### **50-34.32 Unions**

Unions shall be brass or malleable iron. All unions shall withstand the working pressure range requirements of the pipes with which they are used.

### **50-34.33 Irrigation Control Wires**

Control wire for automatic control valves shall be #10, #12, or #14 as necessary for operation, shall be UL rated for direct burial, and shall be underground feeder type identified as UF.

Control wire shall have 4/64 inch (56 mils) minimum thickness of TW grade polyvinyl chloride insulation. Control wire shall be able to withstand a crush test of five thousand (5000) psi. Common or neutral conductors shall be white. The control wires to the automatic control valves shall be red. The spare wires shall be yellow.

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Splices for control wire shall be specifically designed to ensure waterproof underground direct bury 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.

### **50-34.34 Pull Boxes**

Pull boxes for irrigation control wiring shall be No. 5 or larger unless otherwise shown on the Plans, and shall conform to these Specifications.

Pull boxes shall be precast portland cement concrete boxes with concrete covers, unless otherwise noted.

Pull box covers for pull boxes used solely for irrigation control wiring shall be marked "IRRIGATION" or "IRRIGATION CONTROL" in cast-in letters. Cover markings shall be clearly defined and uniform in depth and may be placed parallel to either the long or the short sides of the cover. Marking letters shall be between one inch (1") and three inches (3") high.

### **50-34.35 Pressure Gauges**

Pressure gauges shall be hermetically sealed, water tight, and dust proof. Gauge shall be a two-inch (2") bottom-connected gauge with one-quarter-inch (1/4") brass standard pipe thread and shatterproof face. Gauge shall be rated for one hundred pounds per square inch (100 psi).

## **50-35 ENGINEERING FABRICS**

Engineering fabrics shall conform to Section 88, "Engineering Fabrics", of the State Specifications.

## **50-36 PAINT**

Unless otherwise specified in the Special Provisions, paint shall conform to Section 91, "Paint", of the State Specifications. Colors shall be as specified in the Contract.

## **50-37 ASPHALT BINDERS**

Asphalt binders shall conform to Section 92, "Asphalt Binders", of the State Specifications.

## **50-38 ASPHALTIC EMULSION**

Asphaltic emulsion shall conform to Section 94, "Asphaltic Emulsions", of the State Specifications and these Specifications.

Emulsified asphalt shall be Cationic type polymer modified grade PMCRS-2h.

The Contractor shall submit test results of the proposed emulsified asphalt, indicating compliance with these Specifications. Test results, including date of testing, of proposed emulsions and aggregate shall be submitted in writing to the City. Samples of the proposed emulsions and aggregate may also be requested by the City. The required tests shall conform to those specified in Section 94, "Asphaltic Emulsions", of the State Specifications, and the following:

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<b>TEST</b>	<b>TEST METHOD</b>	<b>REQUIREMENT</b>
Viscosity @ 122°F	AASHTO T-59	100-250 sec.
Demulsibility	AASHTO T-59	60% - 95%
Penetration @ 77°F (100g 5 sec)	AASHTO T-49	40-65
Ductility @ 77°F (5 cm/min.)	AASHTO T-51	60 cm/min.
Percent Residue	Cal Test 331	65% min.
Torsional Recovery	Cal Test 332	18% min.
Oil Distillate (by volume of emulsion)	AASHTO T-59	3% max.
Solid Polymer Content (by weight)	Cal Test 401	2.5%
Ring and Ball Softening Point	AASHTO T-53 1-2	125°F min.

The binder shall conform to the aggregate with a ten percent (10%) minimum film stripping as tested by California Test Method 302.

The laboratory used to develop the job mix formula and to perform quality control shall meet the requirements of ASTM Designation: D 3666. A certification signed by the manager of the laboratory stating that it meets these requirements shall be submitted to the City prior to the start of work.

At the option of the Contractor, polymer shall be Neoprene, Ultrapave, or SBR. The polymer shall be added to either the asphalt or the emulsion at their locations of manufacture. The temperature of the polymer modified asphaltic emulsion at the time of application shall be between 130°F and 180°F.

The Contractor shall maintain a quality control system that will provide reasonable assurance that all materials submitted for use conform to these Specifications. The Contractor shall perform two (2) random samples each day, to verify compliance with the operations quality control. Samples shall be taken from the spray bar of the distributor truck at mid-load. The tests shown above shall be performed on each sample taken. The City reserves the right to suspend Contractor activities and reject the material until it can be shown that the material is in compliance with these Specifications.

If a sample of asphaltic emulsion taken during a Working Day does not conform to these Specifications, the price paid per ton for that day's production of asphaltic emulsion will be subject to the penalties listed for the nonconformities in the following table:

<b>TABLE 50-9</b>	
<b>Nonconformity</b>	<b>Penalty</b>
Viscosity is in excess of 75 seconds or less than 300 seconds.	5 percent deduction from the bid price per ton for emulsified asphalt.
Torsional recovery exceeds 11 percent but is less than 18 percent.	5 percent deduction from the bid price per ton for emulsified asphalt.
Torsional recovery is less than 11 percent.	10 percent deduction from the bid price per ton for emulsified asphalt.

Test results shall be identified by the production date and time of sample and shall be

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submitted, in writing, to the City within two (2) working days of the sample date. The City reserves the right to witness the quality control testing performed by the testing lab and to test any material at any time during the course of the work. Each distributor truck shall be equipped, at all times, with the proper measuring stick and calibration card. On-site calibration of distributor trucks, for determining actual spread rate of asphaltic emulsion, shall be performed when directed by the City. The asphaltic emulsion shall be stored in heated circulation tanks at controlled temperatures, between 140°F and 180°F, for a period not to exceed seven (7) days. The temperatures of the asphaltic emulsion shall be between 130°F and 180°F at the time of application.

### **50-39 EPOXY**

Epoxy shall conform to Section 95, “Epoxy”, of the State Specifications.

### **50-40 PAVING STONES**

Paving stones, including type and color, shall be approved by the City. All paving stones shall be installed per manufacturer’s recommendations and per plan. All paving stones shall be cleaned and sealed with an approved seal prior to initial acceptance.

### **50-41 COLORED OR PATTERNED CONCRETE**

The mix design, including color, pattern and compressive strength of concrete shall be approved by the City. Contractor shall be required to prepare up to two (2) test panels in accordance with Section 51-1.01D(2)(c) of the Caltrans Standard Specifications to demonstrate color, texture, finish, and overall quality of the specified decorative concrete pavement for City approval. If more than two (2) test panels are required, City will issue a change order for the additional panels prepared.

All colored or patterned concrete shall be cleaned and sealed with an approved seal prior to initial acceptance.