Technical Specifications—100% CD Submittal

G11 Parking Lot, 1 Harpst Street, Arcata, Humboldt County, California

Prepared for:

California State Polytechnic University, Humboldt

February 2026

025150

Phone: (707) 441-8855 **Email:** info@shn-engr.com
Web: shn-engr.com • 812 W. Wabash Avenue, Eureka, CA 95501-2138

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812 W. Wabash Ave.
Eureka, CA 95501-2138
(707) 441-8855

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QA/QC:JOB___

Reference: 025150

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CPH G11 Parking Lot G11 Improvements
Project No. 025150

SECTION 00 01 07
SEALS PAGE

Cal Poly Humboldt XPL344 Parking Lot G11 Improvements

Prepared for: California State Polytechnic University, Humboldt

1 Harpst Street

Arcata, CA 95521

Tel. 707-826-3646

DESIGN PROFESSIONALS OF RECORD:

Architect (AOR)

Cal Poly Humboldt

1 Harpst Street

Arcata, CA 95521

Tel: 707-826-5076

[Full Name] [License and expiration]

Civil Engineer (CEOR)

SHN Engineers & Geologists

812 W. Wabash Ave.

Eureka, CA 95501-2138

Tel: 707-441-8855

Jared Scott O'Barr, PE 76125, expiration: June 30, 2026

[Full Name] [License and expiration]

Landscape Architect (LAOR)

Groundworks Office

1792 5th Street

Berkeley, CA 94710

Tel: 510-833-2111 [Full Name] [License and expiration]

Electrical Engineer (EEOR)

Frontier Consulting Engineers

2727 Bechelli Lane

Redding, CA 96002

Tel. 530-232-6160 [Full Name] [License and expiration]

END OF SECTION

Section 05
Metals

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SECTION 05700

ORNAMENTAL METAL

PART 1 GENERAL

1.1 SUMMARY

A. Work Included in this Section:

1. Provision of custom fabricated ornamental metal work including, but not necessarily limited to, the following:

a. All steel guardrails and handrails, and any site conditions requiring guardrail protection.

b. All exterior fence special conditions, extensions, etc.

1.2 INCORPORATED DOCUMENTS

A. Published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to work of this Section where cited by abbreviations noted below.

1. American Society for Testing and Materials (ASTM).

2. State of California, California Code of Regulations, Title 24 (CCR Title 24).

3. National Association of Architectural Metal Manufacturers':

a. "Heavy Duty Metal Bar Grating Manual", (ANSI /

b. "Metal Stairs", (AMP 510-92). NAAMM MBG 532-94).

c. "Pipe Railing Manual" (ANSI/ NAAMM AMP 521-01).

1.3 QUALITY ASSURANCE

A. Design Criteria:

1. Drawings show external profiles required. Minor modifications for greater strength may be proposed for the Trustees' approval.

2. Fabricate in accordance with NAAMM-MS standards from steel sections noted. All ornamental metal shall be fabricated to meet NAAMM-Metal Stair Manual standards "Architectural Class" and NAAMM-Pipe Railing Systems Manual standards "Type 1" as a minimum.

3. Work not specifically sized on the Drawing shall be designed to support normally imposed loads as noted in CCR Title 24 Table 23-B.

1.4 SUBMITTALS

A. Product Data.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Pack, ship, unload, store, and protect materials to prevent abuse, damage, and defacement such as stains, discolorations, scratches, abrasions, or soiling from any source.

1. Deliver materials only after proper facilities are available.

2. Store indoors in clean, dry location free from dust and corrosive fumes.

1.6 PROJECT CONDITIONS

A. Temporary Protection:

1. From fabrication through construction period, protect materials from damage using protective sleeves, polyethylene sheets, or other suitable means.

2. Remove protective devices only when required to perform work for in absence of damage-producing conditions prior to the Trustees' final acceptance.

B. Coordination:

1. Coordinate layout and fabrication of ornamental metal work with other trades to ensure proper assembly.

2. Coordinate details with details of adjacent work to assure proper attachments and clean junctions.

3. Provide materials such as backing, sleeves, etc. to be installed by the Contractor.

PART 2 PRODUCTS

2.1 MATERIALS

A. Steel Pipe: ASTM A53-07.

B. Steel Tubing: ASTM A500-07, A501-07.

C. Steel Plate: ASTM A6/A6M-08.

D. Steel Sheet: ASTM A1011-07 or A1008-07a

E. Steel Bars: ASTM A283-03 (2007), A1011-07, A633/A633M-01 (2006).

F. Stainless Steel: ASTM A167-99 (2004), Type 304.

G. Mechanical Fasteners (Bolts, nuts, washers, screws and other fasteners necessary for proper erection or assembly of ornamental work): Stainless steel; type and size as required.

1. Stainless Steel Bolts, Nuts, Washers, Etc.: Type 316 stainless steel, socket head cap screws, with washers, nuts, and spacers.

H. Brazing and Soldering Materials: As required.

I. Items for Permanent Protection from Dissimilar Metals and Materials:

1. Formerly Zinc Chromate Primer (VOC compliant): (meeting Fed Spec TT-P-641G) !Cl's No. 4120 Devguard "Multi-Purpose Metal Primer"; or approved equal.

2. Rust-Inhibiting Primer: (meeting Fed Spec TT-P-641G, TT-P-645B, TT-P-615D, TT-P-636D)

3. !Cl's No. 4160 Devguard "Multi-Purpose Tank & Structural Primer"; or approved equal.

4. Aluminum Metal and Masonry Paint: (meeting Fed Spec TT-P-641G) !Cl's No. 4348 Devguard "Alkyd Industrial Enamel"; or approved equal.

5. Bituminous Paint: Fed. Spec. TT-C-494A.

6. Compressible Tape: Closed cell black neoprene tape meeting requirements of ASTM C509-06, size as noted, with adhesive system as recommended by the manufacturer

2.2 FABRICATION

A. Do not begin fabrication of ornamental metal work until Shop Drawings have been reviewed by the Trustees.

B. Accurately fabricate ornamental metal work to desired profile, design, and dimensions in accordance with Preliminary Plans, and as reviewed in submitted Shop Drawings.

C. Employ only skilled workmen, especially trained, and experienced in this Work.

D. Perform fabrication operations prior to finishing.

E. Fabricate work true to detail with sharp, clean profiles, straight, and free from defects impairing strength or appearance.

F. Welds: Make uniform and grind smooth. Ease all exposed edges of plates and bars.

G. Screws shall be flat head, countersunk and finish smooth and flush, unless otherwise noted.

H. Accurately machine joints.

I. Steel Pipe Railings, Handrails, and Guardrails:

1. Fabricate in largest sections practicable and in accordance with NAAMM-PRM Standards.

2. Shop weld joints; fit field joints with concealed pins and sleeves.

3. Flush fittings may be used for crosses and tees.

4. Return all handrail rails to wall.
5. Provide galvanize sleeve and cover flange at post.
6. Close ends with welded cap and ease edges.
7. Handrail brackets shall be of "cast" type
8. All exposed welded joints to be continuous around entire joint perimeter and ground smooth, with even fillet radiuses and all pockets or dimples filled and sanded smooth to NAAMM-PRM standards for Architectural Class Stairs and Railing Joint Construction System - Type 1 Ornamental Quality.
9. Provide all materials for complete installation.

2.3 FINISHES

A. Typical Exterior Exposed Ornamental Metal Work: All steel handrails shall receive a factory-applied powder-coat finish over properly prepared surfaces, in color as selected by the Architect, providing a uniform, durable, and corrosion-resistant coating.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive work and verify that dimensions and adjoining work are correct to permit proper installation.

B. Do not start installation until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install ornamental work plumb, level, square, true to line, securely anchored and in proper alignment and relationship to adjoining work.

B. Protect dissimilar metals from contact with each other or other materials causing corrosion.

3.3 CLEANING

A. Before the Trustees' final acceptance, remove soil or other forms of discoloration.

END OF SECTION

Section 26
Electrical

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SECTION 26 00 00

ELECTRICAL

PART 1 GENERAL

1.1 INCLUDED

A. This section covers electrical work, complete. Work includes furnishing, installing, calibrating, adjusting, testing, documenting, and starting up equipment in accordance with these Specifications, the accompanying Plans, and the directions of the Engineer.

1.2 LICENSES, PERMITS, AND FEES

A. The Contractor shall provide, procure, and pay for all licenses, permits, fees, etc. as required to carry on and complete their work.

1.3 CODES AND STANDARDS

A. All work shall be done in code with all applicable local, state, and federal building safety codes, ordinances, and regulations. Additionally, all work shall conform to the latest editions of the following standards:

1. National Fire Protection Association.

2. Underwriters Laboratories.

3. Titles 8, 17, 19, 21, 24 of the California Code of Regulations.

4. California Electric Code.

B. When the Contract Documents call for materials or construction of a higher standard than is required by the above, the Contract Document requirements shall take precedence over the requirements of the applicable laws, ordinances, rules, or regulations. Nothing in the Contract Documents shall be interpreted as permitting work in violation of said laws, rules, and/or regulations.

C. The Contractor for this work shall furnish, without extra charge, any additional materials and/or labor as may be required for compliance with these laws, rules, and/or regulations though such materials and/or labor are not specially set forth in the Contract Documents.

1.4 LICENSING REQUIREMENTS

A. All work of Division 26 shall be performed by an appropriately licensed contractor. The licenses shall be current, valid through the term of the contract and in the name of the contractor.

B. The contractor must also be an or hire an approved Acceptance Test Employer with Acceptance Test Technicians (ATT). The ATT will be responsible for performing all required acceptance testing and associated forms.

1.5 SUBMITTALS

A. General Requirements

1. Submittal lists and drawings shall include identifying marks assigned by the Drawings and Specifications.

2. Review of drawings and other material submitted shall not be construed as complete check or constitute a waiver of the requirements of the Drawings and Specifications, but will indicate that the material submitted is acceptable in quality and utility. This review shall not relieve the Contractor of the responsibility to fit the proposed materials to the spaces provided, and to effect necessary rearrangements or construction of other work.

3. All fixtures, materials, and equipment equal in quality and utility to these herein mentioned will be accepted. When specific names are used in describing fixtures, materials, and equipment they are mentioned as standards only, but this implies no right on the part of the Contractor to use other fixtures, material, and equipment or methods, unless approved as equal in quality and utility by the Architect.

4. Before any fixtures, materials, or equipment are purchased, the Contractor shall submit to the Architect for approval, a complete list of materials, fixtures, and equipment, giving the manufacturer's names, catalog number, capacity, size, power requirements, etc.

5. The Contractor shall submit for the approval of the Architect, shop drawings of proposed material and equipment that differ from the specified materials and equipment, and of any specified materials and equipment with special conditions and/or arrangements. These drawings shall show necessary modifications of owner, plumbing, electrical, and mechanical work required by the proposed materials and equipment.

B. Submittal - Product Data

1. Submit manufacturer's product data for all electrical equipment, in compliance with specifications.

1.6 COOPERATION WITH OTHER TRADES

A. Cooperate fully with other trades doing work on the project as may be necessary for the proper completion of the project. Refer to the Structural, Plumbing, and Electrical Drawings for details of the building structure and equipment installation that will tend to overlap, conflict with or require coordination with the work of this Section, and schedule this work accordingly.

B. Any work done without regard for other trades shall be moved, replaced, or redone as required, without extra charges to Owner.

1.7 AS-BUILT DRAWINGS

A. A complete set of Contract Drawings shall be maintained at the work site, and all changes in the work shall be recorded on this set, on a daily basis. The final as-built drawings shall be submitted to the Architect for approval.

1.8 DESIGN DRAWINGS

A. The drawings indicate diagrammatically the general layout of the electrical systems and other related work. Field verification of scaled dimensions taken from the Drawings is required.

B. The Contractor shall review and compare the Architectural, Civil, Structural, and Electrical Drawings and all Owner supplied equipment Drawings, and adjust their work to be in conformity with the conditions indicated thereon. Discrepancies between drawings, between drawings and actual field conditions, or between Drawings and Specifications, shall promptly be brought to the attention of the Architect for a determination of the modifications to be affected. In the event that a major modification is required, a Change Order will be prepared.

1.9 VERIFICATION OF EXISTING CONDITIONS AND DEMOLITION

A. Before installation of any new work, verify the location, size, and other conditions at all points of connection to services or other existing piping, and at all locations where new work will cross or pass near existing piping, electrical, or other facilities.

B. Deliver removed material to the Owner as directed by the Architect. Dispose of all other removed material offsite.

1.10 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Furnish three sets of typewritten instructions covering maintenance, adjustment, and operation of each piece of apparatus, bound in a hard cover loose-leaf binder. Neatly obscure or cross out inapplicable data from manufacturer's literature. Submit data to the Architect.

B. Operating instructions shall show sequence of operations, lubrication, care, and maintenance requirements of all equipment. Final acceptance of the work will not be made until a satisfactory submission of this material is received and approved by the Architect.

C. The Owner's authorized representative shall be instructed in the operation and servicing of all power & lighting systems.

1.11 ACCURACY OF DATA

A. The data given herein and on the Drawings are as exact as could be reasonably secured, but absolute accuracy is not guaranteed. Exact locations, distances, elevations, etc. will be governed by shop drawings, the building itself, and actual field conditions.

1.12 DELIVERY, STORAGE, AND HANDLING

A. Contractor shall be responsible for delivery, storage, protection, and placing of all equipment and materials.

1. Contractor shall protect the work and materials from damage during construction. Equipment stored at the job site shall be protected from dust, water, or other damage, and be covered if equipment is exposed to weather. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.

2. Any items damaged shall be repaired or replaced, at no additional cost to the Owner.

1.13 WARRANTIES

A. Equipment warranties shall be provided for all equipment, with all necessary information filled in, except purchase date, in favor of the Owner.

B. The contractor shall guarantee that all work under this Section is free from defects in material and workmanship for a period of one year from the date of filing the Notice of Completion. Replacement of defective work and damage caused to work of other trades as a result of such defective work shall be the responsibility of the Contractor, and shall be made at no cost to the Owner.

1.14 ALTERNATIVE MATERIALS AND METHODS

A. These plans and specifications describe the general scope of the electrical systems. These plans and specifications do not preclude the submittal of alternative methods or materials. Manufacturer's names and catalog numbers are stated to identify the type and quality of the equipment or materials required for the project.

B. The contractor may submit shop drawings and/or technical information on alternative equipment, materials or installation details to accomplish the intent of the plans and specifications. Approval of the alternative equipment, materials or installation details shall not relieve the contractor of any responsibility for complying with the intent of the plans and specifications. Submit the manufacturers' technical information, shop drawings, and/or written description of alternative methods for each item described by manufacturer's name and catalog number and for each component, equipment, material, or installation detail required.

1.15 SITE EXAMINATION

A. Thoroughly examine the site and verify the actual work conditions. No extra compensation will be allowed for expenses due to failure to discover site conditions which affect the work.

PART 2 PRODUCTS

2.1 GENERAL

A. Unless otherwise indicated, provide all first-quality new materials, free from any defects, and suitable for the intended use and the space provided. Provide materials approved by UL wherever standards have items not specifically shown or specified which are required to provide the complete systems specified herein. Where two or more units of the same class of material pr equipment are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.

B. Equipment Finish: Unless otherwise indicated, finish for electrical equipment and enclosures shall be manufacturer's standard gray or ANSI 61 gray over a primer and rust inhibitor.

2.2 RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

A. Metal Conduits and Fittings

1. Metal Conduit:

a. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

b. GRC: Comply with ANSI C80.1 and UL 6.

c. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.

1) Comply with NEMA RN 1.

2) Coating Thickness: 0.040 inch, minimum.

d. EMT: Comply with ANSI C80.3 and UL 797.

e. FMC: Comply with UL 1; zinc-coated steel.

f. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

2. Metal Fittings:

a. Comply with NEMA FB 1 and UL 514B.

b. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

c. Fittings, General: Listed and labeled for type of conduit, location, and use.

d. Fittings for EMT:

1) Material: Steel.

2) Type: Setscrew.

e. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.

f. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch, with overlapping sleeves protecting threaded joints.

3. Joint Compound for GRC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

B. Non-metallic Conduits and Fittings

1. Nonmetallic Conduit:

a. Listing and Labeling: Nonmetallic conduit shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

b. ENT: Comply with NEMA TC 13 and UL 1653.

c. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.

d. LFNC: Comply with UL 1660.

2. Nonmetallic Fittings:

a. Fittings, General: Listed and labeled for type of conduit, location, and use.

b. Fittings for ENT and RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.

1) Fittings for LFNC: Comply with UL 514B.

c. Solvents and Adhesives: As recommended by conduit manufacturer.

C. Boxes, Enclosures and Cabinets

1. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.

2. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.

3. Metal Floor Boxes:

   a. Material: Cast metal or sheet metal.

   b. Type: Fully adjustable.

   c. Shape: Rectangular.

   d. Listing and Labeling: Metal floor boxes shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

4. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.

5. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

6. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

D. Handholes and boxes for exterior underground wiring

1. General Requirements for Handholes and Boxes:

   a. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.

   b. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

   a. Standard: Comply with SCTE 77.

   b. Configuration: Designed for flush burial with open bottom unless otherwise indicated.

   c. Cover: Weatherproof, secured by tamper-resistant locking devices and having

structural load rating consistent with enclosure and handhole location.

d. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.

e. Cover Legend: Molded lettering, "ELECTRIC.".

f. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

g. Handholes 12 Inches Wide by 24 Inches Long and Larger: Have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.3 LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

A. Copper Building Wire

1. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

2. Standards:

a. Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and use.

b. RoHS compliant.

c. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

3. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

4. Conductor Insulation: Type THHN and Type THWN-2: Comply with UL 83, 90ºC dry or 75ºC wet.

B. Connectors and Splices

1. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and use.

2. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

3. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

a. Material: Copper.

b. Type: Two hole with standard barrels.

c. Termination: Compression.

2.4 IDENTIFICATION FOR ELECTRICAL SYSTEMS

A. Labels

1. Vinyl Wraparound Labels: Preprinted, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.

2. Snap-around Labels: Slit, pre-tensioned, flexible, preprinted, color-coded acrylic sleeves, with diameters sized to suit diameters and that stay in place by gripping action.

3. Self-adhesive Wraparound Labels: 3-mil-thick, polyester flexible label with acrylic pressure-sensitive adhesive.

   a. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.

   b. Marker for Labels: Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.

4. Self-Adhesive Labels: Polyester, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.

   a. Minimum Nominal Size:

      1) 1-1/2 by 6 inches for raceway and conductors.

      2) 3-1/2 by 5 inches for equipment.

      3) As required by authorities having jurisdiction.

B. Tape

1. General purpose, flame retardant: 7 mil, vinyl plastic, rated for 90ºC minimum; complies with requirements of UL 510.

2. Flame retardant, cold and weather resistant: 8.5 mil, vinyl plastic.

C. Tags

1. Nonmetallic Preprinted Tags: Polyethylene tags, 0.015 inch thick, color-coded for phase and voltage level, with factory screened permanent designations; punched for use with self-locking cable tie fastener.

2. Write-on Tags:

    a. Polyester Tags: 0.010 inch thick, with corrosion-resistant grommet and cable tie for attachment.

    b. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

D. Signs

1. Baked-Enamel Signs:

    a. Preprinted aluminum signs, high-intensity reflective, punched or drilled for fasteners, with colors, legend, and size required for application.

    b. 1/4-inch grommets in corners for mounting.

    c. Nominal Size: 7 by 10 inches.

2. Metal-Backed Butyrate Signs:

    a. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396- inch galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.

    b. 1/4-inch grommets in corners for mounting.

    c. Nominal Size: 10 by 14 inches.

3. Laminated Acrylic or Melamine Plastic Signs:

    a. Engraved legend.

    b. Thickness:

        1) For signs up to 20 sq. in., minimum 1/16 inch thick.

        2) For signs larger than 20 sq. in., 1/8 inch thick.

        3) Engraved legend with black letters on white face.

        4) Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

E. Cable Ties

1. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

a. Minimum Width: 3/16 inch.

b. Tensile Strength at 73 Deg F according to ASTM D 638: 7000 psi.

c. UL 94 Flame Rating: 94V-0.

d. Temperature Range: Minus 50 to plus 284 deg F.

e. Color: Black.

2.5 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

A. Description

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CEC, by a qualified testing agency, and marked for intended location and application.

2. Comply with UL 467 for grounding and bonding materials and equipment.

B. Conductors

1. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

2. Bare Copper Conductors:

a. Solid Conductors: ASTM B 3.

b. Stranded Conductors: ASTM B 8.

c. Tinned Conductors: ASTM B 33.

d. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.

e. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.

f. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

g. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Connectors

1. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.

2. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

3. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to the ground bus bar.

4. Cable-to-Cable Connectors: Compression type, copper or copper alloy.

5. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.

6. Straps: Solid copper, cast-bronze clamp. Rated for 600 A.

D. Grounding Electrodes

1. Ground Rods: Copper-clad steel, sectional type; 5/8 inch by 8 feet.

2. Ground Plates: 1/4 inch thick, hot-dip galvanized.

2.6 WIRING DEVICES

A. General Requirements

1. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

2. Comply with NFPA 70.

3. RoHS compliant.

4. Comply with NEMA WD 1.

5. Devices that are manufactured for use with modular plug-in connectors may be substituted under the following conditions:

   a. Connectors shall comply with UL 2459 and shall be made with stranding building wire.

   b. Devices shall comply with requirements in this Section.

6. Devices for Owner-Furnished Equipment:

a. Receptacles: Match plug configurations.

b. Cord and Plug Sets: Match equipment requirements.

7. Wall Plate Color: For plastic covers, match device color.

B. Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding.

2. Configuration: NEMA WD 6, Configuration 5-20R.

3. Standards: Comply with UL 498 and FS W-C-596.

4. Tamper-resistant: Provide device listed and labeled as complying with NFPA “Tamper Resistant Receptacles” in locations specified by NFPA 70 406.12.

5. Weather-resistant: Provide device listed and labeled as complying with NFPA 70 “Receptacles in Damp or Wet Locations” in locations as shown on the plans.

C. GFCI Receptacles, 125V, 20A

1. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.

2. Configuration: NEMA WD 6, Configuration 5-20R.

3. Type: Feed through.

4. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.

5. Tamper-resistant: Provide device listed and labeled as complying with NFPA “Tamper Resistant Receptacles” in locations specified by NFPA 70 406.12.

6. Weather-resistant: Provide device listed and labeled as complying with NFPA 70 “Receptacles in Damp or Wet Locations” in locations as shown on the plans.

D. Wall Plates

1. Single and combination types shall match corresponding wiring devices.

a. Plate-Securing Screws: Metal with head color to match plate finish.

b. Material for Finished Spaces: Smooth, high-impact thermoplastic.

c. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.

d. Material for Damp Locations: Thermoplastic with spring-loaded lift cover and listed and labeled for use in wet and damp locations.

2. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant thermoplastic with lockable cover.

2.7 LUMINAIRES

A. General Requirements:

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. California Title 24 compliant.

B. Fixtures: As shown on the plans.

2.8 LIGHTING CONTROLS

A. Control Units

1. Unit with integrated transformers shall be used to provide power to occupancy sensors and other control devices.

2. Unit shall be located within or connected to junction boxes.

3. Unit shall be 120-277V rated with no minimum load.

4. In some cases, multiple relays may be required to control the indicated switch legs or other loads.

PART 3 EXECUTION

3.1 WORKMANSHIP

A. General: The installation of materials and equipment shall be performed in a neat, workmanlike and timely manner by an adequate number of craftsmen knowledgeable of the requirements of the Contract Documents. They shall be skilled in the methods and craftsmanship needed to produce a quality level of workmanship. Personnel who install materials and equipment shall be qualified by training and experience to perform their assigned tasks.

B. Acceptable Workmanship: Acceptable workmanship is characterized by first-quality appearance and function, conforming to applicable standards of building system construction, and exhibiting a high degree of quality and proficiency which is judged by the

Architect as equivalent as or better than that ordinarily produced by qualified industry tradesmen.

1. Comply with NECA 1 and NFPA 70.

C. Performance: Personnel shall not be used in the performance of the installation of material and equipment who, in the opinion of the Architect, are deemed to be careless or unqualified to perform the assigned tasks. Material and equipment installations not in compliance with the Contract Documents, or installed with substandard workmanship and not acceptable to the Architect, shall be removed and reinstalled by qualified craftsmen, at no change in the contract price.

3.2 PROTECTION AND CLEAN UP

A. Protection and Restoration: Suitably protect equipment provided under this Division during construction. Restore damaged surfaces and items to "like new" condition before a request for substantial completion inspection.

B. Handling: Materials shall be properly protected and Raceway openings shall be temporarily closed by the Contractor to prevent obstruction and damage. Post notice prohibiting the use of systems provided under this Contract, prior to completion of work and acceptance of systems by the Owner's representative. The Contractor shall take precautions to protect his materials from damage and theft.

C. Safeguards: The Contractor shall furnish, place and maintain proper safety guards for the prevention of accidents that might be caused by the workmanship, materials, equipment or systems provided under this contract.

D. Cleanup: Keep the job site free from debris and rubbish. Remove debris and rubbish from the site and leave premises in clean condition on a daily basis.

3.3 SYSTEMS GUARANTEE

A. General: Provide a one-year guarantee. This guarantee shall be by the Contractor to the Owner for any defective workmanship or material, which has been provided under this Contract at no cost to the Owner for a period of one year from the date of substantial completion of the System. The guarantee shall include lamps, for ninety days after date of Substantial Completion of the System. Explain the provisions of guarantee to the Owner at the "Demonstration of Completed System".

3.4 FINAL OBSERVATION

A. General: Work shall be completed, and forms and other information shall be submitted for acceptance one week prior to the request for final observation of the installation.

3.5 SPECIAL CONSIDERATIONS

A. Comply with special requirements imposed at site by Owner. This may include badging of employees, prohibition of smoking, special working hours, or special working conditions.

3.6 METHODS FOR RACEWAY INSTALLATION

A. Raceway Application

1. Outdoors: Apply raceway products as specified below unless otherwise indicated:

a. Exposed Conduit: GRC, RNC, or Type EPC-40-PVC.

b. Concealed Conduit, Aboveground: GRC.

c. Underground Conduit: RNC, Type EPC-40-PVC.

d. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

e. Boxes and Enclosures, Aboveground: NEMA 250, Type 4.

2. Indoors: Apply raceway products as specified below unless otherwise indicated:

a. Exposed, Not Subject to Physical Damage: EMT.

b. Exposed, Not Subject to Severe Physical Damage: EMT.

c. Concealed in Ceilings and Interior Walls and Partitions: EMT.

d. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.

e. Damp or Wet Locations: GRC.

f. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.

3. Minimum Raceway Size: 3/4-inch trade size.

4. Raceway Fittings: Compatible with raceways and suitable for use and location.

a. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.

b. EMT: Use setscrew, steel fittings. Comply with NEMA FB 2.10.

c. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

5. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.

6. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F.

B. Raceway Installation

1. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.

2. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

3. Complete raceway installation before starting conductor installation.

4. Arrange stub-ups so curved portions of bends are not visible above finished slab.

5. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.

6. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.

7. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.

8. Support conduit within 12 inches of enclosures to which attached.

9. Raceways Embedded in Slabs:

a. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.

b. Arrange raceways to cross building expansion joints at right angles with expansion fittings.

c. Arrange raceways to keep a minimum of 1 inch of concrete cover in all directions.

d. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.

10. Stub-ups to Above Recessed Ceilings:

    a. Use EMT or RMC for raceways.

    b. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

11. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

12. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.

13. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.

14. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.

15. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.

16. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

17. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

18. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:

    a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

    b. Where an underground service raceway enters a building or structure.

    c. Conduit extending from interior to exterior of building.

d. Conduit extending into pressurized duct and equipment.

e. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.

f. Where otherwise required by NFPA 70.

19. Comply with manufacturer's written instructions for solvent welding RNC and fittings.

20. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 36 inches of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

    a. Use LFMC in damp or wet locations subject to severe physical damage.

    b. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

21. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

22. Locate boxes so that cover or plate will not span different building finishes.

23. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.

24. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

C. Installation of Underground Conduit

1. Direct-Buried Conduit

    a. Excavate trench bottom to provide firm and uniform support for conduit.

    b. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction.

    c. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through floor unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.

d. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.

1) Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete for a minimum of 12 inches on each side of the coupling.

2) For stub-ups at equipment mounted on outdoor concrete bases and where conduits penetrate building foundations, extend steel conduit horizontally a minimum of 60 inches from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.

e. Warning Planks: Bury warning planks approximately 12 inches above direct-buried conduits but a minimum of 6 inches below grade. Align planks along centerline of conduit.

D. Installation of Underground Handholes and Boxes

1. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

2. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

3. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.

4. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables but short enough to preserve adequate working clearances in enclosure.

5. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.7 METHODS FOR CONDUCTOR INSTALLATION

A. Materials Applications

1. Feeders: Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

2. Branch Circuits: Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

B. Conductor Insulation and Wiring Methods

1. Service Entrance: Type THHN/THWN-2, single conductors in raceway.

2. Feeders; exposed or concealed: Type THHN/THWN-2, single conductors in raceway.

3. Branch Circuits; exposed or concealed: Type THHN/THWN-2, single conductors in raceway.

C. Installation of Conductors and Cables

1. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

2. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

3. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

4. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

D. Connections

1. Tighten electrical connectors and terminals according to manufacturer's published torque- tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

2. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

3. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

4. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches of slack.

E. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service feeder and branch-circuit conductors.

1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.

2. Colors for 240-V Circuits:

a. Phase A: Black.

b. Phase B: Red.

3. Colors for 208/120-V Circuits:

a. Phase A: Black.

b. Phase B: Red.

c. Phase C: Blue.

4. Colors for 240-V Circuits:

a. Phase A: Black.

b. Phase B: Red.

5. Colors for 480/277-V Circuits:

a. Phase A: Brown.

b. Phase B: Orange.

c. Phase C: Yellow.

6. Color for Neutral: White.

7. Color for Equipment Grounds: Bare copper.

3.8 METHODS FOR ELECTRICAL SYSTEM IDENTIFICATION

A. Installation of Identification Products

1. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

2. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

3. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:

a. "EMERGENCY POWER."

b. "POWER."

c. "UPS."

4. Vinyl Wraparound Labels:

   a. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.

   b. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.

5. Snap-around Labels: Secure tight to surface at a location with high visibility and accessibility.

6. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.

7. Self-Adhesive Labels:

   a. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.

   b. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1- 1/2-inch-high label; where two lines of text are required, use labels 2 inches high.

8. Snap-around Color-Coding Bands: Secure tight to surface at a location with high visibility and accessibility.

9. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.

10. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.

11. Tape and Stencil: Comply with requirements in painting Sections for surface preparation and paint application.

12. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.

13. Underground Line Warning Tape:

    a. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple

tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

b. Install underground-line warning tape for direct-buried cables and cables in raceways.

14. Metal, Nonmetallic Preprinted, and Write-on Tags:

a. Place in a location with high visibility and accessibility.

b. Secure using UV-stabilized and plenum-rated cable ties.

15. Baked-Enamel, Metal-backed Butyrate, and Laminated Acrylic Signs:

a. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.

b. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on minimum 1-1/2-inch-high sign; where two lines of text are required, use signs minimum 2 inches high.

16. Cable Ties: General purpose, for attaching tags, except as listed below:

a. Outdoors: UV-stabilized nylon.

b. In Spaces Handling Environmental Air: Plenum rated.

B. Identification Schedule

1. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

2. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

3. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 A and 120 V to Ground: Identify with self-adhesive raceway labels.

4. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

5. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:

a. "EMERGENCY POWER."

b. "POWER."

c. "UPS."

6. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels to identify the phase.

   a. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

7. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.

8. Equipment Identification Labels:

   a. Indoor Equipment: Laminated acrylic or melamine sign.

   b. Outdoor Equipment: Laminated acrylic or melamine sign.

   c. Equipment to Be Labeled:

      1) Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a self-adhesive, engraved, laminated acrylic or melamine label.

      2) Enclosures and electrical cabinets.

      3) Switchboards.

      4) Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.

      5) Enclosed switches.

      6) Enclosed circuit breakers.

9. For equipment labels, follow the convention examples below:

PANEL A
FED FROM MSB
400A, 120/240V, 1Ø 22KAIC

HEAT PUMP HP-1
FED FROM PANEL M

XFMR A
FED FROM PANEL A
480:120/240V, 1Ø, 75KVA

MOTOR CONTACT ENCLOSURE
FED FROM PANEL A

3.9 METHODS FOR GROUNDING AND BONDING

A. Applications

1. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.

2. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

3. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.

   a. Install bus horizontally, on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.

   b. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down; connect to horizontal bus.

4. Conductor Terminations and Connections:

   a. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.

   b. Underground Connections: Welded connectors except at test wells and as otherwise indicated.

   c. Connections to Structural Steel: Welded connectors.

B. Grounding at the Service

1. Equipment grounding conductors and grounding electrode conductors shall be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

C. Grounding Separately Derived Systems

1. Generator: Install grounding electrode(s) at the generator location. The electrode shall be connected to the equipment grounding conductor and to the frame of the generator.

D. Equipment Grounding

1. Install insulated equipment grounding conductors with all feeders and branch circuits.

2. Install insulated equipment grounding conductors with the following items, in addition to those required by CEC:

   a. Feeders and branch circuits.

   b. Lighting circuits.

   c. Receptacle circuits.

   d. Single-phase motor and appliance branch circuits.

   e. Three-phase motor and appliance branch circuits.

   f. Flexible raceway runs.

   g. Armored and metal-clad cable runs.

   h. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.

3. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

E. Installation

1. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

2. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

3. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to CEC; use a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG.

   a. If concrete foundation is less than 20 feet long, coil excess conductor within base of foundation.

   b. Bond grounding conductor to reinforcing steel in at least four locations and to anchor bolts. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.

3.10 METHODS FOR WIRING DEVICE INSTALLATION

A. Installation

1. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.

2. Coordination with Other Trades:

   a. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.

   b. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.

   c. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.

   d. Install wiring devices after all wall preparation, including painting, is complete.

3. Conductors:

   a. Do not strip insulation from conductors until right before they are spliced or terminated on devices.

   b. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

   c. The length of free conductors at outlets for devices shall comply with NFPA 70, Article 300, without pigtails.

   d. Existing Conductors:

      1) Cut back and pigtail, or replace all damaged conductors.

      2) Straighten conductors that remain and remove corrosion and foreign matter.

      3) Pig-tailing existing conductors is permitted, provided the outlet box is large enough.

4. Device Installation:

   a. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.

   b. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

c. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.

d. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.

e. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.

f. Use a torque screwdriver when a torque is recommended or required by manufacturer.

g. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.

h. Tighten unused terminal screws on the device.

i. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

5. Receptacle Orientation:

a. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

6. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

B. Identification

1. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with white-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

3.11 METHODS FOR SWITCHBOARD AND PANELBOARD INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Install panelboards and accessories according to NECA 407 and NEMA PB 1.1.

C. Equipment Mounting: Attach panelboard to the vertical finished or structural surface behind the panelboard.

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

E. Mount top of trim 90 inches above finished floor unless otherwise indicated.

F. Mount panelboard cabinet plumb and rigid without distortion of box.

G. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

H. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker trip ranges.

2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

I. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

J. Install filler plates in unused spaces.

K. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

3.12 METHODS FOR LOW-VOLTAGE TRANSFORMER INSTALLATION

A. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.

B. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

C. Secure transformer to concrete base according to manufacturer's written instructions.

D. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.

E. Remove shipping bolts, blocking, and wedges.

3.13 METHODS FOR ENCLOSED SWITCHES AND CIRCUIT BREAKERS INSTALLATION

A. Enclosure Environmental Rating Applications

1. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.

    a. Indoor, Dry and Clean Locations: NEMA 250, Type 1.

    b. Outdoor Locations: NEMA 250, Type 3R.

B. Installation

1. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

2. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

3. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3.14 METHODS FOR EXTERIOR LIGHTING INSTALLATION

A. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

B. Fasten luminaire to structural support.

C. Supports:

1. Sized and rated for luminaire weight.

2. Able to maintain luminaire position after cleaning and relamping.

3. Support luminaires without causing deflection of finished surface.

4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

D. Wiring Method: Install cables in raceways. Conceal raceways and cables.

E. Coordinate layout and installation of luminaires with other construction.

F. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

3.15 METHODS FOR LIGHTING CONTROLS INSTALLATION

A. Sensor Installation

1. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

2. Install and aim sensors in locations to achieve not less than 90-percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

B. Contactor Installation

1. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration unless contactors are installed in an enclosure with factory-installed vibration isolators.

C. Wiring Installation

1. Wiring within Enclosures: Separate power-limited and non-power-limited conductors according to conductor manufacturer's written instructions.

2. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

3. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.16 SUPPORTS AND HANGERS

A. All hangers, supports, and attachments to the structure must be capable of withstanding three times the anticipated load.

3.17 FIELD QUALITY CONTROL

A. Perform tests and inspections with the assistance of a factory-authorized service representative.

B. Perform the following visual and electrical tests:

1. Conductors and Cables:

a. After installing conductors and cables and before electrical circuitry has been energized, test feeder conductors and all conductors #6 AWG and larger.

1) Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.

2) Test bolted connections for high resistance using a low-resistance ohmmeter.

3) Inspect for correct identification.

4) Inspect cable jacket and condition.

5) Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.

6) Continuity test on each conductor and cable.

7) Uniform resistance of parallel conductors.

2. Grounding and Bonding

a. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.

b. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.

c. Report measured ground resistances that exceeds 25 ohms.

d. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

3. Wiring Devices

a. Line Voltage: Acceptable range is 105 to 132 V.

b. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.

c. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.

d. Using the test plug, verify that the device and its outlet box are securely mounted.

e. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault-current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new and retest as specified above.

4. Switches

a. Visual and Mechanical Inspection

1) Inspect physical and mechanical condition.

2) Inspect anchorage, alignment, grounding, and clearances.

3) Verify that the unit is clean.

4) Verify blade alignment, blade penetration, travel stops, and mechanical operation.

5) Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.

6) Verify correct phase barrier installation.

7) Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

b. Electrical Tests

1) Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

2) Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.

3) Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

5. Molded Case Circuit Breakers

a. Visual and Mechanical Inspection

1) Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

2) Measure contact resistance across each switchblade fuse holder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's

published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

3) Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.

4) Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

5) Inspect operating mechanism, contacts, and chutes in unsealed units.

6) Perform adjustments for final protective device settings in accordance with the coordination study.

b. Electrical Tests

1) Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

2) Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.

3) Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.

4) Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two meg-ohms.

5) Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.

6) Verify operation of charging mechanism. Investigate units that do not function as designed.

6. Exterior Lighting

a. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.

b. Verify operation of photoelectric controls.

c. Illumination Tests:

d. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IES testing guide(s):

1) IES LM-5.

2) IES LM-50.

3) IES LM-52.

4) IES LM-64.

5) IES LM-72.

7. Lighting Control Devices

a. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.

b. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Devices will be considered defective if they do not pass tests and inspections.

3.18 CLEANUP

A. Upon completion of the work of this Section, remove all material, debris, and equipment associated with or used in the performance of this work.

END OF SECTION

Section 31
Earthwork

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SECTION 31 00 00

EARTHWORK

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Furnishing all labor, materials and equipment necessary for all earthwork as indicated on drawings and specified here-in, or as required for completion of the Contract, as applicable. Includes items such as the following:

a. Rough grading.

b. Filling and backfilling.

c. Excavation.

d. Onsite utility verification.

e. Protection of work, people and existing site elements.

f. Seasonal limits.

g. Materials.

h. Execution of work.

B. Related Sections:

1. Section 01 50 00: Temporary Facilities and Controls.

2. Section 31 23 33: Trenching and Backfilling.

C. Reference Standards:

1. 2025 California Building Code (CBC).

2. ASTM-International (ASTM) D1557: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft/lbf/ft^3 [2,700 kN-m/m^3]).

3. ASTM D422: Standard Test Method for Particle-Size Analysis of Soils.

4. ASTM D4318: Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

5. California Department of Transportation (Caltrans) Standard Specifications, Current Edition.

6. California Division of Occupational Safety and Health (Cal-OSHA), Title 8, Section 1590 (e).

7. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction, and shall not begin until all of those governing authorities have been notified.

1.3 SUBMITTALS

A. Refer to "Section 01 33 00 Submittal Procedures."

1. Import Materials: Submit information regarding all materials to be imported to the site for use as engineered fill, aggregate base, trench backfill, or other materials required to accomplish the earthwork element of this project.

2. Native Materials: Submit information regarding all native materials proposed to be used as engineered fill.

3. Project Record Drawings: Accurately record locations of utilities remaining, re-routed utilities, new utilities, and newly discovered utilities by horizontal dimensions, elevations, inverts, and slope gradients.

1.4 QUALITY ASSURANCE

A. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.

B. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.

C. Geotechnical Investigation:

1. A geotechnical investigation report has been prepared for this Project. Contractor is responsible for being aware of the requirements provided in the geotechnical report.

2. Compaction densities specified for structural fills under footings, slabs, or pavements shall be determined in accordance with the geotechnical engineer's written recommendations.

3. If there are any discrepancies between the project specifications and the project geotechnical report, the project geotechnical report shall govern.

D. The representatives of the Owner's testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner's testing lab representatives nor the testing by the Owner's testing lab shall excuse the contractors or subcontractors for defects discovered in their work during or following completion of the project. Correcting inadequate compaction or moisture content is the sole responsibility of the Contractor.

E. Tests: See Part 3 for Compaction Testing.

F. Contractor shall be solely responsible for all subgrades built. Failures resulting from inadequate compaction or moisture content are the responsibility of the Contractor. Contractor shall be solely responsible for any and all repairs.

1.5 PROTECTION

A. Protect all existing structures, fences, roads, sidewalks, paving, curbs, and other items as necessary from earthwork activity.

B. Protect above or below grade utilities which are to remain.

C. Repair damage to any existing site features which are to remain.

D. Repair and restoration shall be equal to quality and appearance of prior condition and to the satisfaction of the Owner's Representative.

1.6 GRADE STAKES AND LINES

A. All grading and subgrading shall be controlled by Contractor-installed intermediate grade stakes and lines necessary to obtain the finished grade elevations shown or implied in the Drawings. Subgrade and finish grade surfaces shall conform to the control planes established by these grade stakes and lines.

B. Protect and maintain all existing benchmarks, monuments, and other reference points. If disturbed or destroyed, they shall be replaced at the Contractor's expense.

C. Contractor shall set temporary benchmarks as necessary to properly complete construction operations.

1.7 SURVEYING

A. Contractor shall be responsible for hiring a licensed professional surveyor to perform all surveying, layout, and staking.

1.8 WARRANTY

A. Refer to General Conditions.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Transport, store and handle in strict accord with the local jurisdiction.

B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Engineered Fill Materials: All fill shall be of approved local materials supplemented by imported fill if necessary. "Approved" local materials are defined as local soils tested and approved by Geotechnical Engineer. Refer to the project geotechnical investigation report for detailed guidance on engineered fill materials and compaction criteria.

1. Proposed Engineered Fill Materials:

a. Shall have less than 2 percent by dry weight of organic materials

b. Shall meet the gradation requirements specified in the project geotechnical investigation report.

c. Fine grained soil with a liquid limit greater than 35 and a plasticity index greater than 12 will not be allowed for use as engineered fill.

B. Aggregate Base: Provide ¾-inch Class 2 Aggregate Base conforming to standard gradation and material requirements specified in Caltrans Standard Specifications, Section 26. For Class 2 Aggregate Base below asphalt concrete paving or concrete flatwork, the aggregate shall have at least 50% crushed course particles with at least one fractured face using Caltrans Test Method 205. Aggregate for Class 2 aggregate base shall be free from organic matter and other deleterious substances and shall be of such nature that it can be compacted readily under watering and rolling to form a firm, stable base.

C. Imported fill shall be free of contaminants and have corrosion characteristics within the acceptable limits. All import fill material shall be tested and approved by Geotechnical Engineer prior to transportation to the site. Proposed fill material shall comply with Department of Toxic Substance Control (DTSC) guidelines to include Phase 1 environmental site assessment and related tests. Refer to the October 2001 DTSC Information Advisory for clean imported fill material:

1. DTSC Testing: Site work Contractor is to coordinate testing with an analytical lab, hired by the owner, licensed by the State of California for the DTSC testing. The costs associated with the testing will be paid by the Contractor.

2. DTSC testing shall include documentation as to the previous land use, location, and history. Soils shall be analyzed for all compounds of concern to ensure the imported soil is uncontaminated and acceptable. Testing shall be performed per the recommendations included in DTSC Imported Fill Advisory Soils shall be tested prior to import to the project site.

3. Lab shall determine geographically which tests and analysis comparison will be appropriate for the testing. (CAM 17 / Title 22); Regional Water Quality Control Board (RWQCB); or Office of Environmental Health Hazard Assessment (OEHHA).

4. Frequency of testing shall be conducted in accordance with DTSC's Imported Fill Advisory as follows:

Fill Material Sampling Schedule Area of Individual Borrow Area	Sampling Requirements
2 acres or less	Minimum of 4 samples
2 to 4 acres	Minimum of 1 sample every ½ acre
4 to 10 acres	Minimum of 8 samples
Greater than 10 acres	Minimum of 8 locations with 4 subsamples per location

Volume of Borrow Area Stockpile	
Up to 1,000 cubic yards	1 sample per 250 cubic yards
1,000 to 5,000 cubic yards	4 samples for the first 1,000 cubic yards + 1 sample per each additional 500 cubic yards
Greater than 5,000 cubic yards	12 samples for the first 5,000 cubic yards + 1 sample per each additional 1,000 cubic yards

5. Results of the testing analysis shall be sent to the Owner; Architect; Project Inspector, Project Civil Engineer, DTSC.

D. Water: Contractor shall furnish all required water for construction purposes, including compaction and dust control. Water shall be potable.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Contractor shall acquaint himself with all site conditions. If unknown active utilities are encountered during work, notify Architect promptly for instructions. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

B. Existing conditions are shown on the plans to the extent known. Should the Contractor encounter any deviation between actual conditions and those shown, they are to immediately notify the Owner before continuing work. Unknown buried utility lines may exist. If encountered, notify Owner’s Representative immediately for direction and re-direct work to avoid delay. Failure to notify will make Contractor liable for damage to these utilities arising from Contractor's operations subsequent to discovery of such unknown active utilities.

1. Cooperate and coordinate with Owner’s Representative and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility district.

2. Do not interrupt existing utilities serving occupied facilities without proper notification to, and written direction from, Owner’s Representative.

C. Excavation dewatering may be necessary. Contractor shall provide any and all tools, equipment and labor necessary for excavation dewatering no matter what the source. Dewatering shall be continuous until all site utilities are installed and backfilled.

3.2 ONSITE UTILITY VERIFICATION AND REPAIR PROCEDURES

A. Ground-breaking requirements:

1. All underground work performed by a Contractor must be authorized by the Owner's Construction Manager prior to start of construction.

2. The Contractor is to obtain and keep the original construction utility plans on site during all excavation operations. Contractor can contact the Owner to procure the drawings.

B. Underground Utility Locating:

1. Contractor shall hire an underground utility locating service to locate existing underground utility pathways in areas affected by the scope of work for excavation.

2. Contractor must use an Underground Utility Locator Service with a minimum of 3 years of experience. The equipment operator must have demonstrated experience.

3. The Underground Utility Locator Service must be able to locate existing utilities at a depth of at least 72 inches.

4. The Underground Utility Locator Service must be able to locate, but are not limited to, locating the following types of utility pathways:

   a. All conduit pathways containing 110 volts or greater (50-60 hertz [Hz]) electrical wire.

   b. All conduit pathways containing an active cable TV system.

   c. All conduit pathways containing wire or conductor in which a signal can be attached and generated without damaging or triggering the existing systems.

   d. All empty conduit pathways or pipe in which a signal probe or sonde (miniature transmitter) can be inserted.

   e. All conduit pathways containing non-conductive cables or wires in which a signal probe or sonde (miniature transmitter) can be inserted.

   f. All plastic and other nonconductive water lines in which a transmitter can be applied to create a low frequency pressure waive (signal) without damaging or triggering the existing systems.

   g. All copper or steel waterlines and plastic or steel gas lines.

5. All markings made by the Underground Utility Locator Service or other shall be clear and visible.

6. The Contractor shall maintain all markings made by Underground Utility Locator Service or other throughout the entire length of the project.

7. The Underground Utility Locator Service shall provide the Contractor with two sets of maps showing the location of utilities and average depth. They will be referenced to permanent buildings. Contractor will deliver one copy to the Owner at no additional charge.

8. Contractor is responsible to contact Underground Service Alert (USA 800-642-2444) and receive clearance prior to any excavation operations.

9. Contractor shall inform the Owner no later than five (5) days prior to the date scheduled for the utility locator service to be on site.

3.3 PROTECTION

A. Adequate protection measures shall be provided to protect workmen and passers-by on and off the site. Adjacent property shall be fully protected throughout the operations. Blasting will not be permitted. Prevent damage to adjoining improvements and properties both above and below grade. Restore such improvements to original condition should damage occur. Replace trees and shrubs outside the building area disturbed by operations.

B. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.

C. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on, or near the construction site.

D. Provide shoring, sheeting, sheet piles and or bracing to prevent caving, erosion, or gullying of sides of excavation.

E. Surface Drainage: Provide for surface drainage during the period of construction in order to avoid creating nuisances to adjacent areas. The Contractor shall make a reasonable effort on a daily basis to keep all excavations and the site free from water during entire progress of work, regardless of cause, source, or nature of water.

F. Adjacent streets and sidewalks shall be kept free of mud, dirt or similar nuisances resulting from earthwork operations.

G. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance. Dust control measures shall be in accordance with the local jurisdiction.

3.4 SEASONAL LIMITS

A. No fill material shall be placed, spread, or rolled during unfavorable weather conditions. When work is interrupted by rains, fill operations shall not be resumed until field tests indicate that moisture content and density of fill are satisfactory.

B. Excessively wet fill material shall be bladed and aerated.

3.5 INSPECTION LAYOUT AND PREPARATION

A. Prior to installation of the work of this section, carefully inspect and verify by field measurements that installed work of all other trades is complete to the point where this installation may properly commence.

B. Layout all work, establish grades, locate existing underground utilities, set markers and stakes, setup and maintain barricades and protection facilities prior to beginning actual earthwork operations. Layout and staking shall be done by a licensed Land Surveyor or Professional Civil Engineer.

C. Verify that specified items may be installed in accordance with the approved design.

D. In event of discrepancy, immediately notify Owner. Do not proceed in discrepant areas until discrepancies have been fully resolved.

3.6 PERFORMANCE

A. General: Do all grading, excavating and cutting necessary to conform finish grade and contours as shown. All cuts shall be made to true surface of subgrade.

B. Archaeological Artifacts: Should any artifacts of possible historic interest be encountered during earthwork operations, halt all work in area of discovery and immediately contact the Owner for notification of appropriate authorities.

C. Degree of Compaction: Percentage of maximum density, hereinafter specified as degree of compaction required, means density equivalent to that percentage of maximum dry density and such expressed percentage thereof will be minimum acceptable compaction for specified work.

D. Moisture Content: Moisture content shall be as noted below and as called for on the plans. Moisture content shall be maintained until subgrade is covered by surfacing materials.

3.7 DEMOLITION, DISPOSAL, AND DISPOSITION OF UNDESIRABLE MAN-MADE FEATURES

A. All other obstructions, such as abandoned utility lines, septic tanks, concrete foundations, and the like shall be removed from site. Excavations resulting from these removal activities shall be cleaned of all loose materials and widened as necessary to permit access for compaction equipment. Areas exposed by any required over-excavation should be scarified to a depth of 12 inches, moisture-conditioned to near optimum moisture content, and recompacted to at least 90% of the maximum dry density.

3.8 TESTING AND OBSERVATION

A. General: Refer to “Section 01 40 00 Quality Requirements.”

B. All grading and earthwork operations shall be observed by the Geotechnical Engineer or his representative, serving as the representative of the Owner.

C. Field compaction tests shall be made by the Geotechnical Engineer or his representative. If moisture content and/or compaction are not satisfactory, Contractor will be required to change equipment or procedure or both, as required to obtain specified moisture or compaction. Notify Geotechnical Engineer at least 48 hours in advance of any filling operation.

D. Earthwork shall not be performed without the notification or approval of the Geotechnical Engineer or his representative. The Contractor shall notify the Geotechnical Engineer at least 48 hours prior to commencement of any aspect of the site earthwork.

E. If the Contractor should fail to meet the compaction or design requirements embodied in this document and on the applicable plans, they shall make the necessary readjustments until all work is deemed satisfactory, as determined by the Geotechnical Engineer.

F. Costs of Geotechnical Engineer or his representative will be borne by Owner, except those costs incurred for re-tests or re-inspection will be paid by Owner and back charged to Contractor.

1. If Contractor elects to process or mine onsite materials for use as Suitable Fill, Aggregate Sub Base, Aggregate Base, Rock, Crushed Rock or sand the cost of all testing of this material shall be paid for by the Contractor.

2. Testing of import fill for compliance with Department of Toxic Substance Control (DTSC) shall be paid for by the Contractor.

3.9 CLEARING AND GRUBBING

A. Prior to grading, remove all debris offsite. Remove trees and brush, including the root systems. Holes resulting from tree and brush removal should be prepared and backfilled. This may require deepening and/or widening the holes to adequately remove disturbed soil and provide room for compaction equipment. Strip the surface of all organics.

3.10 CUTTING

A. Building pads that are located within a cut/fill transition area will have to be over-excavated to provide a semi-uniform fill beneath the building pad. The portions of building pads located in cut areas shall be over-excavated to provide no more than 1 foot difference in fill placed in the same building pad.

B. Do all cutting necessary to bring finish grade to elevations shown on Drawings.

C. When excavation through roots is necessary, cut roots by hand.

D. Carefully excavate around existing utilities to avoid unnecessary damage. The Contractor shall anticipate and perform hand work near existing utilities, without additional claims or cost.

3.11 SUBGRADE PREPARATION

A. Grade compact and finish all subgrades within a tolerance of 0.10 feet of grades as indicated on Drawings and so as not to pool water. Subgrade within building pads and concrete walks shall be within 0.05 feet of grades indicated.

B. After clearing, grubbing and cutting, subsurface shall be plowed or scarified to a depth of at least 12 inches, until the surface is free from ruts, hummocks or other uneven features and is uniform and free from large clods. Moisture condition to optimum moisture content, recompact and proof-roll, unless otherwise stated in the project geotechnical report. If the existing soils are at a water content higher than specified, the Contractor shall provide multiple daily aerations by ripping, blading, and/or disking to dry the soils to a moisture content where the specified degree of compaction can be achieved. After 7 consecutive working days of daily aerations, and the moisture content of the soil remains higher than specified, the Contractor shall notify the Engineer. If the existing soils have a moisture content lower than specified, the Contractor shall scarify, rip, water and blade existing soil to achieve specified moisture content.

The Contractor shall make proper allowance in schedule and methods to complete this work.

C. Compacted subgrade should be non-yielding under construction traffic, including a 10-wheel truck, such as a water truck or dump truck, in all pavement areas. Removal and subsequent replacement of some material (such as areas of excessively wet materials, unstable subgrade, or pumping soils) may be required.

1. Proof-roll prepared subgrade surface below Class 2 Aggregate Base supporting concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

2. Completely proof-roll base in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 miles per hour (mph).

3. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons.

D. Subgrade preparation for pavement areas shall extend laterally at least 2 feet beyond the edge of pavement.

E. Where Contractor over-excavates building pads through error, resulting excavation shall be recompacted as engineered fill at Contractor's expense.

3.12 PLACING, SPREADING, AND COMPACTING ENGINEERED FILL MATERIAL

A. See the “Slope Construction” section of this specification for requirements when constructing in areas with existing slopes.

B. Selected fill material shall be placed in loose horizontal lifts not exceeding 8 inches which, when compacted, shall not exceed 6 inches in compacted thickness. Each layer shall be spread evenly and thoroughly mixed to insure uniformity in moisture content.

C. Selected fill material shall be moisture-conditioned to specified moisture content. Selected fill material shall be unfrozen. When moisture content of fill material is below that specified, add water until proper moisture content is achieved. When moisture content is above that specified, aerate by blading, or other methods noted in this section, until moisture content is satisfactory.

D. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to the levels specified in the project geotechnical report and as shown on the project plans. Compact each layer over its entire area until desired density has been obtained.

E. Compaction of Fill in Trenches: See Specification “Section 31 23 33 Trenching and Backfilling.”

F. Jetting of fill materials will not be allowed.

3.13 SLOPE CONSTRUCTION

A. Cut slopes shall be constructed to no steeper than 2H:1V (horizontal to vertical). Fill slopes shall be constructed to no steeper than 2H:1V. Prior to placement of fill on an existing slope, the existing slope shall be benched. The benches shall be excavated in accordance with the project geotechnical report. The face of the fill slopes shall be compacted as the fill is placed, or the slope may be overbuilt and then cut back to the design grade. Compaction by track walking will not be allowed.

3.14 FINISH GRADING

A. At completion of project, the site shall be finished graded, as indicated on Drawings. Finish grades shall be “flat graded” to grades shown on the drawing. Mounding of finish grades will not be allowed unless otherwise directed on the landscape drawings. Tolerances for finish grades in drainage swales shall be ±0.05 feet. Tie in new and existing finish grades.

B. Leave all landscaped areas in finish condition for lawn seeding. Landscaped planters shall be graded uniformly from edge of planter to inlets. If sod is used for turf areas, the finish grade on which it is placed shall be lowered to allow for sod thickness. All landscape areas shall be left free of rock or foreign material. All landscape areas shall be approved by Architect prior to any planting.

3.15 SURPLUS MATERIAL

A. Excavated material not required for grading or backfill shall be removed from site at Contractor’s expense.

3.16 CLEANING

A. Remove from fill all vegetation, wood, form lumber, casual lumber, and shavings, in contact with ground; buried wood will not be permitted in any fill.

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SECTION 31 23 33

TRENCHING AND BACKFILLING

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Trench excavation, shoring, dewatering, unsuitable subgrade removal and replacement, trench backfill and compaction, and all other associated work involved in trench excavations.

B. Reference Standards:

1. American Association of State Highway and Transportation Officials (AASHTO) T 180: Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-pound [lb]) Rammer and a 457-millimeter (mm; 18 inches [in.]) Drop.

2. ASTM-International (ASTM) D1557: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 [2,700 kN m/m^3]).

3. ASTM D6938: Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.3 SUBMITTALS

A. See "Section 01 33 00 Submittal Procedures."

B. Material information for all backfill material.

C. Mix design for slurry cement being used for trench backfilling.

D. Load slips for all material delivery trucks shall be delivered to the job site with the truck. The Contractor shall retain all load slips and shall make them available to the Engineer upon request.

1.4 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. Prevent contamination.

C. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. General: Material specifications listed on the Plans, where applicable, shall supersede those listed in this Section.

B. Aggregate Base: Aggregate base shall be Class 2 aggregate base (3/4-inch maximum) and shall conform to Section 26 "Aggregate Bases" of the Caltrans Standard Specifications.

C. Permeable Material: Permeable material shall consist of crushed rock conforming to the following gradation requirements, unless otherwise approved by the Engineer:

Sieve Size	Percent Passing
3/4-inch	90-100
1/2-inch	30-60
3/8-inch	0-20
No. 4	0-5

1. The portion of the material that is retained on a 3/8-inch sieve shall contain at least 50% of particles having three or more fractured faces. Not over 5% shall be pieces that show no fractured faces. Rounded rock material (commonly called "washed rock") that shows little evidence of the crushing process is not acceptable and will be rejected.

D. Sand Bedding: Bedding around utilities shall consist of sand having a sand equivalent (SE) of at least 30. Bedding shall extend from 6 inches below to 1 foot above the utility pipe or conduit. Sand bedding shall be compacted to a minimum of 90 percent relative compaction.

E. Slurry Cement Backfill: Slurry cement backfill shall conform to Section 19-3.02E, "Slurry Cement Backfill" of the Caltrans Standard Specifications and shall consist of a fluid, workable mixture of aggregate, cement, and water. Slurry cement backfill shall be either 1-sack, 1½-sack, or 2-sack mix, depending on the application. 1-sack mix shall contain 94 pounds of Portland cement per cubic yard of material; 1½-sack shall contain 141 pounds of Portland cement per cubic yard; 2-sack mix shall contain 188 pounds of Portland cement per cubic yard of material. Mix type used for each specific application shall be as indicated on the plans or as directed by the Engineer.

F. Native Backfill: Native backfill shall consist of material excavated during the course of the project, shall be free of organic and other deleterious material, and shall have a sand equivalent (SE) greater than 15.

G. Imported Topsoil: Imported topsoil shall be sandy loam, shall be friable, shall have a high degree of fertility, and shall be free of weeds, clods, roots, rocks, gravel, sticks, brush, and other deleterious material. An imported topsoil analysis shall be submitted to the Engineer for approval prior to delivery of any imported topsoil to the project site. Should the Engineer reject any portion of the delivered soil for any reason, it shall be removed immediately at no cost to the City. The Contractor shall be responsible for maintaining all placed topsoil until the project has been accepted.

H. Native Topsoil: Native topsoil shall consist of material excavated from the upper soil layer (from the surface to a depth of approximately six inches) during the course of the project. Native topsoil shall be stockpiled separately from native subsoil.

I. Provide soil material free from Organic matter and deleterious substances, containing no rocks or lumps over 2 inches in greatest dimensions.

PART 3 EXECUTION

3.1 EXAMINATION

A. Utilities on the Plans may be shown incorrectly or not at all. The Contractor shall contact Underground Service Alert (USA) at 1-800-227-2600 at least forty-eight (48) hours, but not less than two (2) working days, prior to any demolition or excavation and request field markings of all underground utilities.

B. Verify that survey benchmarks and intended elevations for the work are as indicated.

3.2 PREPARATION

A. Take necessary steps to assure that service is not interrupted. If water or sewer service to any residents, buildings, or facilities within the work area will be interrupted during portions of the work, the Contractor shall notify all affected residents at least 2 (two) full working days in advance of anticipated water or sewer shutdowns. Unless otherwise noted on the Plans, the maximum duration for water shutdown is 8 hours.

B. Identify required lines, levels, contours, and datum locations.

C. Grade top perimeter of trenching area to prevent surface water from draining into trench. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by the Engineer.

3.3 TRENCHING

A. Trench Excavation

1. The Contractor shall perform all excavation required to accomplish the construction, regardless of the type, nature, or condition of material encountered. Excavations within 24 inches of marked underground utilities shall be dug with hand tools.

2. The Contractor shall excavate the trench to the elevations, lines, and grades shown on the Plans. Allowance shall be made within the excavation for shoring, forms, working space, bedding, and backfill. Over-excavation below the grade lines shown on the Plans or established by the Engineer shall be backfilled at the Contractor's sole expense with trench backfill material approved by the Engineer and compacted to specified densities (including over-excavation required to remove existing utilities shown on the Plans as to be removed). Over-excavation required due to unsuitable subgrade soils is addressed in this specification.

3. The Contractor shall control excavations through careful backfill and shoring placement that prevents trench wall sloughing and shall remove all material that sloughs into the trench. In addition, all voids or cavities that result from sloughing trench walls shall be backfilled and

compacted with the same material at the same compaction/vibration requirements as shown on the trench detail for that section of trench. If, in the opinion of the Engineer, additional asphalt, concrete, or other surface material must be removed to adequately compact or vibrate the backfill placed in these voids or cavities, the Contractor shall sawcut and remove the surface material to the limits of the voids or cavities as directed by the Engineer. All costs associated with the removal of material that has sloughed into the trench; placement and compaction of the additional backfill material; and the sawcutting, removal, and patching of additional surface material shall be the sole responsibility of the Contractor, and no additional payment will be made to the Contractor for this work.

B. Trench Shoring and Safety

1. All trench excavations requiring shoring shall conform to the requirements of the California Occupational Safety and Health Act (Cal-OSHA). The Contractor shall furnish and install all shoring and bracing required to support the trench walls for the protection of all personnel working in the excavation. Shoring and bracing shall be removed in a manner that protects the workers and prevents sloughing of trench walls.

2. The Contractor is solely responsible for the safety of all workers, the general public, and private and public property within the project site for the duration of the project. This responsibility shall be in effect at all times.

3. For trenches requiring shoring or bracing, the Contractor shall submit to the Engineer a detailed plan showing the proposed design of shoring, bracing, or other provisions to be made to protect the trench from sloughing or collapse. Shoring and bracing plans shall be submitted at least 10 (ten) working days before the Contractor intends to begin trenching work.

4. If shoring and bracing plans vary from the shoring system standards established by the Construction Safety Orders of Cal-OSHA, the plans shall be prepared, sealed, and signed by a Civil or Structural Engineer currently registered in California. Signed and sealed copies of calculations necessary to qualify the system shall be included with the plans. If the Contractor proposes to use trench jacks or speed shores, shoring and bracing plans shall show the length and type of shoring, vertical and horizontal spacing, and any vertical or horizontal wales. Trench shields, when proposed or used, shall specify maximum allowed depth for the soils expected to be encountered.

5. It is the sole responsibility of the Contractor to submit shoring and bracing plans that either conform to the Construction Safety Orders of Cal-OSHA, or as approved by a California-licensed Civil or Structural Engineer. No shoring or bracing plans shall be submitted to the Engineer that do not meet either of these requirements.

6. The Engineer shall review the Contractor’s shoring and bracing plans to verify the general scope of the work only. This review is not intended to include approval of the shoring system, or a review of the adequacy of the Contractor's safety supervisor, the safety program, or any safety measures taken in, on, or near the construction site. This review shall not in any way relieve the Contractor from sole responsibility for the design, construction or installation, proper maintenance, and safety of shoring and bracing systems.

C. Trench Dewatering

1. The Contractor shall dewater all excavations for pipelines, sewer laterals, water main fittings and valves, and other underground items to keep groundwater out of the excavation. Water and residual sewage will not be allowed in excavations during bedding, concrete pours, or backfill and compaction. If excessive groundwater is present and cannot be adequately controlled, the Engineer may deem the bottom of the trench unsuitable for placement of bedding material.

2. The Contractor shall have pumps on hand of sufficient capacity and horsepower to pump all residual water and sewage from sewer mains, laterals, and services that may be anticipated entering the trench, from existing water mains and services as they drain, and from existing sewer laterals downstream from the bypass point.

3. The Contractor shall provide/construct sedimentation measures to contain sediment from dewatering operations from migrating into the storm drain system of waterways.

D. Unsuitable Subgrade and Backfill

1. Unsuitable subgrade is native trench material at subgrade that, in the opinion of the Engineer, is unsuitable to use as a pipe bed and must be removed to provide a solid construction surface. Examples of this type of subgrade are plant material, logs, trash, wood chips and debris, mud, soft or spongy soil, and the like. It DOES NOT refer to material that sloughs into the trench from the sidewalls due to insufficient trench shoring and must be dug out. If unsuitable material is encountered under the pipe, the Engineer shall direct the Contractor as to the total volume of unsuitable material to be removed PRIOR to its removal from the trench.

2. Once the unsuitable material has been excavated to the satisfaction of the Engineer, the Contractor shall backfill the over-excavation up to the elevations, lines, and grades shown on the Plans or as shown on survey staking cut sheets provided by the Engineer or Project Surveyor. Backfill material for unsuitable over-excavations shall be Class 2 Aggregate Base, as approved by the Engineer, compacted to 90% relative compaction, unless otherwise directed by the Engineer or indicated on the plans.

3. If, upon over-excavation, the resulting subgrade, in the opinion of the Engineer, is still unsuitable to use as a compaction bed, the Contractor shall backfill the over-excavation up to the elevations, lines, and grades shown on the Plans Class 1 permeable material (3/4-inch maximum). If the length of the Permeable Material placement exceeds 20 feet as measured along the trench, the Contractor shall construct slurry cement waterstops that extend from 12 inches above the top of the pipe to the bottom of the over-excavation every 20 feet measured along the trench. Slurry cement waterstops placed under these conditions shall be considered as trench backfill, and no additional payment shall be made to the Contractor for their inclusion in the trench backfill.

4. If, in the opinion of the Engineer, an excessive amount of groundwater is flowing (not seeping) in the trench and cannot be removed from the trench by pumping, the Engineer may deem the trench subgrade unsuitable. However, this condition will not require removal of the unsuitable subgrade. Instead, the Engineer may opt to require the Contractor to place Permeable Material for pipe bedding in the section of trench that the groundwater is flowing into. If the length of the Permeable Material placement exceeds 20 feet measured along the trench, the Contractor shall construct slurry cement waterstops that extend from

12 inches above the top of the pipe to the bottom of the trench every 20 feet. Slurry cement waterstops placed under these conditions shall be considered as trench backfill, and no additional payment shall be made to the Contractor for their inclusion in the trench backfill.

E. Incompatible Areas

1. When pipelines cross through areas where compaction cannot occur (underneath large conduits or other obstacles), the Contractor shall bed and backfill the pipe (up to 12 inches above the top of the pipe or to the bottom of the obstacle, whichever is less) with Permeable Material. If the length of the Permeable Material placement exceeds 20 feet measured along the trench, the Contractor shall construct slurry cement waterstops that extend from 12 inches above the top of the pipe to the bottom of the bedding material every 20 feet. Slurry cement waterstops placed under these conditions shall be considered as trench backfill, and no additional payment shall be made to the Contractor for their inclusion in the trench backfill.

F. Bedding and Backfill

1. In general, 6 inches of pipe bedding shall be laid on firm, undisturbed native material true to line and grade. Bedding material shall be placed into the trench prior to pipe placement, shall be compacted to a minimum of 90% relative compaction, and an additional 1 foot of bedding material shall be placed above the utility conduit or pipe. Bedding material under the coupling bells shall be hand-excavated so that there is a minimum clearance under the bell of 1 inch.

2. Backfill material in the pipe haunching zone between the bottom of the pipe and the springline of the pipe shall be “shovel-sliced” underneath the pipe overhang, then hand-tamped with “J” bars or pneumatic “pogo stick” to a relative compaction of 90% along the entire length of the pipe. Tamping with a shovel is not sufficient and does not meet this requirement.

3. Slurry cement backfill shall be consolidated using motor-driven vibrators to remove all voids and shall be placed in the work within one hour after mixing. The vibrator used shall be large enough to vibrate the slurry cement to the satisfaction of the Engineer. In addition, the slurry cement mixture shall contain enough water that it “flows” into the hole left when the vibrator is removed. Slurry material that does not “flow” into the hole left by the vibrator shall have water added to it in the truck in an amount sufficient to attain a “flowing” behavior. Slurry cement shall not be covered with other material for at least 4 hours after placement.

4. Class 2 aggregate base backfill shall be placed in loose, 8-inch lifts as indicated in the project geotechnical report, and compacted to a maximum thickness of 6 inches.

5. In non-paved areas where native material backfill is specified, the backfill shall be placed in lifts as directed by the Engineer. The maximum lift thickness will be determined by the Engineer based upon the compaction method being employed; however, the maximum lift thickness when hand-operated compaction devices are used shall not exceed one (1) foot. All loose soil within the excavation shall be removed prior to fill placement.

G. Trench Bedding and Backfill Compaction

1. Trench bedding and backfill shall be compacted to the densities shown on the trench detail on the Plans, and as specified in this Section.

2. Compaction testing shall be performed by the Engineer to determine whether or not the Contractor's compaction efforts are meeting the minimum compaction requirements. Trench bedding and backfill that fails compaction tests shall be re-compacted as necessary to meet the minimum compaction requirements at the sole expense of the Contractor.

H. Workmanship Guarantee

1. The Contractor shall guarantee his trench work against settlement for a period of 1 year after the Notice of Completion has been filed. During this time, the Contractor shall repair, at his own expense and to the satisfaction of the Engineer, all failed trench backfill and resurfacing. For the purpose of this contract, failure shall be deemed to have occurred if any of the following conditions exists:

   a. On paved streets, a depression in a pavement patch of 1/8 inch (0.01 feet) below the sides of the uncut portion of pavement (includes trench lines and pavement widening).

   b. Along shoulder areas, behind sidewalks, and in other unpaved portions of the right-of-way, a depression of 3/4 inches (0.06 feet) below the average of the sides of the uncut portion.

   c. Across all fields, pastures, or areas untraveled by automotive equipment, a depression causing the ponding of water between the sides of the uncut portion.

   d. Any other settlement that causes drainage problems or concentrations of water to run along the excavation line.

3.4 TOLERANCES

A. Top Surface of General Backfilling: Plus or minus 1 inch from required elevations.

3.5 FIELD QUALITY CONTROL

A. See "Section 01 40 00 Quality Requirements," for general requirements for field inspection and testing.

B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, or ASTM D6938.

C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D1557 ("modified Proctor"), AASHTO T 180, or ASTM D698 ("Standard Proctor").

D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

3.6 CLEANING

A. Leave unused materials in a neat, compact stockpile.

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Section 32
Exterior Improvements

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SECTION 32 01 90
LANDSCAPE MAINTENANCE

PART 1 – GENERAL

1.1 SUMMARY

A. Work Included: Provide continuous Landscape Maintenance, complete as specified during progress of the work, after installation, and for a minimum period of 90 days after Preliminary Acceptance, and as required by warranty and Article 3.8, Termination of the Maintenance Period.

B. Related Sections include:

1. Section 32 91 19 - Landscape Finish Grading
2. Section 32 84 00 - Irrigation
3. Section 32 91 13 - Soil Preparation and Soil Mixes
4. Section 32 93 00 - Planting

1.2 SUBMITTALS

A. Submittals to include all materials described in this section and all other materials identified as required by maintenance issues that develop during the course of the maintenance period.

B. Quality Control Submittals:

1. An irrigation system audit report @ the 30 day benchmark, submitted to building property manager.
2. Schedule of maintenance operations and monthly status report including list of equipment, materials proposed for the job.
3. Licenses, permits and insurances required by City, County, State or Federal government pertaining to maintenance work.
4. Monthly record of all herbicides, insecticides and disease control chemicals used for the project.
5. Written application recommendation by a licensed agricultural pest control advisor for all weed, pest and disease controls restricted by the Director of Agriculture proposed for this work.
6. Schedule of recommended annual fertilizer and soil conditioning program provided by Soils Testing Lab based on plant schedule.

B. Project Close-out Submittal: Include in a single, 3-ring binder a landscape maintenance

manual containing an indexed collection of all schedules, records and permits listed above, as well as a documentation of accepted condition of planting and irrigation at Final Acceptance.

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Experience: The landscape contractor or maintenance subcontractor shall have a full-time employee assigned to the job as foreman for the duration of the contract. He/she shall have a minimum of four (4) years of experience in landscape maintenance supervision, with experience or training in turf management, entomology, pest control, soils, fertilizers and plant identification.

2. 2. Labor Force: The landscape maintenance labor force shall be thoroughly familiar with, and trained in, the work to be accomplished and shall perform the task in a competent, efficient manner acceptable to the University.

B. Requirements by Applicable Standards: Apply standards as described in the following:

1. Fertilizing Woody Plants, University of California, Cooperative Extension Leaflet #2958, 9/79.

Pruning Landscape Trees, University of California, Cooperative Extension Leaflet #2574, 1/79.

3. American National Standard for Tree Care Operations - ANSI A300, Parts 1 and 2

4. International Society of Arboriculture BMP for Tree and Shrub Fertilization, and for Tree Pruning

5. Irrigation Association BMP's.

C. Requirements:

1. Supervision: The foreman shall directly supervise the work force at all times. Notify University of all changes in supervision.

2. Identification: Provide proper identification at all times for landscape maintenance firm's vehicles and labor force. Be uniformly dressed in a manner satisfactory to the University.

1.4 PROJECT/SITE CONDITIONS

A. Site Visit: At beginning of maintenance period, visit and walk the site with the Landscape Architect to clarify scope of work and understand existing project/site conditions.

B. Documentation of Conditions: Document general condition of existing trees, shrubs, vines, groundcovers and lawn recording all plant materials which are healthy, thriving, damaged, dead or dying.

C. Irrigation System: Document general condition of existing irrigation system, making sure that faulty electrical controllers, broken or inoperable sprinkler heads or emitters are reported.

1.5 SEQUENCING AND SCHEDULING

A. Perform all maintenance during hours mutually agreed upon between University and Contractor.

B. Work force shall be present at the project site at least once a week and as often as necessary to perform specified maintenance in accordance with the approved maintenance schedule.

PART 2 PRODUCTS

2.1 MATERIALS

A. General: All materials and equipment shall be provided by the Contractor, except as specified below.

B. Water: Clean, potable and fresh, as available from

University. Fertilizers:

1. Tightly-compressed, slow-release and long-lasting complete fertilizer tablets bearing manufacturer's label of guaranteed analysis of chemicals present.

2. Balanced, once-a-season application, controlled-release fertilizers with a blend of coated pills which supply controlled-release nitrogen, phosphorus and potassium, and uncoated, rapidly soluble pills containing nitrogen and phosphorus.

D. Herbicides, Insecticides, and Fungicides:

3. Best quality materials with original manufacturers' containers, properly labeled with guaranteed analysis.

4. Use non-staining materials.

E. Perennials/groundcovers: Nursery-grown in 4 in. pots, full, healthy plants just ready to bloom.

F. Replacement Tree Stakes and Ties: Match originally accepted existing materials on the site.

2.2 EQUIPMENT

A. General: Use only the proper tool for each job. Maintain all tools in sharp, properly-functioning condition. Clean and sterilize pruning tools prior to usage.

B. Insect/Disease Prevention: Take all acceptable measures to prevent introduction of insect or disease-laden materials onto the site.

PART 3 GENERAL

3.1 GENERAL

A. Duration: Continuously maintain each plant and each portion of groundcover area after installation, during progress of work, and for a period of one year (365 calendar days) after completion of all planting work until Final Acceptance.

B. Perform sufficient litter pick-up of pathways, flower beds, driveways, and recreational areas on a daily basis.

C. The Contractor shall be responsible for once yearly inspection of the surface drains located within the landscaped areas. These drains shall be checked to assure proper functioning. Remove any debris or vegetation that might accumulate at the inlet to prevent proper flow of water. Contractor shall notify Client, in writing, of any problems within one week of inspection.

D. Contractor shall exercise due case to avoid hitting trees and shrubs and will be responsible for the replacement of trees and shrubs damaged by its personnel.

E. Contractor shall submit to Client copy of any and all tests. The Contractor shall be responsible for having any tests made to affirm the soil chemistry, plant disease, insect pests, to properly maintain the landscape.

3.2 ESTABLISHING THE MAINTENANCE PERIOD

A. Preliminary Review: As soon as planting is substantially completed per documents, hold a preliminary review to determine the condition of the work.

B. Date of Review: Notify Landscape Architect at least five (5) workings days prior to anticipated date of review.

C. Beginning of the Maintenance Period: The date on which the Landscape Architect issues a letter of Preliminary Acceptance to the Contractor.

D. Ending of the Maintenance Period: The date on which the Landscape Architect issues a letter of Final Acceptance to the Contractor.

3.2 PREPARATION

A. Protection:

1. Protect all new planting areas from damage of all kinds from beginning of work until sufficiently established or until Final Acceptance.

2. Provide temporary protection fences, barriers and signs as required for protection.

B. Replacements:

1. Immediately treat or replace all plants, which become damaged or injured as a result of Contractor's operations or negligence, as, directed by Landscape Architect, at no cost to the University.

2. Replacement plants shall match size, condition and variety of plants replaced.

3.3 PLANTING

A. Watering Basins:

1. For supplemental hand watering of watering basins, use a water wand to break the water force. Do not permit use of "jet" type watering equipment. Do not permit crown roots to become exposed to air through dislodging of soil and mulch.

2. Maintain originally called for depth of mulch to reduce evaporation and frequency of watering.

3. In rainy season, open basins to allow surface drainage away from the root crown where excess water may accumulate. Restore watering basins at end of rainy season.

B. Resetting: Reset plants to proper grades and upright position.

C. Weed Control:

1. All areas between plants, including watering basins, shall be weed free at all times.

2. Use only recommended and legally approved herbicides to control weed growth.

3. Avoid frequent soil cultivation that destroys shallow roots and breaks the seal of pre-emergent herbicides.

D. Pruning:

1. Prune trees to select and develop permanent scaffold branches that are smaller in diameter than the trunk or branch to which they are attached, and which have vertical spacing of 18 in. to 48 in. and radial orientation so as not to overlay one another.

2. Prune trees to eliminate diseased or damaged growth, and narrow V-shaped branch forks that lack strength. Reduce toppling and wind damage by thinning out crowns.

3. Prune trees to maintain growth within space limitations, maintaining a natural appearance and balancing crown with roots.

4. No stripping of lower branches ("raising up") of young trees will be permitted.

5. Retain lower branches in a "tipped back" or pinched condition to promote caliper trunk growth (tapered trunk). Do not cut back to fewer than six buds or leaves on such branches. Only cut lower branches flush with the trunk after the tree is able to stand erect without staking or other support.

6. Thin out and shape evergreen trees when necessary to prevent wind and storm damage. Do primary pruning of deciduous trees during the dormant season. Do not permit any pruning of trees prone to excessive "bleeding" during growth season.

7. Prune damaged trees or those that constitute health or safety hazards at any time of year as required.

8. Make all cuts clean and close to the trunk, without cutting into the branch collar. "Stubbing" will not be permitted. Cut smaller branches flush with trunk or lateral branch. Make larger cuts (1 in. in diameter or larger) parallel to shoulder rings, with the top edge of the cut at the trunk or lateral branch.

9. Branches too heavy to handle shall be precut in three stages to prevent splitting or peeling of bark. Make the first two cuts 18 in. or more from the trunk to remove the branch. Make the third cut at the trunk to remove the resulting stub.

10. Do not prune or clip shrubs into balled or boxed forms unless specifically called for by design.

11. Take extreme care to avoid transmitting disease from one infected plant to another. Properly sterilize pruning tools before going from one infected plant to all other plants.

12. Pruning Season: Prune tree's during dormant season consistent with arboricultural standards for species to be pruned.

E. Staking and Guying of Trees: Inspect stakes at least once a month to check for rubbing that causes bark wounds.

3.4 GROUNDCOVERS

A. Watering:

1. Check for moisture penetration throughout the root zone at least twice a month.

2. Water as frequently as necessary to maintain healthy growth of groundcovers.

B. Weed Control:

1. Control weeds, preferably with pre-emergent herbicides and with selective systemic herbicides.

2. Minimize hoeing of weeds in order to avoid plant damage.

C. Fertilization:

1. Verify specific plant requirements, if any.

2. Recently installed plant materials: Verify with University actual completion date of planting installation and rate of prior application of fertilizers.

3. New plant materials: Place one (1) 5-gram tablets (20-10-5; N-P-K) beside the root ball about an inch from root tips.

4. Established Plant Materials: Do not use complete fertilizers unless soil test shows specific nutrient deficiencies.

D. Mowing and Edging:

1. Edge groundcovers to keep in bounds. Trim top growth as necessary to achieve an overall even appearance.

2. Groundcovers, which lend themselves to mowing, shall be mowed to specified height above finished grade in order to renew growth, improve density and attractiveness.

E. Replace dead and missing plants after obtaining University's agreement to pay for replacement. Damages due to Contractor's negligence shall be paid for without charge to the University.

3.5 ANNUALS, PERENNIALS AND SUCCULENTS

A. Watering:

1. Species, sizes of plants, container sizes and orientation shall dictate frequency of watering. Submit to University a watering schedule for different seasonal requirements.

B. Weed Control: All planters with annuals and perennials shall be weed-free at all times.

C. Pruning:

1. Limit pruning to removal of damaged or dead twigs and foliage.

2. Remove spent flowers on a weekly basis.

D. Fertilization: Incorporate slow-release fertilizers per manufacturer's current specifications, and rake smooth.

3.6 INSECTS, PESTS, AND DISEASE CONTROL

A. Inspection: Inspect all plant materials for signs of stress, damage and potential trouble from the following:

1. Presence of insects, moles, gophers, ground squirrels, snails and slugs in planting areas.
2. Discolored or blotching leaves or needles.
3. Unusually light green or yellowish green color inconsistent with normal green color of leaves.

B. Personnel: Only licensed, qualified, trained personnel shall perform spraying for insect, pest and disease control

C. Application: Spray with extreme care to avoid all hazards to any person or pet in the area or adjacent areas.

3.7 IRRIGATION SYSTEM

A. General:

1. Repair without additional charge to the University all damages to system caused by Contractor's operations. Perform all repairs within one (1) watering period.
2. Report promptly to University Representative all accidental damage not resulting from Contractor's negligence or operations.
3. Set and program automatic controllers for seasonal water requirements.
4. Twice a month, use a probe or other acceptable tool to check the rootball moisture of representative plants as well as the surrounding soil.

B. Cleaning and Monitoring the System:

1. Continually monitor the irrigation systems to verify that they are functioning properly as designed. Make program adjustments required by changing field conditions.
2. Clear irrigation systems once a year and as often as necessary to keep the irrigation systems free of sand and other debris.
3. Prevent spraying on windows, building walls, (game courts) by balancing the throttle control on the remote-control valves and the adjustment screws on the sprinkler heads. Do not allow water to atomize and drift.

3.9 TERMINATION OF THE MAINTENANCE PERIOD

A. Final Acceptance Procedure:

1. Work will be accepted by the Landscape Architect upon satisfactory completion of all work, including maintenance period, but exclusive of replacement of materials under the Warranty Period.

2. Submit a written request to Landscape Architect for review for Final Acceptance at least five (5) working days prior to anticipated Final Review date, which is at the end of the Maintenance Period.

3. Submit maintenance operations manual to the University's Representative.

B. Corrective Work:

1. Work requiring corrective action or replacement shall be performed within ten (10) calendar days after the Final Review.

2. Perform corrective work and materials replacement in accordance with the Drawings and Specifications and shall be made by the Contractor at no cost to the University.

3. After corrective work is completed, the Contractor shall again request a Final Review for Final Acceptance as outlined above.

4. Continue maintenance of all landscaped areas until such time as all corrective measures have been completed and accepted.

C. Conditions for Acceptance of Work at End of Maintenance Period:

1. Each plant shall be alive and thriving, showing signs of growth and no signs of stress, disease, or any other weaknesses.

2. Replace all plants not meeting these conditions. An additional Warranty Period equal in length to the original shall be commenced for all such plants and planted areas.

D. Final Acceptance Date: The date on which the Landscape Architect issues a Letter of Final Acceptance. Upon Final Acceptance, the University will assume responsibility for maintenance of the work.

3.10 CLEANING

A. Dispose of all pruned materials, vacuum all lawn clippings and leaves, sweep all walkways and rake smooth all mulched areas.

B. Remove from the site all containers and evidence of maintenance activities.

3.11 CLOSE OUT

A. Landscape Maintenance and Operations Manual: Submit binder to the University with all documentation and records required and utilized during the maintenance period with recommended operations and maintenance procedures and schedules.

B. Keys and Identification: Return all keys and identification materials supplied by the University for the purpose of site access.

END OF SECTION

SECTION 32 12 16

ASPHALT PAVING

PART 1 GENERAL

1.1 SUMMARY

A. Furnish all material, equipment and labor required to construct hot mix asphalt pavement, including, but not limited to, placement of hot mix asphalt paving, tack coat, and adjustment to grade of all traffic boxes and manhole frames and grates.

B. Related Sections:

1. Section 01 33 00: Submittals.

2. Section 31 00 00: Earthwork.

C. Reference Standards:

1. California Department of Transportation (Caltrans) Standard Specifications, Current Edition.

2. Caltrans California Test 216: Method of Test for Relative Compaction of Untreated and Treated Soils and Aggregates.

3. Caltrans California Test 231: Method of Test for Relative Compaction of Untreated and Treated Soils and Aggregates Using Nuclear Gage.

4. Caltrans California Test 309: Method of Test for Determining Theoretical Maximum Specific Gravity and Density of Hot Mix Asphalt.

5. Caltrans California Test 375: Determining the In-Place Density and Relative Compaction of Hot Mix Asphalt Using Nuclear Gages.

6. California Division of Occupational Safety and Health (Cal-OSHA), Title 8, Section 1590 (e).

7. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction and shall not begin until all of those governing authorities have been notified.

1.2 SUBMITTALS

A. Refer to “Section 01 33 00 Submittal Procedures.”

B. Job Mix Formula Proposal, Hot Mix Asphalt Design Data, and Job Mix Formula Verification per Caltrans Standard Specifications for all hot mix asphalt material being used on the project.

1. Job Mix Formula Proposal: CEM-3511

2. Hot Mix Asphalt Design Data: CEM-3512

3. JMF Verification: CEM-3513

C. Load slips for all material delivery trucks shall be delivered to the job site with the truck. The Contractor shall retain all load slips and shall make them available to the Engineer upon request.

1.3 QUALITY ASSURANCE

A. All materials shall conform to the applicable sections of the Caltrans Standard Specifications unless otherwise specified in these Specifications or on the Plans.

B. Use only new materials and products, unless existing materials or products are specifically shown otherwise on the Drawings to be salvaged and re-used.

C. All materials, components, assemblies, workmanship and installation are to be observed by the Owner's Inspector of Record. Work not so inspected is subject to uncovering and replacement.

D. The representatives of the Owner's testing lab will not act as supervisor of construction, nor will they direct construction operations. Neither the presence of the Owner's testing lab representatives nor the testing by the Owner's testing lab shall excuse the Contractors or Subcontractors for defects discovered in their work during or following completion of the project. Correcting inadequate compaction is the sole responsibility of the Contractor.

E. Contractor shall provide verification that asphalt mix temperature meets the requirements of this specification at time of application.

F. Contractor shall be solely responsible for all subgrades built. Any repairs resulting from inadequate compaction are the responsibility of the Contractor.

G. Sieve analysis from testing laboratories identifying rock/sand percentages within the asphalt mix shall have a testing date within 90 days of contract signing.

H. Sieve analysis from a testing laboratory identifying rock/sand percentages within the Class 2 aggregate base rock shall have a testing date within 90 days of contract signing.

1.4 WARRANTY

A. Refer to General Conditions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Transport, store and handle in strict accord with the local jurisdiction.

B. Make delivery to job when notified by Contractor verifying that the job is ready to receive the work of this Section and that arrangements have been made to properly store, handle and protect such materials and work.

PART 2 PRODUCTS

2.1 MATERIALS

A. Aggregate Base: See Specifications "Section 31 00 00 Earthwork."

B. Hot Mix Asphalt: Shall be Type "A" Hot Mix Asphalt, and shall conform to the requirements for Type "A" hot mix asphalt with 1/2 inch HMA Type A grading as specified in Section 39-2.02, of the Caltrans Standard Specifications.

C. Asphalt Binder: Asphalt Binder for Type "A" hot mix asphalt shall be PG 64-16, as specified in Section 92 of the Caltrans Standard Specifications.

D. Prime Coat: Prime coat on aggregate base will not be required.

E. Tack Coat: Tack coat shall conform with, and be applied in conformance with Section 94, "Asphaltic Emulsions" of the Caltrans Standard Specifications. Tack Coat shall be type SS1 or RS1, and shall be applied to all vertical surfaces of existing pavement, curbs, gutters and construction joints.

F. Seal Coat: No seal coat will be required.

G. Pavement Reinforcing Fabric: If pavement reinforcing fabric is required, it shall conform to Section 96-1.02J, "Paving Fabric" of the Caltrans Standard Specifications.

H. Crack Treatment:

1. Crack Seal, if required, shall conform to Section 37-6, "Crack Treatment," and Section 41-5, "Joint Seals" of the Caltrans Standard Specifications.

2. Crack seal treatment shall be "hot-applied" type.

3. The Contractor shall provide the Engineer with a Certificate of Compliance for each shipment of crack sealant. The certificate shall certify that the sealant conforms to the specifications and shall be accompanied with storage and heating instructions and calculations for the material.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Environmental Requirements:

1. Base Course: Do not lay base course on muddy subgrade, during wet weather, or when atmospheric temperature is below 40 degrees Fahrenheit (°F).

2. Asphalt Surfacing: Do not apply asphaltic surfacing on wet base, during wet weather, or when atmospheric temperature is below 50°F.

3.2 PROTECTION OF WORK

A. Curbs and other work shall be covered with suitable material and protected from staining or damage by equipment or contact with oil, emulsion, and asphalt. All manholes, catch basins, and gratings shall be covered with suitable material so that no asphalt or emulsion will come in contact with the inside walls or floors of the structures.

3.3 PAVEMENT GRINDING

A. Pavement grinding, when required, shall be performed in accordance with the requirements of Section 39-3.04 and Section 42-3, of the Caltrans Standard Specifications, as specified in these specifications, and as directed by the Engineer.

B. The Contractor shall exercise care to avoid damaging existing concrete curbs and drainage facilities during all grinding operations. Damage to existing improvements shall be repaired at the Engineer's direction, and at the sole expense of the Contractor.

C. Prior to conducting grinding operations, the Contractor shall remove all weeds and dirt in the gutters and in cracks in the existing pavement surface to the satisfaction of the Engineer. The Contractor will not be permitted to use herbicides, and the method of weed removal shall be subject to the approval of the Engineer.

D. The Contractor shall completely remove all existing raised reflective markers from the areas being ground.

E. The grinded areas shall be swept throughout the course of the grinding operations and shall be left thoroughly clean and clear of all grindings at the end of each working day. The Contractor shall exercise care to avoid spilling grindings into drainage inlets and culverts, and shall promptly clean out any grindings that do spill into inlets or culverts.

F. Prior to initiation of grinding operations, the Contractor shall lower all traffic boxes and manhole lids and frames within the limits of the work.

G. Abrupt edges shall not be left in place when traffic is allowed back into the grinding area. Where abrupt edges exist (mid-block or on cross streets or alleys), or where directed by the Engineer, the Contractor shall build a transition ramp no shorter than 25 feet long that spans the entire length or width of the abrupt edge, lifting traffic out of the ground area and onto the surrounding pavement.

3.4 PAVEMENT SAWCUTTING

A. Pavement sawcutting shall be performed with a wheel roller, pneumatic pavement cutter, or other sawcutting equipment approved by the Engineer.

B. All pavement sawcutting shall be to the full depth of the pavement, regardless of depth. All pavement material inside the sawcut limits shall be completely removed. Sawcuts shall be straight and shall provide clean, solid, vertical faces free from loose or cracked material. All damaged or disturbed adjoining pavement shall be sawcut and removed.

C. When sawcutting is necessary for utility, storm drain, or culvert installation, sawcutting shall be made 12 inches wider on all sides than the width of the excavation.

D. When possible, sawcuts shall be either parallel or perpendicular to the roadway centerline.

E. The number of jogs in the sawcut lines shall be held to minimum and shall be subject to approval by the Engineer. The Contractor may be required to remove additional undisturbed pavement if, in the opinion of the Engineer, the lines are too erratic or contain too many jogs.

3.5 INSTALLATION

A. Subgrade shall be prepared in accordance with “Section 31 00 00 Earthwork” of these project specifications. Compaction and moisture content shall be verified immediately prior to placement of aggregate base.

B. Cleaning: Existing surfaces and new surfaces shall be clean of all dirt, sand, oil or grease. All cracks shall be cleaned and free of all debris and vegetation.

C. Base Placement

1. Install in accord with Caltrans Standard Specifications, Section 26. Compact to relative compaction of not less than 95%, Caltrans 216/231. The material shall be deposited on the subgrade in such a manner as to provide a uniform section of material within five percent tolerance of the predetermined required depth. Deposition will be by spreader box or bottom dump truck to prevent segregation of the material. The material so deposited on the subgrade shall have sufficient moisture which, in the opinion of the Engineer, is adequate to prevent excessive segregation. It shall then be immediately spread to its planned grade and cross section. Undue segregation of material, excessive drifting or spotting of material will not be permitted. If in the opinion of the site geotechnical engineer, the material is unsuitably segregated, it shall be removed or completely reworked to provide the desired uniformity of the material.

2. Moisture content and compaction of base material shall be tested immediately prior to placement of asphalt paving.

D. Liquid Asphalt Tack Coat: Apply as "tack coat" to all vertical surfaces of existing paving, curbs, walks, and construction joints in surfacing against which paving is to be placed. When being applied for paving fabric installation, tack coat shall extend 3 inches beyond the width of the paving fabric on all sides. Tack coat shall be applied in one application at a rate of from 0.02-gallon to 0.10-gallon per square yard of surface covered.

E. Pavement reinforcing fabric, when specified, shall be installed immediately after the tack coat is applied, in accordance with Section 39-2.01C(3)(g), “Geosynthetic Pavement Interlayer” of the Caltrans Standard Specifications, and in accordance with the manufacturer’s instructions.

F. Hot Mix Asphalt Construction

1. All hot mix asphalt shall be installed in accordance with Section 39-2.01C, “Construction” of the Caltrans Standard Specifications. Type “A” hot mix asphalt shall be placed only when the atmospheric temperature is above 50°F. Failure to meet temperature restrictions is grounds for rejection of the work by the Engineer.

2. Theoretical maximum specific gravity and density of hot mix asphalt shall be determined in accordance with Caltrans California Test 309.

3. In-place density and relative compaction shall be determined using a nuclear gage in accordance with Caltrans California Test 375.

4. The completed surface shall be thoroughly compacted, smooth, and free from ruts, humps, depressions, or irregularities. Any ridges, indentations or other objectionable marks left in

the surface of the hot mix asphalt by rollers, rakes, or other equipment shall be eliminated immediately.

5. Contractor shall schedule and attend a pre-paving meeting at least 2 hours in advance of the paving operation.

6. Placement and adjustment of Frames, Covers, Boxes and Grates: The Contractor shall set and adjust to finish grade all proposed and existing frames, covers, boxes, and grates of all manholes, drop inlets, drain boxes, valves, cleanouts, electrical boxes and other appurtenant structures prior to placement of asphaltic concrete.

G. Hot Mix Asphalt Acceptance

1. Acceptance of Hot Mix Asphalt shall be as specified in Section 39-2.02A94)(b), 39-2.02A(4)(e) ASPHALT CONCRETE, under subsection "Quality Assurance" except as modified below:

a. Final gradation shall be smooth, uniform and free of ruts, humps, depressions or irregularities.

b. Maximum variation in slopes shall be 0.5%.

c. Pavement Surface Drainage Test: The Contractor shall perform a Pavement Surface Drainage Test on all paved areas to confirm positive drainage. Testing shall be conducted in the presence of the Project Inspector. The Contractor shall uniformly apply water to the pavement surface by flooding or controlled spraying evaluate surface runoff. Areas exhibiting ponding or standing water shall be corrected and retested until acceptable drainage is achieved.

d. The surface elevations of asphalt paving shall not vary more than 1/8 inch above or below the elevations established on the plans.

e. In no case shall grades in accessible areas, including accessible parking stalls and accessible path of travel, exceed the maximum allowable grades for accessibility.

f. Pavement thickness shall be within 1/4 inch of the specified thickness.

g. Suitable corrective actions must be agreed upon by the Owner and the Engineer and may consist of full-depth removal and replacement, or overlaying.

3.6 DEFECTIVE ASPHALT

A. Contractor is responsible for replacing or modifying defective asphalt, using method approved by the Engineer. Contractor is responsible for costs associated with replacing or modifying defective asphalt

B. Defective asphalt is as described below:

1. Exposed rock pockets on the finished surface.

2. Asphalt not placed to the design grades or elevations.

3. Asphalt that ponds water.

4. Asphalt that was compacted below the minimum required temperatures.
5. Asphalt that fails to meet the minimum compaction requirements.
6. Asphalt that lacks the minimum thickness required per plan.
7. New asphalt contaminated by a petroleum product, or spilled paint.
8. Asphalt that has depressions, cracks, raveling, segregation, slippage, bleeding, or potholes.
9. Asphalt placed on pumping, unstable sub-grades.

3.7 CLEANING

A. Upon completion of work of this Section promptly remove from the working area all scraps, debris and surplus material of this Section.

B. Clean excess material from surface of all concrete walks and utility structures.

END OF SECTION

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SECTION 32 13 13

SITE CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Related Sections include the following:

1. Section 31 00 00: Earthwork.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag.

1.3 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM-International (ASTM) C94/C94M requirements for production facilities and equipment:

1. Manufacturer certified according to National Ready Mixed Concrete Association’s (NRMCA's) "Certification of Ready Mixed Concrete Production Facilities."

B. American Concrete Institute (ACI) Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

PART 2 PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces:

1. Use flexible or curved forms for curves with a radius of 100 feet (30.5 meters [m]) or less.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

A. Reinforcement to meet requirements and products specified in California Department of Transportation (Caltrans) Standard Specifications Section 52.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Shall be as defined in Caltrans Standard Specifications Section 40.

B. Normal-Weight Aggregates: Shall be ¾-inch maximum size aggregate in mixes.

C. Water: ASTM C94/C94M.

D. Air-Entraining Admixture: ASTM C260.

E. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1% water-soluble chloride ions by mass of cementitious material.

2.4 CURING MATERIALS

A. Curing materials to meet requirements and products specified in Caltrans Standard Specifications.

2.5 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber.

B. Bonding Agent: ASTM C1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Detectable Warning Panels: See Specification “Section 32 17 26 Tactile Warning Surface.”

2.6 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mixes or field experience:

1. Use a qualified independent testing agency for preparing and reporting proposed concrete mixture designs for the trial batch method.

B. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days):

a. Sidewalks, walkways, curbs and other areas not exposed to vehicle traffic: 3,000 pounds per square inch (psi)

b. Driveways, crosswalks, parking stalls, and other areas exposed to vehicle traffic: 4,000 psi

c. Site retaining walls: 4,000 psi

d. Structural and building elements: Not included in this specification section

2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.5

3. Slump Limit: 3 inches, plus or minus 1 inch

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content: 5½ percent plus or minus 1.5 percent for curb and gutter

2. Air Content: 5½ percent plus or minus 1.5 percent for sidewalks and driveways

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

F. Cementitious Materials - Limit percentage, by weight, of cementitious materials other than Portland cement according to ACI 301 requirements as follows:

1. Fly Ash or Pozzolan: 20 percent.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Furnish batch certificates for each batch discharged and used in the Work:

1. When air temperature is between 85 degrees Fahrenheit (°F) and 90°F, reduce mixing and delivery time from 1½ hours to 75 minutes; when air temperature is above 90°F, reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.1 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities and general public access.

3.2 EXAMINATION

A. Examine exposed sub-grades and sub-base surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subgrade surface below Class 2 Aggregate Base supporting concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

1. Completely proof-roll base in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 miles per hour (mph).

2. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons.

3. Base with soft spots and areas of pumping or rutting exceeding depth of 1 inch or as determined by the Engineer require correction according to requirements in Division 31.

4. In areas that rut less than 1 inch, the ruts shall be filled with base material, compacted, and brought to grade.

C. Class 2 Aggregate base placed above the subgrade shall be compacted to 90% relative compaction for vehicular and non-vehicular concrete pavements as indicated on the Plans.

D. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

3.3 PREPARATION

A. Remove loose material from compacted sub-base surface immediately before placing concrete.

3.4 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.5 STEEL REINFORCEMENT

A. General: Comply with Concrete Reinforcing Steel Institute's (CRSI's) "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

3.6 JOINTS

A. General: Form construction, expansion, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated:

1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints:

1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.

C. Expansion Joints: Form expansion joints of pre-formed joint-filler strips where indicated:

1. Locate expansion joints at intervals of 50 feet (15.25 meters), unless otherwise indicated.

2. Locate reinforcing bar mid-depth within the concrete slab.

3. Extend joint fillers full width and depth of joint.

4. Terminate joint filler not less than 1/2 inch (13 millimeters [mm]) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.

5. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.

6. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.

7. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary pre-formed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated:

1. Locate isolation joints at the perimeter of rigid structures (stormwater treatment basins, columns, and so on), unless otherwise indicated.

2. Extend joint fillers full width and depth of joint.

3. Terminate joint filler not less than 1/2 inch (13 mm) or more than 1 inch (25 mm) below finished surface if joint sealant is indicated.

4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.

5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.

6. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

E. Contraction Joints—Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows to match jointing of existing adjacent concrete pavement:

1. Locate expansion joints at maximum intervals of 10 feet (3.05 meters), unless otherwise indicated.

2. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch (6-mm)-radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.

3. Sawed Joints: Form contraction joints with saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch (3-mm)-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks. After concrete is poured, saw cuts shall be completed within:

   a. 1 to 4 hours with early-entry dry cut saws (1 hour for hot weather to 4 hours for cold weather); or,

b. 4 to 12 hours with conventional wet or dry saws (4 hours for hot weather to 12 hours for cold weather).

c. Vacuum and remove debris from joint after saw cutting is complete.

F. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to the radii indicated on the plans. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.7 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, ponded water, or frost from sub-base surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten sub-base to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery.

F. Do not add water to fresh concrete after testing.

G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping:

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed:

1. Remove and replace concrete that has been placed for more than 15 minutes without being covered by top layer, or use bonding agent if approved by Architect.

J. Screed pavement surfaces with a straightedge and strike off.

K. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

L. Finishing of Unformed Surfaces: Unless otherwise shown on the plans, unformed surfaces shall be finished as follows:

1. Finishes that are exposed and subject to foot traffic shall receive a broom finish with a texture of plus or minus one-sixteenth (±1/16) inch or as designated on the plans.

2. Stairways and Sidewalks: Strike smooth tops of stairs and sidewalks and finish with a light broom providing a texture of plus or minus one-sixteenth (±1/16) inch.

M. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified for formed concrete. If results are not approved, remove and replace with formed concrete.

N. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures:

1. When air temperature has fallen to or is expected to fall below 40°F (4.4 degrees Celsius [°C]), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50°F (10°C) and not more than 80°F (27°C) at point of placement.

2. Do not use frozen materials or materials containing ice or snow.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mix designs.

O. Hot-Weather Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90°F (32°C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.

3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.8 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared, and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture:

1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

3.9 CONCRETE PROTECTION AND CURING

A. Refer to Caltrans Standard Specifications for Concrete Protection and Curing.

3.10 ACCESSIBLE. CURB RAMP CONSTUCTION

A. Sidewalk curb approach ramps shall be constructed to current Americans with Disability Act (ADA) standards as detailed in the plans.

B. Surface Texture: Accessible surface texture requirements shall be met with the installation of the accessible compliant detectable warning panels inserted in the sidewalk approach ramps as indicated in the details.

C. Slope:

1. New construction:

a. Running Slope: Maximum slope in the direction of travel shall be 1 foot vertical to 12 feet horizontal (1:12). Maximum rise for any run shall be thirty (30) inches or less.

b. Cross Slope: Maximum slope perpendicular to the direction of travel shall be 1 foot vertical to 48 feet horizontal (1:48).

c. Flared Side Slope: When curb ramps are located where pedestrians must walk across the ramp, the ramp shall have flared sides with a maximum slope of 1 foot vertical to 10 feet horizontal (1:10).

3.11 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:

1. Elevation: 1/4 inch (6 mm).

2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).

3. Surface: Gap below 10-foot (3-m)-long, unleveled straightedge not to exceed 1/4 inch (6 mm).

4. Joint Spacing: 3 inches (75 mm).

5. Contraction Joint Depth: Plus 1/4 inch (6 mm), no minus.

6. Joint Width: Plus 1/8 inch (3 mm), no minus.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C172 shall be performed according to the following requirements for vehicular concrete, retaining walls, and equipment pads, testing is not required for pedestrian concrete:

1. Test Locations: Driveways, Valley Gutters, Accessible Parking Stalls, Crosswalks, and Retaining Walls.

2. Testing Frequency: Obtain at least 1 composite sample for each 100 cubic yards (76 cubic meters) or fraction thereof of each concrete mix placed each day:

   a. When frequency of testing will provide fewer than five (5) compressive-strength tests for each concrete mixture, testing shall be conducted from at least five (5) randomly selected batches or from each batch if fewer than five are used.

3. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.

4. Air Content: ASTM C231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.

5. Concrete Temperature: ASTM C1064; one test hourly when air temperature is 40°F (4.4 °C) and below and when 80°F (27°C) and above, and one test for each composite sample.

6. Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one (1) set of three (3) standard cylinder specimens for each composite sample.

7. Compressive-Strength Tests: ASTM C39/C39M; test 1 specimen at 7 days and 2 specimens at 28 days:

   a. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 megapascals [MPa]).

D. Test results shall be reported in writing to Architect, Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as a sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect.

G. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.13 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 32 17 23

PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Parking lot markings, including parking bays, arrows, loading zones, access aisles, international symbols of accessibility (ISA), and curb markings.

B. Related Section:

1. Section 32 12 16: Asphalt Paving.

C. Reference Standards:

1. California Building Code (CBC) Chapter 11B: Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.

2. Master Painters Institute Approved Products List (MPI APL); Master Painters and Decorators Association; current edition, www.paintinfo.com.

1.2 DEFINITIONS

A. Pavement Stripe: Includes traffic control, materials, and all appurtenances not otherwise specified.

B. Pavement Markings: Includes traffic control, setup, materials, and all appurtenances not otherwise specified in the bid schedule.

1.3 SUBMITTALS

A. All paint products to be used for pavement markings.

1.4 QUALITY ASSURANCE

A. All pavement striping, pavement marking shall be installed in accordance with manufacturer's instructions.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

PART 2 PRODUCTS

2.1 MATERIALS

A. Traffic Paint:

1. Type: Water base, roadway traffic lane marking type; colors as selected.

2. Acceptable Manufacturers:

a. Dunn-Edwards, Vin-L-Stripe No. W-801, vinyl-epoxy as a standard of quality.

b. J. E. Bauer latex base Formula No. 1030A9 White, No. 1056A9 Yellow, No. 1865A9 Blue, No. 1118A9 Green, and No. 1854A9

c. Red Sinclair No. 160 Vinyl Traffic Line Paint, water base.

d. Ennis Traffic Safety Solutions, product 6000 white & 6006 blue.

B. Line and Zone Marking Paint: MPI (APL) No. 97 Latex Traffic Marking Paint:

1. Roadway Markings: White.

2. Symbols of Accessibility: Blue and white, as indicated on the Plans.

C. Striping: Thermoplastic Stripe, In accordance with State of California, Department of Transportation (Caltrans), Standard Specifications, Section 84.

D. Pavement Markings: Thermoplastic Markings, In accordance with Caltrans, Standard Specifications, Section 84.

PART 3 EXECUTION

3.1 FIELD CONDITIONS

A. Do not install products under environmental conditions outside manufacturer's absolute limits.

3.2 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.3 JOB CONDITIONS

A. Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 degrees Fahrenheit (°F) for oil-based materials, 50°F for water-based materials, and not exceeding 95°F.

B. Sequencing, Scheduling: Coordinate with paving work. Verify that paint type is compatible with asphalt paving surfaces.

1. Do not apply pavement markings for 14 days after installation of hot mix asphalt.

2. Do not apply pavement markings until concrete has cured for 30 days.

C. Protection: After application, protect from traffic until thoroughly dry.

3.4 PREPARATION

A. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

B. Clean surfaces thoroughly prior to installation:

1. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods.

C. Where oil or grease are present, scrub affected areas with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application; after cleaning, seal oil-soaked areas with cut shellac to prevent bleeding through the new paint.

D. Establish survey control points to determine locations and dimensions of markings; provide templates to control paint application by type and color at necessary intervals.

3.5 INSTALLATION

A. Apply in accordance with manufacturer's instructions using an experienced technician that is thoroughly familiar with equipment, materials, and marking layouts.

B. Apply markings in locations determined by measurement from survey control points; preserve control points until after markings have been accepted.

C. Apply uniformly painted markings of color(s), lengths, and widths as indicated on the drawings true, sharp edges and ends:

1. Apply paint in one coat only.

2. Wet Film Thickness: 0.015 inch, minimum.

3. Width Tolerance: Plus or minus 1/8 inch.

D. Parking Lots: Apply parking space lines, entrance and exit arrows, painted curbs, and other markings indicated on drawings:

1. Mark the International Symbol of Accessibility at indicated parking spaces.

2. Hand application by pneumatic spray is acceptable.

3.6 DRYING, PROTECTION, AND REPLACEMENT

A. Protect newly painted markings so that paint is not picked up by tires, smeared, or tracked.

B. Provide barricades, warning signs, and flags as necessary to prevent traffic crossing newly painted markings.

C. Allow paint to dry at least the minimum time specified by the applicable paint standard and not less than that recommended by the manufacturer.

D. Remove and replace markings that are applied at less than minimum material rates; deviate from true alignment; exceed length and width tolerances; or show light spots, smears, or other deficiencies or irregularities.

E. Remove markings in manner to avoid damage to the surface to which the marking was applied, using carefully controlled sand blasting, approved grinding equipment, or other approved method.

F. Replace removed markings at no additional cost to Owner.

END OF SECTION

SECTION 32 17 26

TACTILE WARNING SURFACING

PART 1 GENERAL

1.1 SUMMARY

A. Scope:

1. Truncated dome pre-cast pavers meeting State of California Americans with Disabilities Act (ADA) 11B requirements.
2. Paving base
3. Portland cement mortars
4. Grout

B. Related Sections:

1. Section 32 13 13: Concrete Paving
2. Section 32 17 23: Pavement Markings

C. Reference Standards:

1. 49 Code of Federal Regulations (CFR) 37: Transportation Services for Individuals with Disabilities (ADA); current edition.
2. ADA Standards: ADA Standards for Accessible Design; 2010.
3. ASTM-International (ASTM) A666: Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
4. ASTM D2047: Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.
5. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.
6. ATBCB PROWAG: Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way.
7. FED-STD-595C: Colors Used in Government Procurement (Fan Deck).
8. Accessibility Requirements:
    a. Americans with Disabilities Act of 1990, as amended:
        i. ADA Title II Regulations & the 2010 ADA Standards for Accessible Design.

b. California Building Code (CBC) 2025 (California Code of Regulations [CCR] Title 24, Part 2, as adopted and amended by Division of the State Architect [DSA]):

   i. CBC Chapter 11B, Access to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing.

1.2 SUBMITTALS

A. See "Section 01 33 00 Submittal Procedures."

B. Product Data: Submit manufacturer's product data, standard details, details specific to this project; written installation and maintenance instructions.

C. Samples: Submit two (2) samples of tactile warning surface pavers, in pattern and color specified.

D. Color contrast data per CBC Section 11B-705.1.1.3.2

E. Shop Drawings.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than 5 years' documented experience.

B. Accessibility Requirements:

1. Detectable warning surfaces shall comply with CBC Section 11B-705.1.

2. Detectable warning surfaces shall provide a minimum of 70-percent visual contrast with adjacent walking surfaces. See CBC Section 11B-705.1.1.3.2.

3. Detectable warning surfaces shall differ from adjoining surfaces in resiliency or sound-on-cane contact. Such constraint shall not be required for detectable warning surfaces at curb ramps, islands, or cut-through medians. See CBC Section 11B-705.1.1.4.

1.4 WARRANTY

A. See "Section 01 77 00 Closeout Procedures."

B. Pavers: Provide manufacturer's standard five (5) year warranty against manufacturing defects, breakage or deformation. Warranty shall also indicate compliance with architectural standards as published in the current edition of the California Building Standards Code, and also include durability criteria which indicate that the shape, color fastness, confirmation, sound-on-cane acoustic quality, resilience, and attachment will not degrade significantly for specified years after initial installation:

1. As used in this specification, "not degrade significantly" means that the product maintains at least 90 percent of its approved design characteristics, as determined by the enforcing agency.

C. Installer's Warranty: 1 year.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Tactile Warning Surfacing shall be suitably packaged or crated to prevent damage in shipment or handling. Finished surfaces shall be protected by sturdy plastic wrappings to protect tile from concrete residue during installation.

B. Tactile Warning Surfacing shall be delivered to location at the site for storage prior to installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Truncated Dome Pavers:

1. Endicott Clay Products Co.

a. www.endicott.com

2. Or approved equal.

3. Substitutions: See "Section 01 25 00 Substitution Procedures and Form."

B. Surface Applied tiles are not permitted.

2.2 TACTILE AND DETECTABLE WARNING DEVICES

A. Installation Method: Mortar set and grouted.

B. Shape: Rectangular.

C. Dimensions 3-5/8" x 7-5/8"

D. Color: Dark Ironspot

1. Provide a minimum of 70-percent visual contrast with adjacent walking surfaces, meeting CBC 11B-705.1.1.3.2

E. Finish: Wirecut

F. Pattern: Alternating

G. Truncated Dome Dimensions:

1. Height: 0.2 inch (5.1 millimeters [mm]).

2. Base Diameter: 0.9 inches (22.9 mm) minimum to 0.92 inches (23.4 mm) maximum.

3. Top Diameter: 0.45 inches (11.4 mm) minimum to 0.47 inches (11.9 mm) maximum.

4. Pattern:

a. Wide Inline (Square) Pattern: Center-to-Center spacing of 2.3 inches minimum to 2.4 inches maximum each way.

b. Radial Pattern: Center-to-Center spacing of 1.6 inches minimum to 2.4 inches maximum each way.

5. Tile Dimensions: As specified on Drawings.

2.3 ACCESSORIES

A. Mortar: One part Portland cement, six parts damp sand by volume.

B. Grout: Colored grout as recommended by manufacturer of truncated dome pavers. Color to match color of truncated dome pavers.

C. Portland Cement: ASTM C150, Type I.

D. Sand: ASTM C144, washed, sharp durable, particles free from silt, loam, clay, salts or organic impurities.

1. For settling beds:

a. 100% Passing No. 4 sieve

b. Not more than 5% passing 100-mesh sieve

2. For Grout

a. 100% Passing 30-mesh sieve

b. Not more than 5% passing 100-mesh sieve

E. Expansion Joint Sealant

1. Polyurethane two-part sealant

PART 3 EXECUTION

3.1 EXAMINATION

A. When installation location is near site boundary or property line, verify required location using property survey.

B. Verify that work area is ready to receive work:

1. If existing conditions are not as required to properly complete the work of this section, notify Architect.

2. Do not proceed with installation until deficiencies in existing conditions have been corrected.

3. Verify that dimensions, tolerances, and attachment methods for work in this section are properly coordinated with other work on site.

3.2 INSTALLATION, GENERAL

A. Install in accordance with manufacturer's written instructions:

1. Dampen concrete slab prior to placement of mortar setting bed.
2. Place mortar setting bed and screed and tamp firmly to required lines, grades, and planes.
3. Set pavers in full beds of Portland cement mortar.
4. Apply a dust coat of dry Portland cement over the plastic setting bed, or apply a skim coat of Portland cement to the backs of pavers.
5. Lay pavers in position and tamp into place to achieve full bearing.
6. Rack joints 3/8 inch to 1/2 inch wide, full depth of pavers.
7. Rod joints and maintain natural color joint appearance.
8. Place grout in joints until completely filled.
9. Apply a second grout application and tool joints flush with the face of pavers.
10. Remove excess grout and prevent grout accumulation on exposed faces of pavers.

B. Do not install damaged, cracked, chipped, bowed, dented, abraded, or otherwise defective units.

C. The concrete shall be poured and finished true and smooth to the required dimensions and slope prior to the tile placement. The tile shall be placed true and square to the curb edge in accordance with the drawings. Tiles shall be tamped into the setting bed to ensure the field level of the tile is flush to adjacent concrete surface.

D. The elevation and slope of the tile shall be set consistent with the contract drawings to permit water drainage and eliminate ponding.

E. Field Adjustment:

1. Locate relative to curb line in compliance with CBC Chapter 11B, Section 705.
2. Orient so the dome pattern is aligned with the direction of the ramp.
3. Align truncated dome pattern between adjacent units.

F. Install units fully seated to substrate, square to straight edges and flat to required slope.

3.3 CLEANING

1. Pavers shall be cleaned after grouting. Acid or acid cleaners shall not be used. Remove all mortar stains and other deleterious substances from the surface. Use care not to damage the surface finish.

3.4 PROTECTION

A. Protect installed units from traffic, subsequent construction operations or other imposed loads until mortar and grout are fully cured and the project is open to the public.

B. Touch-up, repair or replace damaged products prior to Date of Substantial Completion.

END OF SECTION

SECTION 32 84 00
IRRIGATION

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

A. Review the General and Supplementary Contract Conditions and Division One, General Requirements, which contain information and requirements that apply to this Section.

1.2 DESCRIPTION OF WORK

A. Provide all products and execute all labor to achieve installation of the irrigation system complete as indicated by the Drawings and Specifications.

1.3 RELATED WORK IN OTHER SECTIONS

A. Related Landscape Work:
   1. Planting Area Finish Grading
   2. Soil Preparation and Soil Mixes
   3. Plant Material

B. Other Related Work: Consult all other relevant Specification Sections to determine the extent and character of work specified elsewhere, but related to that included herein.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

A. Laws, Codes and Regulations: Perform work in accordance with all applicable laws, codes, and regulations required by authorities having jurisdiction over such work.

B. Inspections and Permits: Provide for all inspections and permits required by federal, state and local authorities in furnishing, transporting and installing materials.

1.5 TRAFFIC CONTROL

A. It is the responsibility of the contractor to ensure adequate protection and controls for pedestrian and vehicular traffic in the vicinity of the project areas. The contractor shall provide all signs, barricades, flagmen, etc., necessary to meet all traffic requirements for this project at his own expense.

1.6 APPLICABLE STANDARDS

A. Comply with the current applicable specifications and guidelines of the following:
   1. DIV — Division of Industrial Safety.
   2. UPC — Uniform Plumbing Code published by the Association of Western Plumbing Officials.
   3. ASTM — American Society for Testing and Materials.
   4. NSF — National Sanitation Foundation.

1.7 SUBMITTALS

A. Product data: Prior to delivery to site, submit 5 copies of current manufacturer's specifications and catalog cuts for the complete list of materials and assemblies to be installed.

B. Final Record Documents: Submit Final Record Documents to the Landscape Architect at Preliminary Review.

1.8 RECORD DOCUMENTS

A. Progress Record Documents:
   1. Maintain on the construction site at all times a record of all materials and equipment installed each day.
   2. Daily record information neatly to scale, on full-size prints of the irrigation construction documents.
   3. Record information neatly to scale, on full-size prints of the irrigation construction documents.
   4. Information shall include all changes, substitutions, and manufacturer's names and catalogue members for materials and equipment. Show actual locations of all valves and irrigation piping. Show dimensions from easily-identifiable permanent structures such as walls, curbs, fences, buildings or walks.

B. Final Record Documents:
   1. Transfer all information noted on Progress Record Documents.
   2. After Work completion, transfer information noted on prints. Submit Progress Record Documents to the landscape architect for review of general information content (landscape architect will not be responsible for errors or omissions).
   3. Contractor shall be responsible for accuracy of information and errors or omissions.
   4. If first submittal is not accepted by landscape architect, resubmit until accepted.
   5. Once accepted, submit accepted final Record Documents to Owner

1.9 SERVICE MANUALS

A. Submittal Procedure: At Preliminary Review, submit five individually bound Service Manuals to the Landscape Architect.

B. Content:
1. Complete drawings, diagrams and spare parts lists of all equipment installed showing components and catalog numbers together with the manufacturer's name and address.
2. Index sheet indicating the Contractor's name, address and telephone number.
3. Copies of equipment, warranties and certificates.
4. Complete operating and maintenance instructions in sufficient detail to permit operating personnel to understand, operate, and maintain all equipment.

1.10 DEFINITION OF ACCEPTANCE

A. Wherever the terms "acceptance" or "accepted" are used herein, they mean acceptance of Landscape Architect in writing.

1.11 INTENT OF DRAWING AND SPECIFICATIONS

A. It is the intent of the Drawings and Specifications to provide a complete operable irrigation system. Any items not specifically shown in the Drawings or called for in the Specifications, but which are normally required to conform with such intent, are to be considered as part of the work.

1.12 SUBSTITUTIONS

A. Written Acceptance: Specific reference to manufacturer's names and products specified in these sections are used as standards; this implies no right to substitute other materials or methods without written acceptance of the Landscape Architect.

B. Contractor's Responsibility: Installations of accepted substitution(s) must be made to the satisfaction of Landscape Architect and without additional cost to Owner.

1.13 REVIEW OF SITE

A. Visit project site and review conditions as they exist prior to submitting bid.

1.14 WORK SCHEDULE

A. Submit a proposed work schedule to the Landscape Architect for acceptance

at least fourteen days prior to start of irrigation work. Submit revised schedule(s) to the Landscape Architect immediately.

1.15 COORDINATION

A. Coordinate and cooperate with other contractors to enable the work to proceed as rapidly and efficiently as possible in a workmanlike manner.

1.16 PROTECTION OF EXISTING CONDITIONS

A. General: The Contractor shall use every possible precaution to prevent damage to existing conditions to remain such as structures, utilities, irrigation systems, plant materials and paving on or adjacent to the site of the work.

B. Barriers: Provide barricades, fences or other barriers as necessary to protect existing conditions to remain from damage during construction.

C. Operations: Do not store materials or equipment, permit burning, or operate or park equipment under the drip line of existing plants to remain.

D. Notification of Damages: Submit written notification of all conditions damaged during construction to the Owner and Landscape Architect immediately.

E. Determination of Damage: Landscape Architect will determine the extent of damage and value of damaged plant material.

F. Replacement of existing plant material: Replace existing plants to remain which are damaged during construction with plants of the same species and size as those damaged at no cost to the Owner.

1.17 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Labeling: Furnish standard products in unopened manufacturer's standard containers bearing original labels showing quantity, analysis and name of manufacturer.

B. Storage: Store products with protection from weather or other conditions which would damage or impair the effectiveness of the product. Protect PVC pipes and fittings from direct sunlight. Beds on which pipe is stored must be full length of pipe.

1.18 ANALYSIS OF SAMPLES AND TESTS

A. Analyses: Samples of materials may be taken and analyzed for conformity to specification at any time. The Contractor shall furnish samples as requested.

B. Rejected Materials: Contractor shall remove rejected materials immediately from the site.

C. Cost of Testing: The Contractor shall pay cost of testing of materials not meeting specifications.

1.19 HYDROSTATIC TESTING REVIEW

A. Time of Review: The Owner's Representative will review the completed irrigation work during the hydrostatic testing prior to the backfilling of the trenches.

B. Notification of Review: Notify the Owner's Representative at least 72 hours prior to the anticipated review.

1.20 WARRANTY

A. In addition to manufacturer's guarantees or warranties, work shall be warranted for 1 year from the date of Final Acceptance against defects in material, equipment and workmanship. Warranty shall also cover repair of damage to any part of the premises resulting from leaks or other defects in materials, equipment, and workmanship to the satisfaction of the Owner.

1.21 WARRANTY FOR SPRINKLER IRRIGATION SYSTEM

A. Include the following warranty on contractor's letterhead with service manuals:
1. WE HEREBY WARRANT THAT THE IRRIGATION SYSTEM WE HAVE FURNISHED AND INSTALLED IS FREE FROM DEFECTS IN MATERIALS AND WORKMANSHIP, AND THE WORK HAS BEEN COMPLETED IN ACCORDANCE WITH THE DRAWINGS AND SPECIFICATIONS. WE AGREE TO REPAIR OR REPLACE ANY DEFECTS IN MATERIAL OR WORKMANSHIP, ANY SETTLING OF BACKFILLED TRENCHES, WHICH MAY DEVELOP DURING THE PERIOD OF ONE YEAR FROM DATE OF ACCEPTANCE AND ALSO TO REPAIR OR REPLACE ANY DAMAGE CAUSED BY ANY DEFECTS IN THE IRRIGATION SYSTEM OR RESULTING FROM THE REPAIRING OR REPLACING OF SUCH DEFECTS AT NO ADDITIONAL COST TO THE OWNER. ORDINARY WEAR AND TEAR, UNUSUAL ABUSE OR NEGLECT ARE EXCEPTED. WE SHALL MAKE SUCH REPAIRS OR REPLACE-MENTS, INCLUDING COMPLETE RESTORATION OF ALL DAMAGED PLANTING, PAVING, OR OTHER IMPROVEMENTS OF ANY KIND, WITHIN A REASONABLE TIME, AS DETERMINED BY THE OWNER, AFTER RECEIPT OF WRITTEN NOTICE. IN THE EVENT OF OUR FAILURE TO MAKE SUCH REPAIRS

OR REPLACEMENTS WITHIN A REASONABLE TIME AFTER RECEIPT OF WRITTEN NOTICE FROM THE OWNER, WE AUTHORIZE THE OWNER TO PROCEED TO HAVE SAID REPAIRS OR REPLACEMENTS MADE AT OUR EXPENSE AND WE WILL PAY THE COSTS AND CHARGES THEREFORE UPON DEMAND.

PROJECT: _____

LOCATION: _____

CONTRACTOR: _____

LICENSE No.: _____

TELEPHONE: _____

GUARANTEE TO: _____

_____

_____

DATE OF ACCEPTANCE: _____

AUTHORIZED REPRESENTATIVE: _____

PART 2 – PRODUCTS

2.1 PIPE

A. General: All pipe shall be NSF approved.

B. Piping on Pressure Side of Control Valves:
1. ASTM D 1785 polyvinyl chloride (PVC) 1120-1220, Schedule 40.

C. Piping on Non-pressure Side of Control Valves:
1. ASTM D 1784 polyvinyl chloride (PVC) 1120-1220, Class 200.
2. Drip: As listed on Drawings.

2.2 FITTINGS

A. Fittings for Pressurized Solvent-Welded Pipe:
1. ASTM D 2466 Schedule 40 PVC as provided by the same manufacturer as the pipe.
2. Connections of Mains to Remote Control and Quick-coupling Valves: ASTM D 2467 Schedule 80 PVC solvent-weld socket fittings.

B. Fittings for Non-Pressurized Solvent-Welded Pipe:
1. ASTM D 2466 and ASTM D 2467 Schedule 40 and Schedule 80, polyvinyl chloride, standard weight, as manufactured by "Sloane," "Lasco," or accepted substitute. Refer to installation details.
2. Threaded PVC Nipples: Schedule 80 PVC.

2.3 NIPPLES

A. Non-Ferrous: Schedule 40 red brass (85% copper, 15% zinc) with MIPT at both ends; ASTM B43.

B. Plastic: Schedule 80, Type I, Grade 1 polyvinyl chloride (PVC); threaded both ends; ASTM D1784 and D1785; uniformly grey in color.

C. Flexible: Factory made and assembled consisting of flexible polyvinyl chloride (PVC) hose fitted at each end with Schedule 40 PVC male adaptors; test rated at 200 psi static.

2.4 SLEEVE FOR CONTROL WIRE AND WATER LINE

A. PVC 1120-1220, Schedule 40 pipe.

2.5 IRRIGATION CONTROLLER

A. As shown on the Drawings.

2.6 REMOTE CONTROL VALVES

A. As shown on the Drawings.

2.7 CONTROL WIRE

A. As shown on the Drawings.

B. Splicing Materials: DBR/Y-6 as manufactured by 3M.

2.8 VALVE BOXES FOR REMOTE CONTROL VALVES IN PLANTING AREAS

A. Model No.: 1419B-12B.

B. Color of Box and Lid: As shown on Drawings.

C. Manufacturer: Oldcastle Precast, Inc., 1002 15th Street SW, Auburn, WA 98001, (800) 735-5566.

2.9 VALVE BOXES FOR QUICK COUPLING VALVES IN PLANTING AREAS

A. Model No.: 910-12B.

B. Color of Box and Lid: As shown on Drawings.

C. Manufacturer: Oldcastle Precast, Inc., 1002 15th Street SW, Auburn, WA 98001, (800) 735-5566.

2.10 VALVE BOXES

A. For Remote Control Valves:
1. Planted Areas: Injection molded of Polyesters and fibrous inorganic temperature resistant components. Box shall provide adequate clearance to operate and service valve. Box and lid to be black, as manufactured by "Oldcastle Precast" or accepted equal.

2.11 QUICK-COUPLING VALVES

A. Valve and Key: As specified on Drawings.

B. Valve shall be as shown on the Drawings, 3/4" two-piece brass with locking cover.

C. Furnish two Rainbird No. 33-DK valve keys fitted with 3/4" swivel hose cells.

2.12 STEEL STAKES AND PIPE CLAMPS

A. As shown on Drawings.

PART 3 – EXECUTION

3.1 LAYOUT

A. General: During installation, conform as closely as possible to Drawings. Drawings are diagrammatic to the extent that swing joints, offsets and all fittings are not shown.

B. Coverage: Make any necessary minor adjustments to layout required to achieve full coverage of irrigated areas at no additional cost to Owner.

C. Stubouts: Where connections to existing stubouts are required, make necessary adjustments should stubouts be located differently than shown

on the Drawings.

D. Piping: Where piping is shown to be under paved areas but running parallel and adjacent to planted area, install piping in planted areas, unless specifically noted to be installed under paved areas. Do not install directly over another line in same trench.

3.2 TRENCHING

A. Trench Depths:
   1. 18-inch deep over pipe on pressure side of irrigation control valve, control wires and quick-coupling valves.
   2. 12-inch deep on non-pressure side of irrigation control valve.

B. Trench Slopes:
   1. Mains: Slope to drain to control valves.
   2. Laterals: Slope to or from control valves.

3.3 CONDUITS AND SLEEVES

A. Conduit: Furnish and install conduit where control wires pass under or through structures or paving. Conduits to be of adequate size to accommodate retrieval for repair of wiring and shall extend 12 inches beyond edges of walls.

B. Sleeving: Install sleeves for all pipes passing through or under structures or paving as shown on Drawings. Sleeving to be of adequate size to accommodate retrieval of wiring

or piping for repair and shall extend 12 inches beyond edges of paving or other structures.

3.4 PIPE LINE ASSEMBLY

A. General:
1. Install pipes and fittings in accordance with manufacturer's latest printed instructions.
2. Clean all pipes and fitting of dirt, scales and moisture before assembly.
3. Install pipe fittings with at least 2 inches clearance from other pipes or fittings.

B. Solvent-Welded Joints for PVC Pipes:
1. Use solvents and methods specified by pipe manufacturer.
2. Let solvents cure a minimum of 1 hour before applying any external stress on the piping and at least 24 hours before placing the joint under water pressure.

C. Threaded Joints for Swing Joints:
1. Use Teflon tape on threaded PVC fittings for swing joints only.
2. Use strap-type friction wrench only. Do not use metal-jawed wrench.

D. Laying of Pipe:
1. Remove from trench all rocks or clods 1 inch diameter or larger. Bed pipes in at least 2 inches of soil excavated from trench. Backfill on all sides of piping to provide a uniform bearing.
2. Snake pipe from side to side of trench bottom to allow for expansion and contraction. One additional foot per 100 ft. of pipe is the minimum allowance for snaking.
3. Install pipeline warning tape for all supplyline pipes supplied with well water. Install longitudinally on supplyline and secure with duct tape every 5 feet.
4. Do not lay PVC pipe when there is water in the trench.

3.5 IRRIGATION CONTROL VALVES

A. Valve Locations: Install control valves where shown on Drawings and group together where practical.

B. Valve Box Locations: Where two or more valves are installed adjacent to each other, provide at least 6 inches separation between valve boxes and align boxes parallel to each other in a row.

C. Valve Boxes: Install valve boxes over valves to be flush with accepted finish grade.

3.6 QUICK COUPLING VALVES

A. Install on a swing joint assembly as detailed on the drawings.

3.7 AUTOMATIC CONTROLLER

A. General: Install per local code and manufacturer's latest printed instructions.

B. Connection to Valves: Connect remote valves to controller in clockwise sequence to correspond with station setting beginning with Stations 1, 2, 3, etc.

C. Labeling: Affix controller name (i.e., "CONTROLLER A") on inside of controller cabinet door with minimum of 1 inch high permanent letters.

D. Irrigation Diagram: Affix a non-fading copy of irrigation diagram to cabinet door below controller name. Irrigation diagram to be sealed between two plastic sheets 20 mil. minimum thickness. Irrigation diagram shall be a reduced copy of the Record Drawing, clearly showing all valves operated by the controller, station number, valve size, and type of planting irrigated.

E. Grounding and Certification: Per Manufacturers specifications and requirements.

3.8 CONTROL WIRING

A. Placement: Install control wires in common trenches with sprinkler mains and laterals wherever possible. Lay to the bottom side of pipe line. Provide a minimum of 3 feet of looped slack at valves.

B. Splicing: Crimp control wire splices at remote control valves. Seal with specified splicing materials. Line splices will be allowed only on runs of more than 2,500 feet.

3.9 CLOSING OF PIPE AND FLUSHING OF LINES

A. Capping: Cap or plug all openings as soon as lines have been installed to prevent entrance of materials that would obstruct the pipe. Leave in place until removal is necessary for completion of installation.

B. Flushing: Thoroughly flush out all water lines before installing heads, valves and other hydrants.

C. Testing: Test as specified below. Upon completion of testing, complete assembly and adjust sprinkler heads for proper water distribution.

3.10 HYDROSTATIC TESTING

A. Procedure: Make hydrostatic tests with risers capped when welded PVC joints have cured at least 24 hours. Center load piping with backfill to prevent pipe from moving under pressure. All couplings and fitting shall be exposed. Apply continuous static water pressure of 125 psi as follows:
   1. All Piping on the Pressure Side of Control Valves: Four hour test.
   2. All Piping on the Non-pressure Side of Control Valves: Two hour test.

B. Leaks and Retest: Repair leaks observed from tests and repeat testing until system passes tests.

3.11 BACKFILLING AND COMPACTING

A. Backfill Material at Planting Areas:
   1. After system is operating and required tests and reviews have been made, backfill excavations and trenches with clean sand and soil, free of debris.
   2. Backfill in 6-inch lifts with compaction performed between each lift.

B. Backfill Material at Unsleeved Pipe Under Paving: Provide all PVC pipe under paving with minimum of 4 inches of sand backfill on all sides and 24 inches cover to bottom of paving.

C. Backfill Material at Existing Underground Pipes: Use only backfill material which has been screened to eliminate all material larger than 3/8 inches when backfilling adjacent to existing underground pipe lines.

D. Backfill Compaction:

   1. Regardless of the type of pipe covered, compact to minimum 95% density under pavements, and 85% in planted areas.
   2. Compact trenches in areas to be planted by thoroughly flooding or jetting.
   3. Compact trenches in paved areas in 6-inch lifts.

E. Finish Grading: Dress off all areas to accepted finish grades.

3.12 CLEAN-UP

A. Daily: Keep all areas of work clean, neat and orderly at all times.

B. Final: Clean up and remove all deleterious materials and debris from the entire work area prior to Final Review.

END OF SECTION

SECTION 32 91 13
SOIL PREPARATION AND SOIL MIXES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes planting soils specified by composition of the mixes.

B. B. Related Requirements:

1. Section 32 84 00 - Irrigation
2. Section 32 91 19 - Landscape Finish Grading
3. Section 32 93 00 - Planting - for placing planting soil for plantings
4. Section 32 94 00 - Planting Accessories

1.3 DEFINITIONS

A. Retain terms that remain after this Section has been edited for a project.

B. AAPFCO: Association of American Plant Food Control Officials.

C. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or un-amended soil as indicated.

D. CEC: Cation exchange capacity.

E. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.

F. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.

G. Imported Soil: Soil that is transported to Project site for use.

H. Layered Soil Assembly: A designed series of planting soils, layered on each other, that to-gather produce an environment for plant growth.

I. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.

J. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through inter-laboratory sample exchanges and statistical evaluation of analytical data.

K. Organic Matter: The total of organic materials in soil exclusive of un-decayed plant and ani-mal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."

L. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modi-fied as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

M. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.

N. SSSA: Soil Science Society of America.

O. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

P. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally oc-curring soil profile, typified by less than 1 percent organic matter and few soil organisms.

Q. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil"; but in disturbed areas such as urban environments, the surface soil can be subsoil.

R. USCC: U.S. Composting Council.

1.4 PREINSTALLATION MEETINGS

Pre-installation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include recommendations for application and use.

2. Include test data substantiating that products comply with requirements.

3. Include sieve analyses for aggregate materials.

4. Material Certificates: For each type of imported soil and soil amendment and fertilizer before delivery to the site, according to the following:

a. Manufacturer's qualified testing agency's certified analysis of standard products.

b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.

c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

B. Samples: For each bulk-supplied material, 1 -quart volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

1.6 INFORMATIONAL SUBMITTALS

Qualification Data: For each testing agency.

Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.

Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Retain "Testing Agency Qualifications" Paragraph below if Contractor or manufacturer selects testing agency or if Contractor is required to provide services of a qualified testing agency in "Field Quality Control" Article. Qualification requirements are in addition to those specified in Section 014000 "Quality Requirements."

B. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.

Laboratory: Subject to compliance with requirements, provide testing by the following, or an approved equivalent laboratory:

a. Waypoint Analytical, Inc., 4741 E Hunter Avenue, Suite A, Anaheim, CA 92807, www.waypointanalytical.com, (714) 282-8777.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction soil analyses on existing, on-site soil, imported soil and manufactured lightweight soil mixes for on-structure installations.
1. Notify Landscape Architect seven days in advance of the dates and times when laboratory samples will be taken.

Preconstruction Soil Analyses: For each un-amended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.

1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

1.9 SOIL-SAMPLING REQUIREMENTS

General: Extract soil samples according to requirements in this article.

Sample Collection and Labeling: Have samples taken and labeled by Contractor in presence of Landscape Architect or soil scientist (CPSS) certified by SSSA under the direction of the testing agency.

1. Number and Location of Samples: Minimum of eight representative soil samples from where indicated on Drawings for each soil to be used or amended for landscaping purposes.
2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils.”.
3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to the University for its records.
4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.10 TESTING REQUIREMENTS

General: Perform tests on soil samples according to requirements in this article.

Physical Testing:

1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":
   a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
   b. Hydrometer Method: Report percentages of sand, silt, and clay.
2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
4. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction according to ASTM D 698 (Standard Proctor).

C. Chemical Testing:

1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analy-sis - Part 3- Chemical Methods."

2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1- Physical and Mineralogical Methods."

3. Generally retain "Metals Hazardous to Human Health" Subparagraph below for brown-field redevelopment sites.

4. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective ac-tion.

5. Generally retain "Phytotoxicity" Subparagraph below. Some plants are more sensitive to the presence and concentrations of trace minerals.

6. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of SSSA NAPT WERA-103, including the following:

1. Percentage of organic matter.

2. CEC, calcium percent of CEC, and magnesium percent of CEC.

3. Soil reaction (acidity/alkalinity pH value).

4. Buffered acidity or alkalinity.

5. Nitrogen ppm.

6. Phosphorous ppm.

7. Potassium ppm.

8. Manganese ppm.

9. Manganese-availability ppm.

10. Zinc ppm.

11. Zinc availability ppm.

12. Copper ppm.

13. Sodium ppm and sodium absorption ratio.

14. Soluble-salts ppm.

15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommen-dations for corrective action.

16. Other deleterious materials, including their characteristics and content of each.

E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."

F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.

1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. for 6-inch depth of soil.

2. Generally, adjust soil reaction (pH) only in soils where the pH is near the extreme ends of the acceptable range for the plants indicated.

3. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. for 6-inch depth of soil.

1.11 DELIVERY, STORAGE, AND HANDLING

Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.

2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.

3. Do not move or handle materials when they are wet or frozen.

4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Regional Materials: Imported soil, manufactured planting soil and soil amendments and fertilizers shall be manufactured within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.

2.2 PLANTING SOILS SPECIFIED BY COMPOSITION

A. General: Soil amendments, fertilizers, and rates of application specified in this article are guidelines that may need revision based on testing laboratory's recommendations after preconstruction soil analyses are performed.

B. Existing, on-site surface soil shall not be used for this project. Refer to requirements of Di-vision 31, Earthwork, for disposition of on-site lime treated soils.

C. Planting-Soil Type I: Imported, naturally formed soil from off-site sources and consisting of sandy loam soil according to USDA textures; and modified to produce viable planting soil.

1. Sources: Take imported, unamended soil from sources that are naturally well-drained sites where topsoil occurs at least 6 inches deep, not from agricultural land, bogs, or marshes; and that do not contain undesirable organisms; disease-causing plant pathogens; or obnoxious weeds and invasive plants including, but not limited to, quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass.

2. Additional Properties of Imported Soil before Amending: Soil reaction of pH 6 to 7.9 and minimum of 4 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration.

3. Unacceptable Properties: Clean soil of the following:

a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing com-pound, acid, and other extraneous materials that are harmful to plant growth.

b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 8 percent by dry weight of the imported soil.

c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 2 inches in any dimension.

4. Amended Soil Composition: Blend imported, un-amended soil with the following soil amendments and fertilizers in the following quantities to produce planting soil:

a. Volume of Compost: 3 to 4 cubic yards per 1000 square feet per 6 inches of soil depth.

b. Weight of Agricultural Gypsum: 30 pounds per 1000 sq. ft. per 6 inches of soil depth.

c. Weight of Blood Meal: 8 pounds per 1000 sq. ft. per 6 inches of soil depth.

2.3 INORGANIC SOIL AMENDMENTS

A. If using ground-up, recycled gypsum board debris as a soil amendment, replace or revise "Agricultural Gypsum" Paragraph below or insert another paragraph for this additional material. Coordinate with planting-soil mixes retained in "Planting Soils Specified by Composition" Article.

B. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.

2.4 ORGANIC SOIL AMENDMENTS

Organic Compost:

1. The organic amendments, and fertilizer rates and quantities listed in Part Three are to be used for bid basis only. The contractor shall provide a copy of a recent lab analysis (not older than 30 days) and recommendations performed by Methods of Soil Analysis, Part 1, Physical and Mineralogical Methods of Soil Analysis, Part 3 Chemical Methods, Soil Science Society of America, Inc., for compost properties. Adjustments to project costs resulting from the soil report recommendation shall be submitted as a modification of the base bid.

2. Compost Properties:

   a. Humus material shall have an acid-soluble ash content of no less than 6% and no more than 20%. The organic matter content shall be at least 50% on a dry weight ba-sis.

   b. The pH of the material shall be between 6 and 7.5.

   c. The salt content shall be less than 10 millimho/cm @ 25° C. (ECe less than 10) in a saturated paste extract.

   d. Boron content of the saturated extract shall be less than 1.0 part per million.

   e. Silicon content (acid-insoluble ash) shall be less than 50%.

   f. Calcium carbonate shall not be present if to be applied on alkaline soils.

   g. Types of acceptable products are composts, manures, mushroom composts, straw, alfalfa, peat mosses etc. low in salts, low in heavy metals, free from weed seeds, free of pathogens and other deleterious materials.

h. Composted wood products are conditionally acceptable [stable humus must be pre-sent]. Wood based products are not acceptable which are based on red wood or cedar.

i. Sludge-based materials are not acceptable.

j. Carbon:nitrogen ratio is less than 20:1.

k. The compost shall be aerobic without malodorous presence of decomposition products.

l. Solvita maturity index 6 or higher.

m. SAR (sodium adsorption ratio) less than 5.

n. Seed germination - over 80% germination in saturation extract diluted 1 to 3 in water compared to seeds germinated in deionized water.

o. Germination vigor - equal to or better than seed length for seeds germinated in de-ionized water.

p. Molar ratio of ammoniacal nitrogen to nitrate nitrogen less than 2.

q. The maximum particle size shall be 0.5 inch, 80% or more shall pass a No. 4 screen.

r. Maximum total permissible pollutant concentrations in amendment in parts per mil-lion on a dry weight basis:

arsenic	20	copper	150	selenium	30
cadmium	15	lead	100	silver	10
chromium	100	mercury	10	vanadium	200
cobalt	50	molybdenum	20	zinc	200
nickel	100				

2.5 FERTILIZERS

Blood Meal: Minimum 13 percent nitrogen.

PART 3 - EXECUTION

3.1 GENERAL

A. Contractor is to provide soil amendments and fertilizers as specified in the soil analysis re-port prepared by soil testing laboratory. Materials used shall meet all environmental requirements that meet nursery standard and state regulations.

B. Soil amendments and fertilizers used on project shall be used for both initial soil preparation and planting operations. A formulation for each planting condition and type shall be formulated withing nursery industry standards and will be fully documented

C. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.

D. Proceed with placement only after unsatisfactory conditions have been corrected.

3.2 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING

A. Retain "Excavation" Paragraph below if Contractor is required to perform soil excavation and stockpiling.

B. Excavation: Excavate soil from designated area(s) to a depth of 18 inches and stockpile until amended, unless otherwise indicated on Drawings.

C. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

D. Unsuitable Materials: Clean soil to contain a maximum of 8 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.

3.3 PLACING AND MIXING PLANTING SOIL OVER EXPOSED SUBGRADE

A. Generally retain this article if existing, on-site soil or imported soil will be amended and applied to areas that have been stripped of existing soils or that have poor existing soils regarded as subgrade.

B. General: Apply and mix un-amended soil with amendments on-site to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

C. Subgrade Preparation: Till subgrade to a minimum depth of 6 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off University's property.

1. Apply, add soil amendments, except compost, and mix approximately half the thickness of un-amended soil over prepared, loosened subgrade according to "Mixing" Paragraph below. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil.

D. Mixing: Spread unamended soil to total depth of 6 inches unless otherwise indicated on Drawings, but not less than required to meet finish grades after mixing with amendments and natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.

1. Amendments: Apply soil amendments and fertilizer, if required, evenly on surface, and thoroughly blend them with unamended soil to produce planting soil.

a. Mix fertilizer with planting soil no more than seven days before planting.

2. Lifts: Apply and mix unamended soil and amendments in lifts not exceeding 6 inches in loose depth for material compacted by compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

E. Retain last option in "Compaction" Paragraph below if more than one compaction value is required for different locations.

F. Compaction: Compact each blended lift of planting soil to 75 to 85 percent of maximum Standard Proctor density according to ASTM D 698 and tested in-place.

G. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.4 BLENDING PLANTING SOIL IN PLACE

A. Generally retain this article if existing, unamended, on-site surface soil is amended without excavating to produce planting soil.

B. General: Mix amendments with in-place, unamended soil to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

C. Preparation: Till unamended, existing soil in planting areas to a minimum depth of 6 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off University's property.

D. Retain option in "Mixing" Paragraph below if applying compost component of planting-soil mix to surface and lightly tilling in lieu of blending compost throughout planting-soil mix.

E. Mixing: Apply soil amendments, except compost, and fertilizer, if required, evenly on sur-face, and thoroughly blend them into full depth of unamended, in-place soil to produce planting soil.

1. Mix fertilizer with planting soil no more than seven days before planting.

F. Retain last option in "Compaction" Paragraph below if more than one compaction value is required for different locations.

G. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.5 APPLYING COMPOST TO SURFACE OF PLANTING SOIL

A. Generally retain this article if applying a separate compost layer or applying the compost component of a planting-soil mix to surface of in-place planting soil in lieu of blending compost throughout the planting-soil mix.

B. Application: Apply compost component of planting-soil mix 6 inches of compost to surface of in-place planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

C. Finish Grading: Grade surface to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.6 PLACEMENT OF MANUFACTURED LIGHTWEIGHT SOIL MIX ON STRUCTURE

A. Verify placement of perforated drain pipe, drain rock and drainage mat, filter fabric, poly-styrene fill, protection board and filter fabric prior to soil mix placement.

B. Coordinate placement of soil mix with the irrigation system installation and planter drain and clean out locations. Protect irrigation equipment and drainage structures during placement.

C. Install soil mix in 9-inch maximum lifts. Install soil mix layers to depths as indicated on Drawings.

D. Compact each lift by thoroughly watering or jetting in the entire planting area. Maximum compaction to 85 percent relative compaction.

3.7 FIELD QUALITY CONTROL

A. Retain "Testing Agency" and "Perform the following tests(and inspections)" paragraphs below to identify who shall perform tests and inspections. If retaining second option in "Testing Agency" Paragraph, or if retaining "Perform the following tests(and inspections)" Paragraph, retain "Field quality-control reports" Paragraph in "Informational Submittals" Article.

B. Testing Agency: University will engage a qualified testing agency to perform tests and inspections.

C. Retain "Perform the following tests(and inspections)" Paragraph below to require Contractor to perform tests and inspections.

D. Perform the following tests:

1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D 698. Space tests at no less than one for each 2000 sq. ft. of in-place soil or part thereof.

2. Soil Testing Lab report to include soil fertility, agricultural suitability, particle size appraisal, pH, salinity, nitrate. ammonium, phosphate, potassium, calcium, magnesium, boron, sodium absorption rate (SAR), organic content, and infiltration rate. Space tests at no less than one for each 2000 sq. ft. of in-place soil or part thereof.

E. See Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

F. Soil will be considered defective if it does not pass tests.

G. Prepare test reports.

H. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

3.8 PROTECTION

A. Revise "Protection Zone" Paragraph below to suit Project. Delete if referenced Section is not used.

B. Protection Zone: Identify protection zones according to Section 015639 "Temporary Tree and Plant Protection."

C. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:

1. Storage of construction materials, debris, or excavated material.

2. Parking vehicles or equipment.

3. Vehicle traffic.

4. Foot traffic.

5. Erection of sheds or structures.

6. Impoundment of water.

7. Excavation or other digging unless otherwise indicated.

D. If planting soil or subgrade is over-compacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Landscape Architect and replace contaminated planting soil with new planting soil.

3.9 CLEANING

A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off University's property unless otherwise indicated.

1. Retain subparagraph below if required; revise to suit Project.
2. Dispose of excess subsoil and unsuitable materials on-site where directed by the Univer-sity.

END OF SECTION

SECTION 32 91 19
LANDSCAPE FINISH GRADING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following: Landscape Finish Grading.

B. Related requirements:

1. Section 32 01 90 - Landscape Maintenance
2. Section 32 91 13 - Soil Preparation and Soil Mixes
3. Section 32 84 00 - Irrigation
4. Section 32 93 00 - Planting

1.3 PROJECT/SITE CONDITIONS

A. Existing Conditions: For protection of existing trees to remain, see Division 01, Section “Temporary Tree and Plant Protection”.

B. Prior to fine grading, Contractor shall verify that the rough grading, under drainage system, planting soil mixes and irrigation system have been accepted.

C. Dust Nuisance: Assume full responsibility for alleviation or prevention of dust as a result of grading work.

1.4 SEQUENCING AND SCHEDULING:

A. Complete all finish grading prior to installation of irrigation systems in each area graded.

B. Regrade as required to finish grades established by Landscape Architect once the irrigation system is installed.

PART 2 - PRODUCTS

A. Not Used.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Verify that the following items have been completed

prior to commencement of finish grading:

1. Installation of topsoil and soil preparation including debris removal.
2. Incorporation of soil amendments.
3. Prior to fine grading, Contractor shall verify that the rough grading, under drainage sys-tem, planting soil mixes and irrigation system have been accepted.

3.2 INSTALLATION

A. Provide all grades for natural runoff of water without low spots or pockets. Accurately set flow line grades at 2 percent minimum gradient unless otherwise noted in Drawings.

B. Finish grades shall be smooth, even and on a uniform plane with no abrupt changes of surface. Slope uniformly between given spot elevations.

C. Grades not otherwise indicated shall be uniform levels or slopes between points where elevations are given, or between points established by walks, paving, curbs or catch basins.

D. Tops and toes of all slopes shall be rounded to produce a gradual and natural-appearing transition between relatively level areas and slopes.

E. Trenching for drainage shall not extend into the bearing angle off of the foundation.

F. Drainage designed so as not to have landscape area drain over sidewalks.

G. Surface drainage shall drain to drains/catch basins in planting areas and in paved areas.

H. The subgrade shall be inspected prior to the start of subsoil placement for conformance with the Drawings for elevations of subgrade relative to finish grade. Subgrade shall be graded smooth and parallel to the finish grades.

I. Where settling occurs, before final acceptance or during the warranty period, remove finish surfacing, backfill with additional approved material, compact to specified rates, and restore any disturbed areas to a condition acceptable to the City.

J. Protect newly graded areas from traffic, freezing and erosion. Keep free of trash, debris or construction materials from other work.

K. Set sufficient grade stakes for checking the finished grades. Stakes must be set at the bottom and top of slopes and the centers of plant beds. Grades shall be established which are accurate to 1/10th of a foot either way. Connect contours and spot elevations with an even slope. All grading will insure drainage away from structures.

L. After topsoil or planting soil mix has been spread, it shall be carefully prepared by scarifying and hand raking. All large stiff clods, lumps, brush, roots, stumps, litter and other foreign matter, and stones over one inch in diameter shall be removed from the topsoil. Topsoil shall also be free of smaller stones in excessive quantities as determined by the Landscape Architect.

M. Fine grade planted areas to smooth, free draining, even surfaces with fine texture. Roll, rake and drag areas to flatten ridges and fill depressions, except as select areas shown

on drawings. Control moisture content to maintain optimum conditions, but do not create a muddy condition.

N. Rolling - Typical: Roll the entire area with a hand roller weighing not more than 100 pounds per foot of width. During the rolling, all depressions caused by settlement of rolling shall be filled with additional topsoil and the surface shall be regraded and rolled until presenting a smooth and even finish to the required grade or to the shapes and configurations as shown on the details.

O. Maintenance and Restoration: Restore prepared areas to specified condition if eroded, settled, or otherwise disturbed after fine grading and prior to lawn planting. Restore area disturbed by planting to achieve full healthy growth as approved by Landscape Architect. Vehicular traffic routes must conform to pre-approved routing of construction operations.

P. Driving over new lawns: The Contractor is strictly prohibited from tracking or driving over new lawns or planted areas.

Q. Grades not otherwise indicated to be uniform slopes between points where elevations are given, or between points established by paving, curbs or catch basins.

R. Round tops and toes of all slopes to produce a gradual, natural-appearing transition between relatively level areas and slopes.

3.3 TOLERANCES

A. All planting areas, including lawn areas, shall be true to grade within 1 in. when tested with a 10 ft. straightedge.

B. Hold finished grades below top of adjacent pavement, headers, curbs, or walls as follows:

C. Shrub and Groundcover Areas: 1-1/2 inches.

D. Sodded Lawn Areas: 1 inch.

E. Planters: 2 inches.

END OF SECTION

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SECTION 32 93 00
PLANTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: Plants.

B. Related Requirements:

1. Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

2. Section 32 01 90 - Landscape Maintenance

3. Section 32 91 13 - Soil Preparation and Soil Mixes

4. Section 32 91 19 - Landscape Finish Grading

5. Section 32 84 00 - Irrigation

6. Section 32 94 00 - Planting Accessories

1.3 REFERENCES

A. "An Annotated Checklist of Woody Ornamental Plants of California, Oregon and Washing-ton, (Number 4091)", McClintock and Leiser, Division of Agricultural Sciences, University of California, 1979.

B. "American Standard for Nursery Stock", ANZI z.60.1-2004 Edition, American Association of Nurserymen, Inc.

1.4 DEFINITIONS

A. Retain terms that remain after this Section has been edited for a project.

B. Backfill: The earth used to replace or the act of replacing earth in an excavation.

C. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than sizes indicated; wrapped with burlap, tied, rigidly sup-ported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

D. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than sizes indicated.

E. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than the mini-mum root spread according to ANSI Z60.1 for type and size of plant required.

F. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

G. Finish Grade: Elevation of finished surface of planting soil.

H. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.

I. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

J. Planting Area: Areas to be planted.

K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Section 329113 "Soil Preparation and Soil Mixes" for drawing designations for planting soils.

L. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

M. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

N. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

O. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.5 COORDINATION

A. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.6 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.7 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.

2. Plant Photographs: Include color photographs in digital format of each required species and size of plant material as it will be furnished to Project. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. For species where more than 50 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

1.8 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of university's contact persons.

B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

1. Manufacturer's certified analysis of standard products.

2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

D. Sample Warranty: For special warranty.

1.9 CLOSEOUT SUBMITTALS

Maintenance Data: Recommended procedures to be established by University for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

1.10 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in

successful establishment of plants.

1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Five years' experience in landscape installation in addition to requirements in Division 1.
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's field supervisor shall have certification in all of the following categories from the Professional Landcare Network:

    a. Landscape Industry Certified Technician - Exterior.

    b. Landscape Industry Certified Interior.

    c. Landscape Industry Certified Horticultural Technician.
5. Pesticide Applicator: State licensed, commercial.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
    1. Selection of plants purchased under allowances is made by Landscape Architect, who tags plants at their place of growth before they are prepared for transplanting.

C. Revise "Measurements" Paragraph below to suit Project.

D. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.

    1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.

    2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

E. Plant Material Observation: Landscape Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Landscape Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.

    1. Notify Landscape Architect of sources of planting materials seven days in advance of delivery to site.

1.11 DELIVERY, STORAGE, AND HANDLING

Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.

A. Bulk Materials:
   1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
   2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
   3. Accompany each delivery of bulk materials with appropriate certificates.

B. Deliver bare-root stock plants within 36 hours of digging. Immediately after digging up bare-root stock, pack root system in wet straw, hay, or other suitable material to keep root system moist until planting. Transport in covered, temperature-controlled vehicles, and keep plants cool and protected from sun and wind at all times.

C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

D. Handle planting stock by root ball.

E. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

F. Apply anti-desiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
   1. If deciduous trees or shrubs are moved in full leaf, spray with anti-desiccant at nursery before moving and again two weeks after planting.

K. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

L. Deliver plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
   1. Heel-in bare-root stock. Soak roots that are in less than moist condition in water for two hours. Reject plants with dry roots.
   2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
   3. Do not remove container-grown stock from containers before time of planting.
   4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.12 FIELD CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Planting Restrictions: Delay shipment and planting during freeze periods. Replace plants killed or disfigured by freeze or frost conditions.

C. Coordinate planting periods with maintenance periods to provide continuous required maintenance from date of Substantial Completion.

D. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

1.13 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:

   a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of ad-equate maintenance, or neglect by the University.

   b. Structural failures including plantings falling or blowing over.

   c. Deterioration of metals, metal finishes, and other materials beyond normal weather-ing.

2. Warranty Periods: From date of Substantial Completion.
   a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.

   b. Ground Covers, Biennials, Perennials, and Other Plants: 3 months.

3. Include the following remedial actions as a minimum:

   a. Immediately remove dead plants and replace unless required to plant in the succeed-ing planting season.

   b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.

   c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.

   d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); cross-ing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots are unacceptable.

2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Landscape Architect, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

D. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

E. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery.

2.2 FERTILIZERS

A. Green Cross, available from Bioscape Inc., Petaluma, CA (877) 246-7227.

B. Organic Biolink Fertilizer available from Westbridge Agricultural Products, www.west-bridge.com (800) 876-2767.

C. Or approved equivalent.

2.3 PESTICIDES AND HERBICIDES

A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and

as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer. Use one of the following products or acceptable equivalent:

1. 100% organic, corn gluten meal weed suppressant “Bio-Weed” available from Bioscape Inc., Petaluma, CA (877.246.7227).

2. Weedban corn gluten meal by Fertrell Company, www.fertrell.com (717.367.1566).

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated. Use one of the following products or acceptable equivalent:

1. “Scythe” natural herbicide by Mycogen Corp., San Diego, CA (800.745.7476).

2. “Weed Zap” available from JH Biotech, www.jhbiotech.com (800.650.8933).

D. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per pound of vesicular-arbuscular mycorrhizal fungi and 95 million spores per pound of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.

2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.

3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.

4. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Landscape Architect and replace with new planting soil.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Landscape Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Slow-release Fertilizer Tablets: Place evenly distributed in plant pits when backfilled 2/3 according to the following schedule or per Manufacturer's latest specifications.

(Container stock)

1 gallon can - 2 tablets	24 in. box - 8 tablets
5 gallon can - 4 tablets	36 in. box - 10 tablets
15 gallon can - 6 tablets	48 in. box - 12

tablets (B & B stock)

1 tablet per 1/2 in. caliper or 1 ft. of height, whichever is less

E. Lay out plants at locations directed by Landscape Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.

3.3 PLANTING AREA ESTABLISHMENT

A. General: Prepare planting area for soil placement, mix planting soil and place soil and soil mixes according to Section 32 91 13 "Soil Preparation and Soil Mixes."

B. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

C. Application of Mycorrhizal Fungi: At time directed by Landscape Architect, broadcast dry product uniformly over prepared soil at application rate according to manufacturer's written recommendations.

3.4 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits.

1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not fur-ther disturb base. Ensure that root ball will sit on undisturbed base soil to prevent set-tling. Scarify sides of planting pit smeared or smoothed during excavation.

2. Retain first two subparagraphs below if applicable. Retain one of four options in first subparagraph to suit Project.

3. Excavate approximately three times as wide as ball diameter for balled and burlapped and container-grown stock.

4. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.

5. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.

6. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate sub-grades of adjacent paving, structures, hardscapes, or other new or existing improve-ments.

7. Maintain supervision of excavations during working hours.

8. Keep excavations covered or otherwise protected when unattended by Installer's per-sonnel.

9. Retain subparagraph below if applicable.

10. If sub-drain pipe is indicated on Drawings or required under planting areas, excavate to top of porous backfill over tile.

B. Backfill Soil: Subsoil and topsoil removed from excavations may be used as backfill soil unless otherwise indicated.

C. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

D. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE, SHRUB, AND VINE PLANTING

A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.

1. Backfill: Planting soil as indicated on Drawings.

2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do

not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.

3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.

4. Place planting fertilizer equally distributed around each planting pit when pit is approxi-mately one-half filled in accordance with manufacturer's recommendations. Do not place fertilizer in bottom of the hole.

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.

1. Backfill: Planting soil as indicated on Drawings.

2. Carefully remove root ball from container without damaging root ball or plant.

3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.

4. Place fertilizer equally distributed around each planting pit when pit is approximately one-half filled. Place fertilizer beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.6 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees, shrubs, and vines as directed by Landscape Architect.

C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Landscape Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

D. Do not apply pruning paint to wounds.

3.7 PLACING SOIL IN PLANTERS

A. Place a layer of drainage gravel with filter fabric and fill planters as specified in Section 32 94 00 - Landscape Accessories.

B. Fill planter with planting soil per Section 32 91 13 “Soil Preparation and Soil Mixes”.

3.8 GROUND COVER AND PLANT PLANTING

A. Revise spacing in first paragraph below to suit Project. Insert spacing for each plant if pre-ferred, or indicate spacing on Drawings.

B. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.

C. Retain first paragraph below if planting-soil type is not indicated on Drawing; revise if other types of backfill are required.

D. Use planting soil per Section 32 91 13 - Soil Preparation and Soil Mixes and as indicated for backfill.

E. Dig holes large enough to allow spreading of roots.

F. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.

G. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

H. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

I. Protect plants from hot sun and wind; remove protection if plants show evidence of recov-ery from transplanting shock.

J. Place device on top of the mulch at base of tree stem and fill with water according to man-ufacturer's written instructions.

3.9 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restor-ing planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.

B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.10 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with University's operations and others in proximity to the Work. Notify Univer-sity before each application is performed.

B. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas according to manufacturer's written recommendations. Do not apply to seeded areas.

C. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat al-ready-germinated weeds and according to manufacturer's written recommendations.

3.11 REPAIR AND REPLACEMENT

A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Landscape Architect.
   1. Submit details of proposed pruning and repairs.
   2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.
   3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Landscape Architect.

B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition or are damaged during construction operations that Landscape Architect determines are incapable of restoring to normal growth pattern.
   1. Provide new trees of same size as those being replaced for each tree of 4 inches or smaller in caliper size.

C. Species of Replacement Trees: Species selected by Landscape Architect.

3.12 CLEANING AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off University's property.

C. Protect plants from damage due to landscape operations and operations of other contrac-tors and trades. Maintain protection during installation and maintenance periods. Treat, re-pair, or replace damaged plantings.

D. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Pro-ject site.

E. Retain paragraph below if tree-watering devices are required.

F. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

3.13 MAINTENANCE SERVICE

A. Maintenance Service for Plants, per Section 32 01 90 - Landscape Maintenance: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:

1. Maintenance Period: 12 months from date of Substantial Completion.

END OF SECTION

SECTION 32 94 00

PLANTING ACCESSORIES

PART 1 GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Root Ball Fixing System
2. Metal Landscape Edging
3. Mulch Materials
4. Asphalt Edge Restraint
5. Gravel Band

B. Related Requirements:

1. Section 32 01 90 - Landscape Maintenance
2. Section 32 91 13 - Soil Preparation and Soil Mixes
3. Section 32 91 19 - Landscape Finish Grading
4. Section 32 93 00 - Planting

1.3 SUBMITTALS

A. Furnish four (4) copies of manufacturer's literature for products specified under this Section.

B. Samples:

1. Metal Landscape Edging: Six-inch section of specified type, size, and finish.
2. Mulch Materials: 5-lb bag of samples of each specified.
3. Asphalt Edge Restraint: Six-inch section of specified type, size, and finish.
4. Gravel Band Aggregate: 5-lb bag of samples of each specified aggregate.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of planting accessory from single source from single manufacturer.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packing and Shipping

1. Provide materials in original, unopened containers with manufacturer's labels intact and legible.

B. Acceptance at Site

1. Damaged materials will not be accepted, as determined by visual inspection.

2. Rejected materials shall be removed from project site immediately.

C. Storage and Protection

1. Store materials in flat, dry area in manufacturer's protective packaging, in original containers with labels and instructions intact.

1.6 CLEAN-UP

A. Keep all areas of work clean, neat and orderly at all times. Keep all paved areas clean during planting and maintenance operations. Clean up and remove all deleterious materials and debris from the entire work area prior to beginning of landscape maintenance period to the satisfaction of the University's Representative.

PART 2 PRODUCTS

1.7 ROOTBALL FIXING SYSTEM

A. Contractor shall use staking materials, necessary to meet requirements of specifications, subject to approval of Landscape Architect:

1. Tree Stakes:

a. Platypus Rootball Fixing System, with Plati-Mat.

b. Or equal, as approved by Landscape Architect

1.8 METAL LANDSCAPE EDGING

A. Manufacturer:

1. Sure-loc Corporation, Holland, MI, (800) 787- 3562.

2. Or equal, as approved by Landscape Architect.

B. Model: Steel, 1/4" thickness by 5 inches deep, in 16’ sections.

C. Color and Finish: black, powder coated.

D. Stakes: Tapered steel, a minimum of 12 inches long.

E. Accessories: Standard tapered ends, corners, and splicers, to match edging.

1.9 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of the following:

1. Type-1: Lyngso – Premium Arbor Mulch or equal

2. Color: Natural

1.10 ASPHALT EDGE RESTRAINT

A. Manufacturer:

1. Permaloc Edging, (616) 399-9600.

2. Or equal, as approved by Landscape Architect.

B. Model: Aluminum, 4” x 3”, .21” thickness in 8’ sections.

C. Color and Finish: black.

D. Stakes: Tapered steel, a minimum of 12 inches long.

E. Accessories: Standard tapered ends, corners, and splicers, to match edging.

1.11 GRAVEL BAND

A. Install gravel band as indicated on Drawings.

PART 3 EXECUTION

1.12 EXAMINATION

A. Check to ensure that all underground lines, irrigation hoses, and other cables are installed below the maximum depth of edging, root barrier, and stakes to be installed.

B. Any damage to site work or structures due to installation of planting accessories shall be repaired at the expense of the Contractor.

1.13 ROOTBALL FIXING SYSTEM

A. Rootball fixing shall be completed immediately after planting. Trees shall stand plumb after rootball fixing.

1. Install rootball fixing system per manufacturer's specifications.

1.14 METAL LANDSCAPE EDGING

A. Install edging as indicated on Drawings. Install edging according to manufacturer's written instructions, unless otherwise noted. Anchor edging with stakes approximately 30 inches apart, driven below top elevation of edging.

B. Top of edging shall not exceed 1/2" above adjacent finish grade.

1.15 MULCHING

A. Mulch planting area surfaces and other areas as indicated on Drawings.

END OF SECTION

Section 33
Utilities

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SECTION 33 42 11

STORMWATER GRAVITY PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:

1. Storm drainage piping, fittings, and accessories.
2. Connection of drainage system to municipal sewers.
3. Drain inlets, plant area drains, paved area drainage, site surface drainage, and swales.

B. Related Requirements:

1. Section 31 23 33: Trenching and Backfilling.

C. Reference Standards:

1. American Association of State Highway and Transportation Officials (AASHTO) M252: Standard Specification for Corrugated Polyethylene Drainage Pipe.
2. AASHTO M294: Standard Specification for Corrugated Polyethylene Pipe, 300- to 1,500-millimeter (mm; 12- to 60-inch) Diameter.
3. ASTM-International (ASTM) D2680: Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Polyvinyl Chloride (PVC) Composite Sewer Piping.
4. ASTM F667: Corrugated polyethylene tubing and fittings.
5. ASTM D1056: Specification for Flexible Cellular Materials: Sponge or Expanded Rubber.
6. ASTM D1248: Specification for Polyethylene Plastics Molding and Extrusion Material.
7. ASTM D3350: Specification for Polyethylene Plastics Pipe and Fittings Materials.
8. ASTM D2321: Standard practice for underground installation.

1.2 SUBMITTALS

A. See “Section 01 33 00 Submittal Procedures.”

B. Product Data: Provide data indicating pipe, pipe accessories, and area drains.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

PART 2 PRODUCTS

2.1 STORM WATER DRAINAGE PIPE MATERIALS

A. Provide pipe and associated materials of the size indicated on the Drawings and meeting the following requirements:

1. High-density Polyethylene Pipe (HDPE):

a. Acceptable products:

i. "N-12" Dual Wall High Density Polyethylene storm drain pipe and fittings, manufactured by Advanced Drainage Systems, 4640 Trueman Boulevard, Hillard, OH 43026. Phone: (800) 821-6710, Fax: (614) 658-0204.

ii. Or approved equivalent.

b. Storm drain pipe shall be N-12 dual wall high density polyethylene corrugated exterior/smooth interior pipe. Pipe and fitting shall be "Water Tight."

c. Perforated subdrain pipe shall be N-12 dual wall HDPE corrugated exterior/smooth interior pipe. Pipe and fittings shall be "Soil Tight." Perforated HDPE subdrain pipe may be substituted with perforated SDR 35 PVC, if approved by the engineer.

i. Maximum perforation width: 0.125 inches

ii. Maximum Perforation length: 0.875 inches

2. High-density Polyethylene material shall comply with:

a. AASHTO M252 for material from 3 to 10 inches in size.

b. AASHTO M294 for material 12 to 36 inches in size.

c. ASTM D1248 for standard specifications for Polyethylene Plastics Molding and Extrusion Materials.

d. ASTM D3350 for pipe and fitting.

e. ASTM D2321 standard practice for underground installation.

3. Joints and Fittings:

a. The material supplied under this specification shall be N-12 dual wall high density polyethylene corrugated exterior/smooth interior pipe. Pipe and fittings shall match the pipe classification ("Soil Tight" or "Water Tight").

b. All fittings shall conform to AASHTO M294.

4. Banded Shielded Couplings:

a. Banded Shielded Coupling: 300 series stainless steel shear bands, minimum thickness of 0.012 inches, and 316 stainless steel clamps with nut and bolt take up.

b. Coupling bands shall cover at least one full corrugation on each section of pipe. When gasketed couple bands are required, the gasket shall be made of closed-cell synthetic expanded rubber meeting the requirements of ASTM D1056, Grade RE42. All coupling bands shall meet or exceed the soils-tightness requirements of the AASHTO Standard Specifications for Highway Bridges, Section 23, paragraph 23.3.2.5.4.(e).

2.2 DRAIN INLETS, TRENCH DRAIN, CLEANOUT, AND AREA DRAIN COMPONENTS

A. General:

1. Construct manholes, inlets, and junction structures of reinforced concrete or precast reinforce concrete, complete with metal frames and covers or gratings, and with fixed ladder rungs where indicated on the Drawings or required by codes. Prefabricated structures may be used when shown on the plans and approved by the engineer. Supporting documentation must be provided to indicate that the prefabricated structures are acceptable for use at the designed burial depths.

2. Rungs shall be individual wall-mounted aluminum, plastic-covered steel, or galvanized steel rungs are acceptable.

B. Materials:

1. Mortar for pipe joints and connections to other drainage structures, and manhole construction:

   a. Comply with requirements of ASTM C270, type M, except the maximum placement time shall be 1 hour.

   b. Hydrated lime complying with ASTM C141, type B, may be added to the mixture of sand and cement in an amount equal to 25% of the volume of cement used.

   c. Provide a quantity of water in the mixture sufficient to produce a stiff workable mortar, which shall be clean and free from harmful acids, alkalis, and organic impurities. Use the mortar within 30 minutes after water is added to the mix.

2. Precast reinforced concrete manholes:

   a. Comply with ASTM C478, precast rings and cone sections.

   b. Fully bed the joints between precast concrete risers and tops in mortar, and smooth both interior and exterior surfaces uniformly.

   c. Acceptable products:

      i. Manufactured by Jensen Precast.

      ii. Manufactured by Oldcastle.

      iii. Approved equivalent.

3. Landscape area drains shall be Nyloplast drain basins, or approved equal.

4. Reinforcement: Provide intermediate grade billet steel complying with ASTM A615, grade 40.

5. Frames and covers or gratings:

    a. Provide all gratings or covers from the same manufacturer.

    b. Frames and grates for precast reinforced drain inlets shall be galvanized steel or ductile iron.

    c. Grates for landscape area drains shall be bronze screw-down grates.

    d. Grates located in pedestrian travel areas shall be Americans with Disabilities Act (ADA) compliant.

6. Precast concrete catch basins:

    a. Provide reinforced and bottom open for field pouring to ensure slope through the structure.

    b. Contractor may select this option in lieu of cast-in-place concrete catch basins

    c. Acceptable products:

        i. Manufactured by Jensen Precast.

        ii. Manufactured by Oldcastle.

        iii. Approved equivalent.

    d. Manufacturer is responsible for the design of drain inlets and ensuring that the design is adequate for the proposed burial depths, loading conditions, and pipe connections.

2.3 IN-LINE DRAINS AND CATCH BASINS

A. In-Line Drains: In-line drains (trench drains) shall be ACO KlassikDrain or approved equal. Specific model of KlassikDrain is indicated on the plans.

B. Catch Basins: In-line drain catch basins shall be ACO K1-901 G/S or approved equal.

C. Grates shall be ADA accessible. Traffic rated grates at locations indicated on the plans.

2.4 BEDDING AND COVER MATERIALS

A. See “Section 31 23 33 Trenching and Backfilling,” and project plans.

PART 3 EXECUTION

3.1 PRODUCT HANDLING

A. Comply with pertinent provisions of “Section 01 60 00 Product Requirements.”

3.2 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed.

B. Correct conditions detrimental to timely and proper completion of the work.

C. Do not proceed until unsatisfactory conditions are corrected.

3.3 TRENCHING AND BACKFILLING

A. See "Section 31 23 33 Trenching and Backfilling."

3.4 INSTALLATION - PIPE

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

B. General:

1. Carefully examine each pipe prior to placing:

a. Promptly set aside defective pipe and damaged pipe.

b. Clearly identify defects.

c. Do not install defective pipe or damaged pipe.

2. Place pipe to the grades and alignment indicated, with a tolerance of one in 1,000 vertical and one in 500 horizontal, unless otherwise directed by the Architect.

3. Provide adequate facilities for lowering pipe safely into the trenches.

4. Do not place pipe in water, nor place pipe when trench or weather is unsuitable for such work.

C. PVC pipe joints: Install with the specified materials and in accordance with the manufacturer's recommendations as approved by the Engineer, applying solvent cement to pipe and fitting.

D. HDPE: Installation shall be in accordance with ASTM D2321 and as recommended by the pipe manufacturer. Backfill shall be ASTM D2321 Class I, II, or III soils, or Unified Soil Classification System (USCS) material corresponding to these ASTM designations.

E. Joining pipes of different materials: Provide fittings or couplings made for the pipe material jointing, or provide a concrete collar as approved by the Engineer.

F. Joining pipe of different sizes:

1. Provide reducer fittings to the larger pipe.

2. Where pipes are different materials as well as different sizes, use the same material for reducer fittings as in the larger pipe.

3. Use saddle connection when branch lines join a main or collector main.

4. Use eccentric coupler and maintain a continuous flowline, when the slope of the pipe is less than 1%.

G. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

H. Connect to building storm drainage system, foundation drainage system, and utility/municipal sewer system.

3.5 INSTALLATION - CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

C. Establish elevations and pipe inverts for inlets and outlets as indicated.

D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.6 FIELD QUALITY CONTROL

A. Perform field inspection in accordance with Division 01: General Requirements.

B. Visually inspect the pipe for deflection:

1. Deflection is limited to 7.5% of the base diameter.

2. If the visual inspection determines the pipe may have deflection problems, the engineer can direct a mandrel test be performed.

3. Such test will be performed at the contractor's expense.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.7 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

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