

Duck Farm Phase 1A – Step 1

Landscape Specifications

August 26, 2010 Submittal

Unincorporated Los Angeles County, California

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Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

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. Metal conduits, tubing, and fittings.
 - 2. Nonmetal conduits, tubing, and fittings.
 - 3. Boxes, enclosures, and cabinets.
 - 4. Handholes and boxes for exterior underground cabling.

1.3 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. LEED Submittals:
 - 1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
 - 2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

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1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Qualification Data: For professional engineer.
- C. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.
 - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
 - 4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.
- D. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 3. Anamet Electrical, Inc.
 - 4. Electri-Flex Company.
 - 5. O-Z/Gedney; a brand of EGS Electrical Group.
 - 6. Picoma Industries, a subsidiary of Mueller Water Products, Inc.
 - 7. Republic Conduit.
 - 8. Robroy Industries.
 - 9. Southwire Company.
 - 10. Thomas & Betts Corporation.
 - 11. Western Tube and Conduit Corporation.
 - 12. Wheatland Tube Company; a division of John Maneely Company.

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- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC: Comply with ANSI C80.1 and UL 6.
- D. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch (1 mm), minimum.
- E. EMT: Comply with ANSI C80.3 and UL 797.
- F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
 - 2. Fittings for EMT:
 - a. Material: Steel.
 - b. Type: Setscrew or compression.
 - 3. 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.
 - 4. Coating for Fittings for PVC-Coated Conduit: Minimum thickness of 0.040 inch (1 mm), with overlapping sleeves protecting threaded joints.
- H. 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.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Anamet Electrical, Inc.
 - 3. Arnco Corporation.
 - 4. CANTEX Inc.
 - 5. CertainTeed Corp.
 - 6. Condux International, Inc.
 - 7. Electri-Flex Company.
 - 8. Kraloy.
 - 9. Lamson & Sessions; Carlon Electrical Products.

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10. Niedax-Kleinhuis USA, Inc.
 11. RACO; a Hubbell company.
 12. Thomas & Betts Corporation.
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D.
- E. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- F. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- G. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 BOXES, ENCLOSURES, AND CABINETS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Adalet.
 2. Cooper Technologies Company; Cooper Crouse-Hinds.
 3. EGS/Appleton Electric.
 4. Erickson Electrical Equipment Company.
 5. FSR Inc.
 6. Hoffman; a Pentair company.
 7. Hubbell Incorporated; Killark Division.
 8. Kraloy.
 9. Milbank Manufacturing Co.
 10. Mono-Systems, Inc.
 11. O-Z/Gedney; a brand of EGS Electrical Group.
 12. RACO; a Hubbell Company.
 13. Robroy Industries.
 14. Spring City Electrical Manufacturing Company.
 15. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
 16. Thomas & Betts Corporation.
 17. Wiremold / Legrand.

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- B. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- E. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb (23 kg). Outlet boxes designed for attachment of luminaires weighing more than 50 lb (23 kg) shall be listed and marked for the maximum allowable weight.
- F. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, galvanized, cast iron with gasketed cover.
- G. Device Box Dimensions: 4 inches by 2-1/8 inches by 2-1/8 inches deep (100 mm by 60 mm by 60 mm deep).
- H. Gangable boxes are prohibited.

2.4 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. General Requirements for Handholes and Boxes:
 - 1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
 - 2. 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.
- B. 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.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. CDR Systems Corporation; Hubbell Power Systems.
 - d. NewBasis.
 - e. Oldcastle Precast, Inc.; Christy Concrete Products.
 - f. Synertech Moulded Products; a division of Oldcastle Precast, Inc.
 - 2. Standard: Comply with SCTE 77.
 - 3. Configuration: Designed for flush burial with integral closed bottom unless otherwise indicated.
 - 4. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.

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5. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
6. Cover Legend: Molded lettering, "ELECTRIC."
7. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

2.5 SOURCE QUALITY CONTROL FOR UNDERGROUND ENCLOSURES

- A. Handhole and Pull-Box Prototype Test: Test prototypes of handholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
 1. Tests of materials shall be performed by an independent testing agency.
 2. Strength tests of complete boxes and covers shall be by either an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 3. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012 and traceable to NIST standards.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 1. Exposed Conduit: GRC.
 2. Concealed Conduit, Aboveground: EMT.
 3. Underground Conduit: RNC, Type EPC-40-PVC, direct buried.
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
 1. Exposed, Not Subject to Physical Damage: EMT or RNC.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Exposed and Subject to Severe Physical Damage: GRC. Raceway locations include the following:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - d. Gymnasiums.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.

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5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: GRC.
 7. 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.
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use compression, steel fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install nonmetallic conduit where ambient temperature exceeds 120 deg F (49 deg C).

3.2 INSTALLATION

- A. 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.
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.

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- F. 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 (300 mm) of changes in direction.
- G. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- H. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- I. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch (27-mm) 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 (3-m) intervals.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange raceways to keep a minimum of 2 inches (50 mm) of concrete cover in all directions.
 - 4. Do not embed threadless fittings in concrete unless specifically approved by Architect for each specific location.
- J. Stub-ups to Above Recessed Ceilings:
 - 1. Use EMT, IMC, or RMC for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- K. 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.
- L. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- M. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- N. 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 (35mm) trade size and insulated throat metal bushings on 1-1/2-inch (41-mm) trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- O. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- P. 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.

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- Q. Cut conduit perpendicular to the length. For conduits 2-inch (53-mm) trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- R. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- S. 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.
- T. 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:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where an underground service raceway enters a building or structure.
 - 3. Where otherwise required by NFPA 70.
- U. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
- V. Expansion-Joint Fittings:
 - 1. Install in each run of aboveground RNC that is located where environmental temperature change may exceed 30 deg F (17 deg C) and that has straight-run length that exceeds 25 feet (7.6 m). Install in each run of aboveground RMC conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
 - 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 - d. Attics: 135 deg F (75 deg C) temperature change.
 - 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F (0.06 mm per meter of length of straight run per deg C) of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F (0.0115 mm per meter of length of straight run per deg C) of temperature change for metal conduits.

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4. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 5. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- W. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations subject to severe physical damage.
 2. Use LFMC in damp or wet locations not subject to severe physical damage.
- X. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- Y. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- Z. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- AA. Locate boxes so that cover or plate will not span different building finishes.
- BB. 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.
- CC. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Section 312000 "Earth Moving" for pipe less than 6 inches (150 mm) in nominal diameter.
 2. Install backfill as specified in Section 312000 "Earth Moving."
 3. 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 (300 mm) of finished grade,

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make final conduit connection at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."

4. 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.
5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete for a minimum of 12 inches (300 mm) on each side of the coupling.
 - b. 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 (1500 mm) from edge of foundation or equipment base. Install insulated grounding bushings on terminations at equipment.
6. Underground Warning Tape: Comply with requirements in Section 260553 "Identification for Electrical Systems."

3.4 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. 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.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. 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.

3.5 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260533

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SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

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. Identification for conductors.
 - 2. Underground-line warning tape.
 - 3. Warning labels and signs.
 - 4. Equipment identification labels.

1.3 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

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- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 1 to 2 inches (25 to 50 mm) wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches (50 mm) long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- E. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- F. Write-On Tags: Polyester tag, [0.010 inch (0.25 mm)] [0.015 inch (0.38 mm)] <Insert dimension> thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Marker for Tags: Permanent, waterproof, black ink marker recommended by tag manufacturer.
 - 2. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 FLOOR MARKING TAPE

- A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.3 UNDERGROUND-LINE WARNING TAPE

- A. Tape:

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1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical utility lines.
2. Printing on tape shall be permanent and shall not be damaged by burial operations.
3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

B. Color and Printing:

1. Comply with ANSI Z535.1 through ANSI Z535.5.
2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.

C. Baked-Enamel Warning Signs:

1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 7 by 10 inches (180 by 250 mm).

D. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES (915 MM)."

2.5 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.6 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).

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- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches (400 mm) overall.
- G. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 480/277-V Circuits:

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

- 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
- d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- B. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
1. Limit use of underground-line warning tape to direct-buried cables.
 2. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- C. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- D. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
1. Comply with 29 CFR 1910.145.
 2. Identify system voltage with black letters on an orange background.
 3. Apply to exterior of door, cover, or other access.
- E. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
 - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
 - b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
 - c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
 - d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
 2. Equipment to Be Labeled:

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

- a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
- b. Enclosures and electrical cabinets.
- c. Access doors and panels for concealed electrical items.
- d. Switchboards.
- e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
- f. Push-button stations.
- g. Contactors.

END OF SECTION 260553

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Preparing subgrades for slabs on grade, walks, pavements, turf, grass and plants.
2. Drainage course for concrete slabs-on-grade.
3. Subbase course for concrete walks and pavement.
4. Subbase course and base course for paving.
5. Excavating and backfilling for utility trenches.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt or concrete paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

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- G. Fill: Soil materials used to raise existing grades.
- H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.
- K. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 QUALITY ASSURANCE

- A. Preexcavation Conference: Conduct conference at project site.

1.4 PROJECT CONDITIONS

- A. Utility Locator Service: Notify utility locator service for area where Project is located before beginning earth moving operations.
- B. Do not commence earth moving operations until plant-protection measures specified in Division 01 Section "Temporary Tree and Plant Protection" are in place.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory and Unsatisfactory soils to be determined by the soil engineer.
- C. Terms, descriptions, and gradations of granular soil materials in remaining paragraphs are examples only. Revise to comply with local practices and to suit Project. For example, granular materials may be referenced by state or local highway designations rather than by ASTM classifications.
- D. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

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- E. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- G. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- H. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.2 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored to comply with local practice or requirements of authorities having jurisdiction.
- B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored to comply with local practice or requirements of authorities having jurisdiction.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth moving operations.
- B. Protect and maintain erosion and sedimentation controls during earth moving operations.
- C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

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3.2 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.3 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
- B. Excavations at Edges of Tree- and Plant-Protection Zones:
 - 1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
 - 2. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.5 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit unless otherwise indicated.
- C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
 - 1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course.

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D. Trenches in Tree- and Plant-Protection Zones:

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Division 01 Section "Temporary Tree and Plant Protection."

3.6 SUBGRADE INSPECTION

- A. Proof-roll subgrade below slabs and pavement with a pneumatic-tired dump truck to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
- B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.7 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by soil engineer.
 1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by soil engineer.

3.8 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.9 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.

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- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Trenches under Roadways: Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course.
- D. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- E. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- F. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill.
 - 5. Under footings and foundations, use engineered fill.

3.11 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM 689:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 85 percent.
 - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 95 percent.
 - 3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
 - 4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.13 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
- B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Turf or Unpaved Areas: Plus or minus 1 inch.
 - 2. Walks: Plus or minus 1 inch
 - 3. Pavements: Plus or minus 1/2 inch.

3.14 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

- A. Place subbase and base course on compacted subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
 - 1. Shape subbase and base course to required crown elevations and cross-slope grades.
 - 2. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

3. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.15 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
 1. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.16 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.
- D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.17 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

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- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 312000

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Driveways.
 - 2. Roadways.
 - 3. Parking lots.
 - 4. Curbs and gutters.
 - 5. Walks.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each exposed product and for each color and texture specified.
- C. Other Action Submittals:
 - 1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.3 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. ACI Publications: Comply with ACI 301 unless otherwise indicated.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:
 - 1. Portland Cement: ASTM C 150, gray portland cement Type I

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- B. Normal-Weight Aggregates: ASTM C 33, Class 4S uniformly graded. Provide aggregates from a single source.
- C. Water: Potable and complying with ASTM C 94/C 94M.
- D. Air-Entraining Admixture: ASTM C 260.
- E. Chemical Admixtures: Admixtures certified by manufacturer to be compatible with other admixtures and to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material.
- F. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis.
 - 1. Color: As selected by Landscape Architect from manufacturer's full range.

2.2 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry cotton mats.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. White, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B, dissipating.

2.3 RELATED MATERIALS

- A. Joint Fillers: ASTM D 1752, cork or self-expanding cork in preformed strips.
- B. Slip-Resistive Aggregate Finish: Factory-graded, packaged, rustproof, nonglazing, abrasive aggregate of fused aluminum-oxide granules or crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials.

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2.4 CONCRETE MIXTURES

- A. Prepare design mixtures, proportioned according to ACI 301, with the following properties:
 - 1. Compressive Strength (28 Days): 4000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
 - 3. Slump Limit: 4 inches plus minus 1 inch .
 - 4. Air Content: 6 percent plus or minus 1.5 percent.
- B. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.
- C. Synthetic Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than 1.0 lb/cu. yd. .
- D. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions.

2.5 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116M. Furnish batch certificates for each batch discharged and used in the Work.

PART 3 - EXECUTION

3.1 EXAMINATION AND PREPARATION

- A. Proof-roll prepared subbase surface below **concrete paving** to identify soft pockets and areas of excess yielding.
- B. Remove loose material from compacted subbase surface immediately before placing concrete.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides 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.

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

3.3 JOINTS

- A. General: Form construction, isolation, and contraction joints and tool edges true to line, with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline unless otherwise indicated.
- B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
- C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
- D. 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[, to match jointing of existing adjacent concrete paving]:
- E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.4 CONCRETE PLACEMENT

- A. Moisten subbase to provide a uniform dampened condition at time concrete is placed.
- B. Comply with ACI 301 requirements for measuring, mixing, transporting, placing, and consolidating concrete.
- C. 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.
- D. Screed paving surface with a straightedge and strike off.
- E. 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.

3.5 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.

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

1. Burlap Finish: Drag a seamless strip of damp burlap across float-finished concrete, perpendicular to line of traffic, to provide a uniform, gritty texture.
 2. 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. Medium-to-Coarse-Textured Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.
- C. Slip-Resistive Aggregate Finish: Before final floating, spread slip-resistive aggregate finish on paving surface according to manufacturer's written instructions.
1. Cure concrete with curing compound recommended by slip-resistive aggregate manufacturer. Apply curing compound immediately after final finishing.
 2. After curing, lightly work surface with a steel wire brush or abrasive stone and water to expose nonslip aggregate.

3.6 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing curing compound[or a combination of these.

3.7 PAVING TOLERANCES

- A. Comply with tolerances in ACI 117 and as follows:
 1. Elevation: 3/4 inch.
 2. Thickness: Plus 3/8 inch , minus 1/4 inch .
 3. Surface: Gap below 10-foot- long, unlevelled straightedge not to exceed 1/2 inch
 4. Joint Spacing: 3 inches .
 5. Contraction Joint Depth: Plus 1/4 inch no minus.
 6. Joint Width: Plus 1/8 inch, no minus.

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

3.8 REPAIRS AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Landscape Architect.
- B. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- C. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

SECTION 321314- DECOMPOSED GRANITE PAVING

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. Subgrade preparation
- 2. Decomposed granite placement
- 3. TechniSoil placement
- 3. Concrete header.

- B. Related Sections:

- 1. Section 329300 - Plants
- 2. Section 329201 – Native Grasses and Wildflowers

1.3 SUBMITTALS

- A. Submit the following items for review by the Owner's Authorized Representative:

- 1. 5-pound sample of decomposed granite.
- 2. Submit cut sheets of Stabilizer product, or equal.
- 3. Sieve analysis for grading of decomposed granite.

1.4 ON-SITE MOCK-UP

- A. Furnish one 4-foot x 12-foot x 4-inch sample of each specified decomposed granite paving material as specified in this Section. The mock-up shall include all proposed headers or containment systems. Locate the mock-up in a safe and convenient place. The approved mock-up(s) shall be the standard(s) for decomposed granite paving work.
- B. Completely remove the mock-up(s) from the site upon completion of the project.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Decomposed Granite Stone and TechniSoil Stone

Washed, natural crushed granite stone, free of clay, friable materials and debris and graded in accordance with ASTM C136 within the following limits:

Sieve Size	Percent Passing
1/2"	100-95
3/8"	90-100
No. 4	50-100
No.30	25-55
No.100	10-20
No. 200	5-20

- B. Approved Supplier
 - 1. Decomposed Granite- "Gail's Gold" as supplied by Gail Materials www.gailmaterials.net or approved equal.
 - 2. TechniSoil- "Pyrite Tan" as supplied by Gail Materials www.gailmaterials.net or approved equal.

2.2 STABILIZER BINDER

- A. TechniSoil and Decomposed Granite Binders as distributed by Gail Materials or approved equal. Binder materials shall be incorporated with the granite fines by the use of a twin pug mill that includes a metered pump insuring the proper ratio of binders to granite fines. Blending with the use of a bucket loader or similar is not acceptable.

2.3 SOIL SEPARATOR FABRIC

- A. Mirafi 700X geotextile soil separator as supplied by Mirafi, Inc., (800) 223-0512, or equal.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify that the subgrade to receive decomposed granite paving has been depressed 4-inches from adjacent grade, compacted to 95 percent and is relatively dry.
- B. Verify that the gradients and elevations of the subgrade are correct.

3.2 BLENDING STABILIZER

- A. Blend 10 pounds of Stabilizer powder per ton of decomposed granite screenings. It is critical that Stabilizer be thoroughly and uniformly mixed through the decomposed granite screenings.

3.3 PLACEMENT OF THE DECOMPOSED GRANITE SCREENINGS

- A. Install soil separator fabric on compacted subgrade. Overlap all seams at least 6-inches. Protect the fabric from sun exposure if exposed for more than 72 hours before placing decomposed granite screenings.
- B. Spread and level the Stabilized decomposed granite screenings to the 4" depth.
- C. Grade and smooth the Stabilized decomposed granite screenings per the approved sample.

- D. Apply water until moisture penetrates to the full depth of the Stabilized decomposed granite screenings. It is critical that the full section of the Stabilized decomposed granite screenings receive water at this time.
- E. Upon thorough moisture penetration and after all surface water has disappeared, compact the Stabilized decomposed granite screenings to within 95 percent relative compaction by using a vibrating plate tamp or similar compaction equipment. Care shall be taken in compacting the decomposed granite screenings adjacent planting, irrigation systems and edgings.
- F. Allow the finished surface enough time to dry completely before allowing traffic.

3.4 CLEANUP

- A. Upon completion of the work under this section, the Contractor shall remove all rubbish, waste and debris resulting from his operations off-site or as directed by the Owner's Authorized Representative. Remove all equipment and implements of service and leave the entire work area in a neat and clean condition as accepted by the Owner's Authorized Representative.

END OF SECTION 321314

SECTION 321314- DECOMPOSED GRANITE PAVING

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. Subgrade preparation
2. Decomposed granite placement
3. TechniSoil placement
3. Concrete header.

B. Related Sections:

1. Section 329300 - Plants
2. Section 329201 – Native Grasses and Wildflowers

1.3 SUBMITTALS

A. Submit the following items for review by the Owner's Authorized Representative:

1. 5-pound sample of decomposed granite.
2. Submit cut sheets of Stabilizer product, or equal.
3. Sieve analysis for grading of decomposed granite.

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

1.4 ON-SITE MOCK-UP

- A. Furnish one 4-foot x 12-foot x 4-inch sample of each specified decomposed granite paving material as specified in this Section. The mock-up shall include all proposed headers or containment systems. Locate the mock-up in a safe and convenient place. The approved mock-up(s) shall be the standard(s) for decomposed granite paving work.
- B. Completely remove the mock-up(s) from the site upon completion of the project.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Decomposed Granite Stone and TechniSoil Stone

Washed, natural crushed granite stone, free of clay, friable materials and debris and graded in accordance with ASTM C136 within the following limits:

Sieve Size	Percent Passing
1/2"	100-95
3/8"	90-100
No. 4	50-100
No.30	25-55
No.100	10-20
No. 200	5-20

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

- B. Approved Supplier
 - 1. Decomposed Granite- "Gail's Gold" as supplied by Gail Materials www.gailmaterials.net or approved equal.
 - 2. TechniSoil- "Pyrite Tan" as supplied by Gail Materials www.gailmaterials.net or approved equal.

2.2 STABILIZER BINDER

- A. TechniSoil and Decomposed Granite Binders as distributed by Gail Materials or approved equal. Binder materials shall be incorporated with the granite fines by the use of a twin pug mill that includes a metered pump insuring the proper ratio of binders to granite fines. Blending with the use of a bucket loader or similar is not acceptable.

2.3 SOIL SEPARATOR FABRIC

- A. Mirafi 700X geotextile soil separator as supplied by Mirafi, Inc., (800) 223-0512, or equal.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Verify that the subgrade to receive decomposed granite paving has been depressed 4-inches from adjacent grade, compacted to 95 percent and is relatively dry.
- B. Verify that the gradients and elevations of the subgrade are correct.

3.2 BLENDING STABILIZER

- A. Blend 10 pounds of Stabilizer powder per ton of decomposed granite screenings. It is critical that Stabilizer be thoroughly and uniformly mixed through the decomposed granite screenings.

3.3 PLACEMENT OF THE DECOMPOSED GRANITE SCREENINGS

- A. Install soil separator fabric on compacted subgrade. Overlap all seams at least 6-inches. Protect the fabric from sun exposure if exposed for more than 72 hours before placing decomposed granite screenings.
- B. Spread and level the Stabilized decomposed granite screenings to the 4" depth.

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

- C. Grade and smooth the Stabilized decomposed granite screenings per the approved sample.
- D. Apply water until moisture penetrates to the full depth of the Stabilized decomposed granite screenings. It is critical that the full section of the Stabilized decomposed granite screenings receive water at this time.
- E. Upon thorough moisture penetration and after all surface water has disappeared, compact the Stabilized decomposed granite screenings to within 95 percent relative compaction by using a vibrating plate tamp or similar compaction equipment. Care shall be taken in compacting the decomposed granite screenings adjacent planting, irrigation systems and edgings.
- F. Allow the finished surface enough time to dry completely before allowing traffic.

3.4 CLEANUP

- A. Upon completion of the work under this section, the Contractor shall remove all rubbish, waste and debris resulting from his operations off-site or as directed by the Owner's Authorized Representative. Remove all equipment and implements of service and leave the entire work area in a neat and clean condition as accepted by the Owner's Authorized Representative.

END OF SECTION 321314

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

SECTION 328400-PLANTING IRRIGATION

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 design and furnishing of all labor, materials, supplies, equipment, tools, and transportation, and to perform all operations in connection with and reasonably incidental to the complete installation of the irrigation system, and guarantee/warranty.
- B. It is the intent of the specifications and drawings that the finished system is complete in every respect and shall be ready for operation satisfactory to the Owner.
- C. Items of work specifically included are:
 - 1. Procurement of all applicable licenses, permits, and fees.
 - 2. Connection of electrical power supply to the irrigation control system.
 - 3. Maintenance period.

1.3 RELATED SECTIONS

- A. Section 329201 – Grasses and Wildflowers.

1.4 IRRIGATION SYSTEM DESCRIPTION

- A. Design requirements: The irrigation system will be a combination of pop-up rotor, pop up spray sprinklers, and deep well bubblers to trees.
- B. Water service: The design of the irrigation systems shall allow for the future transfer from clean water to reclaimed water service. The systems design and built shall incorporate hardware, labeling of hardware etc., which meet local water department regulations.
- C. Design Requirements: Design of the irrigation system shall observe water conservation requirements of local water district and Owner requirements. Contractor to provide water usage calculations and other necessary documentation as required by code.

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1.5 CONSTRUCTION DRAWINGS

- A. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, sleeves, etc. which may be required. The Contractor shall carefully investigate the structural and finished conditions affecting all of his work and plan his work accordingly, furnishing such fittings, etc. as may be required to meet such conditions. Drawings are generally diagrammatic and indicative of the work to be installed. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, planting, and architectural features.
- B. All work called for on the drawings by notes or details shall be furnished and installed whether or not specifically mentioned in the specifications. When an item is shown on the plans but not shown on the specifications or vice versa, it shall be deemed to be as shown on both. The Irrigation Consultant shall have final authority for clarification. When a conflict occurs between an item shown on the plan and as shown on the specifications, the Irrigation Consultant shall have final authority for clarification.
- C. The Contractor shall not wilfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in area dimensions exist that might not have been considered in engineering. Such obstructions or differences should be brought to the attention of the Landscape Architect as soon as detected. In the event this notification is not performed, the Irrigation Contractor shall assume full responsibility for any revision necessary.

1.6 QUALITY ASSURANCE

- A. Provide at least one English speaking person who shall be present at all times during execution of this portion of the work and who shall be thoroughly familiar with the type of materials being installed and the manufacturer's recommended methods of installation and who shall direct all work performed under this section.
- B. Manufacturer's directions and detailed drawings shall be followed in all cases where the manufacturer of articles used in this contract furnishes directions covering points not shown in the drawings and specifications.
- C. All local, municipal and state laws, rules and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications, and their provisions shall be carried out by the Contractor. Anything contained in these specifications shall not be construed to conflict with any of the above rules and regulations of the same. However, when these specifications and drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the above rules and regulations, the provisions of these specifications and drawings shall take precedence.
- D. All materials supplied for this project shall be new and free from any defects. All defective materials shall be replaced immediately at no additional cost to the **Owner**.

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- E. The Contractor shall secure the required licenses and permits including payments of charges and fees, give required notices to public authorities, verify permits secured or arrangements made by others affecting the work of this section.

1.7 HOLD HARMLESS & INDEMNIFICATION CLAUSE

- A. Contractor agrees to assume sole responsibility for job site conditions during the course of construction of this project, including safety of all persons and property; that this requirement shall apply continuously and not be limited to normal working hours, and that the contractor shall defend, indemnify, and hold the Owner, Developer, the County of local jurisdiction, Landscape Architect, and Irrigation Consultant harmless from any and all liability real or alleged, in connection with the performance of work on this project, excepting for liability arising from sole negligence of the Owner, Developer, County of local jurisdiction, Landscape Architect or Irrigation Consultant.

1.8 SUBMITTALS

- A. Materials List:
 - 1. After award of contract and before any irrigation system materials are ordered from suppliers or delivered to the job site, Contractor shall submit to the Landscape Architect for approval five (5) copies of a detailed list of each material proposed for use in the project and/or processes proposed to be furnished and installed as part of this contract. List shall include all items indicated on drawings and/or specifications.
 - 2. No work shall commence before receipt of approved material list and descriptive material.
 - 3. The submittals shall include the following information:
 - a. A title sheet with the job name, the Contractor's name, Contractor's address and telephone number, submittal date and submittal number.
 - b. An index sheet showing the item number (i.e. 1, 2, 3, etc.); an item description (i.e. sprinkler head); the manufacturer's name (i.e. Hunter Industries); the item model number (i.e. I-40-ADV/36V); and the page(s) in the submittal set that contain the catalog cuts.
 - c. The catalog cuts shall be one or two pages from the most recent manufacturer's catalog that indicate the product submitted. Do not submit parts lists, exploded diagrams, price lists or other extra information.
 - d. The catalog cuts shall clearly indicate the manufacturer's name and the item model number. The item model number, all specified options and specified sizes shall be circled on the catalog cuts.
 - e. Submittals for equipment indicated on the legend without manufacturer names, or "as approved", shall contain the manufacturer, Class or Schedule, ASTM numbers and/or other certifications as indicated in these specifications.
 - f. Submittal format requirements:

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- 1) Submittals shall be provided as one complete package for the project. Multiple partial submittals will not be reviewed.
 - 2) Submittal package shall be stapled or bound in such a way as to allow for disassembly for review processing.
 - 3) Submittal package shall have all pages numbered in the lower right hand corner. Page numbers shall correspond with submittal index.
- g. The Landscape Architect will allow no substitutions without prior written acceptance.
 - h. Manufacturer's warranties shall not relieve the Contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.

- B. The Landscape Architect and Irrigation Consultant will not review the submittal package unless provided in the format described above.

1.9 SUBSTITUTIONS:

- A. If the Contractor wishes to substitute any equipment or materials for the equipment or materials listed on the irrigation drawings and specifications, he may do so by providing the following information to the Landscape Architect and Irrigation Consultant for review:
 1. Provide a statement indicating the reason for making the substitution. Use a separate sheet of paper for each item to be substituted.
 2. Provide descriptive catalog literature, performance charts and flow charts for each item to be substituted.
 3. Provide the amount of cost savings if the substituted item is approved.
- B. The Irrigation Consultant shall have the sole responsibility in accepting or rejecting any substituted item as an approved equal to equipment and materials listed on the irrigation drawings and specifications.

1.10 RULES AND REGULATIONS:

- A. Work and materials shall be in accordance with the latest edition of the National Electric Code, the Uniform Plumbing Code as published by the specific plumbing association of the region, such as the Western Plumbing Officials Association or the California Plumbing Code based on IATMO and applicable laws and regulations of the governing authorities.
- B. When the contract documents call for materials or construction of a better quality or larger size than required by the above-mentioned rules and regulations, provide the quality and size required by the contract documents.

1.11 TESTING

- A. Notify the Owner's Authorized Representative three days in advance of testing.

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- the Irrigation Consultant. This test shall be accomplished before any groundcover is planted.
2. Activate each remote control valve in sequence. The Irrigation Consultant will visually observe water application patterns.
 3. Add, adjust, and/or move system components to correct coverage deficiencies as required. All areas shall have no less than head-to-head (100%) coverage. All plant material shall receive adequate water for sustained growth as intended by landscape architect. Irrigation plans may not show all required sprinkler heads and/or drip emitters due to varying site conditions not apparent during design of the system.
 4. Repeat the test until the system passes test.
 5. Upon completion of each phase of work, the entire system shall be tested and adjusted to meet site requirements.

1.12 STORAGE AND HANDLING

- A. Use all means necessary to protect irrigation system materials before, during, and after installation and to protect the installation work and materials of all other trades. In the event of damage, immediately make all repairs and replacements necessary to the acceptance of the Owner's Authorized Representative and at no additional cost to the Owner.
- B. Exercise care in handling, loading, unloading, and storing plastic pipe and fittings under cover until ready to install. Transport plastic pipe only on a vehicle with a bed long enough to allow the pipe to lay flat to avoid undue bending and concentrated external load.

1.13 EXISTING CONDITIONS

- A. The Contractor shall verify and be familiar with the locations, size and detail of points of connection provided as the source of water, electrical supply, and telephone line connection to the irrigation system. Notify the Landscape Architect and Owner's Authorized Representative three days in advance of testing.
- B. Existing irrigation systems as noted on drawings were taken from existing drawings and information taken from Owner's irrigation drawings and/or verbal communication with Owner's maintenance staff. Actual existing locations, sizes, etc. may vary or may not occur. Contractor shall be responsible for verification. If variations occur, Contractor shall notify Landscape Architect and Owner's Authorized Representative immediately. Contractor shall also be responsible for correctly noting on the record set of drawings, all existing mainlines, valves, etc. located during irrigation installation work.
- C. Irrigation design is based on the anticipated flow and water pressure as determined by WCA. Contractor shall verify actual water flow and pressure on the project prior to the start of construction. Should a discrepancy exist, notify the Landscape Architect and Owner's Authorized Representative prior to beginning construction.

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- D. Existing conditions, points of connection (P.O.C.), etc. when noted are approximate and may not be complete. Verify all existing conditions prior to any work including but not limited to grading and irrigation work. Contractor shall notify Landscape Architect and Owner's Authorized Representative for site review prior to any work.
- E. Protect utilities and/or plant materials not designated for removal or modification in place against damage resulting from work of this Contract. Perform any removal and/or modifications only on approval or instruction from the Project Manager or in accordance with applicable provisions noted or specified. Replace damaged existing plant material with like type and size material. Determine the cost of irreplaceable plant material according to the "square inch" method as described by the Council of Tree and Landscape Appraisers "Manual for Plant Appraisers" Handbook current edition and "Guide for Establishing Values of Trees and Other Plants".
- F. Prior to cutting into the soil, the Contractor shall locate all telephone conductors, gas lines, cables, conduits, sewer septic tanks, and other utilities as are commonly encountered underground and he shall take proper precautions not to damage or disturb such improvements. If a conflict exists between such obstacles and the proposed work, the Contractor shall promptly notify the Landscape Architect who will arrange for relocations. The Contractor will proceed in the same manner if a rock layer or any other such conditions are encountered. Call Underground Service Alert (800-422-4133) a minimum of two days prior to any excavation.
- G. The Contractor shall protect all existing utilities and features to remain on and adjacent to the project site during construction. Contractor shall repair, at his own cost; all damage resulting from his operations or negligence.
- H. Should Contractor find any utilities during his inspections or excavations that are not shown on the plans, Contractor shall promptly notify the Landscape Architect and Job Superintendent for instructions as to further action. Failure to do so will make Contractor liable for any damage thereto arising from his operations subsequent to discovery of such utilities not shown on plans.
- I. The Irrigation Contractor shall coordinate with the General Contractor for installation of required sleeves as indicated on the irrigation plans, whether within the notes or shown on drawings.
- J. The Contractor shall verify and be familiar with the existing irrigation systems in areas adjacent to and within the Project area of work.
- K. Prior to any irrigation shut down or mainline rework at new areas, Contractor shall provide temporary water to existing areas not affected by new work, until permanent system is complete.
- L. The Contractor shall protect all existing irrigation systems, in areas adjacent to and within the project area of work, from damage due to his operations.

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- M. Contractor shall notify Landscape Architect and Owner's Authorized Representative if any existing system is temporarily shut off, capped or modified. Provide 48-hour notice, prior to turning off or modifying any existing irrigation system.
- N. Under no circumstances shall the existing irrigation system that is remaining be shut down longer than 48 hours. Reroute system or install temporary system if necessary. Notify Landscape Architect and Owner's Authorized Representative prior to any shut down time.
- O. The Contractor shall repair or replace all existing irrigation systems, in areas adjacent to and within the project area of work, damaged by the construction of this project. Adjacent irrigation systems shall be made completely operational and provide complete coverage of the existing landscaped areas. All repairs shall be complete to the satisfaction of the Landscape Architect and Owner's Authorized Representative.
- P. Transit Pipe Requirements: All work being done to the existing amosite asbestos transit pipe shall be done by a qualified and fully licensed company. The company must be licensed and a certified AHERA company (Certified by the Professional Services Industries, Hall Kimbrell Division) Telephone Number 1-800-346-2860, or approved equal. This work shall include but not limited to the digging and exposure of pipe, wetting, cutting, bagging in plastic bag that's properly marked and identified as asbestos material disposal at approved landfill, capping and applying all new fittings, etc.
- Q. Reclaimed water: New irrigation systems may use future reclaimed water. All work, including new work and rework of existing system etc., all materials, materials code colors, etc. shall comply with all governing codes including but not limited to local Reclaimed Water Use Ordinance.

1.14 EXISTING TREE PRESERVATION

- A. The Contractor shall meet with the Construction Superintendent and Consulting Arborist before beginning work to discuss work procedures, tree protection and monitoring schedule. Any changes to plans affecting trees should be reviewed by the Consulting Arborist with regard to tree impacts. These include, but not limited to, improvement plans, utility and drainage plans, grading plans, landscape and irrigation plans, and demolition plans. Notify the Landscape Architect and Owner's Authorized Representative two days in advance of commencing work in affected (changed) areas.
- B. A Tree Protection Zone shall be established around each tree. No grading, excavation, construction, or storage of materials shall occur within the Tree Protection Zone, except as noted for certain improvements (i.e. fine grading). Spoil from any trenching or other excavation shall not be placed within the Tree Protection Zone, either temporarily or permanently. The Tree Protection Zone limits may be changed by the Consulting Arborist following design changes.
- C. Supplemental irrigation may be required and applied as determined by the Consulting Arborist.

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- D. Prior to excavation for irrigation system piping trees may require root pruning outside the Tree Protection Zone by cutting all roots to the depth of trench. Roots are to be exposed by hand digging or water excavation. The Consulting Arborist should monitor the excavation and root pruning. Roots shall be pruned clean and square at undamaged tissue and perpendicular to the root, with a saw or other approved pruning equipment. The Consulting Arborist shall identify in the field where root pruning is to occur, if required.
- E. Any trenching required within the tree canopy (dripline) and outside of the Tree Protection Zone shall be hand dug to minimize any damage to tree roots. No mechanical trenching allowed. Contractor shall hand dig within dripline of existing tree and take precautions to avoid damaging tree roots greater than 1" in size.
- F. Roots larger than 1" may not be severed when trenching. Pipe or drip tubing shall be installed under any roots larger than 1" in diameter where encountered within trench. Trench shall be formed and sloped where irrigation pipe or drip tubing will not kink approaching and/or under the root. Abrupt trench angles are not allowed. 45 degree elbows may be used to accomplish this requirement for PCV pipe.
- G. When majority of roots are 1" or larger, and a Consulting Arborist is not available then the contractor should employ the services of an Arborist to provide judgment on amount of tree roots acceptable for severing, if any.
- H. Contractor accepts all liability for any tree damage. Any damage to tree resulting in the loss of vigor or life of tree shall require contractor to replace tree with equal size and shape at no cost to Owner.

1.15 REVIEWS

- A. Sprinkler Layout Review:
 - 1. Notify Landscape Architect, Irrigation Consultant, and Owner's Authorized Representative in advance of review. Static pressure at water supply must be verified prior to review.
 - 2. Stake each sprinkler location, remote control valve assembly, isolation valve, and all other irrigation system assemblies. Different sprinkler types shall be clearly marked. Revise layout as directed by Irrigation Consultant. Layout review may be repeated at discretion of Irrigation Consultant.
 - 3. All landscape edging, tree locations, and other known site features must be staked or clearly marked prior to sprinkler layout review.
 - 4. Where the irrigation system must be modified due to discrepancies between the irrigation plans and actual site conditions, the layout shall be modified per the direction of Irrigation Consultant.
 - 5. Layout review shall occur prior to installation of irrigation system unless otherwise directed by Landscape Architect.
 - 6. Failure to comply with the staking process will result in Contractor taking full responsibility for all system component locations.

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- B. Pre-maintenance review will occur at substantial completion of irrigation system and substantial completion of record (as-built) drawings and controller charts. Construction maintenance period will begin at time of Landscape Architect / Owner's Authorized Representative acceptance of project.

1.16 TURN OVER ITEMS

- A. Record Drawings:
 - 1. Record accurately on one set of drawings all changes in the work constituting departures from the original contract drawings and the actual final installed locations of all required components as shown below. The record drawings shall be prepared to the satisfaction of the Landscape Architect.
 - 2. The Contractor shall provide and keep up-to-date a complete record set of blue-line or bond prints which shall be corrected daily, showing every change from the original drawings and specifications and the exact installed locations, sizes, and kinds of equipment. This set of drawings shall be kept on the site and shall be used only as a record set.
 - 3. These drawings shall also serve, as work progress, as a basis for measurement and payment for work completed. These drawings shall be available at all times for observation and shall be kept in a location designated by the Landscape Architect or Owner's Authorized Representative. Should the record drawings not be available for review or not up-to-date at the time of any site reviews, it will be assumed no work has been completed and the Contractor will be assessed the cost of that site visit at the current billing rate of the Irrigation Consultant and Landscape Architect. No other inspections shall take place prior to payment of that assessment.
 - 4. Prior to the final inspection of work, submit Record Drawings to the Landscape Architect. Delivery of the drawings will not relieve the responsibility of furnishing required information that may be omitted from the record prints.
 - 5. All final Record Drawings shall be prepared and submitted.
 - 6. Record Drawing information and dimensions shall be collected on a day-to-day basis during the installation of the pressure mainline to fully indicate all routing locations and pipe depths. Locations for all other irrigation equipment shall be collected prior to the final inspection of the work.
 - 7. Record drawing information and dimensions shall be collected on a day-to-day basis during the installation of the pressure mainline to fully indicate all routing locations and pipe depths. Locations for all other irrigation equipment shall be collected prior to the final inspection of the work.
 - 8. Two dimensions from two permanent points of reference such as buildings, sidewalks, curbs, streetlights, hydrants, etc. shall be shown for each piece of irrigation equipment shown below. Where multiple components are installed with no reasonable reference point between the components, dimensioning may be made to the irrigation equipment. All irrigation symbols shall be clearly shown matching the irrigation legend for the drawings. All lettering on the record drawings shall be minimum 1/8 inch in size.
 - 9. Show locations and depths of the following items:

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- a. Point of connection (including water POC, backflow devices, master control valves, flow sensors, etc.).
 - b. Routing of sprinkler pressure main lines (dimensions shown at a maximum of 100 feet along routing).
 - c. Isolation valves.
 - d. Automatic remote control valves (indicate station number and size).
 - e. Quick coupling valves.
 - f. Main line air relief valves.
 - g. Routing of control wires where separate from irrigation mainline.
 - h. Irrigation controllers (indicate controller number and station count).
 - i. Related equipment (as may be directed).
10. Provide one Controller Zone Chart for inclusion within each automatic controller. Chart shall show the area covered by the particular controller. The areas covered by the individual control valves shall be indicated using colored highlighter pens. A minimum of eight individual colors shall be used for the controller chart unless less than eight control valves are indicated.
 11. Landscape Architect must approve Record Drawings before controller charts are prepared.
 12. The chart is to be a reduced copy of the actual "record" drawing. In the event the controller sequence is not legible when the drawing is reduced, it shall be enlarged to a readable size.
 13. When completed and approved, the chart shall be hermetically sealed between two pieces of plastic, each piece being a minimum 20 mils in thickness.

B. Operation and Maintenance Manuals:

1. Provide Owner's maintenance personnel with instructions for major equipment and show in writing to the Landscape Architect at the conclusion of the project that this service has been rendered.
2. Two individually bound copies of operation and maintenance manuals shall be delivered to the Owner's Authorized Representative at least 10 calendar days prior to final inspection. The manuals shall describe the material installed and the proper operation of the system
3. Each complete, bound manual shall include the following information:
 - a. Index sheet stating Contractor's address and telephone number, duration of guarantee period, list of equipment including names and addresses of local manufacturer representatives.
 - b. Operating and maintenance instructions for all equipment.
 - c. Spare parts list and related manufacturer information for all equipment.
 - d. Complete controller schedule of irrigation run times, whether it varies from the designed schedule or not.

C. Equipment:

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

1. Supply as a part of this contract the following items:
 - a. Three 30-inch sprinkler keys for manual operation of control valves.
 - b. Two door keys for each controller enclosure and two door keys for each automatic controller.
 - c. One quick coupler key and attached swivel hose ell with same size full-port bronze hose bib, upwards bent nose type and hand wheel shutoff, and two QC lid keys, per ten installed quick coupler valves.
 - d. Five extra sprinkler heads of each size and type as shown on drawings.
 - e. For specified isolation gate valves if required: One (1) 5-foot long valve handle, to fit 2-inch square AWWA operating nut, for use with the specified isolation valves.
2. The above mentioned equipment shall be turned over to the Owner's Authorized Representative at the conclusion of the project. Before the final inspection can occur, evidence that the Owner has received these materials must be shown to the Landscape Architect.

1.17 GUARANTEE, WARRANTY AND REPLACEMENT

- A. The purpose of this guarantee/warranty is to insure that the Owner receives irrigation materials of prime quality, installed and maintained in a thorough and careful manner.
- B. For a period of one year from the date of final completion and commencement of the formal maintenance period, guarantee/warranty irrigation materials, equipment, and workmanship against defects. Fill and repair depressions. Restore landscape or structural features damaged by the settlement of irrigation trenches or excavations. Repair damage to the premises caused by a defective item. Make repairs within three days of notification from the Landscape Architect or Owner's Authorized Representative.
- C. Contract documents govern replacements the same as new work. Make replacements at no cost in contract price.
- D. Guarantee/warranty applies to originally installed materials and equipment and replacements made during the guarantee/warranty period. The guarantee for the sprinkler irrigation system shall be made in accordance with the attached form.
- E. Contractor shall complete all forms and labels shipped with and/or attached to the controller; attach his own name, address and phone number to the controller via a permanent label; and shall properly execute and file with the Owner the controller and other equipment guarantees.
- F. The General Conditions and Supplementary Special Conditions of these specifications shall be filed with the Owner prior to acceptance of the irrigation system.
- G. A copy of the guarantee form shall be included in the Operations and Maintenance Manual.

The guarantee form shall be re-typed onto the Contractor's letterhead and shall contain the following information:

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GUARANTEE FOR SPRINKLER IRRIGATION SYSTEM

We hereby guarantee that the sprinkler 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, ordinary wear and tear, unusual abuse, or neglect expected. We agree to repair or replace any defects in material or workmanship that may develop during the period of one year from date of acceptance and to repair or replace any damage resulting from the repairing or replacing of such defects at no additional cost to the Owner. We shall make such repairs or replacements within a twenty-four (24) hour time period, after receipt of written notice by FAX. In the event of our failure to make such repairs or replacements within this 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: _____

ADDRESS: _____

ADDRESS: _____

TELEPHONE: _____

FAX: _____

ACCEPTANCE DATE: _____

BY: _____

LOCATION: _____

E-MAIL: _____

1.18 MAINTENANCE PERIOD

- A. The Contractor shall maintain the entire irrigation system for a minimum period of 365 days after the project has been released to landscape maintenance. The irrigation maintenance period shall continue for as long as the landscape maintenance period is in effect and/or if system deficiencies are found at the end of the 90 day period. The

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maintenance period shall continue until all deficiencies are completed to the Owner's satisfaction.

PART 2 - MATERIALS

2.1 MANUFACTURERS AND PRODUCTS

- A. General: Manufacturers and products, where listed, are intended to set a level of expected quality and performance and are not intended to limit or restrict products from other manufacturers and/or suppliers capable of meeting the requirements of this Specification.
- B. General: Use only new materials of the manufacturer, size and type shown on the drawings and in the specifications.

2.2 QUALITY

- A. Materials used in the system shall be new and without flaws or defects of any type, and shall be the best of their class and kind.
- B. Materials or equipment installed or furnished that do not meet the Irrigation Consultant's or governing agencies standards will be rejected and shall be removed from the site at no expense to the Owner.

2.3 SUBSTITUTIONS

- A. Substitutions are not encouraged and as a general rule will not be allowed.
- B. Submit requests for substitutions within 15 days after date of Owner-Contractor Agreement. Subsequent requests for substitutions will be considered only when a product becomes unavailable or has been discontinued.
- C. Submit complete data showing compliance with the Contract Documents.
- D. In making a request for substitution, the Contractor represents that he:
 - 1. Has investigated the proposed substitution and found that it is of the same or better quality level, capacity, function, or appearance than the specified product.
 - 2. Will coordinate installation and make modifications to the work which may be required for complete installation.
 - 3. Will bear all costs resulting from necessary changes caused by the substitution.
- E. The Irrigation Consultant will determine acceptability of proposed substitution and will notify Contractor of acceptance or rejection.
- F. Pipe sizes referenced in the construction documents are minimum sizes, and may be increased at the option of the Contractor, but never decreased for any reason.

2.4 SLEEVING

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

- A. Install separate sleeves beneath all paved areas to route each run of irrigation pipe or wiring bundle.
- B. Sleeves beneath pedestrian pavements shall be PVC SCH 40 pipe with solvent welded joints.
- C. Sleeves beneath drives and streets shall be PVC SCH 40 pipe with solvent welded joints.
- D. Sleeve Diameter: Twice the diameter of the pipe or wire bundle passing through it. Minimum size for two-wire cable shall be 1 1/4" sleeve.
- E. Provide a 1/8-inch O.D. nylon or a polyethylene rope, rated at 250 pounds tensile strength, in all wire sleeves more than 10 feet in length left empty for future use. Not less than 5 feet of rope shall be left at each end of the sleeve. Tag all lines with a plastic tag at each end indicating the termination/stub location of the opposite end of the sleeve.
- F. Seal all sleeves with expanding foam product where termination is subject to dirt, debris, and/or moisture intrusion or where sleeve penetrates exterior wall, floor or roof.

2.5 PIPE AND FITTINGS

- A. Mainline Pipe and Fittings:
 1. Use rigid, unplasticized polyvinyl chloride (PVC) 1120, 1220 National Sanitation Foundation (NSF) approved pipe, extruded from material meeting the requirements of Cell Classification 12454-A or 12454-B, ASTM Standard D1784, with an integral belled end.
 2. Use Primer approved by pipe manufacturer. Solvent cement to conform to ASTM Standard D2564.
 3. Use Schedule 40 conforming to the dimensions and tolerances established by ASTM Standard D1785 for mainline pipe with a nominal diameter equal to or less than 1 1/2 inches.
 4. Use Class 315, SDR-13.5, rated at 315 PSI, conforming to the dimensions and tolerances established by ASTM Standard D2241 for mainline pipe with a nominal diameter up to 2 1/2 inches.
 5. Use Bell and Gasket type Class 200, SDR-21, rated at 200 PSI, conforming to the dimensions and tolerances established by ASTM Standard D2241 for mainline pipe with a nominal diameter equal to or greater than 3 inches.
 6. Reclaimed water PVC pipe to be colour coded "purple" in colour and marked on two sides with reclaimed water warning statements "CAUTION - RECLAIMED WATER". Reclaimed water piping must be accepted by the local reclaimed water governing agencies. Reclaimed water PVC pipe shall use standard PVC fittings.

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7. Use PVC SCH 40 for mainline fittings with a nominal diameter equal to 1½ inches or less. Use PVC SCH 80 for mainline fittings with a nominal diameter equal to 2 inches up to 3 inches, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784 (except for manifold isolation valves, 4" or less in size). SCH 80 fittings shall be used in only those situations where saddles or ductile iron fittings are not called for either in the Legend, Details, or Plan (i.e. manifold isolation valves, 4" or less in size). Use SCH 80, Type 1, PVC for all threaded fittings.
8. The outlet of the PVC tee or ell fitting and the PVC pipe stub-out used to connect a remote control valve assembly to the main line shall be of the same size as the nominal diameter of the outlet lateral of that valve, except for 3" RCV installations which shall be a 3" iron pipe nipple from iron fitting to RCV.
9. All tee or ell fittings on pressure supply lines 4 inches and greater shall be ductile iron deep bell type. The outlet of the tee or ell of the mainline to the sub-main valve manifold assembly shall be sized per the diameter of the largest lateral pipe of any valve on the sub-main assembly. Ductile iron plugs and PVC SCH 80 male adapters shall be used as required for the reduction of pipe size from mainline to sub-main valve manifold pipe size.
10. Ductile iron fittings shall be manufactured of ductile iron, Grade 65-45-12 in accordance with ASTM A-536. Fitting gaskets shall be in accordance with ASTM F-477. All ductile iron fittings shall be manufactured with exterior lugs. Ductile iron fittings shall be as manufactured by Leemco, Inc., Corona, California.
11. All ductile iron fittings shall be equipped with mechanical joint restraints. All bell and gasket joints 4-inches and larger within fifty (50) feet of a directional change in the mainline shall be equipped with mechanical joint restraints. All 3-inch bell and gasket joints within fifty (30) feet of a directional change in the mainline shall be equipped with mechanical joint restraints. The joint restraint shall secure the PVC pipe directly to the lugs on the ductile iron fittings without the use of bolts, links and adapters. The joint restraint shall secure PVC pipe to PVC pipe and PVC pipe to ring joint isolation valves without the use of threaded linkages. Joint restraints shall be as manufactured by Leemco, Inc., Corona, California.

B. Lateral Pipe and Fittings:

1. Use rigid, unplasticized polyvinyl chloride (PVC) 1120, 1220 National Sanitation Foundation (NSF) approved pipe, extruded from material meeting the requirements of Cell Classification 12454-A or 12454-B, ASTM Standard D1784, with an integral belled end.
2. Use Primer approved by pipe manufacturer. Solvent cement to conform to ASTM Standard D2564.
3. Use SCH 40, conforming to the dimensions and tolerances established by ASTM Standard D1785. Use CL 200, conforming to the dimensions and tolerances established by ASTM Standard D2241. See Irrigation Plan Legend for type.
4. Reclaimed water PVC pipe to be colour coded "purple" in colour and marked on two sides with reclaimed water warning statements "CAUTION - RECLAIMED WATER". Reclaimed water piping must be accepted by the local reclaimed water governing agencies. Reclaimed water PVC pipe shall use standard PVC fittings.

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5. Use Schedule 40 and SCH 80, Type 1, PVC solvent weld fittings conforming to ASTM Standards D2466 and D1784. See irrigation plan legend and details for appropriate use of each type of fitting.
- C. Specialized Pipe:
1. Copper pipe: Type "K" rigid conforming to ASTM Standard B88 for outdoor/underground installation.
 2. Copper pipe: Type "L" for indoor installation.
- D. Specialized Pipe and Fittings:
1. Copper pipe: Type "K" rigid conforming to ASTM Standard B88. Fittings shall be wrought copper or cast bronze, soldered or threaded per the installation details. Solder shall be 95% tin and 5% antimony.
 2. Galvanized and steel pipe: Schedule 40 galvanized steel pipe, ASTM Standard A120. Fittings shall be galvanized, threaded, standard weight, malleable iron fittings.
 3. Use a dielectric union wherever a copper-based metal (copper, brass, bronze) is joined to an iron-based metal (iron, galvanized steel, stainless steel).
 4. Assemblies calling for threaded pipe connections shall utilize PVC Schedule 80 nipples and PVC Schedule 80 threaded fittings.
 5. Joint sealant: Use only Teflon-type tape pipe joint sealant on plastic threads. Use non-hardening, nontoxic pipe joint sealant formulated for use on water-carrying pipes on metal threaded connections.
- E. Dielectric Fittings:
1. Use a dielectric union wherever a copper-based metal (copper, brass, bronze) is joined to an iron-based metal (iron, galvanized steel, stainless steel).
 2. Union shall be a WATTS, model Series 3000, 3003, 3004 for pipe up to 2", 3100, 3110, 3200 (flanged) for 3" and 4" piping, or WILKINS DU Series for pipe up to 2". Installed model number depends on pipe size and material joined.
- F. Flanged Connections:
1. Bolts, Nuts, and Washers: Bolts and nuts for buried flanges, flanges located outdoors above ground, flanges located in open vaults and structures, and submerged flanges shall be Type 316 stainless steel conforming to ASTM A 193, Grade B8M for bolts, and ASTM A 194, Grade 8M for nuts. A washer shall be provided for each nut. Washers shall be of the same material as the nuts.
 2. Gaskets for Flanged Joints: Gaskets for flanged joints shall be 1/8 inch thick, cloth-inserted rubber. Gaskets shall be suitable for a water pressure of 350 psi at a temperature of 180 degrees F. Gaskets shall be John Crane Company Style 777, Johns Manville No. 109, or approved equal.
- G. Pipe Wrapping (Protective Coatings): All buried piping shall be factory wrapped, with the exception of field wrapping at joint conditions, as follows:

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1. Underground steel piping buried directly in the soil shall be factory coated with asphalt, wrapped with asphalt saturated felt, finished with a coat of asphalt, and wrapped with an overwrap of 50 lb. kraft paper. Field wrapping of pipe shall not be acceptable except joints and risers to back flow preventers hose bibs, and the like field wrapped to 6 inches above finished grade.

2.6 MAINLINE COMPONENTS

- A. Design of the irrigation mainline components shall contain compatible hardware systems. Components associated to the system may include but are not limited to:
 1. Backflow Prevention Assembly: Owner approved backflow prevention units shall be used.
 2. Booster Pump Assembly.
 3. Master Valve Assembly.
 4. Flow Sensor Assembly.
 5. Remote Control Zone Valve Assembly.
 6. Quick Coupling Valve Assembly.
 7. Isolation Shutoff Valve Assembly.
 8. Air relief / Vacuum relief Valve Assembly.
 9. Spring Loaded Check Valves.
 10. Surge/Shock (Water Hammer) Arrestors.
 11. Mainline Tracer Tape by Christy's. LATERAL LINE components

2.7 DECODER CONTROL SYSTEM COMPONENTS

- A. Irrigation Controller Unit:
 1. Automatic control system shall be developed within the design of the system. The controller unit shall accommodate all aspects of the design, including multiple schedules, repeat cycles. Controller units shall be enclosed in secure, weather and vandal resistant, locking housing manufactured expressly for that purpose. Controller cabinets shall not be installed within an irrigation spray pattern. Contractor shall add sprinkler heads and/or change nozzle arc patterns as required (quarter, half patterns) to fulfill this requirement.
 2. Wire markers: Pre-numbered or labeled with indelible non-fading ink, made of permanent, non-fading material.
 3. Primary surge protection arrestors: As per manufacturer's recommendations.
 4. Valve output surge protection arrestors: As per manufacturer's recommendations.
- B. Two-wire Decoder Control Cable:
 1. Irrigation decoder control cable shall be compatible with decoders shown on the plans and as determined by decoder manufacturer.
 2. A continuous run of wire shall be used between each remote control valve and the decoder wire connection. Under no circumstances shall splices be used without prior approval. Splices shall only appear within RCV valve boxes.

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3. The 2005 edition of the National Electrical Code ® requires that wires and cables subjected to voltages higher than 30 volts, such as decoder wire, are to be buried a minimum of 24" deep.
 4. Baseline 'biCoder' cable from the controller unit to each decoder/ remote control valve shall be approved for decoder use by the controller manufacturer. Minimum specification: 14/2 solid copper sheathed cable) within electrical conduit.
- C. Decoders:
1. Decoders shall be compatible with irrigation controller. The decoders shall be the type and models shown in the irrigation plans.
- D. Control Wire:
1. Splices: As presented in installation details.
- E. Decoder to Solenoid Wiring:
1. Electric 'decoder' wire from the controller unit to each remote control valve shall be Baseline approved (14/2 solid copper, Type UF cable), UL approved for direct underground burial.
 2. The decoders may be placed no further than 50 ft. from the valve it is servicing.
 3. Contractor shall provide five feet of slack wire coiled in the valve box at every decoder connection. Half of the wire shall go on each side of the decoder to permit withdrawal of the decoder for inspection and service.
 4. The decoder shall be secured with a zip tie to a small vertical stake (wood, PVC or rebar) in the valve box, bottom up.

2.8 DECODER CONTROL SYSTEM GROUNDING

- A. Irrigation Controller Unit:
1. The grounding circuit will include an 8'copper-clad steel ground rod, a copper ground plate and 50 pounds of PowerSet® earth contact material. Make connections with CadWeld®. No other connections shall be approved.
 2. Install the grounding cable and earth ground hardware at right angles to the two-wire path(s).
 3. Locate ground rods 8-12 feet from the controller.
 4. Ground cable shall be no smaller than AWG #6. The sweep from the controller for the grounding cable will be no smaller than 1 ½".
 5. Place the ground rod in a separate 10-inch round valve box to facilitate maintenance.
- B. Decoders:
1. Decoder grounding equipment includes a copper ground plate and 50 pounds of PowerSet® earth contact material.
 2. Grounding shall occur at every 12th decoder or 500 ft. of wire, whichever comes first.

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3. Grounding shall occur at the last decoder in any wire run.
4. Grounding plate shall be installed perpendicular to the wire path and NOT pointing towards another decoder or wire path to ensure that the lightning's energy leaving the plate does not transfer to other parts of the system.

2.9 HYDROMETER/MASTER VALVE

- A. Master Valve/Hydrometer shall be of the manufacturer, size, and type indicated on the drawings.

2.10 HYDROMETER/FLOW SENSOR

- A. Hydrometer shall be of the manufacturer, size, and type indicated on the drawings.

2.11 REMOTE CONTROL VALVE

- A. Automatic control valves shall be of the manufacturer, size, and type indicated on the drawings.
- B. Controller station identification number shall be standard 'reclaimed water' purple tags with permanent numbers by Christy or accepted equal, attached to control wire at solenoid.
- C. Provide and install one control valve box for each electric control valve.

2.12 ID TAGS

- A. RCV ID tags shall be manufactured by T. Christy Enterprises (800) 258-4583; or approved equal. Model shall be ID-STD-Y1 for domestic water systems or shall be ID-STD-P1 for reclaimed water systems or as required by local code. Contractor shall be responsible for meeting local code requirements.
 1. All RCV's shall display the ID tag whether shown in the drawings or not.
- B. Equipment ID tags for recycled, reclaimed, or raw water systems shall be manufactured by T. Christy Enterprises (800) 258-4583; or approved equal. Model shall be ID-MAX-P2-RC006 or wording as required by local code. Contractor shall be responsible for meeting local code requirements.
 1. All equipment shall display the ID tag whether shown in the drawings or not.

2.13 ISOLATION VALVE

- A. All valves shall have a minimum working pressure of not less than 150 psi and shall conform to AWWA standards.
- B. RCV Isolation: LASCO model VXX101N Full Block True Union Ball Valve with EPDM seals.
- C. Mainline Shutoff: LEEMCO model LMB-xx (BB), self-restrained, resilient wedge gate valve for main line 3" and larger. Match main line size.

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2.14 QUICK COUPLING VALVE

- A. Quick coupler valves shall be of the manufacturer, size, and type indicated on the drawings.
- B. Hinge cover shall be the locking type constructed of brass with a rubber-like vinyl cover. Vinyl quick coupler cover to be purple in colour with the words "WARNING - RECLAIMED WATER - DO NOT DRINK" permanently marked on the lid.
- C. Provide and install one valve box for each quick coupler valve.

2.15 IRRIGATION HEADS/NOZZLES

- A. All sprinkler heads/nozzles shall be of the manufacturer, size and type, and deliver the same rate of precipitation with the diameter or radius of spray, operating pressure, and discharge rate in G.P.M. as shown on the Drawings.
- B. Pop-up heads shall be used as indicated on the drawings.
- C. Pop-up heads and gear driven rotors used on reclaimed water systems shall have a colour coded purple cap with reclaimed water warnings embossed on the top surface. Riser heads shall have a self adhesive reclaimed water sticker placed on the riser directly below the sprinkler body. All reclaimed water warnings shall be in English and Spanish and have the international symbol for "Do Not Drink". All reclaimed water warnings shall be as required by the local water utility.

2.16 AUTOMATIC SELF CLEANING FILTER FOR MAINLINE

- A. The filter assemblies shall be ORIVAL, model ORI-040-PE, 4" install filter on mainline before Hydrometer and after booster pump assembly. Contact ORIVAL representative for additional information on installation. Install per manufacturers specifications and recommendations.

2.17 AIR RELIEF VALVE/ASSEMBLY

- A. The air relief valves shall be of the manufacturer, size, and type indicated on the drawings.

2.18 VALVE BOXES

- A. Landscape Fabric for Valve Box Soil Separation
 - 1. Landscape fabric for valve box assemblies shall be a 4.8-6.0 oz/sq. yd. weight woven-needlepunch or non-woven polypropylene material landscape fabric.
 - a. For woven material the minimum puncture strength shall be no less than 50 lbs. and maximum flow rate shall be no more than 12 gpm per square foot.

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- b. For non-woven material the minimum burst strength shall be no less than 320 psi and maximum flow rate shall be no more than 120 gpm per square foot.
2. Fabric manufacturer and type may be: Christy's 4.8 oz. Lifetime; Dewitt PRO 5 woven needle punch; TenCate-Mirafi 150N; Landscape Fabric Landscaper's Choice or Professional's Choice.

2.19 TRANSITION FITTINGS

- A. Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.
- B. Plastic-to-Metal Transition Fittings
 1. Description: PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-socket or threaded end AWWA C219, metal sleeve-type coupling for underground pressure piping.
- C. Plastic-to-Metal Transition Unions
 1. Description: MSS SP-107, PVC four-part union. Include one brass or stainless-steel threaded end, one solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.
- D. Transition Couplings
 1. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

2.20 TRACER/MARKING TAPE

- A. Set tracer tape flat over all irrigation mainlines. Install tracer tape 6" above mainlines and minimum 12" below finish grade. Tracer tape shall be minimum 3" wide, except when otherwise noted. Tape shall be 5.0 mil 100% virgin polyethylene, acid, alkaline and corrosion resistant, with a 2.0 mil solid aluminum foil core encapsulated within a polyethylene (2.55 mil) backing.
 1. Blue color used with potable water, tape Model No. TA-DT-3(6)-BI to read: "CAUTION IRRIGATION LINE BELOW".
 2. Purple color used with non-potable water or recycled/reclaimed water, tape Model No. TA-DT-3-PRW to read: "CAUTION RECYCLED / RECLAIMED WATER LINE BELOW".
 3. Use 3" wide tape on all lines 4" and smaller.
 4. Use 6" wide tape on all lines 6" and larger.
 5. When telephone wire in conduit is run, such as from automatic controllers to automatic controller to telephone cabinets inside buildings, place 3" tracer tape Model No. TA-DT-3-OT red color over the conduit.

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6. Tape shall be as manufactured by T. Christy Enterprises (800) 258-4583 or Architect's approved equal. Install as per manufacturer instructions and recommendations.

2.21 THRUST BLOCKING

- A. Use cast-in-place concrete bearing against undisturbed soil. Install per pipe manufacturers recommendations for thrust blocking. The size of the blocks shall be determined by the average safe soil bearing load of 1500 lbs. per square foot. Thrust blocking shall be required on all mainline pipes 3" and larger, which are not installed using ductile iron fitting joint restraints. Although PVC fitting manufacturers do not require the use of thrust blocking on solvent weld joints because the joints are fused and/or bonded together this project does require the use unless the contractor can unequivocally demonstrate the Irrigation Consultant proper glue techniques on all glued joints and pressure testing of the joints up to 3x the system static pressure or 2x the system operating pressure. This pressure testing is in addition to the mainline pressure testing required under the Mainline Hydrostatic Pressure Test.

2.22 PVC CEMENT AND PRIMER

- A. All solvent cementing of plastic pipe and fittings shall be a two-step process, using primer and solvent cement applied per the manufacturer's recommendations or deviation as shown below. Cement shall never be stored in sun or without lid covering the container during use. Cement shall be of a fluid consistency, not gel-like or ropy. Solvent cementing shall be in conformance with ASTM D2564 and ASTM D2855.
- B. Solvent cement for P.V.C. solvent-weld pipe and fittings shall be manufactured by Weld-On; or accepted equal. Weld-On P-70 primer shall be used on ALL solvent-weld mainline joints and on lateral line joints greater than 1 inch, unless required by local code. Christies "Red-Hot" Glue without primer is not an accepted equal for any size. Installation methods as prescribed by the manufacturer.
- C. Weld-On #P-70 Primer. This Weld-On PVC primer may be used on all lateral pipe and shall be used on all mainline pipe of any size.
- D. Weld-On #2721. This Weld-On blue glue may be used on all lateral pipe and mainline pipe up to 4". It shall not be used on any pipe larger than 1¼" without the use of P-70 Primer. It shall never be used to make solvent cemented joints on mainline pipe without the use of P-70 Primer. It shall never be used to make solvent cemented joints on any SCH 80 pipe or fittings without the use of P-70 Primer.
- E. Weld-On #2711. This Weld-On gray glue may be used on all lateral pipe and mainline pipe up to 12". It shall never be used to make solvent cemented joints on mainline or lateral pipe without the use of P-70 Primer. It shall never be used to make solvent cemented joints on any SCH 80 pipe or fittings without the use of P-70 Primer.

2.23 MISCELLANEOUS EQUIPMENT

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- A. Rain sensor shall be of the manufacturer, size, and type indicated on the drawings.
- B. Direct burial wire connector kits shall be Connector King Corp. pre-filled with XR compound. Use with wire nuts only. Use Model SA101, Model SA102, or Model SP1-F Splice-All for the following connections:
 - 1. SA101; One or two #14 wires and RCV solenoid wire.
 - 2. SA101; One #12 'control' wire and RCV solenoid wire.
 - 3. SA102; Three #14 wires and RCV solenoid wire.
 - 4. SA102; One to three #12 wires and RCV solenoid wire.
 - 5. SA102; One to three #10 wires and RCV solenoid wire.
 - 6. SP1-F; Up to four #8 wires, allows for two splices within unit.
- C. Anti-drain valves for sprinklers shall be of the manufacturer, size, and type indicated on the drawings.
 - 1. Anti-drain valves will have threaded connections the size of the riser or pipe they are to be installed onto, or the next available size. No slip connection anti-drain valves are allowed.

2.24 OTHER COMPOTENTS

- A. Tools and Spare Parts: Provide operating keys, servicing tools, test equipment, other items, and spare parts shall be coordinated with Owner's Authorized Representative.

PART 3 - EXECUTION

3.1 INSPECTIONS AND REVIEWS

- A. Site Inspections:
 - 1. Verify that field conditions are acceptable and are ready to receive work. Obtain in writing from General Contractor that site grading has been completed and is in accordance to the civil drawings.
 - 2. Report irregularities to the Landscape Architect / Owner's Authorized Representative prior to beginning work. If the Landscape Architect / Owner's Authorized Representative is not contacted, Contractor shall be held responsible and/or liable for all issues that may arise due to site conditions and/or irregularities.
 - 3. Verify location of existing utilities.
 - 4. Verify that required utilities are available in proper location and ready for use
 - 5. Beginning work of this section implies acceptance of existing conditions.
- B. Irrigation System Layout Review: Irrigation system layout review will occur after the layout has been completed. Notify the Landscape Architect / Owner's Authorized Representative a minimum of two business days in advance of review. Modifications will be identified by the Landscape Architect / Owner's Authorized Representative at this review.

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- C. Verify locations of underground utilities.

3.2 LAYOUT OF WORK

- A. Stake out the irrigation system. Items staked include: sprinklers, pipe, control valves, controller, and isolation valves.

3.3 EXCAVATION, TRENCHING, AND BACKFILLING

- A. Excavate to permit the pipes to be laid at the intended elevations and to permit work space for installing connections and fittings.
- B. Size trenches and other excavations to accommodate the irrigation system components, conduits, pipe bedding material and other required facilities. Provide additional space to assure proper installation and access for inspections. Minimum 2 inches side clearance on each side of the pipe or conduit shall be provided in all trenches unless otherwise specified. At no time shall pipelines or equipment be subject to unnatural stress due bending from trenching of inadequate width or depth. Contractor shall reinstall any such situation determined by Irrigation Consultant, Landscape Architect, or Owner's representative and may be subject to complete system investigation if such occurrence is found.
- C. No mechanical trenching shall be allowed closer than the dripline of any existing tree. 10 feet from any existing tree trunk of 5 inches in diameter or larger or the actual drip zone of the tree, whichever is greater. Trenching required within the radius limit of affected trees shall be accomplished by hand trenching only. Precautions shall be taken to avoid damaging roots greater than one inch in diameter of any tree. Any damage to a tree resulting in the loss of vigor or life of tree shall require contractor to replace tree with equal size and shape at no cost to the Owner. Pipe routing as shown on drawings is diagrammatic.
- D. Minimum cover over all pipe and wire shall be as presented in the installation details.
- E. Backfill only after lines have been reviewed and tested.
- F. Make the bottom of trenches true to grade and free of protruding stones, roots, or other matter which would prevent proper bedding of pipe or other facilities.
- G. Bed mainline pipe in at least 2-inches of finely divided material or cleaned sand to provide a firm, uniform bearing. Surround the pipe with additional finely divided material or clean sand to at least 2-inches over the top of the pipe.
- H. Backfill balance of trench with clean earth material and applicable base material. Excavated material is generally satisfactory for backfill. Backfill shall be free from rubbish, plant matter, and stones larger than 2 inches in maximum dimension. Remove all material not suitable for backfill.

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- I. Backfill trenches so that the specified thickness of topsoil is restored to the upper part of the trench and compacted to 90% relative compaction.
- J. Backfill shall be mechanically compacted in landscaped areas to a dry density equal to adjacent undisturbed soil in planting areas. Backfill will conform to adjacent grades without dips, sunken areas, humps, or other surface irregularities.
- K. Backfill unsleeved pipe in either of the following manners:
 - 1. Backfill and puddle the lower half of the trench. Allow to dry 24 hours. Backfill the remainder of the trench in 6-inch layers. Compact to density of surrounding soil.
 - 2. Backfill the trench by depositing the backfill material equally on both sides of the pipe in 6-inch layers and compacting to the density of surrounding soil.
- L. Enclose pipe and wiring beneath roadways, walks, curbs, etc., in sleeves. Minimum compaction of backfill for sleeves shall be 95% Standard Proctor Density, ASTM D 698-78. Use of water for compaction around sleeves, "puddling," will not be permitted.
- M. Dress backfilled areas to original grade. Incorporate excess backfill into existing site grades.
- N. Resurface trenches through paved areas to match existing pavement. Contractor shall repair and bring up to grade any trenches that settled after installation.
- O. Flooding of trenches will be permitted only with approval by the Landscape Architect.
- P. Where utilities interfere with irrigation trenching and pipe work, contact the Owner's Authorized Representative for trench depth adjustments. Contractor shall be responsible for documenting adjustments determined by Owner's Authorized Representative. If Owner's Authorized Representative is not contacted Contractor shall be held responsible and/or liable for all issues that may arise due to trench depth.
- Q. If settlement occurs and subsequent adjustments in pipe, valves, sprinkler heads, lawn, planting, or other construction are necessary, the Contractor shall make all required adjustments without additional cost to the Owner.

3.4 SLEEVING AND BORING

- A. Install sleeving at a depth which permits the encased pipe or wiring to remain at the specified burial depth.
- B. Extend sleeve ends twelve inches beyond the edge of the paved surface. Cover pipe ends and mark with stakes. Mark concrete with a chiseled "X" at sleeve end locations.
- C. Bore for sleeves under obstructions which cannot be removed. Employ equipment and methods designed for horizontal boring.

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3.5 ASSEMBLING PIPE AND FITTINGS

A. General:

1. Keep pipe free from dirt and pipe scale. Cut pipe ends square and debur. Clean pipe ends.
2. Keep ends of assembled pipe capped. Remove caps only when necessary to continue assembly.
3. In solvent welding, use only the specified primer and solvent cement and make all joints in strict accordance with the manufacturer's recommended methods including wiping all excess solvent from each weld. Allow solvent welds at least 15 minutes setup time before moving or handling and 24 hours curing time before filling.

B. Mainline Pipe and Fittings:

1. Use only strap-type friction wrenches for threaded plastic pipe.
2. PVC Rubber-Gasket Pipe:
 - a. Use pipe lubricant. Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.
 - b. Pipe joint insertion installation shall be per pipe manufacturer's specifications. Minimum default specification shall be PW Eagle Pipe (1-800-347-0200) Technical Bulletin TB-17, See PW Eagle website www.pwpipe.com/literature/tb/tb-i7.pdf.
3. PVC Solvent Weld Pipe:
 - a. Use primer and solvent cement. Join pipe in a manner recommended by the manufacturer and in accordance with accepted industry practices.
 - b. Cure for 15 minutes before handling and 24 hours before allowing water in pipe.
 - c. Snake pipe from side to side within the trench.

C. Lateral Pipe and Fittings

1. Use only strap-type friction wrenches for threaded plastic pipe.
2. PVC Solvent Weld Pipe:
 - a. Use primer and solvent cement. Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.
 - b. Cure for 15 minutes before handling and 24 hours before allowing water in pipe.
 - c. Snake pipe from side to side within the trench.
3. UV Radiation Resistant Polyethylene Pipe:
 - a. Join pipe in the manner recommended by manufacturer and in accordance with accepted industry practices.
 - b. Snake pipe from side to side on the soil surface, and hold in place with tubing stakes spaced every four feet.

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D. Specialized Pipe and Fittings:

1. Copper Pipe:
 - a. Buff surfaces to be joined to a bright finish. Coat with solder flux.
 - b. Solder so that a continuous bead shows around the joint circumference.
2. Insert a dielectric union wherever a copper-based metal (copper, brass, bronze) and an iron-based metal (iron, galvanized steel, stainless steel) are joined.
3. PVC Threaded Connections:
 - a. Use only factory-formed threads. Field-cut threads are not permitted.
 - b. Use only Teflon-type tape.
 - c. When connection is plastic-to-metal, the plastic component shall have male.
4. Make metal-to-metal, threaded connections with Teflon-type tape or pipe joint compound applied to the male threads only.

3.6 INSTALLATION OF THRUST BLOCKING FOR MAINLINE

- A. Use cast-in-place concrete bearing against undisturbed soil. Install per pipe manufacturers recommendations for thrust blocking. Thrust blocking shall be used on all changes of direction for main line pipe 2 ½" and larger, not installed using ductile iron fitting joint restraints. Examples as shown in drawing detail: Thrust Blocking.

3.7 INSTALLATION OF RECLAIMED WATER PIPELINE

- A. To comply with County Health requirements the contractor shall paint all reclaimed water, gate valve, quick coupler, flushing hydrant, air release, and remote control valve boxes and vaults on the inside and on the top of the cover with purple (Pantone 512) paint an stencil in Minimum ¾" high white letters stating "CAUTION: RECLAIMED WATER – DO NOT DRINK". Contractor shall comply with the following:
1. The Contractor shall arrange for continuous inspection of piping by the Los Angeles County Health Department, Cross Connection Program.
 2. No excavation or open trench may be backfilled without first securing Los Angeles County Health Department approval.
 3. The Contractor shall expose all potable water lines where new irrigation pipe crosses old or new domestic lines.
 4. Unused or abandoned water lines (domestic or other) are to be severed as close to the water mains as practicable, capped and a 10-foot section of abandoned line removed and cemented under County Health Department Supervision.
 5. Parallel construction: A minimum of 10 feet separation shall be maintained between domestic and reclaimed water lines.
 6. Cross-over construction: Keep pipes as close to 90 degrees as possible, with one foot separation from the outside edges of the pipes, with potable pipe above reclaimed wherever possible. Center full pipe length over the crossing.
 7. Alternate cross-over construction: Either the potable or reclaimed water lines may be sleeved with the same class pipe for one full pipe length, (minimum 10 feet) centered over the cross-over.

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8. Potable and reclaimed water lines may not be laid in a common trench.
9. Pipe bedding and backfill requirements shall be the same as for installation of potable water lines.
10. Contractor shall obtain and pay for any plumbing permits required from the Owner Department of Building and Safety.

3.8 INSTALLATION OF MAINLINE COMPONENTS

- A. Backflow Prevention Assembly: Install generally where indicated on the drawings or per Landscape Architect / Owner's Representative's direction.
- B. Backflow Prevention Assembly Enclosure: Install over backflow assembly per manufacturer's specification and installation instructions. Enclosure pad shall as indicated on the drawings.
- C. Master Valve Assembly: Install generally where indicated on the drawings.
- D. Flow Sensor Assembly: Install generally where indicated on the drawings. Install no less than 10x pipe diameter downstream of master valve with no fittings between master valve and flow sensor, and no closer than 5x pipe diameter upstream of any fitting or change in direction.
- E. Remote Control Valve Assembly: Install generally where indicated on the drawings.
- F. Isolation Valve Assembly: Install generally where indicated on the drawings.
- G. Quick Coupling Valve Assembly: Install generally where indicated on the drawings.
- H. Air relief / Vacuum relief Valve Assembly: Install generally where indicated on the drawings.
- I. Spring loaded check valves: Install generally where indicated on the drawings.
- J. Surge/Shock 'Water Hammer' Arrestor: Install arrestor(s) in lateral pipe within 4' of downstream side of each zone RCV where the shock wave is observed. When RCV's are grouped within a manifold then the arrestor(s) may installed within 4' of last RCV in manifold to cover all RCV's within the manifold. When the manifold is longer than 4' then the manifold will be required to be split into 4' sections, or install arrestor(s) for individual RCV's. Installation costs incurred shall be discussed and agreed upon with Owner before work is to commence.

3.9 INSTALLATION OF LATERAL LINE COMPONENTS

- A. Spring-loaded Drain Valves for Freeze Protection:
 1. Install at all LOW points along lateral lines. Contractor shall slope lateral line trenches at a 0.75% slope towards the middle of a section from beginning and from end of a section for all lateral line piping.

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2. Length of pipe section for drainage may be determined by mitigating factors on the job site: such as length of run; hardscape corners; concrete; footings; utilities; etc. but no longer than 100 feet in length.
3. Provide a drain outlet at the section middle and at all other low points within the system.
4. Contractor may slope the section from beginning to end with a drain valve installed at end of the section. Section shall be no longer than 100 feet.
5. Provide adequate drainage below drain valve to allow for all water to leave piping. At no time shall vacated water sit at same level or above drain valve opening.
6. After installation, drain valve shall be covered with a textile cover or other non-penetratable cover, such as the same barrier as used in the RCV valve boxes. At no time shall soil be allowed to contact drain valve, valve fitting, or aggregate below valve.
7. Install 6" round valve box over drain valve with extensions as required to mark valve location.

3.10 PIPELINE/FITTING STRESS

- A. At no time shall pipelines, pipe fittings, or equipment be subject to unnatural stress due bending from trenching of inadequate width or depth or improper cut lengths of pipe. Contractor shall reinstall any such situation determined by Irrigation Consultant, Landscape Architect, or Owner's Representative and may be subject to complete system investigation if such occurrence is found.

3.11 LINE CLEARANCES

- A. When two or more pipelines are installed in the same trench, separate the pipelines by a minimum horizontal clear distance of 4 inches. Install them so that each pipeline, valve, or other pipeline component may be serviced or replaced without disturbing the other.
- B. All irrigation water lines shall have a minimum clearance 12 inches from lines of other trades.
- C. In all pipe trenches, provide minimum 2-inch side clearances.
- D. Parallel lines shall not be installed directly over one another.
- E. When pipelines run parallel in separate trenches they shall be separated horizontally by a minimum distance of 12".

3.12 INSTALLATION OF CONTROL SYSTEM COMPONENTS

- A. Irrigation Control System:
 1. The exact location of the controller shall be approved by the Landscape Architect or Owner's Authorized Representative before installation. The electrical service shall be coordinated with this location.

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2. The Irrigation Contractor shall be responsible for the final 117 volt electrical hook up to the irrigation controller.
3. Install all control system components in accordance with local codes and manufacturer's specifications and instructions.
4. Provide all necessary wiring for a complete installation between the controller and the valves.
5. Provide a grounding connection to known ground as required for lightning protection. Each controller shall have its own independent ground wire.
6. Label each controller, using permanent markings, with the letter identification indicated on the Plans. Affix label on the inside of the controller cabinet door.
7. Remote control valves shall be connected to decoders' controller in numerical sequence as shown on Drawings.
8. The irrigation system shall be programmed to operate during the periods of minimal use of the design area or in accordance with the irrigation schedule provided.

B. Irrigation Conduit Waterproofing:

1. Contractor shall be responsible for the waterproofing of all walls and deck penetrations from all irrigation piping and electrical conduits run through the structure to any outside location. Contractor shall also administer any other requirements as determined by the Engineer for proper installation and fit to return, to a watertight condition, all penetrations from construction.

3.13 CONTROLLER GROUNDING

- A. All grounding of the irrigation control system shall be per the American Society of Irrigation Consultants; ASIC Guideline 100-2002 For Earth Grounding Electronic Equipment in Irrigation Systems. Contractor shall have said guideline available for review on the job site at all times by the Landscape Architect / Owner's Authorized Representative, or Irrigation Consultant. Contact ASIC www.asic.com (312) 372-7090 for information on obtaining this document.

B. Irrigation Controller Unit:

1. The grounding circuit will include (a) minimum of one/three (may require additional, see B.5 below) U.L. approved 8' copper-clad steel ground rod(s) or (a) copper ground plate(s) and 50 pounds of PowerSet® earth contact material. Make connections with the CadWeld® "One-Shot" process only. No other connections shall be allowed or approved.
2. Locate ground rods no less than 12 feet and no more than 15 feet from the controller.
3. Ground conductor cable shall be no smaller than AWG #6. The PVC sweep ell from the controller for the grounding cable shall be no smaller than 1 ½" diameter in size.

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4. Place the ground rod in a separate 10-inch round valve box to facilitate maintenance.
5. Contractor shall measure the resistance of controller ground with the ERICO EST401 Ground Resistance Tester or other similar measuring device. The measured resistance shall not be more than 10 ohm's resistance or the manufacturer's specifications, if manufacturer's specifications are less than 10 ohms. Verified resistance reading shall be submitted to the irrigation consultant via photo.

3.14 ELECTRICAL TESTING OF WIRING SYSTEM AND COMPOTENTS

- A. Field tests shall be performed by the Contractor on all irrigation system conductors in accordance with the requirements specified herein prior to performing the functional tests. Where conductors are installed by trenching and backfilling, such tests shall be performed after at least six (6) inches of backfill material has been placed over the conductors and backfill material has been compacted. Refer to trenching details on the drawings.
- B. Prior to the start of the functional testing, the Contractor shall perform the following tests on all irrigation system electrical conductors in the presence of the Landscape Architect, Owner's Authorized Representative, or Irrigation Consultant.
 1. Each circuit shall be tested for continuity and open circuits.
 2. Each circuit shall be tested for grounds.
 3. An insulation resistance test at 500-volts DC shall be made on each circuit between the circuit and the ground. The insulation resistance shall not be less than 10-megaohms on all circuits.
 4. The functional test for all the electric automatic irrigation system(s) shall consists of a minimum of fifteen (15) working days of operation during which time the controller shall complete at least three (3) complete cycles automatically for each station. The lengths and frequencies of the cycles will be determined by the Landscape Architect, Owner's Authorized Representative, or Irrigation Consultant. If unsatisfactory performance of the system develops, the condition shall be corrected and the test repeated until fifteen (15) working days of continuous, satisfactory operation is obtained.
 5. The functional test shall be satisfactorily completed prior to the start of the plant establishment period.
 6. Repair to the irrigation system shall be made within five (5) working days of a malfunction or damage to any portion of the system. Contractor is responsible for maintaining the proper watering requirements for new or existing plant material affected by this malfunction during repair.

3.15 INSTALLATION OF SPRINKLER AND BUBBLER IRRIGATION COMPONENTS

- A. Sprinkler Assembly:
 1. Install sprinkler heads as designated on Drawings. Sprinkler heads shall be equivalent in all respects to those itemized in the irrigation equipment legend.

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2. Install pop-up sprinkler bodies ½" above finish grade in turf areas and 2" above finish grade or 1" above mulch cover whichever is greater in shrub areas.
 3. Spacing of sprinkler heads shall not exceed the maximum indicated on the Drawings. The spacing shall never exceed the maximum recommended by the manufacturer.
 4. Turf pop-up bodies shall be placed two (2) inches from any edge of adjacent walkway, concrete mow band, concrete curb, header board or other hardscape edging.
 5. Turf pop-up bodies shall be installed flush with the top of adjacent hardscape edging.
 6. Sprinkler head riser nipple sizes shall match or be the same as the riser opening of the sprinkler body.
 7. Install sprinkler heads with internal check valves where heads are located in low drainage areas, i.e. bottom of berms, bottom of drainage swales, toe of slopes, etc.
 8. Install per the installation details at locations shown on the drawings.
 9. Set sprinklers perpendicular to the finish grade.
 10. Set sprinklers at 52-67 degrees from perpendicular to grade on slopes 3:1 or greater.
 11. Supply appropriate nozzle or adjust arc of coverage of each sprinkler for best performance.
 12. Adjust the radius of throw of each sprinkler for best performance.
- B. Deep Well Bubbler Assembly:
1. See Plans and Legend for actual inclusion within project. Install deep well bubbler assembly per the installation details at locations shown on the drawings.

3.16 INSTALLATION OF REMOTE CONTROL VALVES

- A. Install per manufacturer's instructions and as detailed.
- B. Flush mainline before installation of RCV assembly.
- C. Install where indicated on the drawings. Wire connectors and waterproof sealant shall be used to connect control wires to remote control valve solenoid wires. Install connectors and sealant per the manufacturer's recommendations.
- D. If RCV pressure regulator is specified in irrigation legend, adjust the RCV pressure regulator as required to regulate the downstream dynamic (operating) pressure to 32 PSI at the farthest and/or highest sprinkler for spray zones, 45-50 PSI at the farthest and/or highest sprinkler for rotary nozzle zones, 40-45 PSI at the farthest and/or highest sprinkler for small to medium rotor zones, 80 PSI at the farthest sprinkler for large turf rotor zones.

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- E. Install one (1) electric remote control valve per box and whenever possible, group valve boxes together. Align boxes in a straight and neat row allowing at least 12" between valve boxes. Install boxes with lids ½" above finish grade in turf areas and 2" above finish grade or 1" above mulch cover whichever is greater in shrub areas.
- F. All valves shall be tagged for easy identification of valve number. Valve box lids shall be permanently marked 'RCV' and identifying controller letter and valve number in 2" high letters, branded in place.
- G. Install main line branches as required to locate valve boxes outside of turf areas, wherever possible. Actual located point on main line symbol within Drawing is diagrammatic only.

3.17 INSTALLATION OF FLOW SENSING EQUIPMENT

- A. Install at general location where indicated on the Drawings. Install per manufacturer's instructions and as detailed. Actual located symbol on main line within Drawing is diagrammatic only.
- B. Locate valve boxes ½" above finish grade in turf areas and 2" above finish grade or 1" above mulch cover whichever is greater in shrub areas.
- C. Valve box lids shall be permanently marked identifying 'FS' in 2" high letters, branded in place. See Irrigation Legend for flow sensor type.

3.18 INSTALLATION OF ISOLATION VALVES

- A. Install at locations where indicated on the Drawings. Install per manufacturer's instructions and as detailed.
- B. Locate valve boxes ½" above finish grade in turf areas and 2" above finish grade or 1" above mulch cover whichever is greater in shrub areas.
- C. Valve box lids shall be permanently marked identifying 'BV' for ball or butterfly valve and 'GV' for gate valve in 2" high letters, branded in place. See Irrigation Legend for valve type.

3.19 INSTALLATION OF QUICK COUPLER VALVES

- A. Install at locations where indicated on the Drawings. Install per manufacturer's instructions and as detailed.
- B. Locate valve boxes ½" above finish grade in turf areas and 2" above finish grade or 1" above mulch cover whichever is greater in shrub areas. Install twelve inches (12") from walkways, curbs, header boards, etc., and within planted area whenever possible.
- C. Valve box lids shall be permanently marked identifying 'QCV' in 2" high letters, branded in place.

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- D. Install main line sub-branches as required to locate valve boxes outside of turf areas, wherever possible. Actual located point on main line symbol within Drawing is diagrammatic only.

3.20 INSTALLATION OF MISCELLANEOUS EQUIPMENT

- A. Install all assemblies specified herein according to the respective detail drawings or specifications, using best standard practices.
- B. Install rain sensors as indicated in the drawings or as recommended by the manufacturer.
- C. Install wire connectors as indicated in the drawings or as recommended by the manufacturer.
- D. Unless designed as an integral part of the irrigation head, anti-drain valves will be installed directly under every head. The anti-drain valve will be the same diameter as the riser and be integral to the riser assembly.

3.21 FLUSHING THE SYSTEM

- A. After new mainline and remote control valve stub-outs are in place, all necessary diversion work has been completed, and prior to installation of RCV's, the mainline POC shall be opened and a full head of water used to flush out the system. The remote control valve PVC stub-outs shall be capped one-by-one as they flush clear water, starting with the stub-out closest to the POC.
- B. After completion of installation of all RCV's and mainline isolation valves, thoroughly flush the entire pipeline system to remove dirt, scale, PVC chips, or other material. Flushing shall start with the valve closest to the point of connection and proceed with each consecutive valve toward the valve farthest from the point of connection. Each lateral system shall have each riser capped during the flushing commencing with the riser closest to the valve and proceeding to the farthest riser.
- C. After all new lateral pipe lines and risers are in place and connected, all necessary diversion work has been completed, and prior to installation of sprinkler heads, drip tubing, drip risers and emitters, the control valve shall be opened and a full head of water used to flush out the system through all lateral and sub-lateral piping.
- D. Sprinkler heads, bubbler heads, and/or drip emitters shall be installed only after the system has been flushed.
- E. Only after flushing the mainline, conduct the Mainline Hydrostatic Pressure Testing. See section 1.11.

3.22 INSTALLATION OF OTHER COMPONENTS

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- A. Tools and Spare Parts:
 - 1. Prior to the Pre-Maintenance Inspection supply to the Owner, the operating keys, servicing tools, test equipment, and any other items indicated on the drawings.
 - 2. Prior to Final Inspection supply to the Owner, the spare parts indicated in the General Notes/Specifications.
- B. Other Materials: Install other materials or equipment to be part of the irrigation system, even though such items may not have been referenced in these specifications.

3.23 SITE OBSERVATION SCHEDULE

- A. System Test
 - 1. Mainline and installed RCV manifold and QCV manifold review.
 - 2. Mainline Hydraulic test.
- B. Sprinkler Layout
- C. Sprinkler Coverage Test
- D. Pre-maintenance Review
 - 1. Project 'punch list' shall be created on this review walk.
 - 2. If more than one pre-maintenance review is required, Contractor shall pay for additional on-site time and travel expenses incurred by the Landscape Architect and/or Irrigation Consultant. Additional pre-maintenance reviews shall not be scheduled until Contractor has paid all previous invoiced reviews in full.
- E. Final Pre-maintenance Review
 - 1. Maintenance period shall not begin until final review has occurred and project has been accepted for period to start.
 - 2. The Contractor shall have completed all items on the 'punch list' before final review can take place.
 - 3. Final acceptance of irrigation system will not occur until all items on the punch list are completed to the satisfaction of the Landscape Architect and/or Irrigation Consultant.
 - 4. If more than one final review is required, Contractor shall pay for additional on-site time and travel expenses incurred by the Landscape Architect and/or Irrigation Consultant. Additional final reviews shall not be scheduled until Contractor has paid all previous invoiced reviews in full.
- F. Final Inspection After Maintenance Period
 - 1. Maintenance period shall not conclude until this final review has occurred and project has been accepted by Landscape Architect.
 - 2. If more than one final review after maintenance period is required, Contractor shall pay for additional on-site time and travel expenses incurred by the Landscape Architect and/or Irrigation Consultant. Additional final reviews shall not be scheduled until Contractor has paid all previous invoiced reviews in full.

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G. Additional Reviews

1. Additional reviews may be required because of installation related issues generated by the Contractor. Additional reviews are generally required when materials, equipment, and installation procedures are observed to not be according to the irrigation plans and specifications. If this is the case, the Contractor shall be informed by Landscape Architect or Irrigation Consultant as to the issue(s) before the review is conducted.
2. If additional reviews for installation related issues are required, Contractor shall pay for additional on-site time and travel expenses incurred by the Landscape Architect and/or Irrigation Consultant. Additional reviews shall not be scheduled until Contractor has paid all previous invoiced reviews in full.

3.24 FIELD QUALITY CONTROL

A. Adjustment of the System

1. The Contractor shall flush and adjust all sprinkler heads for optimum performance and to prevent over-spray onto walks, roadways, and buildings as much as possible.
2. If adjustments in the irrigation equipment will provide proper and more adequate coverage, the Contractor may also include changes in nozzle sizes and degrees of arc as required.
3. Lowering raised sprinkler heads by the Contractor shall be accomplished within ten days after notification by Irrigation Consultant or Landscape Architect.
4. All sprinkler heads shall be set perpendicular to finished grade unless otherwise designated on Drawings or as required for proper coverage.
5. The Contractor shall adjust the flow control at each valve to obtain the optimum operating pressure for each system, and adjust to provide the operating pressure shown on the irrigation legend to farthest sprinkler from the valve.

3.25 MAINTENANCE

- A. The entire sprinkler irrigation system shall be under fully automatic operation for seven days prior to any planting and for 365 days after system inspection to begin maintenance period.
- B. The Contractor shall continuously maintain all irrigation systems involved in this contract during the progress of the work and during the maintenance period until final acceptance of the work by the Landscape Architect and the Owner's Authorized Representative. Improper maintenance at the conclusion of the scheduled maintenance period may cause postponement of the final completion date of the Contract. Maintenance shall be continued by the Contractor until all work is acceptable. In order to carry out the maintenance work, the Contractor shall furnish sufficient personnel and adequate equipment to perform the work during the maintenance period. Maintenance period shall not start until all elements of construction and

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irrigation for the entire project are in accordance with the Drawings and Specifications. The Contractor shall request an inspection to begin the maintenance period after all irrigation and related work has been completed.

- C. The Landscape Architect / Owner's Authorized Representative reserves the right to waive or shorten the maintenance period.
- D. End of maintenance shall occur only on the written acceptance of the project of the Landscape Architect / Owner's Authorized Representative.

3.26 FINAL OBSERVATION PRIOR TO ACCEPTANCE

- A. The Contractor shall operate each entire system in Owner's Authorized Representative presence at the time of final acceptance. Any items deemed as unacceptable by the qualified observer shall be reworked to the complete satisfaction of the Owner's Authorized Representative.
- B. The Contractor shall show evidence to the Landscape Architect / Owner's Authorized Representative that the Owner has received all accessories, charts, Record Drawings, and equipment as required before final acceptance can occur.
- C. Prior to the date of the final inspection, the Contractor shall deliver to the Landscape Architect / Owner's Authorized Representative the "Landscape and Irrigation Guarantee" as required.

3.27 PROJECT RECORD DRAWINGS

- A. Fourteen days prior to final inspection of work, obtain from the Landscape Architect / Owner's Authorized Representative a reproducible Mylar copy of the Drawings. Submit Record Drawings plotted onto vellum sheets to Landscape Architect / Owner's Authorized Representative for review. Using technical drafting pen duplicate information contained on the As-Built Drawings maintained on site. Lettering shall be of the same size and style as is shown on the drawings. Contractor shall be held accountable for readable drawings as determined by the Landscape Architect and shall make revisions to the copy until gaining approval by the Landscape Architect / Owner's Authorized Representative. Contractor shall be responsible for all plotting costs.
- B. Record work which is installed differently than shown on the construction drawings. Record accurate reference dimensions, measured from at least two permanent reference points, mainline routing, of each irrigation system valve, each backflow prevention device, each controller or control unit, each sleeve end, and other irrigation components enclosed within a valve box.
- C. Label each Irrigation sheet "Record Drawing". On the first sheet, the Contractor or resident superintendent shall execute the following statement: *Having reviewed this document and all attachments, I affirm that, to the best of my knowledge, the information presented here is true and accurate.*

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Signed: _____ Date: _____ Position:

- D. Upon approval, produce Project Record Drawings in electronic form using AutoCAD drafting software 2008 or later version.
1. If unable to complete an electronic form of the Record Drawings deliver approved Record drawings to Irrigation Consultant, Brinkerhoff and Associates, (760) 703-7108. Brinkerhoff and Associates shall provide electronic drafting as a separate service to the Contractor. Service fee shall be according to project size. Brinkerhoff and Associates shall determine fee and contractor shall pay fee before work is to commence. Brinkerhoff and Associates shall input Record Drawing information from Contractor into electronic files using AutoCAD 2008 drafting software or later version and shall transmit electronic Record Drawings to the Landscape Architect.
- E. At Final Review site inspection deliver a reproducible Mylar copy of approved Record Drawings and also electronic drawings on a copy-enabled CD to Landscape Architect CD shall be clearly marked with the project name, file descriptions and date.

3.28 CONTROLLER CHARTS

- A. Prior to Pre-Maintenance inspection, prepare and deliver a reduced copy of the as-built plans from irrigation AutoCAD project record files produced from AutoCAD software, with irrigation zones clearly highlighted in differing colors and each valve number clearly highlighted at the reduced scale to the Landscape Architect . The reduced zone plan shall be sized to fit flat within the controller, laminated in plastic, and placed in the controller. Size of project shall determine number of sheets. If more than one sheet is required then sheets shall be attached together with a key ring.
1. Irrigation Consultant, Brinkerhoff and Associates (760) 703-7108, shall provide the controller chart drafting and color-up as required for a fee billed to the irrigation contractor. Service fee shall be according to size of project. Brinkerhoff and Associates shall determine fee and contractor shall pay fee before work is to commence.
 2. Contractor shall deliver as-built record drawings in electronic AutoCAD files to Brinkerhoff and Associates in CD for creation of the controller charts.
 3. Contractor shall be responsible for printing and lamination as required.
- B. Contractor shall provide the Landscape Architect with the same color coded irrigation station chart on laminated 11x17 sheets (2 copies).
- C. Fourteen days prior to Final inspection, provide a 12-month controller run-time schedule chart for each IRRIGATION ZONE on the controller to the Landscape Architect for review. After approval, place on back side of laminated color-highlighted as-built irrigation plan. Controller run-time schedule charts shall be developed using historical evapotranspiration rates for the area, individual zone precipitation rates, necessary crop factors, and irrigation system efficiencies by zone as the basis for the

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schedule and shall show such within the chart. If repeat cycles are required due to runoff issues, note the proper number of repeat operations and the timing of each repeat. The total run time for all daily cycles shall not be longer than the maximum allowed water window per local water agency regulations. The watering days per week or month shall be such as to permit system operation to be close to the maximum water window allowed. Brinkerhoff and Associates, Irrigation Consultants (760-703-7108), provides a service to produce said controller run-time charts at Contractor's request. Service fees vary depending on the total zone count for each controller.

3.29 SITE DAMAGE

- A. Repair scars, ruts, or other marks in landscaped areas caused by Irrigation Contractor.
- B. Repair all scars, gouges, and any otherwise damage to sidewalks, walls, and any other hardscape or paved surfaces which is caused by Irrigation Contractor operations, equipment, or personnel. All repairs shall be and done in a manner as to return said repairs to original condition and to the Owner's Authorized Representative and Landscape Architect's satisfaction.

3.30 CLEANUP

- A. Dispose of waste, trash, and debris in accordance with applicable laws and ordinances and as prescribed by authorities having jurisdiction. Bury no such waste material and debris on the site. Burning of trash and debris will not be permitted. The Contractor shall remove and dispose of rubbish and debris generated by his work and workmen at frequent intervals or when ordered to do so by the Landscape Architect or Owner's Authorized Representative.
- B. Upon completion of work, remove from site machinery, tools, excess materials, and rubbish resulting from Contractor's operations.
- C. Clean and remove all tire marks left on paved surfaces by equipment used in Contractor operations as directed by Landscape Architect or Owner's Authorized Representative.
- D. Leave work areas in a neat and clean condition as accepted by the Landscape Architect and Owner's Authorized Representative. Sweep clean all paved areas.

- END OF SECTION -

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

SECTION 329201 - GRASSES AND WILDFLOWERS

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. Seeding.
- 2. Grasses and wildflowers.
- 3. Erosion-control material(s).

- B. Related Sections:

- 1. Division 31 Section "Site Clearing" for topsoil stripping and stockpiling.
- 2. Division 32 Section "Irrigation".

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.

- 1. Herbicides: Include product label and manufacturer's application instructions specific to this Project.

- B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

- 1. Certification of each seed mixture for grasses and wildflowers including identification of source and name and telephone number of supplier.

- C. Qualification Data: For qualified landscape Installer.

- D. Product Certificates: For soil amendments from manufacturer.

- E. Material Test Reports: For imported or manufactured topsoil.

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- F. Maintenance Instructions: Submit a grass and wildflower maintenance manual for one calendar year. Submit before expiration of required initial maintenance periods.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful grass and wildflower establishment.
 - 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 turf installation in addition to requirements in Division 01 Section "Quality Requirements."
 - 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 personnel assigned to the Work shall have certification in one of the following categories from the Professional Landcare Network:
 - a. Certified Landscape Technician - Exterior, with installation and maintenance specialty area(s), designated CLT-Exterior.
 - b. Certified Turfgrass Professional, designated CTP.
 - 5. Pesticide Applicator: State licensed, commercial.
- B. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, sealed containers bearing the supplier's certified analysis for percentages of mixture, purity, germination, hard seed, weed seed content, and inert material weight analysis, name and address of manufacturer, and indication of conformance with ams-01 and applicable state and federal laws. The contractor shall acquire all seed material of the required type, sizes and quantities through sources approved by the owner's representative.
 - 1. Seed treated with mercury compounds shall not be used.
 - 2. Weed seed shall not exceed 1 percent by weight of the total mixture.
 - 3. Wet, moldy, or otherwise damaged seed shall be rejected.
 - 4. Legume seed: shall be pellet-inoculated with a viable bacteria compatible for use with that species of seed. All inoculated seed shall be labeled to show the mass of seed, the date of inoculation, and the mass and source of inoculant materials. Legume seed shall be pellet-inoculated in accordance with the provisions in Bulletin 1842, "Range-Legume Inoculation and Nitrogen Fixation by Root-Nodule Bacteria," of the University of California, Division of Agriculture and Natural Resources. Inoculant shall be added at the rate of 2 kg of inoculant per 100kg of legume seed. Inoculated seed shall be sown within 90 days of inoculation.
- B. Bulk Materials:

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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 soil amendments with appropriate certificates.

1.6 PROJECT CONDITIONS

- A. Planting Restrictions: Plant during late fall through winter. Coordinate planting periods with initial maintenance periods to provide required maintenance, described in this section, from date of Substantial Completion.
 1. Fall/Winter Planting: November 1st to March 15th.
- B. 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.

1.7 MAINTENANCE SERVICE

- A. Grass and Wildflower Maintenance Service: Provide full maintenance by skilled employees of Contractor during ninety (90) day establishment period. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable grass and wildflower areas are established, but for not less than ninety (90) days from date of Substantial Completion.
- B. Continuing Maintenance Proposal: From Contractor to Owner, in the form of a standard yearly maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 - PRODUCTS

2.1 GRASSES AND WILDFLOWERS

- A. Wildflower and Grass Seed: Fresh, clean, and dry new seed, of mixed species as follows:
 1. Seed Source shall be S & S Seeds, 805-684-0436, www.ssseeds.com or approved equal. See sheet L-001 for seed mix and quantity.

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2.2 ORGANIC SOIL AMENDMENTS

- A. Compost: Compost shall be derived from green material consisting of chipped, shredded or ground vegetation or clean processed recycled wood products, or a Class A, exceptional quality biosolids compost, as required by US EPA, 40 CFR, part 503c regulations, or a combination of green material and biosolids compost.
1. The compost shall be processed or completed to reduce weed seeds, pathogens, and deleterious material and shall not contain paint, petroleum products, herbicides, fungicides or other chemical residues that would be harmful to plant or animal life. Other deleterious material such as plastic, glass, metal or rocks shall not exceed 0.1 percent by weight or volume.
 2. A minimum internal temperature of 135 degrees f shall be maintained for at least 15 continuous days during the composting process. The compost shall be thoroughly turned a minimum of five times during the composting process, and shall go through a minimum 90 days curing period after the 15 day thermophilic compost process has been completed.
 3. Compost shall be screened through a minimum 1/4-inch screen.
 4. The moisture content of the compost shall not exceed 25%. Moisture content shall be determined by California Test 226. Compost products with a higher moisture content may be used provided the weight of the compost is increased to equal compost with a maximum moisture content of 25%.
 5. Compost shall be tested for maturity/stability with a Solvita Test Kit supplied by the compost producer. The compost shall measure a minimum of 7 on the maturity/stability scale.
 6. Nitrogen (N) content of the compost should not exceed 6% and should preferably be much lower, as guaranteed by the compost producer. A low nitrogen compost is recommended as a precaution to reduce weed encroachment onto the planting area.

2.3 MULCH

- A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rice, or barley. Wheat and barley straw shall not be derived from dry farmed cereal crops. The contractor shall furnish evidence that clearance has been obtained from the County Agricultural Commissioner, as required by law, before straw obtained from outside the County is delivered to the site of the work. Straw that has been used for stable bedding shall not be used. Size of mulch shall be minimum three (3) inches.

2.4 HERBICIDE

- A. General: Herbicide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific

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problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

- B. Herbicide: Herbicide shall be Roundup by Scott's Company, www.roundup.com or approved equal.

2.5 EROSION-CONTROL MATERIALS

- A. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd. (0.5 kg/sq. m), with 50 to 65 percent open area. Include manufacturer's recommended steel wire staples, 6 inches (150 mm) long.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
 - 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. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 - 3. Suspend soil spreading, grading, and tilling 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 and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. 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 AOR and replace with new planting soil.

3.2 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.
 - 1. Protect adjacent and adjoining areas from seeding overspray.

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- 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 the San Gabriel River.

3.3 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

3.4 GRASSES AND WILDFLOWERS

- A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
 - 1. Do not use wet seed or seed that is moldy or otherwise damaged.
- B. Sow seed at a total rate specified on sheet L-001.
- C. Rake seed into top ¼ inch to ½ inch of soil, roll lightly, and water with fine spray.
- D. Protect seeded areas from hot, dry weather or drying winds by applying straw mulch within 24 hours after completing seeding operations. Spread uniformly at a rate of two (2) tons/acre to form a continuous blanket one (1) inch in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

3.5 ESTABLISHMENT PERIOD

- A. Establishment Period begins on the first day after all seeding and mulching is completed, inspected, accepted and approved in writing, by the Authorized Owners Representative (AOR) and continues for a period of ninety (90) days. Maintenance shall continue thereafter for the period of one year.
- B. Maintain all seeded areas by proper weed control, clean up, general care and any other necessary operations during the entire period of installation, germination and establishment and until Final Acceptance by AOR.
- C. Improper maintenance which may cause the poor condition of seeded areas at termination of the scheduled contract period will cause postponement of Final Acceptance of work. Maintenance of all areas shall continue at no additional cost to the Owner until all work is accepted.

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- D. Continuously remove and control weed species during the Establishment Period in all seeded areas including access roads prior to weeds reaching twelve inches (12") in height and before ripening of seeds, at intervals of not more than thirty (30) days.
- E. Control perennial weeds and their root systems by cutting top growth off and spot-spraying the stumps with an approved herbicide that will translocate to the roots. Remove from the site top growth, seed heads and plant mass from the site and dispose of properly. Roots may remain intact in the soil if approved by AOR. Herbicides shall only be applied by a licensed pest control applicator, and as described on the product label.
- F. Control annual weeds by pulling out manually or hoeing. The stems of hoed plants will be cut below ground level. Weed plant mass shall be removed from the site, and disposed of properly. Spot spray weeds only if manually pulling weeds fails to work.
- G. Make periodic close inspections to ensure seeded areas are free of insect infestations and plant diseases. Report any findings to AOR immediately.
 - 1. Remove diseased plants to prevent the spread of diseases and insects.
 - 2. Pesticide and herbicide use beyond the limit of work shall be strictly prohibited. At no time shall pre-emergent herbicides be used.
- J. Monitor seedlings for damage caused by animals, and inform AOR within twenty-four (24) hours of discovery. The Contractor shall propose remedial actions to the AOR for approval. Under no circumstances shall wildlife be exterminated unless directed by the AOR.
- K. Leaf and branch drop, and organic debris of species not identified as weeds shall be left in place unless specially required to be removed for brush management purposes as directed by AOR.
- L. Continuously remove, and dispose off site, all trash and litter during the establishment maintenance period.
- M. At no time shall Contractor apply fertilizers, pesticides, or herbicides other than those specified to any of the seeded areas unless instructed by the AOR.
- N. Control erosion during construction and Establishment Periods. Monitor for erosion within seeded areas and prohibit gullies, rill and sheet erosion, and silt deposition from occurring.
 - 1. Erosion control shall emphasize prevention. If needed, erosion repair shall be performed and include redirection/dissipation of the water source and recontouring of soil, followed by seeding and/or mulching.
 - 2. Strategically-placed and secured hay bales or sand bags may be used to dissipate water sources.

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3. Methods and materials used for re-seeding of eroded areas shall be consistent with this specification. The use of invasive exotic species for erosion control shall not be allowed.

3.11 PERFORMANCE STANDARDS DURING ESTABLISHMENT PERIOD

- A. Seed establishment shall be inspected, once a month during November to May and bi-monthly (every other month) during June through October, by the AOR and Contractor. Areas failing to show acceptable germination and growth, as determined by AOR, will be subject to re-application of seed, at no additional cost to the Owner.
- B. Acceptability of seed establishment shall be determined by the uniformity of germination and growth throughout the seeded areas and be consistent with soil and environmental conditions. Areas that do not germinate and grow as expected compared to adjacent areas shall be re-seeded per original installation specifications.
 1. Overall seedling coverage, as percent of the site, size of bare areas, as well as seedling health and vigor will be considered by the AOR in determination of establishment.
 2. Areas determined by the AOR that fail to establish shall be reseeded as soon as weather conditions are favorable.

3.5 GRASSES AND WILDFLOWER MAINTENANCE

- A. Maintain and establish grasses and wildflowers by watering, weeding, mowing, trimming, replanting, and performing other operations as required to establish a healthy, viable planting area. Roll, regrade, and replant bare or eroded areas and remulch. Provide materials and installation the same as those used in the original installation.
 1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and grasses and wildflowers damaged or lost in areas of subsidence.
 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
 3. Apply treatments as required to keep planting and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
- B. Watering: Install and maintain temporary watering equipment to convey water from sources and to keep meadow uniformly moist if automatic irrigation system is not installed at the time of planting.
 1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.

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2. Water grasses and wildflowers with fine spray at a minimum rate of 1/2 inch per week for six weeks after planting unless rainfall precipitation is adequate.
3. Water once a week at a minimum rate of ½ inch at the minimum during warm season.

3.6 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by planting work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Remove nondegradable erosion-control measures after grass establishment period.

END OF SECTION 329209

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

SECTION 329300 - PLANTS

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. Plants.
- 2. Planting soils.

- B. Related Sections:

- 1. Division 01 Section "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
- 2. Division 31 Section "Site Clearing" for protection of existing trees and plantings, topsoil stripping and stockpiling, and site clearing.
- 3. Division 31 Section "Earth Moving" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.
- 4. Division 32 Section "Native Grasses and Wildflowers" for native grasses and wildflower planting and erosion-control materials.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated, including soils.

- 1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
- 2. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to the Project.
- 3. Plant Photographs: Include color photographs in 3- by 5-inch print format of each required species and size of plant material as it will be furnished to the 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. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery.

- B. Samples for Verification: For each of the following:

- 1. Trees and Shrubs: One (1) samples of each variety and size shall be delivered to the site for review. Maintain approved samples on-site as a standard for comparison.
- 2. Mulch: 1-quart of each organic mulch in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of

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the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.

3. Weed Control Barrier: 12 by 12 inches

C. Qualification Data: For qualified 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 owners' contact persons.

D. 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.

E. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before start of required maintenance periods.

F. Warranty: Sample of special warranty.

1.4 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: Minimum of Five (5) years' experience in landscape installation in addition to requirements in Division 01 Section "Quality Requirements."
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 personnel assigned to the Work shall have certification in one of the following categories from the Professional Landcare Network:

- a. Certified Landscape Technician - Exterior, with installation, maintenance, irrigation specialty area(s), designated CLT-Exterior.
- b. Certified Ornamental Landscape Professional, designated COLP.

5. Pesticide Applicator: State licensed, commercial.

B. Soil-Testing Laboratory Qualifications: An independent or university laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

C. Soil Analysis: For imported top soil, furnish soil analysis and a written report by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; sodium absorption ratio; deleterious material; pH; and mineral and plant-nutrient content of the soil.

1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.

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2. The soil-testing laboratory shall oversee soil sampling; with depth, location, and number of samples to be taken per instructions from Architect. A minimum of three representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
 3. Report suitability of tested soil for plant growth.
 - a. Based upon the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
 - b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.
- D. 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 will be made by Architect, who will tag plants at their place of growth before they are prepared for transplanting.
- E. 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.
- F. Plant Material Observation: 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. Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
1. Notify Architect of sources of planting materials seven (7) days in advance of delivery to site.
- G. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance 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.

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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 fertilizers lime, and soil amendments with appropriate certificates.
- 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. 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. Do not remove container-grown stock from containers before time of planting.
 2. 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.

1.6 PROJECT 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. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
1. Notify Owner no fewer than two (2) days in advance of proposed interruption of each service or utility.
 2. Do not proceed with interruption of services or utilities without Owner's written permission.
- C. 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.

1.7 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:

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- a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
 - b. Structural failures including plantings falling or blowing over.
2. Warranty Periods from Date of Substantial Completion.
- a. Trees, Shrubs and Vines: twelve (12) months.
3. Include the following remedial actions as a minimum:
- a. Immediately remove dead plants and replace unless required to plant in the succeeding 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 will be 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.

1.8 MAINTENANCE SERVICE

- A. Initial Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. 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: Twelve (12) months from date of Substantial Completion.

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 Schedule or Plant Legend shown 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"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots will be rejected.
 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 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 Architect, with a proportionate increase in size of roots or balls.

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

- C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.
- D. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.

2.2 ORGANIC SOIL AMENDMENTS

- A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings; and as follows:
 - 1. Organic Matter Content: 50 to 60 percent of dry weight.
 - 2. Feedstock: Agricultural, food, or industrial residuals; biosolids; yard trimmings; or source-separated or compostable mixed solid waste.
- B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or granular texture, with a pH range of 3.4 to 4.8.
- C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture, with a pH range of 6 to 7.5, and having a water-absorbing capacity of 1100 to 2000 percent.
- D. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.
 - 1. In lieu of decomposed wood derivatives, mix partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. of loose sawdust or ground bark.
- E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

2.3 PLANTING SOILS

- A. Planting Soil: Existing, in-place surface soil. Verify suitability of existing surface soil to produce viable planting soil. Remove stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth. Mix surface soil with the following soil amendments as recommended by soil analysis. The soil analysis report is available by the Owner.

2.4 MULCHES

- A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

1. Type: Shredded hardwood
2. Size Range: 3 inches maximum, 1/2 inch minimum.
3. Color: Natural.

2.5 WEED-CONTROL BARRIERS

- A. Nonwoven Geotextile Filter Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. minimum, composed of fibers formed into a stable network so that fibers retain their relative position. Fabric shall be inert to biological degradation and resist naturally-encountered chemicals, alkalis, and acids.

2.6 PESTICIDES

- A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction for project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.
 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. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 3. Suspend soil spreading, grading, and tilling 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 and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. 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 Architect and replace with new planting soil.

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.

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- C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.
- D. Lay out plants at locations directed by Architect. Stake locations of individual trees and shrubs and outline areas for multiple plantings.
- E. Apply antidesiccant 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 antidesiccant at nursery before moving and again two weeks after planting.
- F. 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.

3.3 PLANTING AREA ESTABLISHMENT

- A. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
- B. Before planting, obtain Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.
- C. Obstructions: Notify Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
- D. Drainage: Notify 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.

3.4 TREE, SHRUB, AND VINE PLANTING

- A. Before 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. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.
- C. 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.

3.5 TREE, SHRUB, AND VINE PRUNING

- A. Remove only dead, dying, or broken branches. Do not prune for shape.

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- B. Prune, thin, and shape trees, shrubs, and vines as directed by Architect.
- C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by 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.

3.6 PLANT MAINTENANCE

- A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring 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. Spray or treat as required to keep trees and shrubs free of insects and disease.
- 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 whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.7 PESTICIDE APPLICATION

- A. Apply pesticides and other chemical products and biological control agents in accordance with authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Pre-Emergent Herbicides (Selective and Non-Selective): Apply to tree, shrub, and ground-cover areas in accordance with manufacturer's written recommendations. Do not apply to seeded areas.
- C. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.8 CLEANUP AND PROTECTION

- A. During planting, keep adjacent paving and construction clean and work area in an orderly condition.
- B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.
- C. 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 Project site.

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

3.9 DISPOSAL

- A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION 329300

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

SECTION 311000 - SITE CLEARING

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. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing site utilities not in use.
7. Temporary erosion- and sedimentation-control measures.

- B. Related Sections:

1. Division 01 Section "Temporary Facilities and Controls" for temporary utility services, construction and support facilities, security and protection facilities, and temporary erosion- and sedimentation-control measures.
2. Division 01 Section "Execution" for field engineering and surveying.
3. Division 01 Section(s) Construction Waste Management and Disposal.
4. Division 02 Section "Structure Demolition" for demolition of site improvements.
5. Division 02 Section "Selective Structure Demolition" for partial demolition of buildings or structures.

1.3 DEFINITIONS

- A. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- B. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.
- C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow.

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- D. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil and is the zone where plant roots grow. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
- E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
- F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, as indicated on Drawings.
- G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

- A. Except for stripped topsoil and other materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

- A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
 - 1. Use sufficiently detailed photographs or videotape.
 - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
- B. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 QUALITY ASSURANCE

- A. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.

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2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.
1. Do not proceed with work on adjoining property until directed by owner.
- C. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises.
- D. Utility Locator Service: Notify utility locator service Dig-Alert for area where Project is located before site clearing.
- E. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.
- F. The following practices are prohibited within protection zones:
1. Storage of construction materials, debris, or excavated material.
 2. Parking vehicles or equipment.
 3. Foot traffic.
 4. Erection of sheds or structures.
 5. Impoundment of water.
 6. Excavation or other digging unless otherwise indicated.
 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- G. Do not direct vehicle or equipment exhaust towards protection zones.
- H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.
- I. Soil Stripping, Handling, and Stockpiling: Perform only when the topsoil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Division 31 Section "Earth Moving."
1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly identify trees, shrubs, and other vegetation to remain
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide Storm Water Pollution Prevention Plan (SWPPP) including BMP and temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.
- B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- D. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

- A. General: Protect trees and plants remaining on-site according to requirements in Division 01 Section "Temporary Tree and Plant Protection."
- B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Landscape Architect.

3.4 EXISTING UTILITIES

- A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.
- B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
 1. Arrange with utility companies to shut off indicated utilities.
 2. Owner will arrange to shut off indicated utilities when requested by Contractor.
- C. Locate, identify, and disconnect utilities indicated to be abandoned in place.
- D. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 1. Notify Architect not less than **two** days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Architect's written permission.
- E. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 2. Grind down stumps and remove roots, obstructions, and debris to a depth of 18 inches below exposed subgrade.
 3. Use only hand methods for grubbing within protection zones.
 4. Chip removed tree branches and dispose of off-site.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to depth indicated on Drawings in a manner to prevent intermingling with underlying subsoil or other waste materials to the satisfaction of the Landscape Architect.

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1. Remove subsoil and nonsoil materials from topsoil, including clay lumps, gravel, and other objects more than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.
1. Limit height of topsoil stockpiles to 72 inches .
 2. Do not stockpile topsoil within protection zones.
 3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
 4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.
 2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.8 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.
- B. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 311000

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

SECTION 334100 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Pipe and fittings.
 - 2. Encasement for piping.
 - 3. Stormwater inlets.
 - 4. Pipe outlets.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Coordination Drawings: Show pipe sizes, locations, and elevations. Show other piping in same trench and clearances from storm drainage system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- C. Product Certificates: For each type of pipe and fitting, from manufacturer.
- D. Field quality-control reports.

PART 2 - PRODUCTS

2.1 CONCRETE PIPE AND FITTINGS

- A. Nonreinforced-Concrete Pipe and Fittings: ASTM C 14 Class 2, with tongue-and-groove ends and gasketed joints with ASTM C 443, rubber gaskets sealant joints with ASTM C 990 , bitumen or butyl-rubber sealant.
- B. Reinforced-Concrete Pipe and Fittings: ASTM C 76 Class II ,with tongue-and-groove ends and gasketed joints with ASTM C 443, rubber gaskets sealant joints with ASTM C 990, bitumen or butyl-rubber sealant.

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

2.2 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R , and the following:
 - 1. Cement: ASTM C 150, Type II.
 - 2. Fine Aggregate: ASTM C 33, sand.
 - 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 - 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
 - 1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
 - 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.
- C. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
 - 1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
 - 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

2.3 PIPE OUTLETS

- A. Head Walls: Cast-in-place reinforced concrete, with apron and tapered sides.
- B. Riprap Basins: Broken, irregularly sized and shaped, graded stone according to NSSGA's "Quarried Stone for Erosion and Sediment Control."
 - 1. Average Size: NSSGA No. R-3, screen opening 2 inches .
 - 2. Average Size: NSSGA No. R-4, screen opening 3 inches .
 - 3. Average Size: NSSGA No. R-5, screen opening 5 inches .
- C. Filter Stone: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. FS-2, No. 4 screen opening, average-size graded stone.
- D. Energy Dissipaters: According to NSSGA's "Quarried Stone for Erosion and Sediment Control," No. A-1, 3-ton average weight armor stone, unless otherwise indicated.

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

3.3 STORMWATER INLET AND OUTLET INSTALLATION

- A. Construct inlet head walls, aprons, and sides of reinforced concrete, as indicated.
- B. Construct riprap of broken stone, as indicated.
- C. Install outlets that spill onto grade, anchored with concrete, where indicated.
- D. Install outlets that spill onto grade, with flared end sections that match pipe, where indicated.
- E. Construct energy dissipaters at outlets, as indicated.

3.4 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

3.5 IDENTIFICATION

- A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
 - 1. Use detectable warning tape over ferrous piping.

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2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.6 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 1. Submit separate reports for each system inspection.
 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 1. Do not enclose, cover, or put into service before inspection and approval.
 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 4. Submit separate report for each test.
 5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
 - a. Exception: Piping with soiltight joints unless required by authorities having jurisdiction.
 - b. Option: Test plastic piping according to ASTM F 1417.
 - c. Option: Test concrete piping according to ASTM C 924.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 334100

Note: Technical specifications will be traded out prior to end of bid period with Public Works 2009 edition version through addendum.