SECTION 000009

CIVIL CERTIFICATION PAGE

LANDSCAPE CERTIFICATION

I, _Cody Peratt__, HEREBY SPECIFY, PURSUANT TO THE STATE OF MISSOURI THAT THE DOCUMENTS INTENDED TO BE AUTHORIZED BY MY SEAL ARE LIMITED TO:

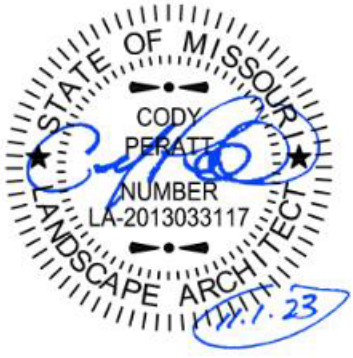
SPECIFICATION SECTIONS

05 7300 Decorative Metal Railings, 32 1313 Concrete Paving, 32 1316 Decorative Concrete Paving, 32 1373 Concrete Paving Joint Sealants, 32 3300 Site Furnishings, 32 8400 Planting Irrigation, 32 9200 Turf and Grasses, and 32 9300 Plants

DRAWINGS

L001	**L200**	**L300**	**L400**
L100	**L201**	**L301**	**L401**
L101	**L202**	**L302**	**L410**
L102	**L203**	**L310**	**L411**
L103	**L204**	**L311**	**L412**
L104	**L205**	**L312**	**L413**
L110		**L313**	**L490**
L111		**L314**	**L491**
L112		**L390**	

AND DISCLAIM ANY RESPONSIBILITY FOR ALL OTHER PLANS, SPECIFICATIONS, REPORTS OR OTHER DOCUMENTS OR INSTRUMENTS RELATING TO OR INTENDED TO BE USED FOR ANY PART OR PARTS FOR TOWNPLACE SUITES IN LEES SUMMIT MISSOURI.
SEAL:



BY: _____ **DATE:** **11/01/2023**

END OF SECTION 000009

SECTION 057300 - DECORATIVE METAL RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum decorative railings.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Manufacturer's product lines of railings assembled from standard components.
2. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, and attachment details. Signed and sealed by structural engineer.

C. Samples: For each type of exposed finish required.

D. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

C. Preconstruction test reports.

D. Evaluation Reports: For post-installed anchors, from ICC-ES.

1.4 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Build mockups for each form and finish of railing consisting of two posts, top rail, infill area, and anchorage system components.

1.5 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on laboratory mockups. Payment for these services will be made by Contractor. Retesting of products that fail to meet specified requirements shall be done at Contractor's expense.

1. Build laboratory mockups at testing agency facility; use personnel, materials, and methods of construction that will be used at Project site.
2. Test railings according to ASTM E 894 and ASTM E 935.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics.

1. Do not modify intended aesthetic effects, as judged solely by Landscape Architect, except with Landscape Architect's approval.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design railings, including attachment to building construction.

B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated and shall me all local and state codes:

1. Handrails and Top Rails of Guards:

a. Uniform load of 50 lbf/ft. (0.73 kN/m) applied in any direction.
b. Concentrated load of 200 lbf (0.89 kN) applied in any direction.
c. Uniform and concentrated loads need not be assumed to act concurrently.

2. Infill of Guards:

a. Concentrated load of 50 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).

b. Infill load and other loads need not be assumed to act concurrently.

2.3 METALS, GENERAL

A. Brackets, Flanges, and Anchors: Same metal and finish as supported rails unless otherwise indicated.

2.4 ALUMINUM

A. Aluminum, General: Provide alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with strength and durability properties for each aluminum form required not less than that of alloy and temper designated below.

B. Extruded Bars and Shapes, Including Extruded Tubing]: ASTM B 221 (ASTM B 221M), Alloy 6063-T5/T52.

C. Extruded Structural Pipe and Round Tubing: ASTM B 429/B 429M, Alloy 6063-T6.

D. Drawn Seamless Tubing: ASTM B 210 (ASTM B 210M), Alloy 6063-T832.

E. Plate and Sheet: ASTM B 209 (ASTM B 209M),.

F. Die and Hand Forgings: ASTM B 247 (ASTM B 247M), Alloy 6061-T6.

G. Castings: ASTM B 26/B 26M, Alloy A356.0-T6.

2.5 FASTENERS

A. Fastener Materials: Unless otherwise indicated, provide the following:
   1. Stainless-Steel Components: Type 316 stainless-steel fasteners.

B. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.
   1. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy, stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).

2.6 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Connections: Fabricate railings with welded or nonwelded connections unless otherwise indicated.

C. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.

1. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Type 1 welds; no evidence of a welded joint.

D. Brazed Connections: Connect copper-alloy railings by brazing. Cope components at connections to provide close fit, or use fittings designed for this purpose. Braze corners and seams continuously.

1. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and brazed surface matches contours of adjoining surfaces.

E. Mechanical Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

F. Form changes in direction by bending.

G. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

H. Close exposed ends of hollow railing members with prefabricated end fittings.

I. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.

J. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.

2.7 ALUMINUM FINISHES

A. Double Premium metallic powder coat and gloss topcoat finish.

1. Color and Gloss: As selected by Landscape Architect from manufacturer's full range of custom colors

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.

1. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
2. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).

C. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1. Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

D. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout.

E. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout.

F. Anchor posts to metal surfaces with flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members.

G. Anchor railing ends to concrete and masonry with brackets on underside of rails connected to railing ends and anchored to wall construction with anchors and bolts.

H. Attach handrails to walls with wall brackets except where end flanges are used.

1. Use type of bracket with predrilled hole for exposed bolt anchorage.
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

I. Secure wall brackets and railing end flanges to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.

3. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.
4. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.
5. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements using self-tapping screws of size and type required to support structural loads.
6. For steel-framed partitions, fasten brackets with toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

J. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

END OF SECTION

SECTION 321313 - CONCRETE 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 Concrete Paving**:**

1. Walks.

B. Related Requirements:

1. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.

1.3 DEFINITIONS

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

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. 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.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified ready-mix concrete manufacturer testing agency.

B. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Applied finish materials.
5. Bonding agent or epoxy adhesive.
6. Joint fillers.

C. Material Test Reports: For each of the following:

1. Aggregates.

D. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

B. Testing Agency Qualifications: Qualified according to ASTM C1077 and ASTM E329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

1.8 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 FORMS

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

1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

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

2.3 CONCRETE MATERIALS

A. Concrete mix shall be City approved mix for concrete pavement. Submit concrete mix specifications for approval by Landscape Architect.

B. Cementitious Materials: Use the following cementitious materials, of same type, brand, and source throughout Project:

1. Portland Cement: ASTM C150/C150M, gray white portland cement Type I Type II Type I/II Type III Type V.
2. Fly Ash: ASTM C618, Class C or Class F.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
4. Blended Hydraulic Cement: ASTM C595/C595M, Type IS, portland blast-furnace slag Type IP, portland-pozzolan Type IL, Portland-limestone Type IT, ternary blended cement.

C. Normal-Weight Aggregates: ASTM C33/C33M, Class 4S Class 4M Class 1N Insert class, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.

1. Maximum Coarse-Aggregate Size: 1-1/2 inches 1 inch 3/4 inch nominal.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

D. Air-Entraining Admixture: ASTM C260/C260M.

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.

1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
2. Retarding Admixture: ASTM C494/C494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C494/C494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

F. Water: Potable and complying with ASTM C94/C94M.

2.4 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry or cotton mats.

B. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.

1. Products: Subject to compliance with requirements, **provide one of the following**:

a. BASF Corporation; MasterKure ER 50 (Pre-2014: Confilm.
b. Bon Tool Co.; 32-301-B7 BonWay Evaporation Retarder.
c. Brickform; a division of Solomon Colors; Evaporation Retarder.
d. ChemMasters, Inc; Spray-Film.
e. Dayton Superior; AquaFilm Concentrate J74.
f. Euclid Chemical Company (The); an RPM company; Eucobar.
g. Kaufman Products, Inc; VaporAid.
h. Lambert Corporation; LAMBCO Skin.
i. Laticrete International, Inc.; E-CON.
j. Metalcrete Industries; Waterhold.
k. Nox-Crete Products Group; MONOFILM.
l. Sika Corporation; SikaFilm.
m. SpecChem, LLC; SpecFilm.
n. TK Products; TK-2120 TRI-FILM.
o. Vexcon Chemicals Inc.; Certi-Vex EnvioAssist.
p. W.R. Meadows, Inc; EVAPRE.
q. Insert manufacturer's name; product name or designation.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.

1. Products: Subject to compliance with requirements, **provide one of the following**:

a. Anti-Hydro International, Inc; A-H Curing Compound #2 DR WB.
b. ChemMasters, Inc; Safe-Cure Clear DR.
c. Dayton Superior; Clear Cure VOC J7WBClear Resin Cure J11WCure & Seal 309 EFCure & Seal 309 J18.
d. Euclid Chemical Company (The); an RPM company; Aqua-Cure VOXDiamond Clear VOXKurez DR VOXKurez W VOX.
e. Kaufman Products, Inc; DR Cure.
f. Lambert Corporation; AQUA KURE - CLEAR.
g. Laticrete International, Inc.; L&M CURE R.
h. Nox-Crete Products Group; Res-Cure DHRes-Cure DS.
i. Right Pointe; Clear Water Resin.
j. SpecChem, LLC; PaveCure Rez.
k. TK Products; TK-2519 DC WB.

l. Unitex by Dayton Superior; Hydroseal 18.
m. Vexcon Chemicals Inc.; Certi-Vex Enviocure 100.
n. W.R. Meadows, Inc; 1100-CLEAR SERIES.
o. Insert manufacturer's name; product name or designation.

2.5 RELATED MATERIALS

A. Joint Fillers: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D8139, semirigid, closed-cell polypropylene foam 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.

C. Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Epoxy-Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1. Types I and II, nonload bearing Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

2.6 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that comply with or exceed requirements.

B. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Pozzolan: 25 percent.
2. Slag Cement: 50 percent.

3. Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content, 1-1/2-inch Nominal Maximum Aggregate Size: 5-1/2 4-1/2 2-1/2 percent plus or minus 1-1/2 percent.
2. Air Content, 1-inch Nominal Maximum Aggregate Size: 6 4-1/2 3 percent plus or minus 1-1/2 percent.
3. Air Content, 3/4-inch Nominal Maximum Aggregate Size: 6 5 3-1/2 percent plus or minus 1-1/2 percent.

D. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 0.30 percent by weight of cement.

E. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture high-range, water-reducing admixture high-range, water-reducing and retarding admixture plasticizing and retarding admixture in concrete as required for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

F. Concrete Mixtures: Normal-weight concrete.

1. Compressive Strength (28 Days): 4000 psi.
2. Maximum W/C Ratio at Point of Placement: 0.45 0.50 Insert ratio.
3. Slump Limit: Minimum of 3 to maximum of 5 inches.

2.7 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M and ASTM C1116/C1116M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.

2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below **concrete paving** to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase. Limit vehicle speed to 3 mph.
2. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 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.

3.4 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.

1. When joining existing paving, place transverse joints to align with previously placed joints 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.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2. Provide tie bars at sides of paving strips where indicated.
3. Butt Joints: Use **bonding agent** at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
4. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
5. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

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.

1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

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, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. **Eliminate grooving-tool marks on concrete surfaces.**

    a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

    a. Tolerance: Ensure that sawed joints are within 3 inches either way from centers of dowels.

3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

3.5 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation**, steel reinforcement,** and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. 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.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

    1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies**, reinforcement,** or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating **reinforcement**, **dowels**, **and** joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.

1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

3.6 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.

1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface, perpendicular to line of traffic, to provide a uniform, fine-line texture.
2. 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.

3.7 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-retaining-cover curing as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

   a. Water.
   b. Continuous water-fog spray.
   c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain at least one composite sample for each [100 cu. yd.] [5000 sq. ft.] or fraction thereof of each concrete mixture placed each day.

   a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143/C143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C231/C231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Concrete Temperature: ASTM C1064/C1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C31/C31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C39/C39M; test one specimen at seven days and two specimens at 28 days.

    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

D. Test results shall be reported in writing to Architect/Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

E. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect/Engineer but will not be used as sole basis for approval or rejection of concrete.

F. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect/Engineer.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.9 REPAIR 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 Architect/Engineer.

B. Drill test cores, where directed by Architect/Engineer, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. 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.

D. 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

SECTION 321316 - DECORATIVE CONCRETE 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. Integral color concrete paving.
2. Stamped integral color concrete paving.

B. Related Requirements:

1. Section 321313 "Concrete Paving" for cast-in-place concrete paving with other finishes, curbs and gutters, and stamped detectable warnings.
2. Section 321373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within decorative concrete paving and in joints between decorative concrete paving and other paving or adjacent construction.

1.3 DEFINITIONS

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

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

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

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer ready-mix concrete manufacturer.

B. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Admixtures.
3. Curing compounds.
4. Applied finish materials.
5. Bonding agent or epoxy adhesive.
6. Joint fillers.

C. Material Test Reports: For each of the following:

1. Aggregates.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer of decorative concrete paving systems.

B. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94/C94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities" (Quality Control Manual - Section 3, "Plant Certification Checklist").

C. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution prior to beginning work.

1. Build mockups of full-thickness sections of decorative concrete paving to demonstrate typical joints; surface color, pattern, and texture; curing; and standard of workmanship.
2. Build mockups of decorative concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Landscape Architect and not less than 48 inches by 48 inches.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Landscape Architect specifically approves such deviations in writing.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

1.8 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301 and as follows when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated in total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless otherwise indicated.

2.2 FORMS

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

1. Use flexible or uniformly curved forms for curves of a radius of 100 feet or less.

B. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration indicated. Provide solid backing and form supports to ensure stability of textured form liners.

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

2.3 STEEL REINFORCEMENT

A. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, fabricated from as-drawn steel wire into flat sheets.

B. Reinforcing Bars: ASTM A615/A615M, Grade 60; deformed.

C. Steel Bar Mats: ASTM A184/A184M; with ASTM A615/A615M, Grade 60 deformed bars; assembled with clips.

D. Joint Dowel Bars: ASTM A615/A615M, Grade 60 plain-steel bars. Cut bars true to length with ends square and free of burrs.

E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified, and as follows:

1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.4 CONCRETE MATERIALS

A. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.

B. Contractor shall use concrete mix used on-site for sidewalks. Mix shall be City approved mix for color concrete. Submit concrete mix specifications for approval by Landscape Architect.

C. Integral Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. The Bomanite Company.
1) Integral color: Sierra Rose
b. Or approved equal.

D. Water: Potable and complying with ASTM C94/C94M.

2.5 STAMPING DEVICES

A. Stamp Mats: Semirigid polyurethane mats with projecting textured and ridged underside capable of imprinting texture and joint patterns on plastic concrete.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. The Bomanite Company.
1) Mat stamp pattern: Medium Ashlar Slate
b. Or approved equal.

2.6 FORM RELEASE AGENT

A. Powdered Release Agent.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. The Bomanite Company.
1) Release agent: Painted Desert
b. Or approved equal.

2.7 CURING AND SEALING MATERIALS

A. Curing Paper: Nonstaining, waterproof paper, consisting of two layers of kraft paper cemented together and reinforced with fiber, and complying with ASTM C171.

B. Vapor Retarding Membrane: 10 mil reinforced polyethylene.

C. Curing Materials: As recommended by integral color concrete manufacturer for compatibility.

D. Sealer: The Bomanite Company Hydrolock water-based, single component, penetrating concrete sealer installed per manufacturer recommendations and specifications.

E. Slip-Resistance-Enhancing Additive: The Bomanite Company Sure Trac polymeric grit coating additive installed per manufacturer recommendations and specifications.

2.8 RELATED MATERIALS

A. Joint Fillers: ASTM D1751, asphalt-saturated cellulosic fiber or ASTM D8139, semirigid, closed-cell polypropylene foam in preformed strips.

B. Bonding Agent: ASTM C1059/C1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Epoxy-Bonding Adhesive: ASTM C881/C881M, two-component epoxy resin capable of humid curing and bonding to damp surfaces; of class suitable for application temperature, of grade complying with requirements, and of the following types:

1. Types I and II, nonload bearing, for bonding hardened or freshly mixed concrete to hardened concrete.

D. Polyethylene Film: ASTM D4397, 1 mil thick, clear.

2.9 CONCRETE MIXTURES

A. Obtain each color, size, type, and variety of concrete mixture from single manufacturer with resources to provide concrete of consistent quality in appearance and physical properties.

B. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.

1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.

C. Cementitious Materials: Use fly ash, pozzolan, slag cement, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent. Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:

1. Fly Ash or Pozzolan: 25 percent.
2. Slag Cement: 50 percent.
3. Combined Fly Ash or Pozzolan, and Slag Cement: 50 percent, with fly ash or pozzolan not exceeding 25 percent.

D. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight concrete at point of placement having an air content as follows:

1. Air Content:

a. 5-1/2 4-1/2 2-1/2 percent plus or minus 1.5 percent for 1-1/2-inch nominal maximum aggregate size.
b. 6 4-1/2 3 percent plus or minus 1.5 percent for 1-inch nominal maximum aggregate size.
c. 6 5 3-1/2 percent plus or minus 1.5 percent for 3/4-inch nominal maximum aggregate size.

E. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 0.30 percent by weight of cement.

F. Chemical Admixtures: Use admixtures according to manufacturer's written instructions.

1. Use water-reducing admixture water-reducing and retarding admixture water-reducing and accelerating admixture in concrete as required for placement and workability.
2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.

G. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

H. Concrete Mixtures: Normal-weight concrete.

1. Compressive Strength (28 Days): 4000 psi.

2. Maximum W/C Ratio at Point of Placement: 0.50.
3. Slump Limit: Minimum of 3 to maximum of 5 inches.

2.10 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Furnish batch certificates for each batch discharged and used in the Work.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C94/C94M. Mix concrete materials in appropriate drum-type batch machine mixer.

1. For concrete batches of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For concrete batches larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd..
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixing time, quantity, and amount of water added.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below decorative concrete paving to identify soft pockets and areas of excess yielding.

1. Completely proof-roll subbase. Limit vehicle speed to 3 mph.
2. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 312000 "Earth Moving."

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

B. Protect adjacent construction from discoloration and spillage during application of color hardeners, release agents, stains, curing compounds, and sealers.

3.3 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.

3.4 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.

1. When joining existing paving, place transverse joints to align with previously placed joints 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.

1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
2. Butt Joints: Use bonding agent at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
3. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.
4. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.

1. Locate expansion joints at intervals of 50 feet unless otherwise indicated.
2. Extend joint fillers full width and depth of joint.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.
6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

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, as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.

    a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.

    a. Tolerance: Ensure that sawed joints are within 3 inches in both directions from centers of dowels.

3. Doweled Contraction Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

3.5 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation, steel reinforcement, and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

D. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

F. 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.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels and joint devices.

H. Screed paving surface with a straightedge and strike off.

I. Commence initial floating using bull floats or darbies to impart an open-textured and uniform surface plane before excess moisture or bleedwater appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.6 FLOAT FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater 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.

3.7 STAMPING

A. Mat Stamping: After floating and while concrete is plastic, apply mat-stamped finish.

1. After application of release agent, accurately align and place stamp mats in sequence.
2. Uniformly load mats and press into concrete to produce required imprint pattern and depth of imprint on concrete surface. Gently remove stamp mats. Hand stamp edges and surfaces unable to be imprinted by stamp mats.
3. Remove residual release agent according to manufacturer's written instructions, but no fewer than three days after stamping concrete. High-pressure-wash surface and joint patterns, taking care not to damage stamped concrete. Control, collect, and legally dispose of runoff.

3.8 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 Compound: Apply immediately after final finishing. Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

1. Cure integrally colored concrete with curing compound.
2. Cure concrete finished with pigmented mineral dry-shake hardener with a curing compound.

F. Curing and Sealing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating, and repair damage during curing period.

G. Curing Paper: Cure with unwrinkled curing paper in pieces large enough to cover the entire width and edges of slab. Do not lap sheets. Fold curing paper down over paving edges and secure with continuous banks of earth to prevent displacement or billowing due to wind. Immediately repair holes or tears in paper.

3.9 SEALER APPLICATION

A. Sealer: Apply uniformly in two coats in continuous operations according to manufacturer's written instructions. Allow first coat to dry before applying second coat, at 90 degrees to the direction of the first coat, using same application methods and rates.

1. Begin sealing dry surface per manufacturer recommended timeframe after concrete placement.
2. Allow stained concrete surfaces to dry before applying sealer.
3. Thoroughly mix slip-resistance-enhancing additive into sealer before applying sealer according to manufacturer's written instructions. Stir sealer occasionally during application to maintain even distribution of additive.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Field inspection and testing will be performed under provisions of Section 014000.

C. Prepare test and inspection reports. Maintain records of placed concrete items. Record date, location of pour, quality, air temperature, and test samples taken.

3.11 REPAIR AND PROTECTION

A. Remove and replace decorative concrete paving that is broken or damaged or does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Detailing: Grind concrete "squeeze" left from tool placement. Color ground areas with slurry of color hardener mixed with water and bonding agent. Remove excess release agent with high-velocity blower.

C. Protect decorative 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.

D. Maintain decorative 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

SECTION 32 1373 - CONCRETE PAVING JOINT SEALANTS

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. Cold-applied joint sealants.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of joint sealant and accessory.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Product Testing: Test joint sealants using a qualified testing agency.

1.6 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

1. Primers: Product recommended in writing by joint sealant manufacturer for adhesion of sealant to joint substrates indicated, as determined from sealant compatibility and adhesion tests and prior experience.

B. Colors of Exposed Joint Sealants: As selected by the Landscape Architect from manufacturer's full range for this characteristic. Submit color samples for review and approval.

C. Joint-Sealant Backer Materials: Non-staining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint sealant manufacturer based on field experience and laboratory testing.

1. Backer Strips for Cold - Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depths, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.
2. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, of diameter and density required to control sealant depths and prevent bottom-side adhesion of sealant.

2.2 COLD-APPLIED JOINT SEALANTS

A. Multicomponent, Nonsag, Urethane, Elastomeric Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Meadows, W.R., Inc.; Pourthane NS.
b. Dow Corning.

c. Pecora Corporation; Urexpan NR-200.
d. Sonneborn Building Products Div., ChemRex Inc.; SL2.
e. L.M. Scofield Company, Lithoseal Trafficalk-3g.

2. Color:
a. Gray Concrete – Dow Corning, 888 grey silicone, as approved by Landscape Architect.
b. Color concrete and pool deck areas – as selected by Landscape Architect from full range of manufacturer's standard colors.

2.3 JOINT-SEALANT BACKER MATERIALS

A. Joint-Sealant Backer Materials: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by joint-sealant manufacturer, based on field experience and laboratory testing.

B. Round Backer Rods for Cold-Applied Joint Sealants: ASTM D 5249, Type 3, of diameter and density required to control joint-sealant depth and prevent bottom-side adhesion of sealant.

C. Backer Strips for Cold Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.4 PRIMERS

A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Before installing joint sealants, clean out joints immediately to comply with joint-sealant manufacturer's written instructions.

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

A. Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated unless more stringent requirements apply.

B. Joint-Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions.

C. Install joint-sealant backings to support joint sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of joint-sealant backings.
2. Do not stretch, twist, puncture, or tear joint-sealant backings.
3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants immediately following backing installation, using proven techniques that comply with the following:

1. Place joint sealants so they fully contact joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint:

1. Remove excess joint sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions unless otherwise indicated.

3.4 CLEANING AND PROTECTION

A. Clean off excess joint sealant as the Work progresses, by methods and with cleaning materials approved in writing by joint-sealant manufacturers.

B. Protect joint sealants, during and after curing period, from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations in repaired areas are indistinguishable from the original work.

END OF SECTION

SECTION 323300 - SITE FURNISHINGS

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. Seating.
2. Tables.
3. Trash receptacles.
4. Planters.
5. Bollards.
6. Firepit.
7. Grill assembly.
8. Towel bins.
9. Towel racks.
10. Umbrellas.
11. Cabanas.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to include in maintenance manuals.

B. Warranties.

1.5 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Manufacturer regulary engaged in manufacture of site furnishings for 10 years.

B. Product Support: Products are supported with complete engineering drawings and design patents.

C. Production: Orders are filled within a 40-day schedule.

D. Facility Operator: Welders and machine operators are certified.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage: Store materials in clean, dry area in accordance with manufacturer's instructions. Keep materials in manufacturer's original, unopened containers and packaging until installation.

C. Handling: Protect materials and finish during handling and installation to prevent damage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. As shown on the plans.

B. Per manufacturer's recommendations and specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Notify Landscape Architect of conditions that would adversely affect installation or subsequent use.

3.2 INSTALLATION

A. Do note begin installation until unacceptable conditions are corrected.

B. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

C. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

D. Install site furnishings level, plumb, true, and positioned at locations indicated on Drawings.

3.3 ADJUSTING

A. Finish Damage: Repair minor damage to finish in accordance with manufacturer's instructions and as approved by Landscape Architect.

B. Component Damage: Remove and replace damaged components that cannot be successfully repaired as determined by Landscape Architect.

3.4 CLEANING

A. Clean furnishings promptly after installation in accordance with manufacturer's instructions.

B. Do not use harsh cleaning materials or methods that could damage finish.

3.5 PROTECTION

A. Protect installed benches to ensure that, except for normal weathering, furnishings will be without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 328400 - PLANTING IRRIGATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes furnishing all labor, materials, accessories and equipment, and performing all operations necessary for the complete installation of the landscape irrigation system, permits and including items listed below:

1. Piping.
2. Manual valves.
3. Automatic control valves.
4. Automatic drain valves.
5. Spray and rotor heads.
6. Driplines
7. Quick couplers.
8. Controller.
9. Boxes for automatic control valves.

B. Irrigation Control System
1. The construction includes one (1) satellite controller as shown on the irrigation plans.
2. Power shall be provided to the irrigation controller by electrical contractor. Final connection by irrigation contractor.

C. All bids should reflect a total “turn-key” installation for the site. This would include all equipment necessary to install satellite controller, central control system, including necessary wiring, communications equipment, electrical service, water supply and lines needed to communicate with the central irrigation control system. Each bid shall include all equipment and labor necessary to provide a “turn-key” installation.

D. Each proposal shall include the cost to install a combination flow meter and master valve as indicated on the design drawings. This meter and valve shall be connected just past the water meter connection at each site. This meter and valve shall be capable of relaying this information to the central irrigation control system point computer to provide flow information of each valve as it waters. It shall also be capable of detecting any flow that is occurring when no valves are operating, such as a broken main line would create. This flow sensor should then be capable of sending a signal to the central irrigation control system that will then in turn close the master valve. The bid for each flow meter and valve shall include the meter/valve and any other items needed for a “turn-key” installation. The bid price for this meter and valve shall be shown as a separate bid item for this site.

E. The contractor shall include a projected time frame for installing the system. It should reflect, in calendar days, the anticipated time required from the day of the award to completion of the system in a fully operational mode. This schedule should reflect

anticipated time for ordering and receiving all components, starting and ending times for installation, starting and ending times for training, system start-up, etc.

1.2 PERFORMANCE REQUIREMENTS

A. Irrigation zone control shall be central control system with automatic operation with controller and automatic control valves.

B. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100 percent irrigation coverage of areas indicated.

C. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties unless otherwise indicated:

1. Irrigation Main Piping: 120 psi
2. Circuit Piping: 60psi

1.3 SEQUENCING/SCHEDULING

A. Obtain information pertaining to the location of all existing utility lines and equipment prior to irrigation installation.

B. Install sleeves for all mainline, laterals, and wire that cross roadways, drives, sidewalks, and all other paving surfaces prior to placement of paving. It is the responsibility of the Irrigation Contractor to coordinate timing of sleeve installation and construction procedure with Paving Contractor to ensure proper sequencing.

C. Give at least seven (7) days notice to the Landscape Architect or his representative prior to all required site visits as indicated herein.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories. Only materials and items of equipment so approved shall be used.

B. Wiring Diagrams: For power, signal, and control wiring.

C. Approvals: Submit documentation of all approvals required by local, municipal, and state jurisdictions.

D. Grounding and Line Surge Protection Verification: The Irrigation Contractor is to provide written documentation and verification that each grounding device meets the manufacturer's specified requirements for grounding and line surge protection. The tests shall be completed using an approved ground resistance tester. The Rain Bird ASP shall conduct testing.

1.5 INFORMATIONAL SUBMITTALS

A. Controller Timing Schedule: Indicate timing settings for each automatic controller zone.

B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operational and Maintenance Data: Submit manufacturer's data in a three-ring binder, labeled and indexed

B. Record Drawings: Irrigation Contractor shall record and submit an “As-Built Drawing” which records actual installed conditions. The As-Built Drawing shall be submitted in an electronic format. Irrigation Contractor shall submit the As-Built Drawing to the Landscape Architect before work under this contract will be considered for Acceptance.

1.7 QUALITY ASSURANCE

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

B. Manufacturing Qualifications: Provide landscape irrigation system as a complete unit produced by acceptable manufacturers for all portions of work, including heads, valves, piping, controllers, and accessories.

C. Installer qualification: Contractor shall be a firm specializing in irrigation work with a minimum of 10 years’ experience in work of this type. The irrigation contractor shall provide written proof of attendance at a manufacture’s supported training program regarding the installation, programming and trouble-shooting for a Rain Bird IQ v4.0 decoder based irrigation control system. These qualifications must be present prior to any work beginning on this project.

D. Authorized Service Provider requirements: Contractor shall have Authorized Service Provider (ASP) provide Rain Bird IQ Commissioning of central irrigation control system including verification of specified Rain Bird Components, Correct wire and connectors, Grounding of required components, proper installation of communication and software has been set up with proper start-up and initial programming.

1. Approved Rain Bird Authorized Service Provider/Central Control Service Provider

a. Irrigation Management Company (IMC) 816-215-1810

E. Referenced Standards: American Society for Testing and Materials, Annual Book of ASTM Standards, latest edition.

F. Codes and Standards: Irrigation installation shall comply with all applicable federal, state and local governing agency requirements and to industry standards. Notify Landscape Architect immediately in writing of any discrepancies, inconsistencies, or contradictory

requirements.

G. Workmanship: Install materials and equipment in a neat and professional manner following manufacturer's recommendations.

1.8 FEES AND PERMITS

A. Work under this Section shall include all fees, permits, licenses, and required inspections by concerned governing agencies.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver materials and equipment in such a manner as not to damage the parts or decrease the useful life of equipment.

B. Store materials away from detrimental elements. Coordinate with Owner's Representative, General Contractor, or Landscape Contractor, as appropriate, to secure a safe staging area.

C. Handle, load, unload, stack, and transport materials carefully to avoid damage. Handle pipe in accordance with manufacturer's recommendations.

1.10 JOB CONDITIONS

A. Prior to commencing any work required under the Contract, the Contractor shall locate all utilities, subsurface drainage, and underground construction so that proper precautions may be taken not to disturb or damage any subsurface improvements. Damage to any of the above mentioned items or other shall be promptly repaired by the contractor at no additional cost to the owner.

B. Water service and electric service will be supplied by the General Contractor as indicated on the plans for the purpose of the automatic irrigation system.

C. Irrigation System is to operate under the water pressure and flow rates prevailing at the project site. Irrigation Contractor shall be responsible for determining these parameters, and shall design the irrigation system in accordance with the existing or anticipated conditions.

D. Insurance on irrigation materials or equipment stored or installed is the responsibility of the Irrigation Contractor. Such insurance shall cover fire, theft, and vandalism. Should the Irrigation Contractor elect not to provide such insurance the Owner shall in no way be responsible for any losses incurred by the aforementioned acts. The Irrigation Contractor is responsible for all costs incurred in replacing damaged or stolen materials or equipment prior to Substantial Completion of the Work.

E. Obtain all required permits and pay all required fees at no additional cost to the Owner. Any penalties imposed due to failure to obtain permits or pay fees are the responsibility of the Irrigation Contractor.

F. Provide and maintain all passageways, guard fences, warning lights, and other protection devices required by local authorities or others having jurisdiction.

G. Irrigation Contractor shall adequately protect adjacent property as provided by law and the Contract Documents.

H. Existing Site Improvements: Perform Work in a manner that avoids damage to existing site improvements. The Irrigation Contractor is responsible for any damage of mechanical nature as well as damage resulting from leaks in the irrigation system whether due to negligence or otherwise.

I. Test water conditions: Irrigation System is to operate under the water pressure and flow indicated on the irrigation plan. It shall be the responsibility of the Irrigation Contractor to measure or analyze the existing or anticipated water supply at the tap. Notify the Landscape Architect if conditions vary from plans.

1.11 WARRANTY AND SUBSTANTIAL COMPLETION

A. Substantial Completion

1. At the completion of the installation of the irrigation system components, and at the direction of the Owner, the Landscape Architect shall observe the conditions of the project for the purpose of verifying compliance with plans, details and specifications. A written report will be provided to the Owner listing any deviations or omissions. These issues will be resolved and verified by the Landscape Architect prior to the issuance of a Letter of Substantial Completion.
2. Contractor shall provide Landscape Architect with written notification from Rain Bird ASP stating that all installation, testing and training of the Central Control System has been completed and approved. Notification shall be received prior to substantial completion.

B. All irrigation equipment including central irrigation control system, controller(s), control valves, sprinklers, rotors, and accessories shall have a five (5) year manufacturer's warranty. All other irrigation equipment, workmanship, and, supplies shall be warranted for one (1) year from date of issuance of the letter of substantial completion. All warranties shall be turned over to the Owner.

1.12 TRAINING

A. A minimum of 2 hours of training, as determined by Rain Bird, for up to two (2) users determined by Owner and Landscape Architect shall be conducted by the ASP on site, with installed system, after completion of project. The contractor is to schedule, coordinate, and attend the training session. Training shall include an overview of system operations as well as detailed one-on-one training for selected individuals for both software and hardware operation.

B. The control system manufacturer is to provide toll-free phone-in support to the Owner at no cost for a period of one (1) year within the initial purchase price of the system.

PART 2 - PRODUCTS

2.1 GENERAL

A. Specific requirements concerning the various materials and the arrangements in which they are to be installed are outlined in this Specification.

B. Quality and Size

1. Material specified by name and / or model number in the Specifications, on the site, or detailed drawings are used for the purpose of identification of materials and to ensure specific use of that material in the construction of the system. No substitutions will be permitted without approval.
2. All materials used in the system must be new and without flaws or defects of any type and be the best quality available.

2.2 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Contractor materials shall comply with all requirements and provide irrigation equipment products from only the following:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products not listed within this section may be incorporated into the Work.
2. Irrigation equipment including spray heads, rotors, nozzles, control valves, quick couplers, master valves, irrigation controller, rain sensors, low volume irrigation equipment, drip tubing and drip fittings including pressure regulators, filters, air relief valves, tree root watering devices, pipe fittings including swing assemblies, swing joints, barbed fittings, swing pipe and compression fittings shall be manufactured by the Rain Bird Corporation.
   a. Or approved equal
3. Decoder based irrigation control system equipment including, field decoders, line surge protection devices, sensors decoder and field transmitters shall be manufactured by the Rain Bird Corporation.
   a. Or approved equal
4. IQ™ v4.0 Central Irrigation Control System equipment, software, modules, and system hardware interface shall be manufactured by the Rain Bird Corporation. Contact John Miller 913-333-9127
   a. Or approved equal
5. Decoder control wire shall be manufactured by Rain Bird Corporation.
   a. Or approved equal
6. Wire connectors shall be manufactured by 3M Corporation.
   a. Or approved equal

2.3 DELIVERY, STORAGE AND HANDLING

A. Manufactured materials shall be delivered in original containers with brand and maker's names marked thereon. Materials in broken containers or showing evidence of damage will be rejected and must be immediately removed from the work.

B. Store plastic pipe on flat pallets and protect from sunlight.

2.4 PIPES, TUBES, AND FITTINGS

A. Main Irrigation supply line for potable water. PVC plastic pipe, ASTM D 2241 Class 200 SDR 21.

1. All PVC pipe from sizes three (3) inches and above shall, unplasticized rigid polyvinylchloride (PVC) pipe with integral bell and rubber ring gasket unless otherwise specified.
2. All PVC pipe from sizes two and one - half (2 1/2) to one (1) inch shall be Class 200, solvent weld PVC pipe.
3. All pipe shall be supplied in standard twenty (20) foot lengths.
4. Polyethylene pipe will not be accepted unless prior written approval is obtained by the landscape architect.

B. Circuit Pipe for potable water (downstream from circuit valves): PVC plastic pipe, ASTM D 2241 Class 200 SDR 21.

1. All PVC pipe from sizes three (3) inches and above shall, unplasticized rigid polyvinylchloride (PVC) pipe with integral bell and rubber ring gasket unless otherwise specified.
2. All PVC pipe from sizes two and one - half (2 1/2) to one (1) inch shall be Class 200, solvent weld PVC pipe.
3. All pipe shall be supplied in standard twenty (20) foot lengths.
4. Polyethylene pipe will not be accepted unless prior written approval is obtained by the landscape architect.

C. All pipe that is exposed or not below grade shall be Schedule 80 PVC or HDPE.Seamless Copper Pipe: ASTM B88, Type M, drawn temper.

D. Sleeving Pipe for Potable Water Irrigation Supply Line: PVC plastic pipe, Schedule 40, ASTM D 1785 and D 1784, PS 21-70.

E. Fittings:

1. For PVC plastic pipe,

a. All pipe fittings size four (4) inches and greater shall be ductile iron.
b. 3" fittings shall be bell and rubber gasket.
c. Fittings 2-1/2” and under shall be Schedule 40 solvent weld PVC. ASTM D 2466 socket fittings with ASTM A 2564 solvent cement.

2. Metallic: Cast bronze with standard iron pipe thread; 125 bl. class rating in conformance with ANSI B16.15.

3. Copper: ANSI B16.22 wrought copper or cast brass, recessed solder joint type fittings.

F. Nipples:

1. Metallic: Schedule 40 red brass (35% copper, 15% zinc) pipe: threaded both ends. Pipe shall be in accordance with ASTM B43.
2. Plastic: Factory-threaded Schedule 80, Type 1, Grade 1 polyvinyl chloride (PVC) pipe, threaded both ends. Pipe shall be in conformance with ASTM D1784 and D1785. Color: grey.

G. Pipe Connection Materials: Solvent, primer and lubricants as recommended by the manufacturer.

1. Joint compound for threaded connections is Teflon or approved equal tape; UL listed.
2. No thinning of solvent or primer is allowed in any manner whatsoever.

2.5 WATER METER

A. Water meter shall be sized as needed, and shall be provided per City specifications. Ref: Building MEP Plans.

2.6 BACKFLOW PREVENTER

A. Back Backflow preventer shall be of the type required by the local water supplier and local codes. Backflow preventer shall be sized to meet flow and pressure requirements of the plans; Ref: Building MEP Plans.

2.7 IRRIGATION CONTROL SYSTEM SLEEVING

A. Install separate sleeve beneath paved areas to route each run of wiring. Any existing sleeving is not to be used without the consent of the owner’s representative.

B. Sleeving material beneath pedestrian pavements shall be PVC Class 200 pipe with solvent welded joints.

C. Sleeving beneath drives and streets shall be PVC Schedule 40 pipe with solvent welded joints.

D. Sleeving diameter shall be equal to twice the diameter of the wiring bundle.

2.8 VALVES

A. Manufacturer's Standard, of type and size required, and as follows:

B. Furnish valves with plastic bodies, glass filled nylon or red brass, unless otherwise indicated.

C. Pressure Reducing Valve: If required, standard capacity water pressure reducing valve with integral strainer, Watts U5 series or equal.

D. Master Valve.

1. Globe valve shall be normally closed 24 VAC 50/60 cycle solenoid actuated with a pressure rating of not less than 200 psi.
2. The valve body and bonnet shall be constructed of heavy cast red brass; diaphragm shall be of nylon reinforced nitrile rubber. All other internal parts shall be made of bronze, brass and stainless steel.
3. The valve shall have both internal and external manual open/close control to manual open and close the valve without electrically energizing the solenoid. The valve shall house a fully-encapsulated one piece solenoid.
4. The valve shall have a stainless steel flow control stem and cross handle for regulating or shutting off flow of water. The valve must open or close in less than one minute at 200psi.
5. The valve shall be sized to meet flow requirements shown on plans.
   a. Potable irrigation system: Rain Bird EFB-CP IVM Series 2” valve

E. Zone Control Valves for potable irrigation system.

1. Globe valve shall be normally closed 24 VAC 50/60 cycle solenoid actuated with a pressure rating of not less than 200 psi.
2. The valve body and bonnet shall be constructed of heavy duty glass filled UV-resistant nylon and have stainless steel studs and flange nuts with a nylon reinforced nitrile rubber diaphragm.
3. The valve shall have both internal and external manual open/close control to manual open and close the valve without electrically energizing the solenoid. The valve shall house a fully-encapsulated one piece solenoid.
4. The valve shall have a brass flow control stem for accurate manual regulation and/or shut off of outlet flow.
5. The valves shall be sized to meet flow requirements shown on plans.
   a. Potable irrigation system: Rain Bird PE-IVM series valves

F. Drip Zone Control Valve.

1. Preassembled Zone Control Valve Assembly designed specifically for drip irrigation applications. The Zone Control Kit shall consist of a valve, ball valve, pressure regulator and 200 mesh filter.
2. Globe configuration valve shall be normally closed 24 VAC 50/60 cycle solenoid actuated with a pressure rating of not less than 150 psi.
3. The valve body and bonnet shall be constructed of high impact, weather resistant plastic, stainless steel and other chemical / UV resistant materials.
4. The valve shall have a one unit diaphragm constructed of durable Buna-N rubber material with a clog resistant metering orifice and a double knife seal. The valve shall have one 90 mesh pilot filter attached to the diaphragm.
5. The valve shall have one fully encapsulated solenoid with captured plunger. The valve shall have one 90-mesh filter attached to the solenoid base.
6. The valve shall be capable of on/off control by turning the solenoid ¼ turn. The valve shall provide a flush mode that is manually activated by ½ turn of the bleed screw where external port is permissible.

7. The pressure regulating filter body shall be constructed of heavy duty, glass filled, UV resistant plastic material with a pressure rating of not less than 150 psi. The filter element shall be constructed of a durable polyester fabric attached to a propylene frame and shall be serviceable for cleaning by unscrewing the cap from the body.
8. The pressure regulator shall have a preset outlet pressure of approximately 40 psi in the 1" size and will accommodate an inlet pressure of not less than 150psi.
9. The valves shall be sized to meet flow requirements shown on plans.

    a. Potable irrigation system: Rain Bird XCZ-100-IVM-Q series valves

G. Pressure Regulating Module for regulating outlet pressure at control valve from 15 – 100 psi.

1. The pressure regulating module shall be a two-piece devise consisting of a glass filled UV resistant nylon housing and dial cartridge. The regulator shall have visible pressure indication scale ranging from 0-100psi and an adjustable knob to provide fine tune adjustments in 1/3 psi increments.
2. The regulator shall have a Schrader valve to accommodate a pressure hose gauge. The regulator shall be waterproof and provide regulation if the valve is manually internal bled or electronically activated.
3. The Pressure Regulating Module shall be Rain Bird PRS-D.

H. Quick Coupling Valve: Brass, Single piece construction, one inch female iron pipe size connection; vinyl covered brass hinged locking cover.

1. Potable irrigation system: Yellow cap Rain Bird 44RC

I. Manual Gate Valves (Isolation Valves): Non-rising stem, 125 lbs. brass body and parts with wedge disc filled for key operation, as supplied by Crane or equal.

J. Pressure Relief Valves: As manufactured by Waterman, or equal.

K. Valve Box Cover and Frame:

1. Manufactures:

    a. Rain Bird VB Series, manufactured by Rain Bird Corporation
    b. Ametek plastic valve boxes, manufactured by Plymouth Products
    c. or equal.

2. Potable water irrigation system:

    a. Turf Areas: Green Cover
    b. Landscape Beds: Black Cover/Brown Cover

3. Sizes:

    a. 12" Standard; Rain Bird VB-STD

L. Drainage Pit Backfill: Cleaned gravel or crushed stone, graded from 2" maximum to 3/4" minimum. AB3 or equivalent is not acceptable backfill material.

2.9 AUTOMATIC DRAIN VALVES

A. Description: Spring-loaded-ball type of corrosion-resistant construction and designed to open for drainage if line pressure drops below 2-1/2 to 3 psig.

2.10 SPRINKLER HEADS

A. Manufacturer's standard unit designed to provide uniform coverage over entire area of spray shown on drawings at available water pressure.

1. Pop-up spray heads, 6" for turf: Rain Bird 1800 Series with plastic body, co-molded wiper seal, precision controlled flush at pop-down, built-in pressure regulator (PRS) built in the stem to maintain constant outlet pressure of 30 psi, designed for use with Rain Bird matched precipitation rate (MPR) plastic nozzles and high efficiency variable arc nozzles (HEVAN) in odd angle locations, installed using Rain Bird SA series swing assemblies. All pop-up spray heads are to have the built-in Seal-A-Matic (SAM) check valve.

2.11 TURF ROTORS

A. Manufacturer’s standard unit to provide uniform coverage over entire area of spray shown on drawings at designated water pressure.

1. 6” Pop-up gear driven turf rotor: Rain Bird 5000 plus seies with flow shut off device, an integral pressure regulator to reduce operating pressure to 45PSI and top arc adjustment using flat bladed screwdriver of 40-360 degrees, pressure activated multi functional wiper seal, designed for use with the MPR nozzle set providing matched precipitation from 25’ to 35’ using Rain Curtain technology installed using Rain Bird TSJ series swing joints. Rotors located in low elevation areas and will be susceptible to lateral pipe drain down as designated by Landscape Architect are to have a spring loaded Seal-A-Matic (SAM) device in the base of the case.

2.12 LANDSCAPE DRIPLINE

A. Flexible In-Line Drip Tubing

1. Polyethylene tubing with factory installed, pressure compensating emitters with a spacing and consistent flow as listed on the plans.
2. Pressure compensation will be accomplished through effective lengthening of the emitter flow path resulting with superior clog resistance.
3. In-line emitter drip line shall have dual outlet ports to ensure direct contact with the ground.
4. All drip tube to be staked in place using 12 gauge galvanized steel staples at 24”-36” OC.

5. Rain Bird Easy Fit Compression Fitting System shall be used to connecting all drip tubing.
6. In-line drip tubing shall be Rain Bird Landscape Dripline.

    a. Potable water irrigation system XFD-06-18 in shrub beds
    b. Potable water irrigation system XFD-09-12 in planters

2.13 AUTOMATIC CONTROL SYSTEM

A. The irrigation controller shall be a Rain Bird ESP-LXIVM controller.

1. The controller shall be housed in a wall-mountable, plastic locking cabinet suitable for either indoor or outdoor installation. The controller shall be capable of supporting up to 60 stations.
2. The controller shall support up to 5 independently managed flow sensors interfaced with sensor decoders. The controller shall support up to five flow zones.
3. The controller shall incorporate a FloManager feature that shall provide real-time flow, power, and station management. FloWatch shall compare the current real-time flow rate to the learned rates and take user defined actions if problem is detected. FloWatch shall automatically determine the location of the flow problem and isolate the problem by turning off the affected station or master valve.
4. The controller shall be compatible with the IQ v4.0 Central Control System utilizing IQ-NCC Network Communication Cartridges providing remote computer control of the controller via a variety of communication options (Direct Connect Cable, Phone, GPRS/Cellular, Ethernet, WiFi, Radio, and IQNet Communication Cable).
5. Shall have the dimensions of:

    a. Width: 14.32 in. (36.4 cm)
    b. Height: 12.69 in. (32.2 cm)
    c. Depth: 5.50 in. (14.0 cm)

B. Surge Protection: Rain Bird Line Surge Protector IVM-SD (built in surge protection), required every 500’ along two-wire path.

1. Output power: Adjustable from controller – Inrush and holding current valves adjustable at controller.
2. Encapsulation: Fully waterproof

    a. Address: Pre-coded from factory Electrical Input: Nominal voltage: 34Vpp (24V AC) from two-wire line. Minimum voltage: 21 Vpp (15V AC). Maximum Voltage: 36 Vpp (25V AC)

3. Electrical Output:

    a. Max. voltage: 36 Vpp

4. Maximum Cable Runs: 14 gauge – Star Pattern: 2.4 miles; Loop Pattern: 9.6 miles

Maximum Critical Path Lengths for 2-Wire Paths					
Nominal Wire Size	Ohms per 1000' or Ohms per Km (per conductor) Miles	Max. Length For Critical Path			
		Star		Loop	
		Km	Miles	Km	Miles
2.5 mm2	7.5 0hms/Km	3.00	1.86	12.00	7.46
14 AWG	2.58 0hms/1000'	2.66	1.65	10.63	6.61
12 AWG	1.62 0hms/1000'	4.23	2.63	16.93	10.52

5. Decoder/Solenoid Wires - Electrical Resistance: Max. 3 ohms
6. Max. Distance Decoder/Solenoids: Cable length: 14 gauge: 456 feet
7. Wiring: Paige special direct burial irrigation control cable,
8. Environment: Working range: 32° to 122° F (0° to 50° C); storage range: -4° to 158° F (-20 to 70° C); Humidity: 100%
9. Surge Protection: 40 V, 1.5 kW transil

2.14 ELECTRIC WIRING

A. 120 Volt AC Wiring: 120 volt service to controller shall consist of three wires: one black, one white, and one ground. Electrical service is to be provided by the General Contractor unless otherwise directed by Owner's Representative.

B. Provide junction box, flush-mounted and gasketed per code as required.

C. 2-Wire Control Wiring shall be dual core, tin-coated, double insulated special irrigation control wire. Minimum wire size shall be fourteen (14) gauge. Wire to be Maxi-cable as manufactured by Rain Bird® Corporation, Azusa, California or approved equal.

D. Splices in controller wiring shall be waterproof direct bury application. Use Rain Bird-DBY T or R wire connectors. No substitutions will be allowed.

2.15 SURGE PROTECTION FOR THE TWO-WIRE PATH

A. An IVM-SD shall be installed on the 2-wire communication path at each ESP-LXIVM controller location.

1. The Rain Bird™ IVM-SD Line Surge Protector decoder specifications include but are not limited to:

   a. The line surge protector decoder shall be grounded on a two-wire path every 500 feet (150 meters) or every 15 valves, whichever is smaller.
   b. Install one (1) within controller cabinet.
   c. The IVM-SD Line Surge Protector decoder shall be placed on a two-wire path.

d. The IVM-SD Line Surge Protector decoder shall be used for surge protection only, and shall not have a decoder address.
e. The IVM-SD Line Surge Protector decoder shall protect against 40V, 1.5kW trasil.

2.16 GROUNDING

A. Controller, decoders and ancillary products used on a two-wire path shall be connected to a grounding system with a ground resistance of ten (10) ohms or less.

2.17 FLOW SENSOR

A. The flow sensor shall be an in-line type with a nonmagnetic, spinning impeller (paddle wheel) as the only moving part. The electronics housing shall have two, ethylenepropylene O-Rings and shall be easily removed from the meter body. The sensor electronics will be potted in an epoxy compound designed for prolonged immersion. Electrical connections shall be 2 single conductor 18 AWG leads 48 inches (1,2 meters) long. Insulation shall be direct burial “UF” type colored red for the positive lead and black for the negative lead. The sensor shall be capable of operating in line pressures up to 400 psi (27,5 bars) and liquid temperatures up to 220° F, and operating in flows of ½ foot per second to 15 feet per second with linearity of ±1% and repeatability of ±1%. The meter body shall be cast 85-5-5-5 bronze, in 1” and 1½”, female iron pipe thread sizes. This flow sensor shall be Rain Bird Model FS200P series

2.18 RAIN SENSOR

A. Provide and install a wired Rain Bird Rain Sensor (RSD-BEx) capable of turning off the irrigation system if adequate rainfall is received.

B. Contractor to install per Rain Bird’s recommendations and specifications. Location to be approved by Landscape Architect.

C. Rain sensor shall employ an electro-mechanical actuating mechanism designed to cause a circuit interrupt if programmable low temperature or rainfall set points are satisfied.

D. The device shall be used with 24VAC controllers and shall be of sufficient capacity to be used with a maximum of six 24VAC 7VA solenoids plus an additional master valve that does not exceed 53VA.

2.19 EQUIPMENT

A. The following list of items shall be submitted to the Owner prior to the final inspection of the irrigation system.

1. 2 quick coupler valve keys, Rain Bird 44-K
2. 2 hose swivel (1" x 3/4"), Rain Bird SH-2
3. 2 gate valve keys (48")

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall install all irrigation system components in accordance with the Irrigation and Landscape Plans, Details and these Specifications.

B. Schedule of Work: The Irrigation Contractor shall be responsible for the installation of the piping and equipment in a manner that will effect the earliest completion of the work in conformance with the construction progress schedules of other Contractors and Trades, and these Specifications.

C. Observations: In addition to normal progress inspection, the Contractor shall give at least 48 hours notice to the Landscape Architect for inspection as follows:

1. Layout of the system.
2. Pressure tests.
3. Coverage adjustment; Automatic operation.
4. Punch list inspection.

D. Quick Coupler Valves: Locate quick coupler valves on mainline runs only, near pavement surfaces, and adjacent to annual planting beds. Space quick coupler valves at maximum 100’ intervals near parking lots, islands, building entries, sidewalks, entry monuments, and annual planting beds. Space quick coupler valves at maximum 200’ interval for large turf areas.

3.2 PROTECTION

A. The Contractor shall be responsible for storage of materials and any damage to the work covered by these Specifications before the final acceptance of the work.

B. Protect work and materials from damage during construction. Storage of polyvinyl chloride (PVC) pipe and fittings shall be protected from direct sunlight. Beds on which materials are stored must be the full length of the pipe to avoid damage. Any pipe that has been damaged or dented shall not be used in the work.

C. Any existing structures, equipment, utilities, pavement, landscaping, etc., damaged by Irrigation Contractor during the course of the work, including any damage caused by leakage or settling of piping systems being or having been installed by them, shall be restored at Contractor's expense and to the Owner's satisfaction.

D. Securely cover openings into the system and cover apparatus, equipment, and appliances, both before and after being set in place, to prevent obstruction in the pipes and the breakage, misuse or disfigurement of the apparatus, equipment or appliances.

3.3 LAYOUT AND VERIFICATION

A. The Contractor shall stakeout the locations of all piping, quick coupling valves, spray heads, rotors, and emitters in accordance with the irrigation design drawings. The

Contractor shall check and verify dimensions of layout and report variations to the Landscape Architect before proceeding. Layout work as accurately as possible to the drawings.

B. Minor changes in locations to the above from locations shown shall be made as necessary to avoid existing or proposed planting, piping, utilities, structures, etc., at the Contractor's expense, or when directed by the Landscape Architect, providing such change is ordered before such items or work directly connected to same are installed, and providing no additional materials are required.

C. The Contractor will be held responsible for the relocating of any items without first obtaining the Landscape Architect's approval. The Contractor shall remove and relocate such items, at his expense; if so directed by the Landscape Architect.

D. Before starting work on irrigation system, carefully check all grades to determine that work may safely proceed, keeping within the specified material depths. The Contractor shall be aware of the fact that the drawings are horizontal dimensions. Actual measurements taken along the slope of a bank will differ from those shown on the drawings.

E. No fittings shall be installed on pipe underneath pavement or walls except where noted on the irrigation drawings. If such a need should occur, the Contractor shall bring it to the attention of the Landscape Architect.

F. Exact sprinkler head placement is based on and shall be coordinated with actual planting layout and shall be verified by the Landscape Architect.

G. All changes shall be recorded daily on the Record Drawings.

3.4 TRENCHING AND BACKFILLING

A. Provide a minimum of 24" cover over top of PVC main line for potable irrigation systems, or per city code.

B. Provide a minimum of 12” cover over top of PVC lateral piping for potable irrigation systems, or per city code.

C. Backfill for irrigation lateral lines shall be with clean material from excavation. Remove organic material as well as rock and debris larger than 1" diameter. Irrigation piping shall have no rock or debris touching at any point along its length. A minimum of 6” clearance is required around all piping from all immovable obstructions. Place acceptable backfill material in 6" lifts, compacting each lift. Compact within 90% of the maximum density of the material used as determined by ASTM D-698 (Standard).

D. Backfill trench to within 6" of finished grade. Continue fill with acceptable topsoil and compact to bring even with existing grade. Thorough compaction at each sprinkler head, valve, and piping will be required. Repair all settled areas.

1. Under pavement areas contractor shall meet compaction requirements of pavement section plans and geotechnical report. Include flowable fill as required.

E. Boring underneath existing pavement may be required. PVC sleeving for irrigation main line shall be installed underneath all pavements.

F. Unless otherwise indicated, comply with requirements of the Uniform Plumbing code, city specifications, and all state or local codes.

3.5 TAPPING AND SUPPLY

A. Verify meter and backflow preventer have been installed in building. Ref: Building MEP plans.

B. Install irrigation mainline tap at stub out provided by building MEP. Coordinate with site contractor.

3.6 MASTER VALVE AND FLOW SENSOR

A. Install master valve, flow sensor and pulse transmitter as per manufacturer's directions.

B. Master valve and flow meter shall be installed in locking valve box per specification on detail sheets.

3.7 SLEEVING AND BORING

A. Install sleeving at a depth which permits the encased wiring to remain at the specified depth.

B. Extend the sleeve ends 6" beyond the edge of the paved surface. Cover pipe ends and mark with stakes.

C. Install separate sleeve beneath paved areas to route each run of wiring. Any existing sleeving is not to be used without the consent of the Owner's Representative.

D. Sleeving material beneath pedestrian pavements shall be PVC Class 200 pipe with solvent welded joints.

E. Sleeving beneath drives and streets shall be PVC Sch. 40 pipe with solvent welded joints.

F. Sleeving diameter shall be equal to twice the diameter of the wiring bundle.

3.8 CIRCUIT VALVES

A. All valves shall be connected to main irrigation line in a plumb position. Each valve shall be installed in a valve box so that all parts of valve can be serviced. Valve boxes shall be installed over 6" of drainage gravel and shall be set so that the cover is flush with finish grade. Thorough compaction at valve boxes is required to bring the top of valve box 1" for turf and 2" for shrubs above finished grade after compaction and settlement has occurred. All settled valve boxes shall be raised prior to establishment acceptance.

B. Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler circuit.

C. Provide pressure regulation modules on the control valves for all zones that exceed recommended operating pressure by 5 psi as indicated in the irrigation zone schedule.

3.9 PIPING

A. Lay pipe in properly excavated trenches.

B. For all mainline piping, slope to manual drain valve and drainage pit at least 1/2" in 10' of run.

C. Install PVC pipe in dry weather when temperature is above 40 F in strict accordance with manufacturer's instructions. Allow joints to cure at least 24 hours at temperatures above 40 F (4 C) before testing, unless otherwise recommended by manufacturer.

D. Manual Drain Valves: Install manual drain valves at all low points in main irrigation supply line. Record location on as-built drawings.

E. Manual Gate Valves: Install manual gate valves at location shown on plan in main irrigation supply line. Record location on as-built drawings.

F. Drainage Pits: 3 cu. ft. of clean gravel, minimum 18” deep, 1-1/12" - 2" size, shall be located at all manual and automatic drain valves. Cover drainage pit with a soil separator and backfill to finish grade with excavated soil material.

G. Sleeves: Install sleeves for all main line, laterals, and wire that cross roadways, drives, sidewalks, and all other paving surfaces. Sleeves shall be a minimum of 4” diameter, and shall be sized to accommodate all equipment necessary. Top of sleeves shall be a minimum of 24” below surface of paving. Sleeves shall extend a minimum of 12” behind back of curb. Permanently mark location of each end of sleeve on back of curb.

3.10 SPRINKLER AND ROTOR HEADS

A. Flush circuit lines with full head of water and install heads after hydrostatic test is completed.

B. All sprinkler heads shall be set plumb at the elevation to be flush with finish grade.

C. Contractor shall adjust, if necessary, the elevation of the sprinkler heads after finish grade and landscape plantings are complete.

D. Install all sprinkler heads with pre-assembled swing-joints or swing-assemblies. Funny pipe will not be accepted for installation of any kind.

3.11 LANDSCAPE DRIPLINE

A. Final installation of drip irrigation to occur after the trees, shrubs and other plant material has been installed.

B. Flexible inline tubing or point source emitter tubing shall be used.

C. Layout drip and distribution tubing as detailed on the plans to place drip tubing near root zone of the plantings. Install drip tubing at or near the surface of planting soil.

D. Install one (1) OPERIND drip system operation indicator per drip zone at the furthest point of the drip zone from the remote control valve.

E. Stake all drip tubing with steel stakes so that no movement of the pipe exists.

F. Pressurize, flush and cap drip tubing.

G. Cover drip tubing with specified depth of mulch.

3.12 CONTROLLER

A. Controller shall be installed in permanent location as shown on plan and verified by Landscape Architect.

B. Contractor shall properly programmed controllers for this particular job prior to substantial completion of this project.

C. Control wire of system shall be 2 x 14 gauge, specifically designed for direct burial use. A minimum of 3’-0” of extra wire shall be spooled at each decoder location, at each splice, at each change in direction and at every 500 feet of straight run. At each termination of the mainline, an additional 6’-0” of wire shall be coiled and located within a valve box.

D. Control wire shall be installed in multiple wire paths as shown on the plans.

E. Wire shall be placed consistently along one side of the pipe in the trench. Splices and connections shall be watertight and leak proof, use Pin-Tight connections. Multiple wires in the trenches shall be banded together at 20-foot intervals for protection. Wire not along mainline pipe shall be placed within an electrical conduit.

F. Install monitoring equipment including Weather Station, Flow Meter, and Soil Moisture Sensor. Electrical connections between controller and monitoring equipment shall be installed by contractor per manufacturer’s recommendations. Irrigation contractor is responsible for all electrical power connections from power supply point adjacent to weather station.

G. Install all surge protection as per manufacturer’s latest instructions.

H. Lightning protection: Drive three 8’ copper-clad grounds into the soil. If soil conditions prevent proper penetration of the ground rods into the soil, contact the Landscape Architect. Connect controller to grounding rod with AWG No. 10 Solid conductor copper wire. Secure wire to grounding rod with brass or bronze clamp.

I. Install electrical connections between controller manufacturer's recommendations.

J. Install all surge protection as per manufacturer's latest instructions.

K. Lightning protection: Drive three 8' copper-clad grounds into the soil. If soil conditions prevent proper penetration of the ground rods into the soil, contact the Landscape Architect. Connect controller to grounding rod with AWG No. 10 Solid conductor copper wire. Secure wire to grounding rod with brass or bronze clamp.

L. Irrigation Control Units
1. The locations of the control units depicted on the drawings are approximate; the Owner's Representative, with assistance from the manufacturer's representative and the Landscape Architect, will determine the exact site locations at the system layout review.
2. General Contractor will provide all communication drop location as designated on the plans. The irrigation contractor is responsible for all connections from stubout locations. Coordinate with General Contractor.
3. General Contractor to provide all 120VAC power for control units. Coordinate location of power with Landscape Architect.
4. Install electrical connections between central control unit components and satellite control units per manufacturer's recommendations.
5. Install electrical connections between satellite control units and monitoring equipment per manufacturer's recommendations.
6. Install all surge protection as per manufacturer's latest instructions.
7. Lightning protection: Drive three 8' copper-clad grounds into the soil. If soil conditions prevent proper penetration of the ground rods into the soil, contact the Owner's Representative. Connect controller to grounding rod with AWG No. 10 solid conductor copper wire. Secure wire to grounding rod with brass or bronze clamp.
8. Attach wire markers to the ends of control wires inside the controller unit housing. Label wires with an identification number that consists of the name and station number of the existing controller to which the control wire had been previously connected.
9. Connect control wire to corresponding control unit terminal. Connect wires to the satellite controller in the same order they are connected to the existing controller.
10. Connection to controller per manufacture recommendation.

M. Irrigation Control System Setup
1. All irrigation schedules and programming shall be set up per manufacture recommendations.
2. Contractor shall set up all modules including connection to all site controllers and sensors.

3.13 HYDROSTATIC TESTING

A. Contact the Landscape Architect, while the necessary piping system components are exposed. All mainline piping is to be subjected to a hydrostatic test. Subcontractor is to supply all testing equipment including pump and all caps and gauges as required.

B. Pressure gauges shall be read in PSI. Calibration shall be such that accurate determination of potential pressure loss can be ascertained. Test supply line at a pressure of 120 PSI for minimum of one hour with an allowable loss of 5 PSI.

C. Re-test as required until the system meets the requirements. During the tests, regardless of the amount of leakage, all detectable leaks are to be stopped and all defects corrected.

3.14 ADJUSTING THE SYSTEM

A. Adjust alignment and coverage of all sprinklers and rotors if it is determined that adjustments in the irrigation equipment will provide proper and more adequate coverage. Make all necessary changes or make arrangements as directed by Landscape Architect. These changes or adjustments shall be made without additional cost.

3.15 RECORD DRAWINGS

A. Indicate actual location of all valves and controls including piping. Show dimensions from easily identifiable existing features such as walls, curbs, fences, buildings, or walks. Submit diagram to the Landscape Architect for approval.

B. Maintain progress drawings on the construction site at all times during installation of the irrigation system. Make a daily record of all work installed each day until completion of the work.

C. Submit to Owner one (1) electronic version of the irrigation record drawings.

D. Submit to Owner one (1) ½ size reduction of the irrigation record drawing, laminated both sides, for inclusion into the inside of the controller door.

E. Submit to Owner two (2) full size plan sets of the irrigation record drawings.

3.16 ACCEPTANCE

A. The ASP shall instruct the owner’s designated personnel in the operation of the system pursuant to the training section already outlined in the specifications.

B. The irrigation control system must be commissioned the ASP prior to final walk through of the system. The ASP shall confirm that the system is installed and grounded per the manufacture’s recommendations. The Contractor shall address any system deficiencies found by the ASP prior to substantial completion.

3.17 GUARANTEE AND MAINTENANCE INSTRUCTIONS

A. The Contractor shall fill and repair all depressions and replace all necessary lawn and planting due to the settlement of irrigation trenches for one year following the completing and acceptance of the job.

B. The Contractor shall also guarantee all materials, equipment and workmanship furnished by him to be free of all defects of workmanship and materials, and shall agree to replace at his expense, at any time within one year after installation is accepted, any and all defective parts that may be found. Contractor shall transfer all manufacturer material warrantees to the Owner. All manufacturer warrantees shall be in effect for the period outlined in the manufacturer literature from the date of installation. Contractor shall detail these warrantees and provide all necessary information regarding them to the Owner in the record drawing submittals.

C. The Contractor shall drain the irrigation system in the fall of the first year, and provide start up in the following spring.

D. After the system is installed and approved, instruct the Owner or Owner's representative as to the complete operation and maintenance.

END OF SECTION 328400

SECTION 329200 - TURF AND GRASSES

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. Hydroseeding.
3. Sodding.

1.3 RELATED SECTIONS

A. Section 328400 – Planting Irrigation

B. Section 329300 - Plants

1.4 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

C. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See [**Section 329113 "Soil Preparation"**] [**Section 329115 "Soil Preparation (Performance Specification)"**] and drawing designations for planting soils.

D. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.5 INFORMATIONAL SUBMITTALS

A. Prior to delivery to the job site, contractor shall submit to the Landscape Architect the source and supplier of all grass sod, seed, fertilizer, and other materials along with the type of equipment to be used on this project. ertification 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.

B. Certification of grass seed.

C. Certification of each seed mixture for turfgrass sod.

D. Product Certificates.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required maintenance periods.

1.7 QUALITY ASSURANCE

A. Regulatory Requirements
   1. Comply with applicable requirements of Federal, State, and Local laws, regulations and codes having jurisdiction at the project site.
   2. Contractor shall be responsible for certificates of inspection of plant material that may be required by Federal and Local authorities to accompany shipments of plants.

B. Reference Standards
   1. “Standardized Plant Names” by the American Joint Committee of Horticultural Nomenclature.
   2. American National Standards Institute (ANSI); Publication Z60.1

C. Coordination
   1. Work in conjunction with other trades as directed, taking all reasonable precautions to avoid disturbance or interference with any other operation or installation on the site. Contractors shall be responsible for the cost of replacing any material damaged as a result of his/her negligence.

D. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
2. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the National Association of Landscape Professionals:

    a. Landscape Industry Certified Technician - Exterior.
    b. Landscape Industry Certified Lawn Care Manager.
    c. Landscape Industry Certified Lawn Care Technician.

3. Pesticide Applicator: State licensed, commercial.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

1.9 JOB CONDITIONS

A. Examination of Site:
1. The bidder must acknowledge that he has examined the site, Drawings and Specifications and the submission of a quotation shall be considered evidence that examinations have been made.

B. Field Conditions:
1. The Contractor shall verify drawing dimensions with actual field conditions and inspect related work and adjacent surfaces. The Contractor shall report to the Landscape Architect all conditions which prevent proper execution of this work.

C. The Contractor shall determine the exact location of all existing utilities, structures, and geogrid reinforcement before commencing work. The Contractor shall conduct his work so as to prevent interruption of service or damage to them. The Contractor agrees to be fully responsible for any and all damage which might be occasioned by the Contractor's failure to exactly locate and preserve and all utilities, structures, and geogrid reinforcement.

SEQUENCING AND SCHEDULING

D. Planting Restrictions: Proceed with and complete planting as rapidly as portions of the site become available, working within seasonal limitations for each kind of landscape work required. Recommended dates for seeding and sodding:

1. Spring Planting: April 1 – June 15.
2. Fall Planting: September 1 – December 15.

E. 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.

MATERIALS CLEAN-UP

A. The Contractor shall keep the premises free from rubbish and all debris associated with their work at all times, and all unused materials and debris shall be removed the site and disposed of in a legal manner.

WARRANTY

A. All plant material (lawns) shall be warranted for a period of not less than one (1) year from the date of issuance of the letter of Substantial Completion.

B. All replacement stock shall be subject to the same warranty requirements as the original stock. Any damage due to replacement operations shall be repaired by the Contractor. At the end of the warranty period, inspections shall be made jointly by the Owner, Landscape Architect, and Contractor. All lawn areas not in healthy growing condition shall be removed and replaced with grasses of like kind and size before the close of the next planting season and before issuance of the letter of Final Completion.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species:

1. Quality, State Certified: State-certified seed of grass species as listed below for solar exposure.
2. Quality, Non-State Certified: Seed of grass species as listed below for solar exposure, with not less than 85 Insert number percent germination, not less than 95 Insert number percent pure seed, and not more than 0.5 Insert number percent weed seed:
3. Full Sun, Cool-Season Grass: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars.
4. Sun and Partial Shade, Cool-Season Grass: Proportioned by weight as follows:

    a. 50 percent Kentucky bluegrass (Poa pratensis).
    b. 30 percent chewings red fescue (Festuca rubra variety).
    c. 10 percent perennial ryegrass (Lolium perenne).
    d. 10 percent redtop (Agrostis alba).

5. Shade, Cool-Season Grass: Proportioned by weight as follows:

    a. 50 percent chewings red fescue (Festuca rubra variety).
    b. 35 percent rough bluegrass (Poa trivialis).
    c. 15 percent redtop (Agrostis alba).

2.2 TURFGRASS SOD

A. Turfgrass Sod: Certified Approved Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.

B. Turfgrass Species, Cool-Season Grass: Sod of grass species as follows, with not less than 85 Insert number percent germination, not less than 95 Insert number percent pure seed, and not more than 0.5 Insert number percent weed seed:

1. Full Sun: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars.

2. Sun and Partial Shade: Proportioned by weight as follows:

    a. 50 percent Kentucky bluegrass (Poa pratensis).
    b. 30 percent chewings red fescue (Festuca rubra variety).
    c. 10 percent perennial ryegrass (Lolium perenne).
    d. 10 percent redtop (Agrostis alba).

3. Shade: Proportioned by weight as follows:

    a. 50 percent chewings red fescue (Festuca rubra variety).
    b. 35 percent rough bluegrass (Poa trivialis).
    c. 15 percent redtop (Agrostis alba).

2.3 FERTILIZERS

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition:

    a. 1 lb/1000 sq. ft. Insert value of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
    b. Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition:

    a. 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
    b. Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.4 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic and free of plant-growth or germination inhibitors; with a maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

C. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

2.5 PESTICIDES

A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
3. Uniformly moisten excessively dry soil that is not workable or which is 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/Engineer 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 hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Before planting, obtain Landscape Architect's acceptance of finish grading, restore planting areas if eroded or otherwise disturbed after finish grading.

3.3 TURF AREA PREPARATION

A. General:
1. Clearing
   a. All areas of turf establishment are to be cleared by the Contractor.
   b. Clearing shall consist of the satisfactory removal and disposal of brush, rubbish, and other vegetative growth occurring within all proposed turf areas unless turf is being overseeded. All debris associated with this work shall be gathered and removed from the Project by the Contractor.

2. Preparation of Planting Mixture
   a. Mix recommended soil amendments and fertilizers with topsoil at rates recommended by the soil test results. Delay addition of fertilizer if planting mixture will not be used within two (2) days.

3. Protection of Existing Vegetation
   a. All areas under drip lines of existing trees shall be kept free of construction equipment, trailers, material storage, and vehicles.
   b. Exercise extreme care when working around existing trees to remain. No soil scarification or compaction from construction vehicles shall occur under any existing tree dripline.
   c. In areas of established turf, the surrounding turf area shall be covered in a manner that will provide protection before excavations begin for sodded turf.

B. Reduce elevation of planting soil to allow for soil thickness of sod.

C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.4 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.

1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
2. Do not use wet seed or seed that is moldy or otherwise damaged.
3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a manufacturer’s recommended rate for new lawns.

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blanket s and 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.

F. Protect seeded areas from hot, dry weather or drying winds by applying planting soil within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.5 HYDROSEEDING

A. Hydroseeding: Mix specified seed, commercial fertilizer slow-release fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with non-asphaltic tackifier.
2. Spray-apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate.
3. Spray-apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydromulching) at a rate of 1000 lb/acre.

3.6 SODDING

A. All sod areas indicated on the plans shall have temporary cover removed, fine graded and sodded as specified herein and in strict accordance with standard horticultural practices.

B. Lay sod within 24 hours of harvesting. Do not lay sod if dormant or if ground is frozen or muddy.

C. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets, and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across slopes exceeding 1:3.
2. Anchor sod on slopes exceeding 1:6 with wood pegs or steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.

D. As sodding is completed in any one section, the entire area shall be rolled or tamped to insure solid contact of roots with the soil surface. Sod shall be watered immediately after rolling and tamping until the underside of the new sod pad and soil surface below the sod are thoroughly moistened. The operations of laying, tamping and watering for any piece of sod shall be completed within eight (8) hours.

E. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.7 TURF MAINTENANCE

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. 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 turf 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 turf 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 piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

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.
2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow turf-type tall fescue to a height of 2 to 3 inches.

D. Turf Postfertilization: Apply commercial fertilizer slow-release fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that provides actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.8 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Architect/Engineer:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements, and continue maintenance until turf is satisfactory.

3.9 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to requirements of 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. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.10 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

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

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

D. Remove nondegradable erosion-control measures after grass establishment period.

3.11 MAINTENANCE

A. The Contractor shall maintain sod and seed areas by weeding and mowing as required for healthy growth until issuance of the letter of Substantial Completion for the entire site and scope of work.

B. The Contractor shall be responsible for watering sod areas until the new irrigation system is completely functional and the letter of Substantial Completion has been issued. Contractor shall be responsible for watering sod areas by hand where irrigation system does not cover. Hand watering of these areas shall continue until letter of Substantial Completion has been issued. Watering shall supplement natural rainfall and shall assure that the sod areas receive a minimum of one (1) inch of water per week. Sod shall be watered daily during the first week and in sufficient quantities to maintain moist soil to a depth of four inches (4"). After the first week sod shall be watered as necessary to maintain adequate moisture.

END OF SECTION

SECTION 329300 - PLANTS

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The Contractor shall furnish all labor, materials, tools, equipment, supervision, and services necessary to install plant material, preparation of soil, fine grading, planting, mulching, guying, pruning, watering, and the proper disposal of any excess earth or debris, all in accordance with the accompanying Drawings and these Specifications.

1.2 SUMMARY

A. Section Includes:

1. Plants.
2. Mulches.
3. Tree stabilization.
4. Tree-watering devices.
5. Landscape edgings.

1.3 RELATED SECTIONS

A. Section 328400 – Planting Irrigation

B. Section 329200 - Turf and Grasses

1.4 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.

C. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

D. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

1.5 COORDINATION

A. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.

1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples of each type of mulch.

1.7 INFORMATIONAL SUBMITTALS

A. Product Certificates

B. Sample Warranty

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year.

1.9 QUALITY ASSURANCE

A. Regulatory Requirements
1. Comply with applicable requirements of Federal, State, and Local laws, regulations and codes having jurisdiction at the project site.
2. Contractor shall be responsible for certificates of inspection of plant material that may be required by Federal and Local authorities to accompany shipments of plants.

B. Reference Standards
1. "Standardized Plant Names" by the American Joint Committee of Horticultural Nomenclature.
2. "American Standard of Nursery Stock" by the American Association of Nurseryman.
3. American National Standards Institute (ANSI); Publication Z60.1.

C. Substitutions
1. Substitutions of plant material will not be permitted unless authorized in writing by Owner or Landscape Architect. If proof is submitted that any plant specified is not obtainable, a proposal will be considered for use of the nearest equivalent size or variety with corresponding adjustment of Contract Price. Such proof shall be substantiated and submitted in writing to the Owner and Landscape Architect at least thirty (30) days prior to start of the work under this Section. These provisions shall not relieve the Contractor of the responsibility of obtaining specified materials in advance if special growing conditions or other arrangements must be made in order to supply specified materials.

D. Condition and Source of Plants
1. Plants shall be subject to review and approval by the Owner or Landscape Architect upon delivery for conformity to Specifications. Such approvals shall not impair the right of review and rejection during progress of the Work. Submit written request for inspection of plant material at place of growth and quantity of plants to be inspected.

E. Coordination
1. Work in conjunction with other trades as directed, taking all reasonable precautions to avoid disturbance or interference with any other operation or installation on the site. Contractors shall be responsible for the cost of replacing any material damaged as a result of his/her negligence.

F. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
1. Pesticide Applicator: State licensed, commercial.

G. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Storage of Materials
1. All materials delivered to the job shall be stored so as to keep them in new condition and free from deterioration. Peat moss, fertilizer, etc., shall be stored in temporary sheds off-site at Contractor’s expense.

B. Packaged Materials
1. Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.

C. Plant Material

1. Plants shall not be delivered to the site until the corresponding beds are fully prepared. All shipments of nursery materials shall be thoroughly protected from the sun and from drying winds during transit. All plants which cannot be planted at once after delivery to the site of the work shall be well protected against the possibility of drying by wind and sun. Balls of earth on B&B plants shall be kept covered with soil or other acceptable material. All materials heeled-in on the property shall be adequately watered.
2. 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.
3. Handle planting stock by root ball.
4. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.
5. 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.
6. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
7. Do not remove container-grown stock from containers before time of planting.
8. 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.

1.11 JOB CONDITIONS

A. Examination of Site:
   1. The bidder must acknowledge that he has examined the site, Drawings and Specifications and the submission of a quotation shall be considered evidence that examinations have been made.

B. Field Conditions: The Contractor shall verify drawing dimensions with actual field conditions and inspect related work and adjacent surfaces. The Contractor shall report to the Landscape Architect all conditions which prevent proper execution of this work.

C. The Contractor shall determine the exact location of all existing utilities, structures, and geogrid reinforcement before commencing work. The Contractor shall conduct his work so as to prevent interruption of service or damage to them. The Contractor agrees to be fully responsible for any and all damage which might be occasioned by the Contractor’s failure to exactly locate and preserve any and all utilities, structures, and geogrid reinforcement.

1.12 SEQUENCING AND SCHEDULING

A. Planting Time: Proceed with and complete planting as rapidly as portions of the site become available, working within seasonal limitations for each kind of landscape work required.

B. Planting Dates:
   1. Trees, shrubs, and perennials shall be planted only when the ground is not frozen, snow covered, or in an otherwise unsuitable condition for planting. Spring planting shall generally occur between Feb 15 and May 31, and fall planting shall generally occur between September 1 and Dec 15.

1.13 MATERIALS CLEAN-UP

A. The Contractor shall keep the premises free from rubbish and all debris associated with their work at all times and all unused materials and debris shall be removed from the site.

1.14 WARRANTY

A. All plant material (trees, shrubs, etc.) and planting supplies (bark mulch, etc.) shall be warranted for a period of not less than one (1) year from the date of issuance of the letter of Substantial Completion.

B. All replacement stock shall be subject to the same warranty requirements as the original stock. Any damage due to replacement operations shall be repaired by the Contractor. At the end of the warranty period, inspections shall be made jointly by the Owner, Landscape Architect, and Contractor. All plants not in a healthy growing condition shall be removed and replaced with plants of a like kind and size before the close of the next planting season and before issuance of the letter of Final Completion.

C. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
      b. Structural failures including plantings falling or blowing over.

PART 2 - PRODUCTS

2.1 TOPSOIL

A. Topsoil shall be fertile, natural topsoil, typical of the locality. Stockpiled topsoil may be used. It shall be free of subsoil, slag, clay, stones, lumps, sticks, plants or their roots, toxic substances or other extraneous matter that may be harmful to plant growth or would interfere with future maintenance. Topsoil pH range shall be 6.0 to 7.0.

B. Soil Testing:
   1. Onsite Topsoil – The Contractor shall be responsible for having onsite topsoil tested by the Local County Extension Office to determine the amounts of amendments needed to meet the desired pH, nutritional organic levels determined to be adequate for the area by the County Extension Agent. The Contractor shall submit topsoil tests to the Landscape Architect.
   2. Offsite Topsoil - The Contractor shall be responsible for having offsite imported topsoil tested by the Local County Extension Office to determine the amounts of amendments needed to meet the desired pH, nutritional organic levels determined to be adequate for the area by the County Extension Agent. The Contractor shall submit topsoil tests to the Landscape Architect.

C. Soil Conditioners and Amendments:
   1. Aluminum sulfate shall be horticultural grade.
   2. Peat shall be a natural product of sphagnum peat (peat moss), derived from a fresh-water site conforming to ASTM D 2607 except as otherwise specified. Peat shall be shredded and conditioned in storage piles for at least 6 months after excavation.
   3. Sand shall be clean and free of toxic materials.
   4. Vermiculite shall be horticultural grade and free of any toxic materials.
   5. Rotted manure shall be unleached stable or cattle manure not less than 8 months or more than 2 years old, containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; and containing no chemicals or ingredients harmful to plants. The manure shall be heat treated to kill weed seeds.
   6. Rotted sawdust shall have 7.5 pounds of nitrogen added uniformly to each cubic yard and shall be free of chips, stones, sticks, soil, and toxic substances.
   7. Gypsum shall be 90 percent pure, free of any toxic materials, and at least 95 percent by weight shall pass a 4-mesh sieve.
   8. Other amendments as recommended by County Extension Agent.

D. Treatment of Saline Soil: Saline soil shall be leached out by a controlled amount of water sufficient enough to leach the salts to a level below the root zone. Water used for this purpose shall have a low salt content.

2.2 PLANTING SOIL MIXTURE

A. The “topsoil mixture” shall be composed of on-site or off-site topsoil and additional soil amendments appropriate for the location and plantings based on the soil test provided in the appendix.

B. The “planting soil mixture” for all planting pits shall be 80% topsoil mixture, 10% peatmoss, and 10% well composted manure. Mix thoroughly for uniformity of texture and distribution before placing in pit.

C. The “planter soil mixture” for all planters shall be 60% topsoil mixture, 10% peatmoss, 10% well composted manure and 20% clean sand. Mix thoroughly for uniformity of texture and distribution before placing in planter.

2.3 PLANT MATERIAL

A. Plant material shall be first quality stock and shall conform to the code of standards set forth in the current edition of the American Standards of Nursery Stock sponsored by the American Association for Nurserymen, Inc.

B. Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

C. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

D. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

E. Species and variety as specified on the Drawings and delivered to the site shall be certified true to their genus, species and variety and as defined within the current edition of "Standardized Plant Names" by the American Joint Committee of Horticultural Nomenclature.

F. The Contractor shall facilitate inspection and identification by labeling of trees, shrubs, and perennials with a durable waterproof label and weather-resistant ink. Labels shall state the correct plant name and size as specified in the plant list of required plants. Labels shall be securely attached to plants and shall be legible for 60 days after delivery to the planting site. Wire identification tags shall not be used. Plants not labeled will be rejected. The Contractor shall remove all tags after the Landscape Architect's acceptance of the installation.

G. Plants shall be nursery grown and shall be of varieties specified in the plant list bearing botanical names.

H. Planting stock shall be well-branched and well formed, sound, vigorous, healthy, free from disease, sun-scale, windburn, abrasion, and harmful insects or insect eggs; and shall have healthy, normal unbroken root systems. Deciduous trees and shrubs shall be symmetrically developed, of uniform habit of growth, with straight trunks or stems, and free from objectionable disfigurements. Evergreen trees and shrubs shall have well-developed symmetrical tops with typical spread of branches for each particular species or variety. Evergreen trees and shrubs shall not be sheared. Plants shall have been grown under climatic conditions similar to those in the locality of the project. Deciduous plants shall be dug in a dormant stage only.

I. Stock Sizes: All stock measurements - caliper, height, branching level, number of canes, ball sizes shall be in strict accordance with the latest edition of the American Standard for Nursery Stock, unless otherwise noted on the plans. Plants used on the project shall meet or exceed all minimum requirements indicated in the size, condition, and remarks sections of the planting legend on the plan sheets.\

J. All stock shall be balled and burlapped or container grown stock. Bareroot stock of any kind is unacceptable.

2.4 FERTILIZERS

A. All fertilizers shall be horticultural grade complete formula fertilizers and shall conform to the applicable State Fertilizer Laws.

B. Plant Stock: Fertilizer shall be "AGRIFORM" slow release fertilizer tablets. To be applied per manufacturer's specifications. Perennials areas: Fertilizer shall be applied at the same rate as the lawn areas.

2.5 MYCORRHIZAL

A. Mycorrhizal Fungi: Dry, granular inoculant containing at least 5300 spores per lb of vesicular-arbuscular mycorrhizal fungi and 95 million spores per lb of ectomycorrhizal fungi, 33 percent hydrogel, and a maximum of 5.5 percent inert material.

B. All mycorrhizal shall be horticultural grade complete formula mycorrhizal and shall conform to the applicable State Mycorrhizal Laws.

C. MYKE Pro Landscape Granular Mycorrhizal Inoculant

1. Distributor: Subject to compliance with requirements, provide products by the following:
2. Arbor Valley Nursery, Brighton, CO, (303) 654-1682, ArborValleyNursery.com
3. For approved equal, reference specific written instructions from manufacturer

2.6 MULCHES FOR PLANTINGS

A. Hardwood Mulch: Mulch in all open planting beds labeled as hardwood mulch shall be shredded double ground oak or dark hardwood mulch of its natural color. Cypress, or dyed or colored mulch is unacceptable. Bark shall be of a relative uniform particle size with a median size of one and one-half inches (1-1/2") and shall be free of sticks, stones, leaves and any other debris.

2.7 GEOTEXTILE FILTER FABRIC

A. Woven Geotextile Filter Fabric: Polypropylene fabric, 3.5 oz to 4.0 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.

2.8 PESTICIDES

A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

2.9 TREE-STABILIZATION MATERIALS

A. Trunk-Stabilization Materials:

1. Steel “T” bar fence post, 8’ long, painted dark green with the top 6” painted white

2. Sawn and sanded, sound, new hardwood, free of knots, holes, cross grain, and other defects, 8’ long by 2” round, pointed at one end. Treated stakes are unacceptable.

B. Tree tie systems shall be easily adjustable, strong in all weather, and easily attached and removed. Hose and wire are not acceptable for staked trees. Tree tie systems shall be the following or approved equal:

1. Cinch Ties, J. Lichtenthaler
P.O. Box 938
Cerritos, CA 90701

2. Adj-A-Type
Heavyweight only, plastic chain twist tie

3. A.M. Leonard and Sons
Piqua, Ohio 43356
Plastic Binder Tye, tie with tapered beads that snap lock

2.10 EDGING

A. Shrub bed edge adjacent to turf areas shall be black powder coat steel 3/16” x 4”x 16’ edging as manufactured by Sure-Loc Edging. or approved equal. 1.800.787.3562

B. Bed edging adjacent to concrete curb, pavement and sidewalk shall be manicured “V” edge per details.

2.11 WATER

A. Water shall not contain elements toxic to plant life. It shall be the Contractor’s responsibility to obtain water to be used for watering of plant material.

2.12 TREE-WATERING DEVICES

A. Slow-Release Watering Device: Standard product manufactured for drip irrigation of plants and emptying its water contents over an extended time period; manufactured from UV-light-stabilized nylon-reinforced polyethylene sheet, PVC, or HDPE plastic.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. BIO-PLEX, Water-It-Well 18 Gal.

b. Spectrum Products, Inc., Treegator Original Slow Release Watering Bag

2. Color: Green

2.13 MISCELLANEOUS PRODUCTS

A. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

B. Burlap: Non-synthetic, biodegradable.

C. Planter Drainage Gravel: Washed, sound crushed stone or gravel complying with ASTM D448 for Size No. 8 Insert requirements.

D. Planter Filter Fabric: Woven geotextile manufactured for separation applications and made of polypropylene, polyolefin, or polyester fibers or combination of them.

E. Trunk Wrapping Material: Tree wrap products shall be two thicknesses of crinkled paper cemented together with a layer of bituminous material. Wrapping material shall be a minimum of 4” inches in width and have a stretch factor of 33 1/3 percent. Twine for tying shall be a grafting cord.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain 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. Preparation of Planting Soil Mixture
1. Mix recommended soil amendments and fertilizers with topsoil at rates recommended by the soil test results. Delay addition of fertilizer if planting mixture will not be used within two (2) days.

F. Protection of Existing Vegetation
1. All areas under drip lines of existing trees shall be kept free of construction equipment, trailers, material storage, and vehicles.
2. Exercise extreme care when working around existing trees to remain. No soil scarification or compaction from construction vehicles shall occur under any existing tree dripline.
3. In areas of established turf, the surrounding turf area shall be covered in a manner that will provide protection before excavations begin.

3.3 PLANTING AREA ESTABLISHMENT

A. General: Prepare planting area for soil placement and mix planting soil Coordinate

B. Placing Planting Soil: Place manufactured planting soil over exposed subgrade.

C. Before planting, restore planting areas if eroded or otherwise disturbed after finish grading.

D. Application of Mycorrhizal Fungi: At time of planting, apply dry product uniformly over prepared soil at application rate according to manufacturer's written recommendations.

3.4 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits.

1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
2. Excavate approximately three times as wide as ball diameter for balled and burlapped stock.
3. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
4. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
5. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
6. Maintain supervision of excavations during working hours.
7. Keep excavations covered or otherwise protected when unattended by Installer's personnel.
8. If drain tile is indicated on Drawings or required under planting areas, excavate to top of porous backfill over tile.

B. Backfill Soil: Subsoil may not be used as backfill and the top six (6) inches of topsoil removed from excavations, if free from subsoil, clay, rocks, roots, or other debris, may be utilized in the topsoil mixture as specified.

C. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

1. Hardpan Layer: Drill 6-inch- diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

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.

3.5 TREE, SHRUB, AND VINE PLANTING

A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Balled and Burlapped and Container-Grown Stock: Balled and burlapped and container grown plants shall be handled and moved only by the ball or container. Container-grown stock shall be removed from containers without damaging plant or root system. Set each plant plumb and in center of planting pit or trench with root flare 2 inches above adjacent finish grades.

1. Backfill: Planting soil as specified.
2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Apply Mycorrhizal to root ball according to manufacturer's recommended rates. Inoculant must be physically rubbed onto the root ball thoroughly prior to backfilling planting hole.
4. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
5. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.

    a. Quantity: Per manufacturer's recommended rates.

6. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.6 TREE, SHRUB, AND VINE PRUNING

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

B. Prune, thin, and shape trees, shrubs, and vines as directed by Landscape Architect.

C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

D. Do not apply pruning paint to wounds.

3.7 TREE STABILIZATION

A. Trunk Stabilization by Upright Staking and Tying: Install trunk stabilization as follows unless otherwise indicated:

1. Upright Staking and Tying:

    a. Trees shall be staked and guyed as indicated on plans within 24 hours of planting.

    b. Stakes shall be driven vertically into the ground to a depth specified in details and in such a manner as to not damage the ball or roots.
    c. Tree tie systems shall be installed as per manufacturer specifications.
    d. All trees 2-1/2 inches in caliper or less shall be staked with two stakes. All trees greater than 2-1/2 inches in caliper shall be staked with three stakes, spaced equal distant around the tree.

2. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.
3. Support trees with two strands of tie wire, connected to the brass grommets of tree-tie webbing at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

3.8 TREE WRAPPING

A. Deciduous trees planted in specified fall timeframe shall have their trunks wrapped with 24 hours after planting.

B. Apply specified tree wrap per manufacturer’s recommendations and specifications.

3.9 PLACING SOIL IN PLANTERS

A. Wrap a layer of drainage gravel at least 4 inches thick in bottom of planter with filter fabric. Secure the filter fabric wrapped drainage gravel with duct tape to prevent soil from migrating into the drainage gravel layer during the soil-filling process.

B. Fill planter with planting soil. Place soil in lightly compacted layers to an elevation of 1-1/2 inches below top of planter, allowing natural settlement.

3.10 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.

B. Use specified planting soil for backfill.

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.11 PLANTING AREA MULCHING

A. Prior to installation of mulch, all areas to be covered shall be weed free and treated with the specified pre-emergent herbicide.

B. Mulching shall take place within 48 hours after planting.

C. Mulch backfilled surfaces of planting areas and other areas indicated.

1. Trees in Turf Areas: Apply organic mulch ring of 3-inch average thickness, with 36-inch radius around trunks or stems. Do not place mulch within 3 inches of trunks or stems.
2. Organic Mulch in Planting Areas: Apply 3-inch average thickness of organic mulch over whole surface of planting area, and finish level with adjacent finish grades. Do not place mulch within 3 inches of trunks or stems.

3. Mulch shall be kept off walls, sidewalks, light standards, and other structures.
4. The top of all areas covered with mulch shall be 1-inch below the top of adjacent curb, walk, wall, wall cap, or edge of pavement.

3.12 INSTALLATION OF EDGING

A. Steel Edging: Install steel edging where indicated on the Drawings according to manufacturer's written instructions.

3.13 INSTALLATION OF SLOW-RELEASE WATERING DEVICE

A. Provide one device for each tree.

B. Place device on top of the mulch at base of tree stem and fill with water according to manufacturer's written instructions.

3.14 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.

B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.15 PESTICIDE APPLICATION

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

B. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas according to manufacturer's written recommendations. Do not apply to seeded areas.

C. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.16 CLEANING AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

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

C. 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.

D. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

E. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

3.17 PLANT MAINTENANCE

A. The Contractor shall maintain trees, shrub, and other plants by pruning, cultivating, and weeding as required for healthy growth until issuance of the letter of Substantial Completion for the entire site and scope of work. The Contractor shall tighten and repair stake and tree tie systems, reset trees and shrubs to proper grades or vertical position, restore or replace damaged wrappings, and apply herbicide and pesticides to keep trees, shrubs, and other plant material free of insects and disease as required until issuance of the letter of Substantial Completion.

B. The Contractor shall be responsible for watering trees, shrubs, and other plant material until the new irrigation system is completely functional and the letter of Substantial Completion has been issued. Contractor shall be responsible for watering trees by hand where tree root watering irrigation does not occur. Hand watering of these trees shall continue for 90 days after letter of Substantial Completion has been issued. Watering shall supplement natural rainfall and shall assure that the trees, shrubs, and other plant material receive a minimum of 1-inch of water per week.

END OF SECTION