SECTION 32 01 13

SLURRY SEALING

PART 1 – GENERAL

1.01 SUMMARY

A. Provide slurry sealing over existing asphalt paving areas as indicated on drawings.
B. Provide striping for parking, roadway, fire lanes and handicapped markings as indicated on drawings.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.
B. Upon request, submit slurry seal mix design for review and approval

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Standards: Comply with the provisions of the following specifications and standards, except as noted or specified.
   1. ASTM C131-06, Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
   2. ASTM D242-09, Specifications for Mineral Filler for Bituminous Paving Mixtures.
   3. ASTM D977-12b, Specifications for Emulsified Asphalt.
   4. ASTM D2397-12, Specifications for Cationic Emulsified Asphalt.
   5. Paint handicap spaces to conform to ADA, ANSI A117.1 and local code requirements.

1.04 PROJECT CONDITIONS

A. Weather limitations:
   1. Apply slurry sealant when ambient temperature is above 50° F, and when temperature has not been below 35° F for 12 hours immediately prior to application. Do not apply when existing paving is wet or contains an excess of moisture.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Design Requirements
   1. This specification shall meet requirements of International Slurry Seal Association, Type I.
B. Asphalt Emulsion
   1. Conform to requirements of ASTM D977-12b or ASTM D2397-12.
   2. Minimum percent of emulsion to aggregate shall be 18 percent.
C. Aggregate
   1. Mineral aggregate consisting of natural or manufactured sand, slag, or combination thereof.

a. Smooth textured sand of less than 1.25% water absorption shall not exceed 50% of total combined aggregate.
b. Material shall be clean and free from organic matter and other deleterious substances and show loss of not more than 35 when tested in accordance with ASTM C131-06.
c. Mineral fillers shall meet requirements of ASTM D242-09, and following gradation requirements:

	Sieve Size	% Passing by Weight
1). (a).	#4	100
(b).	#8	90 to 100
(c).	16	65 to 90
(d).	30	40 to 60
(e).	50	25 to 42
(f).	100	15 to 30
(g).	200	10 to 20

D. Water – Potable and free from harmful soluble salts.
E. Lane and Parking Area Marking Paint: Colors as indicated on drawings. Alkyd-resin type, ready-mixed, AASHTO M 248, Type I.

PART 3 – EXECUTION

3.01 PREPARATION

A. Immediately prior to applying slurry, clean surface of loose material, silt spots, vegetation, oil spots, and other objectionable material. Power brooms, power blowers, air compressors, water flushing equipment, and hand brooms shall be suitable for cleaning existing pavement.
B. Apply tack coat of one part emulsion, 3 parts water at rate of 0.05 to 0.10 gallons per sq. yd.

3.02 APPLICATION

A. Equipment, tools, and machines used in performance of work of this Section shall be maintained in satisfactory working order during performance of work of this Section.
   1. Slurry mixing machine shall be continuous flow mixing unit capable of delivering accurately predetermined proportion of aggregate, water, and asphalt emulsion to mixing chamber and to discharge thoroughly mixed production on continuous basis.
   2. Attach to mixer mechanical type squeegee distributor equipped with flexible material in contact with surface to prevent loss of slurry from distributor.
B. Surface may be pre-wetted by fogging ahead of slurry box providing no water is accumulated in front of slurry box.
C. Maintain adequate amounts of slurry in spreader to insure complete coverage. No lumping, balling, unmixed aggregate, or streaking due to oversize aggregate shall be permitted.
D. Use approved squeegees to spread slurry in areas not accessible to slurry mixer.
E. Apply at rate of 6 to 10 lbs. per sq. yd. based on dry aggregate weight.
F. Roll with 6 to 8 ton pneumatic tired roller with minimum contact pressure of 40 psi after emulsion has broken.
G. No unsightly joints or other visual imperfections are permitted on finished product.
H. Traffic and Lane Markings:
   1. Cleaning: Sweep and clean surface to eliminate loose material and dust.
   2. Striping: Use lane-marking paint, factory-mixed, quick-drying, and non-bleeding; yellow, blue, red, or white color as indicated on drawings or selected by Architect.
   3. Site Tolerances:
      a. General: Make lines parallel, evenly spaced, and with sharply defined edges.

b. Line Widths:
   1). Plus or minus ¼-inch variance on straight segments.
   2). Plus or minus ½-inch variance on curved alignments.
4. Do not apply traffic and lane marking paint until layout and placement has been verified by Architect.
5. Do not apply until slurry sealant has cured 72 hours minimum.
6. Apply paint with mechanical equipment to produce uniform 4" wide straight edges. Apply in 2 coats at manufacturer's recommended rates. Colors as indicated on drawings.

3.03 PROTECTION & CLEANING

A. Allow treated areas to cure 24 hours minimum before opening to traffic.
B. Remove drips, overspray, improper markings, and paint material tracked by traffic by sand blasting, wire brushing, or other method approved by Architect prior to performance.

END OF SECTION

SECTION 32 11 26

HOT-MIXED ASPHALT PAVING

PART 1 – GENERAL

1.01 SUMMARY

A. Provide hot-mixed asphalt paving over prepared subbase where indicated:
   1. Parking areas.
   2. Driveways (Excluding drive aprons specified as concrete construction).
B. Provide striping for parking, roadway, fire lanes and handicapped markings as indicated on drawings.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.
B. Submit for approval product data, test reports, certificates signed by material producer and Contractor, certifying that each material item complies with, or exceeds, specified requirements.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Comply with State highway or transportation department standard specifications, latest edition, and with local governing regulations if more stringent than specified requirements.

1.04 LAYER DESIGN THICKNESS AND TOLERANCES

A. Provide prepared subgrade, granular base, bituminous base course and bituminous surface course as indicated on the drawings or per geotechnical report pavement recommendations if higher quality and more stringent requirements specified. Subgrade shall meet the requirements of Section 31 00 00-Earthwork.
B. Construction Tolerances: Test finished surface of each course for smoothness using 10 foot straightedge, applied parallel with, and at right angles to centerline of paved area. Surfaces will not be accepted if exceeding the following tolerances and smoothness:
   1. Base Course Thickness: Within ½-inch.
   2. Surface Course Thickness: Within ¼-inch.
   3. Base Course Surface Smoothness: Within ¼-inch.
   4. Surface Course Surface Smoothness: Within 3/16-inch. No ponding acceptable.
   5. Crowned Surfaces: Within ¼ inch from template.

1.05 PROJECT CONDITIONS

A. Weather limitations:
   1. Apply prime and tack coats when ambient temperature is above 50° F, and when temperature has not been below 35° F for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.

2. Construct asphalt concrete surface course when atmospheric temperature is above 40° F, and when base is dry. Base course may be placed when air temperature is above 30° F and rising.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Use locally available materials and gradations, which exhibit a satisfactory record of previous installations.
B. Base Course Aggregate: Sound, angular crushed stone, crushed gravel, or crushed slag, sand, stone or slag screenings.
C. Surface Course Aggregate: Crushed stone, crushed gravel, crushed slag, and sharp-edged natural sand.
D. Mineral Filler: Rock or slag dust, hydraulic cement, or other inert material complying with ASTM D 242.
E. Asphalt Cement: Comply with ASTM D 3381 for viscosity-graded material..
F. Prime Coat: Cut-back asphalt type; ASTM D 2027 MC-30, MD-70, or MC-250.
G. Tack Coat: Emulsified asphalt, ASTM D 977.
H. Herbicide Treatment: Commercial chemical for weed control registered by Environmental Protection Agency and acceptable to authorities having jurisdiction.
I. Lane and Parking Area Marking Paint, Colors as indicated on drawings: Alkyd-resin type, ready-mixed, AASHTO M 248, Type I.

2.02 ASPHALT-AGGREGATE MIXTURE

A. Provide plant-mixed, hot-laid asphalt-aggregate mixture complying with geotechnical report pavement recommendations and local DOT and DPW regulations.

PART 3 – EXECUTION

3.01 SURFACE PREPARATION

A. Remove loose material from compacted subbase surface immediately before applying prime coat. Proof roll prepared subbase surface to check for unstable areas and areas requiring additional compaction. Do not begin paving work until deficient subbase areas have been corrected and are ready to receive paving.
B. Prime Coat: Apply at the rate of 0.2 to 0.5 gallons per square yard over compacted subgrade. Apply material to penetrate seal, but not flood, surface. Cure and dry as long as necessary to obtain penetration and evaporation of volatiles.
C. Tack Coat: Apply to contact surfaces of previously constructed asphalt or portland cement concrete and surfaces abutting or projecting into asphalt concrete pavement. Distribute at rate of 0.05 to 0.15 gallons per square yard of surface. Allow to dry until at proper condition to receive paving. Exercise care in applying bituminous materials to avoid smearing of adjoining concrete surfaces. Remove and clean damaged surfaces.

3.02 APPLICATION

A. Placing Mix: Place asphalt concrete mix on prepared surface, spread and strike-off. Spread mixture at minimum temperature of 225° F. Place inaccessible and small areas by hand. Place each course to required grade, cross-section, and compacted thickness. Beginning of work means acceptance of subbase.
   1. Paver Placing: Place in strips not less than 10 feet wide, unless otherwise acceptable to Architect. After first strip has been placed and rolled, place

succeeding strips and extend rolling to overlap previous strips. Complete base course for a section before placing surface course.

2. Joints: Make joints between old and new pavements, or between successive days' work, to ensure continuous bond between adjoining work. Construct joints to have same texture, density and smoothness as other sections of asphalt concrete course. Clean contact surfaces and apply tack coat.

B. Rolling: Begin rolling when mixture will bear roller weight without excessive displacement. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
   1. Breakdown Rolling: Accomplish breakdown or initial rolling immediately following rolling of joints and outside edge. Check surface after breakdown rolling, and repair displaced areas by loosening and filling, if required, with hot material.
   2. Second Rolling: Follow breakdown rolling as soon as possible, while mixture is hot. Continue second rolling until mixture has been thoroughly compacted.
   3. Finish Rolling: Perform finish rolling while mixture is still warm enough for removal of roller marks. Continue rolling until roller marks are eliminated and course has attained maximum density.

C. Patching: Remove and replace paving areas mixed with foreign materials and defective areas. Cut out such areas and fill with fresh hot asphalt concrete. Compact by rolling to maximum density and smoothness.

D. Protection: After final rolling, do not permit vehicular traffic on pavement until pavement has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

E. Traffic and Lane Markings:
   1. Cleaning: Sweep and clean surface to eliminate loose material and dust.
   2. Striping: Use lane-marking paint, factory-mixed, quick-drying, and non-bleeding; yellow or white color as indicated or selected by Architect.
   3. Do not apply traffic and lane marking paint until layout and placement has been verified by Architect.
   4. Apply paint with mechanical equipment to produce uniform 4" wide straight edges. Apply in 2 coats at manufacturer's recommended rates. Colors as indicated on drawings.

END OF SECTION

SECTION 32 13 13

PORTLAND CEMENT CONCRETE PAVING

PART 1 – GENERAL

1.01 SUMMARY

A. Provide cast-in-place concrete paving over prepared subbase where indicated on drawings:
   1. Parking areas.
   2. Driveways.
   3. Vehicular entrances.
   4. Walkways.
   5. Curbs and gutters.
   6. Trash pads.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.
B. Submit for approval product data, mix design, test reports in accordance with Section 03 30 00.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Comply with requirements of Section 03 30 00 for concrete mix design, sampling, testing, quality control, and as specified below.
C. Construction Tolerance: 1/8" in 10' for grade and alignment of top of forms; ¼" in 10' for vertical face on longitudinal axis.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Provide concrete materials, forms, reinforcing, and isolation joint fillers as specified in Section 03 30 00.

2.02 CONCRETE MIX, DESIGN TESTING:

A. Comply with requirements of Section 03 30 00 for concrete mix design, sampling, testing, and quality control as specified below.
B. Design the mix to produce normal-weight concrete consisting of portland cement, aggregate, air-entraining admixture and water to produce the following properties:
   1. Compressive Strength: 4000 psi, at 28 days.
   2. Slump Limits: 4-inches maximum, (plus or minus 1-inch), unless otherwise specified.
   3. Air Content: 5 to 7 percent.
   4. Flexural Strength: ASTM C78-10e1, 550 psi minimum at 28 days.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Comply with requirements of Section 03 30 00 for mixing, testing, placement, reinforcement placement, joints, tolerances, curing, repairs, protection and placing concrete.
B. Proof roll subbase and check for unstable areas. Report unsatisfactory conditions in writing. Beginning paving work means acceptance of subbase.
C. Joints: Construct control, isolation and construction joints true to line with face perpendicular to surface of pavement, unless otherwise indicated.
    1. Construction joints: At locations of separate pours or thickness separations.
    2. Isolation joints:
        a. Walkways: Twenty-four (24) feet on center unless otherwise indicated.
        b. Parking areas, driveways, curbs, and guttering: Twenty-four (24) feet on center maximum.
    3. Control joints:
        a. Walkways: Six (6) feet on center unless otherwise indicated.
        b. Parking areas, driveways, curbs, and guttering: Twelve (12) feet on center maximum.
    4. Seal isolation and construction joints.
    5. Contractor's option to pour concrete curb and gutter integral (monolithic) with concrete paving in lieu of providing key-ways or dowels.
D. Tactile Warning Surface: Comply with Section 32 30 00. Provide tactile warning surfacing material on handicapped curb ramps with truncated domes per ADA and ANSI A117.1 current standards. .
E. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to ¼" radius, unless otherwise indicated. Eliminate any tool marks on concrete surface.
F. Protect Concrete paving until weight of a person will not leave an impression. Exclude traffic from pavement for at least 14 days after placement. Remove and replace concrete paving which shows impressions or other defects. Skim coating defects is not acceptable.
G. Dispose of over-mixed concrete off-site in a legal manner.

END OF SECTION

SECTION 32 30 00

SITE IMPROVEMENTS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide the following site improvements where indicated on drawings:
   1. Bollards
   2. Fencing
   3. Site Signage (Fire lane)
   4. Site signage (Handicapped accessible parking)
   5. Precast concrete parking bumper blocks
   6. Precast concrete downspout splash blocks
   7. Detectable/Tactile Warning Surfaces

1.02 SUBMITTALS

A. None required for this section unless otherwise indicated.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Regulations: ANSI, ADA, and local governing code.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Provide units specifically designed for exterior exposure and intended use:
   1. Bollards: Concrete-filled steel bollards.
      a. Concrete construction shall comply with Section 03 30 00.
      b. Steel construction shall comply with Section 05 50 00.
      c. Painting shall comply with Section 09 90 00.
   2. Site Signage: Handicapped accessible parking.
      a. Steel construction and fasteners shall comply with Section 05 50 00.
      b. Painting shall comply with Section 09 90 00.
      c. Signs: Type and model as shown on drawings.
         1). Manufacturer: Best, Grimco, Seton or approved equal.
         2). Comply with ANSI, ADA, and local governing code.
            (a). Lettering, symbols, color, quantity, and mounting heights.
   3. Precast Concrete Parking Bumper Blocks:
      a. Concrete construction shall comply with Section 03 30 00.
         1). Concrete: 4000 psi, Type A.
         2). Reinforcement: (2) #4's continuous minimum.
      b. Steel construction shall comply with Section 05 50 00.
         1). Anchor with (2) #4 dowels per block.
      c. Size: length 6' –0", height 5", width: 9", with edges rounded with faces chamfered.
   4. Precast Concrete Downspout Splash Blocks
      a. Normal weight concrete construction.

b. Manufacturers standard precast size with channel design.
c. Slope for positive drainage away from building.

5. Fencing: AWPA UC3B treated wood type with steel frame and accessories.
   a. Steel construction and fasterers shall comply with Section 05 50 00.
   b. Wood construction shall comply with Section 06 10 00.
   c. Accessories: Refer to drawings for model number.
      1). Gate hardware:
         (a). Manufacturer: Stanley or approved equal.
      2). Fencing Hardware:
         (a). Manufacturer: Simpson Strong Tie or approved equal.
6. Detectable/Tactile Warning Surfaces: (Locations and layout where indicated on drawings.)
   a. General: Comply with current ADA, ANSI A117.1, and state regulations.
   b. Manufacturers: Equal to “Armor-Tile” as manufactured by Engineered Plastics Inc., Tel: 800-682-2525, or approved equal.
   c. Materials: Vitrified Polymer Composite (VPC) epoxy composition employing aluminum oxide particles in truncated domes.
   d. Color: Color shall be homogeneous throughout the tile. Federal Color Number - Yellow – 33538.
   e. Physical Properties: Dimensions minimum 24”x60”, Face Thickness 0.1878 +/5% max.,Warpage of Edge 0.5% max., Water Absorption – ASTM D 570-98 less than 0.05%, Slip Resistance – ASTM C1028-07, greater than 0.80.
   f. Fasteners: Color matched, flat head drive anchors ¼” diameter x 1 ½” long. Armor Drive™ anchors as supplied by Engineered Plastics Inc. or approved equal.
   g. Adhesive: Armor Bond™ Adhesive as supplied by Engineered Plastics Inc. or approved equal.
   h. Sealant; Armor-Seal™ Perimeter Sealant as supplied by Engineered Plastics Inc. or approved equal
7. Site Signage: Fire lane. Type and model where shown on plans.
   a. Steel construction and fasteners shall comply with Section 05 50 00.
   b. Painting shall comply with Section 09 90 00.
   c. Signs: Type and model as shown on plans.
      1). Manufacturer: Best, Grimco, Seton or approved equal.
      2). Comply with ANSI, ADA, and local governing code.
         (a). Lettering, symbols, color, quantity, and mounting heights.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install materials and systems in accordance with manufacturer’s instructions and approved submittals. Install materials and systems in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections.
B. Restore damaged finishes and test for proper function. Clean and protect work from damage.

END OF SECTION

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.01 SUMMARY

A. Provide chain link fencing and gates system complete, where indicated.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.

B. Submit product data.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Manufacturers: Amico, Boundary Fence & Railing Systems, Guardian Fence Systems, Merchants Metals or approved equal.
B. Steel Chain-Link Fence Fabric:
   1. Mesh and Wire Size: 2 inch mesh, 0.148 inch diameter (9 gage).
   2. Coating: ASTM A 817, Type 2, Class 1, zinc-coated (galvanized) applied after weaving.
C. Framework:
   1. Galvanized steel, ASTM F 1083.
   2. Pipe 2” O.D., Schedule 40.
D. Gates:
   1. Swinging type.
   2. Latching: Spring loaded latches or yokes for locking.
   3. Locking: Best “41B722T” Pad Lock. Keying to match Owner’s maintenance program. Coordinate with Owner.
E. Framing and Fittings:
   1. End, corner, and pull posts.
   2. Line and intermediate posts.
   3. Gate posts.
   4. Top rail.
   5. Tension wire.
   6. Tie wires.
   7. Tension bands.
   8. Post and line caps.
   9. Barbed wire supporting arms.
   10. Barbed wire: Three strands minimum.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install materials in accordance with manufacturer's instructions and approved submittals. Comply

with ASTM F 567. Install materials in proper relation with adjacent construction and with uniform appearance. Coordinate with work of other sections. Install posts to depth to avoid frost heave.

B. Cut pipe with pipe cutters only. Cutting with hacksaws is not acceptable. Tack weld gates for strength. Use spring-loaded latches, not yokes.

C. Restore or replace damaged components. Clean and protect work from damage.

END OF SECTION

SECTION 32 31 32

COMPOSITE FENCES & GATES

PART 1 – GENERAL

1.01 SUMMARY

A. Provide composite fencing and gate systems, complete.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.
B. Product data: Upon request, submit manufacturer's material product data indicating sizes, profiles, surface style, and performance characteristics.
C. Samples: Submit color and texture chart with full range of colors and texture options available for Architect's selection. Upon request submit sample of material in color and texture selected.
D. Warranty: Provide manufacturer's ten (10) year warranty against material rot, decay, splitting, checking, splintering, fungal damage, termite damage, and color fade.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Standards: Comply with the provisions of the following specifications and standards, except as otherwise noted or specified, or as accepted or directed by the Architect:
   1. ASTM D-7032-04: Standard Specification for Establishing Performance Ratings for Wood-Plastic Composite Deck Boards and Guardrail Systems (Guards or Handrails), ASTM International.
   2. ASTM D-7031-04: Standard Guide for Evaluating Mechanical and Physical Properties of Wood-Plastic Composite Products, ASTM International.
   3. ASTM E-84-01: Test Method for Surface Burning Characteristics of Building Materials, ASTM International.
   4. ASTM D 570: Water Absorption of Plastics.
   5. ASTM D 1761: Mechanical Fasteners in Wood.
   6. ASTM D -1413-99: Test method for Wood Preservatives by Laboratory Soil-block Cultures.
   7. ASTM C177: Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Manufacturers; Trex Company, Inc. specified. Equivalent products by Advanced Environmental Recycling Technologies, Inc. "ChoiceDek", Azek Building Products, TimberTech, or approved equal.

B. Wood-Plastic Composite Lumber:
   1. Material Description: Composite Decking consisting of recycled Linear Low Density Polyethylene (LLDPE) and recycled wood. Product extruded into shapes

and sizes with boards 1”x 6” (nominal) minimum in manufacturer’s standard lengths.

2. Physical and Mechanical Properties:
   a. Flame Spread: ASTM E84, 60 minimum.
   b. Thermal Expansion: ASTM D1037, 1.9 x 10-5 inch/inch/degree F.
   c. Moisture Absorption: ASTM D1037, < 1%.
   d. Screw Withdrawal: ASTM D1761, 558 lbs/in minimum.
   e. Fungus Resistance: ASTM D1413, Rating - no decay.
   f. Termite Resistance: AWPAE1-72, Rating = 9.6 or better.
   g. Compression Parallel: ASTM D198, Ultimate 1588 psi, Design 540 psi.
   h. Compression Perpendicular: ASTM D143, Ultimate 1437 psi, Design 540 psi.
   i. Bending Strength: ASTM D198, Ultimate 3280 psi, Design 500 psi.
   j. Shear Strength: ASTM D143, Ultimate 1761 psi, Design 360 psi.
   k. Modulus of Elasticity: ASTM D4761, Ultimate 412,000 psi, Design 200,000 psi.
   l. Modulus of Rupture: ASTM D4761, Ultimate 3280 psi, Design 500 psi.
3. Finish: (Refer Drawings). Unless otherwise indicated, colors, patterns, and textures to be selected by Architect from manufacturer’s full range of options available.

2.02 ACCESSORIES

A. Fasteners:
   1. Comply with Section 05 50 00.
   2. Fasteners: Hex head screws, corrosive resistant, size and lengths per manufacturer’s recommendations for project conditions.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install materials in accordance to manufacturer’s instructions.
B. Cut, drill, and rout using carbide tipped blades. Erect materials and systems in proper relation with adjacent construction. Set plumb, straight, and level. Coordinate with other work.
C. Do not use composite wood material for structural applications.
D. Follow manufacturer’s recommendations for cleaning and protection.

END OF SECTION

SECTION 32 32 23

CONCRETE SEGMENTAL RETAINING WALL SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

A. Provide concrete masonry unit segmental retaining wall system, complete.
   1. Work includes preparing foundation soil, furnishing and installing leveling pad, unit drainage fill and backfill to the lines and grades shown on the construction drawings.
   2. Work includes furnishing and installing geogrid soil reinforcement of the type, size, location, and lengths designated on the construction drawings.

1.02 SUBMITTALS

A. Comply with Section 01 33 00.
B. Shop Drawings (Required for retaining walls exceeding 36” in height):
   1. Submit for approval shop drawings of retaining wall system design, including wall elevation views, geosynthetic reinforcement layout, pertinent details, and drainage provisions. The shop drawings shall be signed by a registered professional engineer licensed in the state of project location.
   2. Design Calculations: Engineering design calculations prepared in accordance with the NCMA Design Manual For Segmental Retaining Walls, or the AASHTO Standard Specifications for Highway Bridges, Section 5.8 (whichever is applicable). Analysis of global stability must be addressed and incorporated into the shop drawings.
C. Submit for approval samples, product data, warranty, test reports, maintenance data.
   1. Samples: Furnish one unit in the color and face pattern specified, if requested. Furnish 12 inch square or larger piece of the geosynthetic reinforcement specified.
   2. Test Reports: Submit a test report documenting strength of specific modular concrete unit and geogrid reinforcement connection. The maximum design tensile load of the geogrid shall be equal to the laboratory tested ultimate strength of geogrid/facing unit connection at a maximum normal force limited by the "Hinge Height" of the structure divided by a safety factor of 1.5. The connection strength evaluation shall be performed in accordance with NCMA test method SRWU-1.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers which have been in satisfactory use in similar service for three years. Deliver, handle, store, and install materials in accordance with manufacturer's instructions. Use experienced installers certified by manufacturer and meeting governing regulation licensing requirements.
   1. Remove damaged or otherwise unsuitable material, when so determined, from the site.
   2. Exposed faces of concrete wall units shall be free of chips, cracks, stains, and other imperfections detracting from their appearance, when viewed from a distance of 10 feet.
   3. Prevent mud, wet cement, adhesives and similar materials which may harm appearance of units, from coming in contact with system components.
B. Comply with requirements of the following related Sections:
   1. Section 31 00 00 Earthwork for compaction, sampling, testing and quality control standards.
   2. Section 03 30 00 Cast-In-Place Concrete for concrete mix design, sampling, testing and quality control standards.

C. Standards: Comply with the following.
   1. ASTM C1372-11 Specification for Segmental Retaining Wall Units
   2. ASTM D422-63 (2007) Particle Size Analysis
   3. ASTM D698-12 Laboratory Compaction Characteristics of Soil -Standard Effort
   4. ASTM D4318-10 Liquid Limit, Plastic Limit and Plasticity Index of Soils
   5. ASTM D4595-11 Tensile Properties of Geotextiles - Wide Width Strip
   6. ASTM D5262-07 (2012) Unconfined Tension Creep Behavior of Geosynthetics
   7. ASTM D3034-08 Polyvinyl Chloride Pipe (PVC)
   8. ASTM D1248-12 Corrugated Plastic Pipe

D. Testing:
   1. If a geotechnical analysis has been prepared for this site, (refer section 00 31 00). Follow geotechnical analysis recommendations.
   2. Comply with Section 01 45 16 – Quality Control Procedures.
   3. Owner to provide the services of a qualified independent geotechnical testing laboratory to perform soil testing and inspection services during earthwork and retaining wall construction.
   4. Testing and inspection shall comply with Section 31 00 00 Earthwork. As a minimum, quality assurance testing shall include foundation soil inspection, soil and backfill testing, verification of design parameters, and observation of construction for general compliance with design drawings and specifications.

PART 2 – PRODUCTS

2.01 MODULAR CONCRETE MASONRY UNIT RETAINING WALL UNITS

A. Manufacturers: Anchor Wall, Keystone Block, Stonewall Select, or approved equal. Modular concrete materials shall conform to the requirements of ASTM C1372-11 - Standard Specifications for Segmental Retaining Wall Units

B. Modular concrete units shall conform to the following architectural requirements:
   1. Color(s): To be selected by Architect from manufacturer's standard samples.
   2. Finish: Exposed vertical surfaces sculptured split face. Concealed and horizontal faces smooth unless otherwise indicated.
   3. Unit Size: 6" (H) x 16" (W) x 12" (D) minimum in angular tri-planer configuration with an integral concrete shear connection flange/locator
   4. Bond configuration - running with bonds nominally located at midpoint vertically adjacent units, in both straight and curved alignments.
   5. Exposed surfaces of units shall be free of chips, cracks or other imperfections when viewed from a distance of 10 feet under diffused lighting.

C. Modular concrete units shall conform to the following structural and geometric requirements measured in accordance with appropriate references:
   1. Compressive strength = 3000 psi minimum;
   2. Absorption = 8 % maximum (6% in northern states) for standard weight aggregates;
   3. Dimensional tolerances = ± 1/8" from nominal unit dimensions not including rough split face, ±1/16" unit height - top and bottom planes;
   4. Unit weight - 100 lbs/unit minimum for standard weight aggregates;
   5. Inter-unit shear strength - 1500 plf minimum at 2 psi normal pressure;
   6. Geogrid/unit peak connection strength -1000 plf minimum at 2 psi normal force.

D. Modular concrete units shall conform to the following constructability requirements:
   1. Vertical setback = 1/8"± per course (near vertical) or 1"+ per course per the design; alignment and grid positioning mechanism - fiberglass pins, two per unit minimum; maximum horizontal gap between erected units shall be - 1/2 inch.

2.02 SHEAR CONNECTORS

A. Shear connectors shall be 1/2 inch diameter thermoset isopthalic polyester resin-

pultruded fiberglass reinforcement rods or equivalent to provide connection between vertically and horizontally adjacent units. Strength of shear connectors between vertical adjacent units shall be applicable over a design temperature of 10 degrees F to + 100 degrees F.

B. Shear connectors shall be capable of holding the geogrid in the proper design position during grid pre-tensioning and backfilling.

2.03 BASE LEVELING PAD MATERIAL

A. Material shall consist of a compacted crushed stone base or non-reinforced concrete as shown on the construction drawings.
   1. Aggregate Base: Crushed stone or granular fill meeting the following gradation as determined in accordance with ASTM D448-12:

Sieve Size	Percent Passing
1 inch	100
No. 4	35 to 70
No. 40	10 to 35
No. 200	3 to 10

      Base Thickness: 6 inches (minimum compacted thickness).
   2. Concrete Base: Nonreinforced lean concrete base.
      a. Compressive Strength: 500 psi (maximum).
      b. Base Thickness: At least 2 inches, but not more than 3 inches.

2.04 UNIT DRAINAGE FILL

A. Drainage Aggregate: Clean crushed stone or granular fill meeting the following gradation as determined in accordance with ASTM D448-12:

Sieve Size	Percent Passing
1 inch	100
3/4 inch	75 to 100
No. 4	0 to 60
No. 40	0 to 50
No. 200	0 to 5

B. One cubic foot, minimum, of drainage fill shall be used for each square foot of wall face. Drainage fill shall be placed within cores of, between, and behind units to meet this requirement.

2.05 REINFORCED BACKFILL

A. Backfill (Comply with geotechnical engineer's recommendations and Section 31 00 00 - Earthwork): Soil free of organics and debris and consisting of either GP, GW, SP, SW, or SM type, classified in accordance with ASTM D2487-11 and the USCS classification system.
   1. Soils classified as SC and CL are considered suitable soils for segmental retaining walls with a total height of less than 15 feet unless the Plasticity Index (PI) is 20 or more.
   2. Maximum particle size for backfill is 2 inches.
   3. Unsuitable soils are organic soils and those soils classified as CH, OH, MH, OL, or PT

B. The maximum aggregate size shall be limited to 3/4 inch unless field tests have been performed to evaluate potential strength reductions to the geogrid design due to damage during construction.

C. Material can be site excavated soils where the above requirements can be met. Unsuitable soils for backfill (high plastic clays or organic soils) shall not be used in the backfill or in the reinforced soil mass.

2.06 GEOGRID SOILD REINFORCEMENT

A. Geosynthetic reinforcement shall consist of geogrids manufactured specifically for soil reinforcement applications and shall be manufactured from high tenacity polyester yarn or high density polyethylene. Polyester geogrid shall be knitted from high tenacity polyester filament yarn with a molecular weight exceeding 25,000 Meg/m and a carboxyl end group values less than 30. Polyester geogrid shall be coated with an impregnated PVC coating that resists peeling, cracking, and stripping.
B. The maximum design tensile load of the geogrid shall not exceed the laboratory tested ultimate strength of the geogrid/facing unit connection as limited by the "Hinge Height" divided by a factor of safety of 1.5. The connection strength testing and computation procedures shall be in accordance with NCMA SRWU-1 Test Method for Determining Connection Strength of SRW.

2.07 ACCESSORIES

A. Drainage Pipe: If required, the drainage pipe shall be perforated or slotted PVC pipe manufactured in accordance with ASTM D3034-08 or corrugated HDPE pipe manufactured in accordance with ASTM D1248-12. The pipe may be covered with a geotextile filter fabric to function as a filter.
B. Construction Adhesive: Exterior grade adhesive as recommended by the retaining wall unit manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION & PREPARATION

A. Examine the areas and conditions under which the retaining wall system is to be erected, and notify the Architect/Engineer in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.
B. Excavation support, if required, is the responsibility of the Contractor, including the stability of the excavation and it's influence on adjacent properties and structures.

3.02 EXCAVATION

A. Contractor shall excavate to the lines and grades shown on the construction drawings. Owner's representative shall inspect the excavation and approve prior to placement of leveling material or fill soils. Proof roll foundation area as directed to determine if remedial work is required.
B. Over-excavation and replacement of unsuitable foundation soils and replacement with approved compacted fill will be compensated as agreed upon with the Owner. Over-excavation not approved by Architect/Engineer will not be paid for by the Owner. Replacement of these soils with compacted fill and/or wall system components will be required at the Contractor's expense. Use care in excavating to prevent disturbance of the base beyond the lines shown.

3.03 BASE COURSE PREPARATION

A. Place base materials to the depths and widths shown on the Drawings, upon undisturbed soils, or foundation soils prepared in accordance with related sections.
B. Extend the leveling pad laterally at least 6 inches in front and behind the lowermost concrete retaining wall unit.
C. Provide aggregate base compacted to 6 inches thick (minimum).
D. The Contractor may at their option, provide a concrete leveling pad as specified in

lieu of the aggregate base.

E. Where a reinforced footing is required by local code official, place footing below frost depth.
F. Compact aggregate base material to provide a level, hard surface on which to place the first course of units.
G. Prepare base materials to ensure complete contact with retaining wall units. Gaps are not allowed.

3.04 MODULAR UNIT INSTALLATION

A. First course of units shall be placed on the leveling pad at the appropriate line and grade. Alignment and level shall be checked in all directions and insure that all units are in full contact with the base and properly seated.
B. Place the front of units side-by-side. Do not leave gaps between adjacent units. Layout of corners and curves shall be in accordance with manufacturer's recommendations.
C. Install shear/connecting devices per manufacturer's recommendations.
D. Place and compact drainage fill within and behind wall units. Place and compact backfill soil behind drainage fill. Follow wall erection and drainage fill closely with structure backfill.
E. Maximum stacked vertical height of wall units, prior to unit drainage fill and backfill placement and compaction, shall not exceed two courses.

3.05 STRUCTURAL GEOGRID INSTALLATION

A. Geogrid shall be oriented with the highest strength axis perpendicular to the wall alignment.
B. Geogrid reinforcement shall be placed at the strengths, lengths, and elevations shown on the construction design drawings or as directed by the Engineer.
C. The geogrid shall be laid horizontally on compacted backfill and attached to the modular wall units. Place the next course of modular concrete units over the geogrid. The geogrid shall be pulled taut, and anchored prior to backfill placement on the geogrid.
D. Geogrid reinforcements shall be continuous throughout their embedment lengths and placed side-by-side to provide 100% coverage at each level. Spliced connections between shorter pieces of geogrid or gaps between adjacent pieces of geogrid are not permitted.

3.06 BACKFILL PLACEMENT

A. Installation of backfill shall be per geotechnical engineer’s recommendations.
B. Place reinforced backfill, spread and compact in a manner that will minimize slack in the reinforcement.
C. Place fill within the reinforced zone and compact in lifts not exceeding 6 to 8 inches (loose thickness) where hand-operated compaction equipment is used, and not exceeding 12 inches (loose thickness) where heavy, self-propelled compaction equipment is used.
D. Only lightweight hand-operated compaction equipment is allowed within 4 feet of the back of the retaining wall units. If the specified compaction cannot be achieved within 4 feet of the back of the retaining wall units, replace the reinforced soil in this zone with drainage aggregate material.
E. Unless otherwise specified by project geotechnical engineer, provided the following minimum compaction requirements for fill placed in the reinforced zone.
    1. Walls Less Than 15 Feet High: Compact to 95 percent of the soil's standard Proctor maximum dry density (ASTM D698) [modified Proctor maximum dry

density (ASTM D1557)] for the entire wall height

2. Walls 15 Feet High BUT NOT MORE THAN 30 Feet High: Change compaction requirements to 98 percent of the soil's standard Proctor maximum dry density (ASTM D698-12) or modified Proctor maximum dry density (ASTM D1557-12) for depths below 15 feet.
3. Walls Over 30 Feet High: Change compaction requirements to 100 percent of the soil's standard Proctor maximum dry density (ASTM D698-12) for depths below 30 feet.
4. Increase compaction requirements for retaining walls with slope heights at the back of the reinforced soil zone greater than 5 feet above the top of wall. Verify compaction requirements with Project geotechnical engineer.
5. Utility Trench Backfill: Compact utility trench backfill in or below the reinforced soil zone to 98 percent of the soil's standard Proctor maximum dry density (ASTM D698-12), or as recommended by the Project geotechnical engineer. If the height from the utility to finish grade is higher than 30 feet, increase compaction to 100 percent of the standard Proctor density. Utilities must be properly designed (by others) to withstand all forces from the retaining wall units, reinforced soil mass, and surcharge loads, if any.
6. Moisture Content: Within 2 percentage points of the optimum moisture content for all wall heights.

F. At the end of each day's operation, slope the last level of compacted backfill away from the interior (concealed) face of the wall to direct surface water runoff away from the wall face.

G. The General Contractor is responsible for ensuring that the finished site drainage is directed away from the retaining wall system. In addition, the General Contractor is responsible for ensuring that surface water runoff from adjacent construction areas is not allowed to enter the retaining wall area of the construction site.

3.07 CAP UNIT INSTALLATION

A. Apply adhesive to the top surface of the unit below and place the cap unit into desired position.
B. Cut cap units as necessary to obtain the proper fit.
C. Backfill and compact to top of cap unit .

3.08 SITE CONSTRUCTION TOLERANCES

A. Vertical Alignment: Plus or minus 1-1/2 inches over any 10-foot distance, with a maximum differential of 3 inches over the length of the wall.
B. Horizontal Location Control From Grading Plan:
   1. Straight Lines: Plus or minus 1-1/2 inches over any 10-foot distance.
   2. Corner and Radius Locations: Plus or minus 12 inches.
   3. Curves and Serpentine Radii: Plus or minus 2 feet.
C. Immediate Post Construction Wall Batter: Within 2 degrees of the design batter of the concrete retaining wall units.
D. Bulging: Plus or minus 1-1/4 inches over any 10-foot distance

3.09 ADJUSTING AND CLEANING

A. Replace damaged units with new units as the work progresses. Remove debris caused by wall construction and leave adjacent areas clean.

END OF SECTION

SECTION 32 80 00

IRRIGATION SYSTEMS

PART 1 – GENERAL

1.01 SUMMARY

A. Provide irrigation system pipe, fittings, valves, sprinklers, backflow prevention, and automatic controls.
B. System design shown on drawings is schematic and approximate. Actual placement may vary slightly as required to achieve full, even coverage without spraying onto buildings, sidewalks, fences, etc.

1.02 SUBMITTALS

A. Submit for approval shop drawings, product data, warranty, test reports, maintenance data. Provide seal, signature, and date of authenticity of landscape architect or licensed irrigator in state of project location when required by local or state regulations.
B. Provide reduced copy of record drawings to half-size, color key circuits and sprinkler zones, and laminate both sides with 5 mil. thick or heavier plastic and mounted adjacent to controller.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Deliver, handle, store, and install materials in accordance with manufacturer's instructions.
B. Use experienced irrigators and installers certified by manufacturer and meeting governing regulation licensing requirements. Submit Certificates of State Registration when requested.
C. Standards: Comply with the following standards, except where otherwise indicated or specified:
    1. ASTM D1785-12 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Shcedules 40, 80, and 120.
    2. ASTM D2239 -12a Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR PR) Based on Controlled Inside Diameter.
    3. ASTM D2241-09 Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure Rated Pide (SDR Series).
    4. ASTM D2466-06 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
D. Water Conservation: Comply with governing codes and regulations.
E. Precipitation Rate: 0.35 minimum per hour for every hour that the system is in operation or as required for local precipitation zone recommendations, whichever is less.
F. Water Coverage:
    1. Turf Areas: As indicated on Drawings.
    2. Other Planting Areas: 100 percent.
G. Testing: Hydrostatic test at 50 psi and 50 gpm.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Rock-Free Soil:
   1. Backfill soil around PVC pipe.
   2. Soil having rocks no larger than ¼-inch in any direction.
B. Gravel:
   1. For use around drains.
   2. ½-inch to ¾-inch maximum round, water worn, washed rock.
C. Sand: Natural or crushed free of silt clay, loam, mica, friable or soluble materials, and organic matter
D. Topsoil: Existing in place material. Remove rocks, roots, sticks, clods, debris, and other foreign matter over 1-1/2 inches longest dimension encountered during trenching.

2.02 COMPONENTS

A. Manufacturer: Rain Bird, Toro, or approved equal. System components shall be of single manufacturer. Conform to requirements shown on drawings for system type and model numbers.
B. Pipe, Pipe Fittings, and Connections:
   1. Pipe shall be continuous and permanently marked with Manufacturer's name, size, schedule, type, and working pressure.
   2. Pipe sizes shown on drawings are minimum. Larger sizes may be substituted without additional cost to Owner.
   3. Pipe:
      a. Pressure lines: ASTM D2241-09 schedule 40 PVC or ASTM D2239-12a 160 psi polyethylene pipe.
      b. Lateral lines: Polyethylene flexible pipe ASTM D2239-12A rated at 100 psi or ASTM D2241-09 Class 200 PVC.
   4. Fittings:
      a. PVC ASTM D2241-09 schedule 40; schedule 80 PVC for threaded nipples.
   5. Sleeves:
      a. Under parking area and driveway paving: PVC plastic, ASTM D1785-12, Schedule 40 pipe; ASTM D2466-06, Schedule 40, PVC plastic socket-type pipefitting; solvent-cemented joints.
      b. All other: Class 200 PVC pipe.
      c. Sleeve diameter shall be double the nominal size of the irrigation pipe enclosed.
      d. Extend sleeves 18-inches minimum beyond walk or pavement edge.
C. Sprinkler heads:
   1. Conform to requirements shown on drawings as to type, size, and radius of throw, pressure, and discharge.
   2. Each type of head shall be product of single Manufacturer.
D. Sprinkler Risers:
   1. Rotor pop-up sprinkler or quick coupling valves shall have an adjustable riser assembly (three ell swing joint assembly) unless otherwise noted on drawings. Swing joint fittings shall be schedule 40 PVC plastic and nipples schedule 80 (gray) PVC unless otherwise designated on drawings.
      a. Horizontal nipple parallel to side of lateral line shall be 12" long minimum. All other nipples on swing joint riser shall be a length required for proper installation of sprinkler head.
   2. Stationary spray pop-up sprinkler heads, shrub spray heads, bubbler heads, and stationary spray sprinkler heads shall have risers made up of one of the following ways:
      a. 4-inch flex-riser #FR-100 connected directly to lateral tee with an appropriately sized schedule 40 PVC threaded ell and schedule 80 (gray) nipple.
      b. Three (3) schedule 40 street ells connected to lateral tee to form an adjustable riser or pop-up riser as detailed.

c. Risers for sprinkler heads shall be 14-inch long minimum and 24-inch maximum.
1). Rainbird swing pipe with spiral barb fittings and street ell as detailed.
2). Toro “Funny Pipe”.
d. Equal as approved by Architect prior to bidding.

E. Automatic Sprinkler Control:
1. Automatic Controller:
a. Manufacturer: Rainbird “E” series or approved equal.
1). Indoor mounted with plug in 120 amp power, no battery required.
2). Three programs: Automatic, semi-automatic, and manual operation with timer.
3). Size station capacity to accommodate system indicated on drawings.
b. Accessories:
1). Rain sensor installed per Manufacturer’s recommendations and at location indicated on drawings.
2). Rain freeze installed per Manufacturer’s recommendations and at location indicated on drawings.
2. Control valves shall be of a size and type indicated on drawings.
3. Control wire shall be UF-UL listed, color-coded copper conductor direct burial size #14 minimum.
4. Waterproof
a. Manufacturers: DBY by 3M, SSC by Imperial, Gel Cap by Spears, or approved equal.
5. Run one extra control wire from panel continuously from valve throughout system similar to common wire for use if a wire fails. Wire shall be different color than all other wires, shall not be green, and shall be marked in control box as an extra wire.

F. Valves:
1. Electric valves shall be of a size and type indicated on drawings.
2. Quick coupling valve:
a. Brass one piece with locking top.
b. Provide one key with hose swivel.

G. Valve Accessories:
1. Valve Boxes:
a. Rectangular heavy duty.
b. Lock top or snap top lids.
c. Sizes large enough for easy removal or maintenance of valves.
d. Use extensions as required.
e. Manufacturers: Ametek, Brooks, or approved equal.

H. Backflow Preventors:
1. Continuous pressure-type vacuum breakers:
a. Manufacturers: Watts, Zurn, Febco, or approved equal. Size and model number indicated on drawings.
b. Locate riser portion of unit within planting bed or location to protect and conceal. Mount lowest point of unit discharge 12-inches minimum above grade.

I. Other Components:
1. Recommended by Manufacturer and subject to Owner’s review and acceptance.
2. Provide components necessary to complete and make system operational.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Trenching & Backfilling:
1. Pulling of polyethylene pipe is permitted. Pulling of PVC pipe is not permitted.

2. Over-excavate trenches 2-inches and bring back to indicated depth by filling with fine, rock-free soil or sand.
3. Cover pipe, both top and sides, with 2-inches of rock-free soil or sand. In no case shall there be less than 2-inches of rock-free soil or sand surrounding pipe.
4. Perform balance of fill and compaction as specified in Section 31 00 00.

B. Sleeving:
1. Sleeve water lines and control wires under walks and paving.
2. Use one water pipe maximum per sleeve. Sleeve control wiring in separate sleeve.
3. Position sleeves with respect to buildings and other obstructions so pipe can be easily removed.
4. Over excavate and provide 4-inches compacted granular backfill on top, sides, and full depth of trench when beneath pavement or traffic areas.

C. Grades & Draining:
1. In areas where freezing may occur, grade piping so system can be completely drained.
   a. Slope pipe to drain to control valve box where possible.
   b. Where this is not possible, slope pipe to a minimum number of low points. At these low points, install:
      1). ¾-inch brass ball valve for manual drain.
      2). 2-inch Class 200 PVC pipe over top of manual drain and cut at finished grade.
      3). Provide rubber valve cap marker.
      4). Provide one cu. ft. gravel sump at outlet of each manual or automatic drain.
      5). Do not use automatic drain valves.
   c. Slope pipes under parking areas or driveways to drain outside these areas.
   d. Provide and install quick coupling valve or valves in location for easy blowout of entire system.

D. Pipe:
1. Install pipe in a manner to provide for expansion, contraction and as recommended by Manufacturer.
2. Unless otherwise indicated on drawings, install main lines with minimum cover of 18-inches below finished grade. Install lateral lines with minimum of 12-inches of cover below finished grade.
3. Install pipe and wires under driveways or parking areas in specified sleeves 18-inches minimum below finish grade unless otherwise indicated on drawings.
4. Locate no sprinkler head closer than 12-inches from building foundation. Heads immediately adjacent to walks or curbs shall be 1-inch minimum below top of walk or curb and have 1-inch minimum horizontal clearance between walk or curb.
5. Clean interior of all pipes, fittings, and joints prior to installation. Exclude entry of foreign material.
6. If pipe is larger than 2-inches, install concrete thrust blocks wherever change of direction occurs on PVC main pressure lines, unless otherwise indicated on drawings.

E. Control Valves & Controller
1. Install controller, control wires, and valves in accordance with Manufacturer's recommendations and according to electrical code.
2. Install valves in heavy-duty plastic boxes located flush with finish grade. Do not install more than two (2) valves in single box. Place 6-inches minimum of gravel below valve for drainage and maintain 4-inches between bottom of valve and top of gravel.
3. Install ¾-inch brass ball valve in valve box on downstream side of automatic valves if lateral line slopes toward valve box.
4. Tape control wiring to side of main line every 10 feet. Where control wire leaves main or lateral line, enclose in class 200 PVC conduit. Use waterproof wire and

connectors at splices and locate all splices within valve boxes. Use white or gray color wire for common wire and other colors for all other wire. Each common wire may serve only one (1) controller.

5. Tie a 24-inch loop in all wiring at change of direction 30° or greater; untie after all connections have been made.
6. Sleeve below all hard surface elements with class 200 PVC twice the diameter of the wire bundled within.

F. Sprinkler Heads
   1. Prior to installation of sprinkler heads, open control valves and use full head of water to flush out system.
   2. Set sprinkler heads and quick-coupling valves perpendicular to finish grade.
   3. Maintain a 12-inch minimum distance from all property lines.

G. Site Test, Adjustment & Instruction
   1. Test pressure lines at line pressure and make certain there are no leaks before backfilling.
   2. Adjust heads to proper grade when turf is sufficiently established, such lowering or raising of heads shall be a part of the original contract with no additional cost to Owner.
   3. Adjust heads for proper distribution and trim so spray does not fall on building or adjacent property.
   4. Adjust water timing of valves to provide proper amounts of water to all plants.
   5. Instruct Owner's personnel in proper operation and maintenance procedures

H. Protection & Cleaning
   1. Protect existing landscaping from damage. Repair and repave cut paving to match paving in original condition.
   2. Restore damaged components and test for proper operation. Clean out system and protect work from damage.

END OF SECTION

SECTION 32 90 00

LANDSCAPING

PART 1 – GENERAL

1.01 SUMMARY

A. Provide landscape work where indicated on drawings:
   1. Trees, shrubs, plants, and ground cover.
   2. Finish grading and lawns.
   3. Topsoil and soil amendments.
   4. Initial maintenance of landscape materials.
   5. Pruning and relocation of existing plant materials.
   6. Reconditioning existing lawns.
   7. Slope protection, riprap stone, and erosion control matting.
B. Plant totals shown on plant list are for convenience of Contractor only and are not guaranteed. Verify amounts shown on drawings. All planting indicated on drawings are required unless otherwise noted.

1.02 SUBMITTALS

A. None required unless submitting for approved equals.
B. Provide 48-hour written notice prior to turnover to Owner for watering and maintenance.

1.03 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
B. Balled and Burlapped Plants and Trees: Graded to American Standard for Nursery Stock, ANSI Z60.1.
C. Testing: Laboratory testing for suitable soil amendments and fertilizer for plants provided.
D. Planting Season: Plant or install materials during normal planting seasons for each type of landscape material utilized. Correlate planting with specific maintenance periods to provide maintenance from date of substantial completion.

1.04 WARRANTY

A. Warrant trees and shrubs for a period of one (1) year after date of Substantial Completion, against defects including death and unsatisfactory growth and except for defects resulting from neglect by Owner, abuse by others, or natural phenomena. Replace unsatisfactory plant material at end of warranty period at no additional expense to the Owner. One replacement is required.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Plants
   1. Conform to requirements of plant list on drawings and to "Horticultural Standards" of American Association of Nurserymen as to kind, size, age, etc.

2. Nomenclature: Plant names used in plant list conform to 'Standard Plant Names" by American Joint Committee on Horticulture Nomenclature except in cases not covered. In these instances, follow custom of nursery trade. Plants shall bear a tag showing the genus, species, and variety of at least 10% of each species delivered to site.
3. Quality:
    a. Plants shall be sound, healthy, vigorous, free of plant disease, insect, pests or their eggs, noxious weeds, and have healthy, normal root systems. Container stock shall be well established and free of excessive root-bound conditions.
    b. Do not prune plants or top of trees prior to delivery.
    c. Plant materials shall be subject to approval by Owner as to size, health, quality, and character.
    d. Bare root trees are not acceptable.
    e. Provide plant material from a licensed nursery.
4. Measurements:
    a. Measure height and spread of specimen plant materials with branches in their normal position as indicated on drawings or plant list.
    b. Measurement should be average of plant, not greatest diameter.
    c. Plants properly trimmed and transplanted should measure same in every direction.
    d. Measure caliper of trees 6-inches above surface of ground.
    e. Where caliper or other dimensions of plant materials are omitted from plant list, plant materials shall be normal stock for type listed.
    f. Plant materials larger than those specified may be supplied with approval of Owner if:
        1). Compliance in all other respects.
        2). No additional cost to Owner.
        3. Size of roots or balls are increased proportionately.
5. Shape and Form:
    a. Plant materials shall be symmetrical or typical for variety and species and conform to measurements specified in plant list.
    b. Well grown material will generally have height equal to or greater than spread. However, spread shall not be less than 2/3 height.

B. Lawns: (Hydroseed), fresh, clean, new crop seed mixture by approved method composed of Falcon Tall Fescue (75%) and Rebel Rye (25%) or Crossfire (25%) and degradable green dyed wood cellulose fiber or 100% recycled long fiber pulp. Mixture shall be free from weeds or other foreign matter toxic to seed germination. Seed purity shall be 95% with a minimum 80% germination.

C. Lawns: (Sod), strongly rooted, 2 years old, ASPA approved, consisting of Falcon Tall Fescue (75%) and Rebel Rye (25%) or Crossfire (25%) cut with minimum ½-inch and maximum 1-inch topsoil base or approved equal.

D. Topsoil: From site stockpile or additional fertile, friable topsoil from local source. Material shall be reasonably free of subsoil, clay, lumps, brush, reproductive parts of noxious weeds, and other litter, and free of roots, stumps, sticks, and stones larger than 2" in any dimensions.

E. Planting Soil Mixture: Provide mixture in ratio of 3 parts topsoil, 1 part peat moss and 1 part sand. Add amendments as required.

F. Soil Amendments:
1. Fertilizer, ten pounds of 13-13-13, non-burning fertilizer per 1000 square foot composed of not less than 50% organic slow acting guaranteed analysis fertilizer or approved equal.
2. Rotted composted manure.
3. Planting Tablets: 21 gram Agriform (20-10-5) or approved equal.
4. Lime, peat moss, and other amendments as required for planting soil mixture.

G. Pre-Emergent Herbicide: Elanco XL, Ronstar, Surflan, or approved equal, complying with regulatory agency requirements.

H. Landscape Materials:
   1. Gravel: Water-worn creek gravel, 5/8" diameter, 3" deep, unless otherwise indicated on drawings.
   2. Filtration Fabric: Water permeable fiberglass or polypropylene fabric, 6 mil. thickness minimum.
   3. Tree Wrapping: Standard burlap, Heavy crepe paper, Tree wrap tape.
   4. Stakes and Guys:
      a. 2" x 2" x 10" new hardwood, treated softwood, or redwood, unless otherwise indicated on drawings.
      b. 16 ga. wire with new rubber hose or strap to protect tree.
   5. Vinyl Edging: 4" wide Hortiscape or approved equal; color black.
   6. Bark or Mulch:
      a. Straw, wood cellulose fiber, ground or shredded bark.
      b. 1-1/2" to 3" pine bark wood chips.
      c. Medium or large size redwood bark.
      d. Shredded pipe bark.
      e. Shredded cedar.
      f. Aged 1 year shredded hardwood.
   7. Riprap: 6"-12" diameter rock 18" thick over filter fabric.
   8. Erosion control matting:
      a. Nylon woven geomatrix: SC150 by North American, Green or approved equal.
      b. Nonwoven polyester geotextile: Akzo or approved equal.
      c. Polyvinyl chloride non-woven mat: Greenstreak or approved equal.

PART 3 – EXECUTION

3.01 LAWN PLANTING

A. For seeded lawns, apply seed at rate of 5 pounds per 1000 square feet. Apply erosion control matting over areas where slopes exceed 1:4 or in areas of concentrated storm water flow.
B. For lawns with sod, place sod tightly, with grain in same direction, joints staggered. Apply wood pegs composed of softwood of sufficient size and length to ensure anchorage at areas where slopes exceed 1:4 and at locations of concentrated water flow.

3.02 TREES AND SHRUB PLANTING

A. Loosen subgrade and spread planting mixture to minimum depth required to meet grades and elevations indicated. Excavate pits/beds/trenches for trees and shrubs. Excavate pits and vertical sides and with bottom of excavation slightly raised at center to provide proper drainage. Loosen hard subsoil on sides and bottom of excavation.
B. Prepare topsoil by mixing fertilizer with loam. Apply fertilizer at a rate of 10 pounds of actual nitrogen per 1000 sq. ft. for plant beds and 2 pounds per inch of trunk for tree pits.
C. Install soil mix to a depth of 18" in plant beds.
D. Add planting tablets in plant pit as follows:
   1. 1 gallon shrub: 1 tablet.
   2. 5 gallon shrub/tree: 3 tablets.
   3. 15 gallon tree: 4 tablets.
   4. 24 inch box tree: 6 tablets.
E. Set trees and shrubs on compacted soil mixture in center of pit. Plant immediately after removing burlap, wrapping, or container. Adjust plant position and place backfill around base and sides, and work each layer to settle backfill and eliminate voids and air pockets.

F. Water thoroughly when excavation is 2/3 full. Place final backfill and water again. Dish top of backfill for mulch application, level backfill for rock type ground cover.
G. Install vinyl edging at locations indicated. Securely anchor or stake per manufacturer's recommendations.
H. Apply specified pre-emergent herbicide to shrub and ground cover planting areas per manufacturer's recommendations.
I. Install adjacent ground covering; refer drawings for types and location.
    1. In lawn areas: Provide 2-inch deep layer of bark or mulch in a 24-inch diameter around base of tree and rake to neat finish appearance.
    2. In gravel areas: Provide layer of filter fabric installed per manufacturer's recommendation and apply 3" deep layer of gravel raked to neat finish appearance.
J. Wrap new deciduous tree trunks neat and snug by applying 6 to 10 inch wide strips spirally from ground line to second finished branches. Hold in place with suitable non-plastic cord.
K. Stake, guy, and support as required.

3.03 CLEANUP, PROTECTION, AND MAINTENANCE

A. Keep pavements clean and work area in an orderly condition. Remove excess, waste material, trash and debris.
B. Replace damaged materials and dead or unhealthy plants prior to turnover to Owner. Maintain lawn areas by mowing, watering, fertilizing and applying weed killer in accordance with manufacturer's recommendations until date of substantial completion. Maintain trees and shrubs until date of substantial completion, but in no case less than 60 days after planting.
C. Correct areas of soil settlement.
D. Instruct Owner on proper maintenance procedures.

END OF SECTION