

321200 - ASPHALTIC PAVING

PART 1 - GENERAL

- A. Summary - Section includes:
 - 1. Flexible pavement for parking areas and drives.
 - 2. Base for elementary play areas and runways for track and field events.
- B. Referenced Standards/Minimum Criteria:
 - 1. Comply with Section 400 - Pavements, Section 700 - Bituminous Materials, Section 702 - Bituminous, and Section 703 - Aggregates, of the Colorado State Highway Department Standard Specifications, latest Edition.
 - 2. Testing of base course compaction and sampling of asphalt concrete mixtures for quality control during paving will be done by the testing laboratory {paid for by the Owner} using applicable ASTM and AASHTO testing procedures.
- C. Submittals Required:
 - 1. Asphalt concrete mixes
 - 2. Pre-emergent
 - 3. Test reports
- D. Restrictions/Critical Criteria:
 - 1. Immediately prior to application of aggregate base course or full depth asphalt, apply Pre-Emergent to subgrade.
 - 2. Second and third lifts must be placed within 48 hours of preceding lift or a tack coat will be required.
 - 3. Apply tack coat of emulsified asphalt to edge of curb and all other concrete surfaces adjoining asphalt paving.
 - 4. Permeable paving may be considered on a case by case basis by the owner where subgrade permeability is conducive and is acceptable to local jurisdictions.

PART 2 - PRODUCTS

- A. Base course materials: Gravel base type and thickness per Geotechnical report.
- B. Asphaltic concrete mixture: Grades S and SX as defined by Colorado State Highway Department Standard Specifications. Use Grade SX for top surface course and Grade S for all other fills. Only virgin materials shall be used in mixture, no reclaimed asphalt pavement {RAP} shall be allowed. Thickness of asphalt as per Geotechnical report. The School District prefers to use fill depth asphalt design sections but will consider including alternates for asphalt on base course design.
- C. Reinforcing Mesh: Reinforcing mesh shall be designed for use under asphalt paving as required by Geotechnical report.
- D. Pre-Emergent: Elanco Treflan Pre-Emergent or approved substitute.

321300-CONCRETE PAVING, CURBS, GUTTERS, & SIDEWALKS

PART 1 - GENERAL

- A. Summary - Section includes: Rigid concrete paving.
 - 1. Curbs and gutters.
 - 2. Sidewalks.
 - 3. Concrete curbs around gravel play areas.
 - 4. Concrete stairs.
 - 5. Concrete drainage swales.

- B. Reference Standards/Minimum Criteria:
 - 1. Concrete work: ACI 301 and ACI 304R.
 - 2. Cold weather placement: ACI 306.
 - 3. Hot weather placement: ACI 605
 - 4. Concrete materials: Ready mixed concrete conforming to ASTM C94 and ASTM C1116. No on-job mixed concrete will be allowed. Slump tests by Contractor per ASTM C143.
 - 5. Expansion joints: ASTM D1751 or D1752.
 - 6. Reinforcing mesh: 6" x 6" x w2.9 x w2.9 conforming to ASTM A18S for vehicle paving and 6" x 6" x w1.4 x w1.4 for sidewalks. Fibrous reinforcing complying with ASTM C1116.
 - 7. Finish with Class B Tolerance. Finish shall be true planes within 1/4" in 10-ft. as determined by a 10-ft. straightedge placed anywhere on the slab in any direction. Use broom finish.
 - 8. Control tests by testing laboratory in accordance with ASTM C391, C138, and C231. Curing of test cylinders per ASTM C31 and C172.
 - 9. Local jurisdiction standards for public sidewalks, curbs, gutters, ramps, driveway approaches and aprons.

- C. Submittals Required:
 - 1. Concrete mix designs.
 - 2. Test reports.
 - 3. Contractor's record listing time, date and temperature of concrete placement.

- D. Restrictions/Critical Criteria:
 - 1. Environmental Requirements: When concrete has been placed in cold weather and the temperature may drop below 35° F, Contractor to provide insulated curing blankets, or other suitable materials. Concrete injured by frost action shall be removed and replaced at the Contractor's expense.
 - 2. Typical thickness of sidewalks is 4". Thickness of vehicle pavement per Geotechnical report.
 - 3. Score Joints: Maximum of 6 feet on center.
 - 4. Expansion Joints: Provide expansion joints thirty (30) feet maximum on center, between site concrete and building. Expansion joints shall extend through the entire slab with bituminous fiber expansion joint filler. Hold top of joint filler down or use removable zip-strip on top of filler at joints to allow for joint sealant.

5. Handicap Ramps: Ramps shall receive tactile warning surface texture in accordance with local jurisdiction Standards and Specifications. Provide pigmented concrete as required by local jurisdiction Standards.

PART 2 - PRODUCTS

- A. Concrete paving is required at all curbs, gutters, sidewalks, and trash pickup areas/dumpster pads.
- B. Concrete paving is preferred at bus traffic/parking areas, and service vehicle/loading dock areas.
- C. Curing and anti-spalling compound is required for all exterior flatwork.
- D. Curb configuration to be vertical with full cut at drives and ramps.
- E. Fibrous mesh additive is required for exterior flatwork.

321313- POST-TENSIONED CONCRETE TENNIS COURTS

PART 1 - GENERAL

- A. Summary - Section includes:
 1. Post-tensioning materials.
 2. Post-tensioning operations.
- B. Referenced Standards/Minimum Criteria:
 1. Post-tensioning strands and anchorages conform to "PTI Guide Specifications for Post-Tensioning Materials".
- C. Submittals Required:
 1. Shop drawings to include:
 - a. Cable layout with dimensions.
 - b. Cable and sheathing profiles showing support chair heights. Indicate location and method of tendon support.
 - c. Details of special reinforcement at cable anchorage points.
 - d. Details, location, and arrangement of cable dead end and stressing end anchorage devices.
 - e. Cable placing sequence and details.
 - f. Jacking sequence and methods.
 - g. Jacking force and jack pressure.
 - h. Maximum temporary jacking force and jack pressure.
 2. Test Results and Certification:
 - a. Mill tests (including typical stress-straw curve).
 - b. Equipment calibration tests (including method of identification of stressing units and a curve relating jack forces to gauge readings).
- D. Restrictions/Critical Criteria:
 1. Acceptable post-tensioned concrete tennis court contractors:

- a. Southwest Recreational Industries, Inc.
- b. Other contractors as pre-approved by the Owner.
2. Provide vapor barrier under slab and over excavation and structural fill under slab if recommended by Geotechnical Engineer.
3. Cables shall be placed no more than 2'-6" on center in each direction based on engineering design.
4. Provide keyed construction joints between each individual court and at net line of each court. No other joints are allowed. Contractor may opt to place concrete in one pour.
5. Concrete shall be placed in one continuous operation without joints with the exception of construction joints. Slab thickness shall be uniform four (4) inches utilizing a minimum sixty-(60) foot long continuous mechanical screed. Finish surface of concrete shall have no water-holding areas deeper than 1/8". Flood court surface to verify slope, drainage, and lack of ponding areas.
6. Contractor shall not apply tensioning force until the concrete has reached a minimum strength of 2,000 psi. Strength of concrete in place shall be determined according to ACI 301. Contractor may make additional cylinders at his expense to determine correct strength. Tensioning may begin one (1) week after the concrete has been verified to have achieved the minimum strength.
7. Each tendon may initially be tensioned to a maximum of eighty percent {80%} ultimate breaking strength and anchored at a minimum of seventy percent {70%} ultimate breaking strength.
8. The cable ends shall be cut off and cone holes shall be grouted flush with edge of slab.

PART 2 - PRODUCTS

A. Acceptable materials:

1. Post-tensioning strands and anchorages shall conform to the "PTI Guide Specifications for Post-tensioning Materials".
2. The tensioning strands shall consist of one-half inch (1/2") diameter, 7-wire, stress relieved strands, having a guaranteed ultimate tensile strength of 270,000 psi (270 Kips). Strands shall conform to ASTM-416. Cables shall be fabricated to proper length for each slab, coated with a permanent rust preventative lubricant and encased in slippage sheathing. All breaks in the sheathing shall be repaired with tape prior to concrete placement. A maximum of six inches {6"} exposed strands is permitted at the dead-end anchor.
3. The concrete shall have a compressive strength of not less than 3,500 psi after twenty-eight (28) days. Ready-mixed concrete shall be mixed and delivered according to ASTM C-94 specifications for ready-mixed concrete with a four inch {4"} maximum slump. Mix design as follows: cement - type 1, six sack unit weight - 140.3 lbs. per cubic foot, air entrainment 6.0%, water/cement ratio - 0.52/1.

321723- PAVEMENT MARKING

PART 1 - GENERAL

- A. Summary • Section Includes:
 - 1. Layout and painting of lines.
 - 2. Direction arrows/signs in pavement.
- B. Referenced Standards/Minimum Criteria:
 - 1. Thickness of paint to comply with Colorado State Highway Department specifications.
- C. Submittals Required:
 - 1. None
- D. Restrictions/Critical Criteria:
 - 1. Pavement marking shall not be done in wet weather or when the temperature is below 40 degrees F.
 - 2. Parking lot lines shall be 4" wide painted by mechanical striping machine.

PART 2 - PRODUCTS

- A. Solvent base paint complying with Colorado State Highway Department specifications. White and blue colors.
- B. Thermoplastic crosswalk, symbols, and other markings as directed by Owner. Thickness to be 90 mil.

321726 - SIGNAGE

PART 1 - GENERAL

- A. Summary • Section includes:
 - 1. Traffic control signs and posts.
- B. Referenced Standards/Minimum Criteria:
 - 1. Comply with requirements of all regulatory agencies having jurisdiction.
 - 2. Comply with applicable requirements of Americans with Disabilities Act, Accessibility Guidelines (ADAAG) and the International Building Code (IBC).
- C. Submittals Required:
 - 1. Shop drawings.
- D. Restrictions/Critical Criteria:
 - 1. Verify type, location, and direction of sign face of signs with school district.
 - 2. Aluminum traffic control signs mounted on galvanized steel framing and 12 gauge galvanized square tube steel posts with perforations as required for attachment of signage to post. Set steel posts in square sleeving {next size up from steel post) in

concrete.

PART 2 - PRODUCTS

- A. Acceptable Manufacturers
1. Vulcan Signs, Inc.
 2. J & S Signs
 3. Colorado Barricade
 4. Midwest Barricade
 5. Signage, Inc.
 6. Scott Sign Systems, Inc.
 7. United Rentals
 8. Approved Substitute

321800 - SYNTHETIC TURF

PART 1 - GENERAL

- A. Summary: The Turf Contractor shall supply and install the Owner selected synthetic turf system, suitable for football, soccer, field hockey and lacrosse. The Turf Contractor's installer must have installed a minimum of 5 fields using the infill system. Synthetic turf shall be a complete system including synthetic turf, granular aggregate base, sub-surface and perimeter drainage, and all necessary concrete edging as specified herein.
- B. Referenced standards/minimum criteria:
1. Permeability (to ASTM D4491): The system shall allow a minimum percolation rate of 5 inches per hour.
 2. Relative Abrasiveness (to ASTM F1015): The system has an Abrasiveness Index of 20.2.
 3. Shock Absorbency (to ASTM F355): G-Max range of 110-130 for duration of 8-year warranty.
 4. Flammability (to ASTM D2859): Pass
 5. RESTRICTIONS:
 - To ensure structural stability: $D_{60}/D_{10} > 5$ and $1 < \frac{D_{30}^2}{D_{10}D_{60}} < 3$
Fragmentation must be 100%
 - To ensure separation of both stones: $\frac{D_{85} \text{ of finishing stone}}{D_{15} \text{ of base stone}} > 2$
And $3 < \frac{D_{50} \text{ of base stone}}{D_{50} \text{ of finishing stone}} < 6$
 - To ensure proper drainage: Permeability of base stone > 600 in/hr (0.42 cm/sec)
Permeability of finishing stone > 150 in/hr (0.106 cm/sec)
Porosity of both stones $> 25\%$
(When stone is saturated and compacted to 95% Proctor.)

Depending on the type of rock present in the crushed stone mix, other mechanical characteristics might be necessary for approval.

"Ox" is the size of the sieve (in mm) that lets pass x% of the stone. For example, 060 is the size of the sieve that lets 60% of the stone pass. These sizes, for calculation purposes, may be obtained by interpolation on a semi-log graph of the sieve analysis.

6. Both the carpet and infill material shall meet all federal, state, and local environmental regulations.
 7. EXISTING CONDITIONS:
 - a. The Owner, through the General Contractor, shall satisfy himself as to the nature of the existing soil conditions on site, and shall be responsible for carrying out all tests necessary for the construction of the sports field base.
 - b. The General Contractor shall carry out all grading work to sub-base level, and shall accept full responsibility for the suitability of this level. The Turf Contractor shall start his work on the existing sub-base.
 8. WARRANTY:
 - a. The Turf Contractor and the Manufacturer shall provide the Owner with a written warranty to guarantee the materials and installation for a period of eight (8) years from the date of acceptance against all defects in workmanship and materials and premature wear and tear, provided that the product is properly maintained and used per the Maintenance Manual, and for a period of eight (8) years from ultraviolet degradation due to normal exposure to the sun.
 - b. Warranty shall include a yearly turf sweeping and repainting of all painted markings prior to each season: August for fall sports; March for spring sports.
 9. MAINTENANCE: Turf Contractor shall supply Owner with a written maintenance manual for proper care of the finished product. The Maintenance Manual shall specify any use limitations for the fields (e.g. heavy vehicle traffic, etc.).
- C. Submittals Required: With the Bid the proposing Turf Contractor must submit the following:
1. Synthetic Turf - One (1) sample - approximately 7" x 11".
 2. Knitted in 4" white line.
 3. Manufacturer's data certifying compliance with these specifications.
 4. Certified list of existing installations, including Owner representative and telephone number, attesting compliance with quality assurance information.
 5. Sieve analysis of the proposed base rock.

Prior to installation the Turf Contractor must submit the following for review and approval:

6. Field drainage system design layout with pipe sizing and spacing.
7. Color coded shop drawing layout of all inlaid and painted lines, numbers, and logo locations corroborated with the latest National Federation of State High School Associations (NFHS) standards and requirements.
8. Contractor shall provide all required documentation to the Owner that all SBA rubber used on this project is Colorado Certified Recycled Rubber (from Colorado tires). Documentation shall be in accordance with the Colorado Waste Tire Recycling Grant Program Guidelines. For more information go to

PART 2 - PRODUCTS

A. SYNTHETIC TURF

1. General: Permeable infilled synthetic grass that provides the look, the feel, and playability of natural grass with respect to ball speed and bounce and maximum safety to the athletes.
2. The entire system shall be resistant to weather, insects, rot, mildew, fungus growth and it is non-toxic.
3. The surface shall provide superior traction in all types of weather with the use of conventional athletic shoes and composition molded-soles. Long cleats are not required and should not be used.
4. The infill materials shall be selected to provide the shock attenuation characteristics of the System. The System shall maintain a G-Max reading as described in ASTM F1936-98 **Shock Absorbing Properties of North American Football Field Playing Systems** as measured in the field.
5. Field Markings:
 - a. Field of play football and soccer perimeter lines, yardage numbers, logos and 5-yard lines shall be tufted in (in-laid). Other markings (hash marks, 1 yard lines, field hockey, and all lacrosse lines) shall be painted on after the insertion of the infill.
 - b. Only paint approved by the Manufacturer is permitted to be used on the turf.
 - c. Install lines and markings for the following sports: Football, soccer, field hockey and lacrosse for both boys and girls where applicable.
6. Carpet Fiber: A low friction blended polyethylene fiber, nominal 2-2 ½" long poly fiber tufted into a permeable double-layered primary backing with a secondary backing. The tufts shall be fanned (or unfolded) at installation. It shall have the following properties:

<u>Property</u>	<u>Units</u>	<u>ASTM</u>
Pile Yarn Type:	UV-resistant poly	
Yarn Denier:	8000 nominal	D1577
Yarn Breaking Strength:	Min. 1.2gms/denier	D2256
Yarn Melting Point:	250 degree F	D789
Minimum Pile Height	2inches	D418
Maximum Pile Height	2 ½ inches	D418
Pile Weight	42 oz/sq. yd.	D418
Machine Gauge	¾ inch centers max.	D418
Tuft Bind (without infill)	6 lbs.	D1335
Grab Tear Strength	170 lbs.	D1682
Pill Burn Test	Pass	D2859
Permeability	10-40 inches/hour	D4491

- a. Primary backing: shall be UV-treated woven polypropylene, weighing approximately 8 oz/sq yd.
- b. Secondary backing: shall be a permeable application of high quality latex or polyurethane, heat activated to lock the fiber tufts into the primary backing materials.

- c. Base Bid shall be fibrillating fiber. Monofilament fiber option shall be included as an alternate bid.
 - 7. Infill: Consists of ground rubber, or a blend of graded dust free sand as approved by the Manufacturer, and ground rubber as approved by the Manufacturer.
 - 8. Approved Manufacturers: The Owner shall have the option of selecting one product line meeting the specifications above from one of the following manufacturers.
 - a. Sportexe
 - b. Challenger Industries
 - c. Desso
 - d. Fieldturf
 - e. Others as approved by Owner
 - 9. Approved Installers:
 - a. Academy Turf
 - b. Hellas Construction
 - c. American Civil Constructors
 - d. Others as approved by Owner
- B. BASE MATERIAL: The Base shall be constructed of crushed stone aggregate per Manufacturer' specifications. The base layer shall be a minimum of 4" at the crown, topped by a finishing layer with a maximum of 2" of finer crushed stone. The final decision on the thickness of the Base layer will be dictated by the permeability of the selected Base stone, the rainfall Intensity-Duration-Frequency (IDF) data for the site location, and the stability and load-bearing capacity of the sub-base. The Turf Contractor shall provide a sieve analysis of the proposed base for approval by Owner's Representative. Recycled concrete may be substituted as approved by Owner.
- C. DRAIN PIPE: The collector drainage pipes shall be rigid PVC plastic wall smooth bore pipe, laid with a minimum slope of 0.3%. The individual field drain shall be 12" Enka Turf Drain material. The Turf Contractor shall carry the collector pipe to its exit outside the field per the drawings. The trench in which the pipe is set shall be filled with permeable granular material, ½" or ¾" drain rock or any similar free draining material as approved by the Owner's Representative.
- D. EDGING: The edging around the fields shall be concrete per the details on the drawings.

321823 - TENNIS COURT SURFACING

PART 1 - GENERAL

- A. Summary - Section includes:
 - 1. Tennis court surfacing.
 - 2. Tennis court boundary lines.
- B. Reference Standards/Minimum Criteria:
 - 1. Installer shall specialize in tennis court surfacing and shall be approved by

system manufacturer.

C. Submittals Required:

1. Product data.
2. Color samples of surfacing and striping paint.

D. Restrictions/Critical Criteria:

1. Two (2) year warrantee for materials and installation.
2. Do not apply surfacing during rainfall or when rainfall is imminent. Do not apply surfacing unless the air temperature is at least 50 degrees F. for a 24hour period of time during and following application.
3. Line Marking: Apply marking conforming to the specifications of the United States Tennis Court and Track Builders Association

PART 2 - PRODUCTS

A. Acceptable tennis court surfacing systems:

1. TPS Coatings, Inc.
2. Nova Sports USA
3. Elite Systems
4. or approved equal

B. Primer

1. The prime coat shall be as specified by the color acrylic manufacturer.

C. Leveling Course(s)

1. Only acrylic based patching compounds are to be used.

D. Acrylic Resurfacer

1. Acrylic resurfacer coats shall consist of the following components:
 acrylic resurfacer
 silica sand, #30
 Sufficient water to make a workable mixture (fresh and potable)
2. Mixture shall be as specified by the color acrylic manufacturer.

E. Acrylic Color

1. The acrylic color applications will consist of one (2) applications the following:
 undiluted acrylic color
 water (fresh and potable)
 silica sand (30 mesh)
2. Mixture shall be as specified by the color acrylic manufacturer.
3. The mixture shall provide not less than 115 gallons of color concentrate per court. (This quantity is before water or any fillers are added.) This provision will be strictly enforced and monitored.
4. Color Selection: To be selected by Owner

F. Playing Lines

1. Playing lines shall be painted on using white, latex acrylic, line paint.

321824- BASEBALL FIELD SURFACING

PART 1 - GENERAL

- A. Summary - Section includes:
 - 1. Baseball field infield.
 - 2. Skinned softball field.
 - 3. Other unseeded surfaces inside baseball and softball fenced areas.
- B. Referenced Standards/Minimum Criteria:
 - 1. None.
- C. Submittals Required:
 - 1. Require contractor to submit sieve analysis and plasticity index of proposed surface mix and pitcher's mound mix before ordering.
 - 2. Require contractor to submit 1 pound sample in plastic bag of each mixture.
- D. Restrictions/Critical Criteria:
 - 1. Elevation and size of pitcher's mound per Colorado State High School standards.
 - 2. Remove debris and rocks larger than 1/2" from area to be surfaced.
 - 3. Surface to be a minimum of 4" deep.

PART 2 - PRODUCTS

- A. Surfacing Mix for Infields:
 - 1. 70% fine fill sand.
 - 2. 30% fine fill clay.
 - 3. submittal required
- B. Surfacing Mix for Pitchers Mound:
 - 1. 60% fine fill sand.
 - 2. 40% fine fill clay.
- C. Surfacing Mix for Warning Tracks:
 - 3. Granite Crusher Fines (breeze) 3/8" minus sieve

321825 - RUNNING TRACK SURFACING

PART 1 - GENERAL

- A. Summary - Section includes:
 - 1. Running track.
 - 2. Field event runways and pads.
 - 3. Line markings for track.
- B. Reference Standards/Minimum Criteria:
 - 1. Installer shall specialize in track surfacing and shall be approved by system manufacturer.

2. The work shall be done in a thorough, workmanlike manner by member contractors of the United States Tennis Court & Track Builders Association. Contractor shall have a Certified Track Builder on staff, and shall conform to the USTC & TBA's standards for track construction.
 3. The track surface will be applied by a licensed firm, which has been installing the material for the past five years. Contractor references for five similar, successfully executed projects will be required.
- C. Submittals Required:
1. Product data.
 2. Samples of surfacing.
- D. Restrictions/Critical Criteria:
1. Three (3) year warrantee for materials and installation for latex tracks.
 2. Five (5) year warrantee for materials and installation for urethane tracks.
 3. The work shall be done in a thorough, workmanlike manner by member contractors of the United States Tennis Court & Track Builders Association. Contractor shall have a Certified Track Builder on staff, and shall conform to the USTC & TBA's standards for track construction.
 4. The track surface will be applied by a licensed firm, which has been installing the material for the past five years. Contractor references for five similar, successfully executed projects will be required.
 5. Do not apply surfacing during rainfall or when rainfall is imminent. Do not apply surfacing unless the air temperature is at least 50 degrees F. for a 24hour period of time during and following application.
 6. Prior to proceeding with surfacing system, flood test asphalt substrate in the presence of the Architect to assure positive drainage as designed and to determine if track has depressions holding water. Flood test with a minimum of a 2" hose attached to an irrigation quick coupler.
 7. Line Marking: Apply marking conforming to the specifications of the National Federation of State High Schools Association.
 8. Contractor shall provide all required documentation to the Owner that all SBR rubber used on this project is Colorado Certified Recycled Rubber (from Colorado tires). Documentation shall be in accordance with the Colorado Waste Tire Recycling Grant Program Guidelines. For more information go to www.dola.colorado.gov/waste_tire

PART 2- PRODUCTS

- A. Acceptable track surfacing installers:
1. Renner Sport Surfaces, Inc.
 2. Hellas Construction
 3. Fisher Tracks
 4. Vibra-Whirl
 5. General Acrylics
 6. others as pre-approved by Owner
- B. Acceptable latex systems for running tracks/runways/pads (use latex binders for middle schools).

1. Primer: SBR latex binder produced by Unocal or Dow Chemical for use in running tracks or approved equal. The latex binder shall have a minimum solids content of 50% per drum.
 2. Black Rubber Base Mat Granule (non-stranded): Manufacturer's specified Styrene Butadiene Rubber (SBR). Maximum size range shall be 1-3mm uniformly graded and containing less than 4% dust - with no trace of fiber or steel. All SBR rubber shall be Colorado Certified Recycled Rubber (from Colorado tires).
 3. Latex Binder: A fortified SBR or acrylic latex binder produced by a reputable manufacturer of such products used in the construction of running tracks. The fortified latex binder shall have a minimum solids content of at least 50% per drum. Asphaltic emulsion binders are not acceptable. Latex binder shall be pigmented black in the final spray layers.
 4. Completed resilient latex surface shall have a minimum thickness of 3/8".
- C. Acceptable urethane systems for running tracks/runways/pads (use polyurethane binders for High Schools):
1. Primers: Polyurethane-based primers, specially formulated to be compatible with the base and track surfacing materials.
 2. Rubber (SBR): The basemat rubber shall be specifically graded Styrene Butadiene Rubber (SBR). Final gradation is to be 1.0-3.0 mm granulated SBR containing less than 4% dust - with no trace of fiber or steel. SBR is to be dried to no less than 2.5% moisture and sealed in bags. All SBR rubber shall be Colorado Certified Recycled Rubber (from Colorado tires).
 3. Black Rubber (EPDM): The wearing course of rubber shall be synthetic colored EPDM, the same color as the liquid polyurethane binder. Final gradation is to be .5mm-1.5mm. Specific gravity is to be 1.53+.02.
 4. Basemat Binder: The basemat shall be bound by moisture-cured liquid polyurethane, compatible with the base mat rubber. No asphaltic emulsions or epoxies are allowed in the base mat.
 5. Structural Spray layers: The black EPDM rubber is to be bound by two coats of spray applied material. Polyurethane is to be moisture-cured, single component, elastomeric polyurethane, applied in a net quantity of 3.8 lbs. per sq. yd. Color to be black.
 6. Total thickness of the installed system shall average 13mm in thickness.
- D. Paint for all track lines and markings shall be Sherwin Williams Metalatex water based acrylic enamel or approved equal. Paint shall not be diluted. Paint shall be delivered to jobsite in new, unopened containers.

323113 - CHAIN LINK FENCES/BACKSTOPS

PART 1 - GENERAL

- A. Summary - Section includes:
1. Fencing around tennis courts to include gates.
 2. Site perimeter fencing to include gates.
 3. Baseball backstops.
 4. Softball backstops.

5. Shot-put backstops.
 6. Exterior utility equipment enclosures.
 7. Interior chain link partitions.
- B. Reference Standards/Minimum Criteria:
1. Chain link fabric and pipe frame material shall comply with standards and specifications of the Chain Link Fence Manufacturers Institute.
 2. All steel, including fabric, pipe, and fittings shall be first quality, full weight, hot-dipped galvanized materials in accordance with ASTM F1083. All weights and dimensions are nominal. Exterior chain link fencing components and material receiving thermally fused and adhered polyvinyl chloride (PVC) coating, minimum 10 mils thick, over galvanized surface shall be in accordance with ASTM F668, Class 2B. Movable and threaded fittings need not be factory coated but field coated per manufacturer's recommendations.
- C. Submittals Required:
1. Shop drawings.
- D. Restrictions/Critical Criteria:
1. Verify with Owner locations where PVC coatings will be required.
 2. Enclosure Top: Provide removable chain link top for exterior utility enclosures of same materials as sides as required by utility company.
 3. Gate posts/Swing gates:

Minimum Gate Post Sizes	Gate Width	
<u>Size</u>	<u>Single</u>	<u>Double</u>
2-3/8" o.d	Under 4'	N/A
2-7/8" o.d.	N/A	Up to 12'

All gate hardware to be heavy duty, galvanized with lockable latches.
 4. Top and bottom selvage of the fabric shall be knuckled.
 5. Set all line posts in concrete.
 6. Top rails for fences and bottom/center rails for tennis court fencing and baseball/softball backstops shall be as nearly parallel to finish grade as possible.
 7. Posts and rails at backstops shall be welded, and top and bottom rails shall be continuous. The center rail of tennis court fencing shall be welded with face of rail flush with fabric side of line posts.
 8. All backstop rails shall be welded to posts.
 9. Fabric shall be placed on players side of posts for backstops and tennis court fencing.
 10. Space line posts for fences not more than 10' feet apart.
 11. Provide 12" wide x 4" thick concrete mow bands along fence line adjacent to irrigated turf.

PART 2 - PRODUCTS

- A. Fabric: No. 9 gauge wire (No. 6 gauge at lower tier of backstops), galvanized and vinyl coated, woven into 2" chain link mesh (1-3/4" mesh at tennis court). Zinc coating by weight will not be less than 1.2 ounces per square foot. Wire used in fabric shall be open hearth steel, containing not less than 0.20% copper with a tensile strength of not less than 85,000 lb. per square inch.

- B. Line Posts: 2-3/8" o.d. up to 6' ht., 2 -7/8" over 6' ht. (2-7/8" o.d. at tennis court and 2-7/8", 4", & 6" o.d. at backstops depending on height), schedule 40 pipe.
- C. Line Post Tops: Heavy galvanized, cast-iron eye-top fittings to be set over post snugly.
- D. Top, Center and Bottom Rails: Schedule 40 pipe, 1-5/8" o.d. weighing 2.27 lb. per foot, provided with 7" long expansion sleeve couplings.
- E. Fabric Ties: No. 11 gauge galvanized steel tie wire shall be used to tie fabric to framework. Ties to tension wire shall be made with heavy galvanized hog rings or wire.
- F. Tension Wire: Two strands of 12 gauge galvanized spiral tension wire with attaching fittings.
- G. Terminal Post Tops: End and corner posts to be fitted with heavy galvanized cast iron tops of bullet-type construction.
- H. Terminal Posts: Schedule 40 pipe. End, corner, and pull posts 2-7/8" o.d. pipe, weighing 5.79 lb. per foot up to 6' height, 4" o.d. over 6' height.
- I. Brace Panel Assembly: All end and gate posts shall be braced with 1-5/8" o.d. Schedule 40 pipe weighing 2.27 lb. per foot, and adjustable 3/8" galvanized truss rod with malleable iron truss tighteners. Corner posts shall be furnished with two complete brace panels assemblies.
- J. Tension Bands: Beveled edge type with either nuts and bolts or special lockpin type.
- K. Footings shall be concrete.

323129 - ROUGH SAWN CEDAR WOOD FENCE

PART 1 - GENERAL

- A. Summary - Standards includes:
 - 1. Wood fencing and post footings.
- B. Referenced Standards/Minimum Criteria:
 - 1. Wood materials shall comply with standards and specifications of the International Fence Industry Association.
- C. Submittals Required:
 - 1. None.
- D. Restrictions/Critical Criteria:
 - 1. Line and terminal Posts: Space line posts as required by length of rails.
 - 2. Rails: Set rails as nearly parallel to the finish grade as possible and at the

specified height of fence. In the case of sloping grades, the rails shall be sloped uniformly parallel to the finish grade as nearly as possible and in a manner to prevent any abrupt changes in grade of the rails.

PART 2 - PRODUCTS

- A. Line Posts: Approximately 6" x 6" rough sawn cedar. 4 sided, 45 degree chamfer 1" down from top all around.
- B. Rails: Shall be 2" x 8" rough sawn cedar, 8' or 10' long. Use 3 rails at play areas, 2 rails in all other locations.
- C. Fastenings: Shall be galvanized 3/8" x 3 1/2" long lag though bolts with washers. 2 per rail at post, countersink nut and washer, head flush at rail.
- D. Footings shall be concrete, 6" all around, 3' deep.
- E. Provide 18" wide x 4" thick concrete mow bands along fence line adjacent to irrigated turf.

323300 - ATHLETIC AND RECREATION EQUIPMENT

PART 1 - GENERAL

- A. Summary - Section includes:
 - 1. Tennis court wind screen fabric.
 - 2. Tennis court nets and posts.
 - 3. Combination soccer/football goal posts.
 - 4. Soccer goals.
 - 5. Baseball field team benches.
 - 6. Football and soccer field corner markers.
 - 7. Field event equipment.
- B. Referenced Standards/Minimum Criteria:
 - 1. Owner review per site/project
- C. Submittals Required:
 - 1. Product Data
- D. Restrictions/Critical Criteria:
 - 1. Install all items per manufacturer's recommendations.

PART 2 - PRODUCTS

- A. Acceptable manufacturers/products.
 - 1. Combination Soccer/Football Goal Posts: Porter or approved equal.
 - 2. Tennis Court Nets and Posts: Porter or approved substitute.
 - 3. Shot-Put Toe Board: Gill Athletics or approved substitute.

4. Tennis Court Wind Screen: Open mesh shade screen or approved substitute, 6 ft. high 7 oz. Open mesh polyester with brass grommets 12" o.c., along all four sides. Provide hog rings and poly rope for attachment.
5. Soccer Goals: Porter or approved substitute.
6. Pole Vault Plant Pit: Gill Athletics or approved substitute.
7. Baseball Field Team Benches: Stationary aluminum bench, no back with stationary legs.
8. Field Corner markers: Standard surveying markers.
9. Others as approved by Owner.

324000 - SITE FURNISHINGS

PART 1 - GENERAL

- A. Summary - Section includes:
 1. Plastic coated steel benches.
 2. Plastic coated trash receptacles.
- B. Referenced Standards/Minimum Criteria:
 1. Owner review per project/site.
- C. Submittals Required:
 1. Product data
 2. Color options
- D. Restrictions/Critical Criteria: Install per manufacturer's recommendations.

PART 2 - PRODUCTS

- A. Acceptable manufacturers:
 1. Owner approved list

325000-GRAVEL PLAY AREAS

PART 1 - GENERAL

- A. Summary - Section includes:
 1. Concrete curb at perimeter of play areas.
 2. Pea gravel fill (by School District)
 3. Play equipment (by School District)
 4. Drainage of play areas
- B. Referenced Standards/Minimum Criteria:
 1. Refer to Sections 02513 and 03300 for concrete requirements.
 2. Refer to Section 02710 subdrainage systems for products to be used to drain play areas.

C. Submittals Required:

1. Product data

D. Restrictions/Critical Criteria:

1. The perimeter of all gravel play areas to have 6" wide x 2'-0" deep reinforced concrete curb. Top edges of curb to have 2" radius (omit radius where curb abuts concrete sidewalk or asphalt play area).
2. Subgrade in play box shall be 14" below top of curb.
3. Slope grades at bottom of play areas a minimum of 1% and maximum of 2% toward perforated drainage pipe that runs the full length of the play area. Perforated pipe to be set in minimum of 12" x 12" trench in bottom of play area. Trench to be filled with 3/4" washed gravel with minimum of 2" below the perforated pipe. Pipe size and daylight connection to be determined by Civil Engineer. Perforated pipe shall include filter fabric sock.
4. Pea gravel and play structures to be installed by School District separately from this work.

PART 2 - PRODUCTS

A. Acceptable products:

1. Filter fabric sock around perforated drainage pipe with 3/4" washed gravel gravel trench.

328400 - IRRIGATION SYSTEM

PART 1 – GENERAL

PURPOSE

The District-Wide Irrigation Standard Specification establishes minimum requirements for design, installation, materials, and acceptance of all irrigation systems installed on Cherry Creek School District No. 5 properties. These standards apply to all new construction, renovations, and capital improvement projects unless other approved in writing by the Owner.

A. Summary-Section includes:

1. Static pressure verification and coordination of irrigation system installation with landscape material installation.
2. Trenching, stockpiling excavation materials, refilling and compacting trenches.
3. Complete irrigation system including but not limited to piping, booster pump (when required), backflow preventer assemblies, valves, fittings, heads, controllers and wiring, and final adjustments to insure complete coverage.
4. Water connections.
5. No deviations from this standard are permitted with written approval from the Owner

B. Referenced Standards (Minimum Criteria):

1. American Society for Testing and Materials (ASTM)-Specifications and Test Methods specifically referenced in this Section.
2. Underwriters Laboratories (UL) - UL Wires and Cables.

3. Installer Qualifications-Installer shall have had considerable experience and demonstrate ability in the installations of irrigation system(s) of specific type(s) in a neat orderly, and responsible manner in accordance with recognized standards of workmanship. To demonstrate ability and experience necessary for this Project, and financial stability, submit if requested by Consultant, prior to contract award the following:
 - a. List of 3 projects completed in the last 2 years of similar complexity to this Project. Description of projects shall include:
 - Name of project.
 - Location.
 - Owner.
 - Brief description of work and project budget.
 - b. Current company financial statement.
4. Special Requirements:
 - a. Work involving substantial plumbing for installation of copper piping, backflow preventer(s), and related Work shall be executed by licensed and bonded plumber(s).
 - b. Secure a permit at least 48 hours prior to start of installation.
 - c. Tolerances: Specified depths of mains and laterals and pitch of pipes are minimums. Settlement of trenches is cause for removal of finish grade treatment, refilling, compaction, and repair of finish grade treatment.
 - d. Coordination With Other Contractors: Protect, maintain, and coordinate Work with Work under other Sections.
 - e. Damage To Other Improvements: Contractor shall replace or repair damage to grading, soil preparation, seeding, sodding, or planting done under other Sections during Work associated with installation of irrigation system at no additional cost to Owner.
 - f. Irrigation operation: Contractor shall conform to all local water district standards and restrictions. Additional irrigation permits and variances required by the project shall be obtained by contractor and paid by owner
5. Pre-construction Conference: Contractor shall schedule and conduct a conference to review in detail quality control and construction requirements for equipment, materials, and systems used to perform the Work. Conference shall be scheduled not less than 10 days prior to commencement of Work. All parties required to be in attendance shall be notified no later than 7 days prior to date of conference. Contractor shall notify qualified representatives of each party concerned with that portion of Work to attend conference, including but not limited to Owner, Architect, Consultant, Contractor's Superintendent, and Installer.
6. Landscape Plan Review and Coordination: Contractor will be held responsible for coordination between landscape and irrigation system installation. Landscape material locations shown on the Landscape Plan shall take precedence over the irrigation system equipment locations. If irrigation equipment is installed in conflict with the landscape material locations shown on the Landscape Plan, the Contractor will be required to relocate the irrigation equipment, as necessary, at Contractor's expense.

7. Static Pressure Verification: Contractor shall field verify the static pressure at the project site, prior to commencing work or ordering irrigation materials, and submit findings, in writing, to Consultant. If Contractor fails to verify static water pressure prior to commencing work or ordering irrigation materials, Contractor shall assume responsibility for all costs required to make system operational and the costs required to replace any damaged landscape material. Damage shall include all required material costs, design costs and plant replacement costs.
- C. Submittals Required:
1. Shop Drawings.
 2. Record Drawings (As-Builts):

At onset of irrigation installation secure cad files of original irrigation design from Owner. At the end of every day, revise prints for Work accomplished that day in red ink. As-built field records shall be brought up-to-date at the close of the working day every Friday by a qualified draftsman. A print of record plan(s) shall be available at Project Site. Indicate zoning changes on weekly as-built drawings. Indicate non-pressure piping changes on as-builts. Upon completion of Project, submit for review, prior to final acceptance, final set of as-built mylar sepias. Dimensions, from two permanent points of reference (building corners, sidewalk, road intersections or permanent structures), location of following items:

 - a. Connection to existing water lines.
 - b. Routing of sprinkler pressure lines (dimension maximum 100 feet along routing).
 - c. Sprinkler control valves.
 - d. Quick coupling valves.
 - e. Drain valves.
 - f. Drip line blow-out stubs.
 - g. Control wire routing if not with pressure mainline.
 - h. All gate valves.
 - i. Drip line blow-out stubs.
 3. Operation Instructions: Submit 3 written operation instructions including winterization procedures and start-up, with cut sheets of products, and coordinate controller/watering operation instructions with Owner maintenance personnel. Include the following controller charts:
 - a. Do not prepare charts until record (as-built) drawings have been reviewed by Consultant.
 - b. Provide one controller chart for each automatic controller installed.
 - Chart may be reproduction of record drawing, if scale permits filling of controller door. If photo reduction prints are required, keep reduction to maximum size possible to retain full legibility.
 - Chart shall be print of actual "as-built" system, showing area covered by that controller.
 - Chart does not require lateral pipe sizing to be visible to maintain clarity at reduced size.
 - c. Identify area of coverage of each remote control valve, using a distinctly different pastel color drawing over entire area of coverage.
 - d. Following review of charts by Consultant, they shall be hermetically sealed between two layers of 20 mm thick plastic sheet.
 - e. Charts shall be completed and reviewed prior to final review of irrigation system.

4. Warranty/Guaranty: Manufacturer shall warrant materials against defects for a period of one year from date of Substantial Completion. Installer(s) shall guarantee workmanship for similar period.
 - a. Settling of backfilled trenches which may occur during guaranty period shall be repaired at no expense to owner, including complete restoration of damaged property.
 - b. Expenses due to vandalism before substantial completion shall be borne by Contractor.
 - c. Owner will conduct normal maintenance operations during warranty period, so as not to hamper proper operation of irrigation system.
 5. Maintenance:
 - a. Furnish the following maintenance items to Owner prior to final Acceptance:
 - 2 Sets of special tools required for removing, disassembling, and adjusting each type of sprinkler head and valve supplied on the Project.
 - Two 6 foot valve keys for operation of gate valves or stop and waste valves. (if applicable).
 - 4 Keys for each automatic controller.
 - 4 Quick coupler keys and 4 matching hose swivels for each type of quick coupling valve installed.
 - 2 aluminum drain valve keys of sufficient length for operation of each type of drain valve.
 - b. Winterization: include cost in bid for winterizing complete system at conclusion of sprinkling season (in which system received final acceptance) within 3 days notification by the Owner. System shall be voided of water using compressed air or similar method reviewed by Consultant. Reopen, operate, and adjust system malfunctions accordingly during April of following season within 3 days of notification by Owner.
 6. Extra Stock: In addition to installed system, furnish the following items to Owner for each School:
 - a. 20 Pop-up spray heads with nozzles of each type used.
 - b. 10 Rotor heads of each type used.
 - c. 100Drip emitters or one 100' roll of inline emitter of each type used.
- D. Restrictions/Critical Criteria:
1. Inspection: Examine areas and conditions under which Work of this Section is to be performed. Do not proceed with work until unsatisfactory conditions have been corrected.
 - a. Underground Utilities shall be installed prior to installation of irrigation system. If irrigation installation takes place prior to utility installation, Contractor shall notify Owner of this condition in writing prior to commencement of irrigation installation.
 - b. Contractor is responsible to notify Consultant of any field conditions that vary from the conditions shown on the Irrigation Construction Documents. If Contractor fails to notify Consultant of these conditions, Contractor will be held responsible for all costs associated with the system adjustments required due to the change in field conditions.

2. Protection of Property:
 - a. Preserve and protect all trees, plants, monuments, structures, and paved areas from damage due to Work of this Section. In the event damage does occur, all items shall be completely repaired or replaced to satisfaction of Owner. All cost of such repairs shall be charged to and paid by Contractor.
 - b. Protect buildings, walks, walls, and other property from damage. Flare and barricade open ditches. Damage caused to asphalt, concrete, or other building material surfaces shall be repaired or replaced at not cost to Owner. Restore disturbed areas to original condition.
3. Existing Trees:
 - a. All trenching or other Work under limb spread of any and all evergreens or low branching deciduous material shall be done by hand or by other methods so as to prevent damage to limbs or branches.
 - b. Where it is necessary to excavate adjacent to existing trees use all possible care to avoid injury to trees and tree roots. Excavation, in areas where 2 inch and larger roots occur, shall be done by hand. Roots 2 inches or larger in diameter, except directly in the path of pipe or conduit, shall be tunneled under and shall be heavily wrapped with burlap to prevent scarring or excessive drying. Where a trenching machine is operated close to trees having roots smaller than 2 inches in diameter, wall of trench adjacent to tree shall be hand trimmed, making clean cuts through roots. Trenches adjacent to trees shall be closed within 24 hours, and when this is not possible, side of trench adjacent to tree shall be kept shaded with moistened burlap or canvas.
4. Protection and Repair of Underground Lines:
 - a. Request proper utility company to stake exact location (including depth) of all underground electric, gas, or telephone lines. Take whatever precautions are necessary to protect these underground lines from damage. If damage does occur, all damage shall be repaired by Utility Owner. All cost of such repairs shall be paid by Contractor unless other arrangements have been made.
 - b. Request Owner, in writing, to locate all private utilities (i.e., electrical service to outside lighting) before proceeding with excavation. If, after such request and necessary staking, private utilities which were not staked are encountered and damaged by Installer, they shall be repaired by Owner at no cost to Installer. If Contractor damages staked or located utilities, they shall be repaired by Utility Owner at Contractor's expense unless other arrangements have been made.
5. Replacement of Paving and Curbs: Where trenches and lines cross existing roadways, paths, curbing, etc., damage to these shall be kept to a minimum and shall be restored to original condition.
6. All grading, with the exception of final grading, shall be completed and approved by Owner before staking or installation of any irrigation system begins.
7. Staking shall Occur as Follows:
 - a. Mark, with powdered lime, routing of pressure supply line and flag heads for first few zones. Contact Consultant 48 hours in advance and request review of staking. Consultant will advise installer as to the amount of staking to be prepared. Consultant will review staking and direct changes if required.
Review does not relieve installer from coverage problems due to improper placement of heads after staking.
 - b. If Project has significant topography, freeform planting beds, or other amenities which could require alteration of irrigation equipment layout as deemed necessary by Consultant. Do not install irrigation equipment in these areas until Consultant has reviewed equipment staking.

8. Install sleeving under asphalt paving and concrete walks prior to concreting and paving operations, to accommodate piping and wiring. Compact backfill around sleeves per geotechnical engineer's recommendations.
9. Trenching: Trench excavation shall follow, as much as possible, layout shown on Drawing. Dig trenches straight and support pipe continuously on bottom of trench. Trench bottom shall be clean and smooth with all rock and organic debris removed. Trench per the following criteria:
 - a. Clearances:
 - No joint trenches shall occur
 - Piping 3 Inches and Larger - Make trenches of sufficient width (14 inches minimum) to properly assemble and position pipe in trench. Minimum clearance of piping 3 inches or larger shall be 5 inches horizontally on both sides of the trench.
 - Piping Smaller than 3 Inches - Trenches shall have a minimum width of 7 inches.
 - Line Clearance - Provide not less than 6 inches of clearance between each line, and not less than 12 inches of clearance between lines of other trades.
 - b. Pipe and Wire Depth:
 - Pressure Supply Piping - 24 inches from top of pipe.
 - PVC Sleeving - 24 inches from top of pipe.
 - Non-pressure Piping (rotor) - 18 inches from top of pipe.
 - Non-pressure Piping (pop-up) - 12 inches from top of pipe.
 - Control Wiring - Side of pressure main.
 - Drip tubing - As detailed for application.
 - c. Boring will be permitted only where pipe must pass under obstruction(s) which cannot be removed. In backfilling bore, final density of backfill shall match that of surrounding soil. It is acceptable to use sleeves of suitable diameter installed first by jacking or boring, and pipe laid through sleeves. Observe same precautions as though pipe were installed in open trench.
10. PVC Piping: Snake pipe in trench as much as possible to allow for expansion and contractions. Do not install pipe when air temperature is below 40°F. Place manual drain valves at low points and dead ends of pressure supply piping to insure complete drainage of system. When pipe laying is not in progress, or at end of each day, close pipe ends with tight plug or cap. Perform Work in accordance with good practices prevailing in piping trades.
 - a. Solvent Weld PVC Pipe: Lay pipe and make all plastic-to-plastic joints in accordance with manufacturer's recommendations.
 - b. Gasketed End Pipes:
 - Lay pipe and make pipe to fitting or pipe to pipe joint, following OR70 recommendations (John-Manville Guide for Installation of Ring-Tite Pipe), or pipe manufacturer's recommendations.
 - Construct thrust blocks behind all pressure main fittings, tees, bends, reducers, line valves, and caps in accordance with pipe manufacturer's recommendations. Contact Consultant prior to placing thrust blocks, for observation of thrust block excavation and initial placement. Consultant to size thrust blocks based on standard engineering practices.

11. Control Wiring:
 - a. Low Voltage Wiring:
 - Bury control wiring between controller and electric valves in pressure supply line trenches, strung as close as possible to main pipe lines with such wires to be consistently located below and to one side of pipe.
 - Bundle all 24 volt wires at 10 foot intervals and lay with pressure supply line pipe to one side of the trench.
 - Provide an expansion loop at every pressure pipe angle fitting, every electric control valve location (in valve box), and every 500 feet. Form expansion loop by wrapping wire at least 8 times around a 3/4 inch pipe and withdrawing pipe.
 - Make all splices and E.C.V. connections using 3M-OBV connectors or similar dry splice method.
 - Install all control wire splices not occurring at control valve in a separate splice valve box.
 - Install one control wire for each control valve.
 - Run two spare #14 A.W.G. U.F.U.L. control wires and one common wire from controller pedestal to the end of each and every leg of mainline. Label spare wires at controller and wire stub box.
 - b. High Voltage Wiring for Automatic Controller:
 - Provide 120-volt power connection to automatic controller.
 - All electric work shall conform to local codes, ordinances, and authorities having jurisdiction. All high voltage electrical work shall be performed by licensed electrician.
12. Automatic Controller:
 - a. **Calsense controllers only.**
 - b. Controllers shall be inspected and approved by an authorized Calsense representative prior to acceptance.
 - c. Connect remote control valves to controller in numerical sequence as shown on Drawings.
 - d. Final location of controller shall be approved by Consultant prior to installation.
 - e. Each controller shall have a dedicated separate ground wire, grounding rod and/or plate as detailed.
 - f. All above ground conduit shall be rigid galvanized or UV rated schedule 80 electrical conduit with appropriate fittings. All below ground conduit shall be schedule 80 electrical conduit.
 - g. Install controller in accordance with manufacturer's instructions as detailed and where shown on Drawings. Verify location with owner prior to installation.
13. Electric Control Valves: Rain Bird PE electric control valves only
14. Install cross-handle 6 inches below finished grade where shown on Drawings as detailed. When grouped together, allow at least 12 inches between valve box sides. Install each remote control valve in a separate valve box. Install individual valve box flush with grade. Maintain proper clearances between box and pipe. Valve box shall not rest on pipe or altered (cut) to obtain relief.
15. Quick Coupling Valves: Install quick couplers on double swing-joint assemblies of Schedule 80 PVC pipe; plumb and flush to grade. Angled nipple relative to pressure supply line shall be no more than 45 degrees and no less than 10 degrees. Install quick coupling valves as detailed.
16. Drip Valve Assemblies: Install drip valve assembly as detailed.
17. Drip Emitters: Stake all surface emitters as detailed and staked with acceptable tubing stakes.

18. Drain Valves: Install manual drain valves at all low points in pressure supply lines. Provide a three cubic foot drainage sump for each drain valve installed.
19. Valve Boxes:
 - a. Carson Jumbo valve boxes only.
 - b. Install one valve box for each type of valve installed as detailed.
 - c. Install gravel sump after compaction of all trenches. Place final portion of gravel inside valve box after valve box is backfilled and compacted.
 - d. Brand controller letter and station number on lid of each valve box. Letter and number size shall be no smaller than 1 inch and no greater in size than 1 ½ inches. Depth of branding shall be no more than 1/8 inch into valve box lid.
20. Sprinkler Heads: Spacing of heads shall not exceed the maximum recommended by manufacturer. Install heads on double swing-joint risers of Marlex PVC pipe. Angled nipple relative to non-pressure line shall be no more than 45 degrees or less than 10 degrees. Swing joint to consist of 3 Marlex Street Ells and one 10 inch schedule 80 nipple. Adjust part circle heads for proper coverage. Adjust heads to correct height after sod is installed. Plant placement shall not interfere with intended sprinkler head coverage, piping, or other equipment. Consultant may request nozzle changes or adjustments without additional cost to the Owner.
21. Backfilling: Do not begin backfilling operations until required system tests have been completed. Consultant and/or Owner shall observe all joints of pressure pipe prior to backfill. Backfill shall not be done in freezing weather except with review by Consultant. Leave trenches slightly mounded to allow for settlement after backfilling is completed. Trenches shall be finish graded prior to walk-through of system by Consultant.
 - a. Materials: Excavated material is generally considered satisfactory for backfill purposes. Backfill material shall be free of rubbish, vegetable matter, frozen materials, and stones larger than 1 inch in maximum dimension. Do not mix subsoil with topsoil. Material not suitable for backfill shall be hauled away. Contractor shall be responsible for providing suitable backfill if excavated material is unacceptable or not sufficient to meet backfill, compaction, and final grade requirements.
 - b. Do not leave trenches open for a period of more than 48 hours. Open excavations shall be protected in accordance with OSHA regulations.
 - c. Compact backfill per geotechnical recommendations.
22. Piping Under Paving:
 - a. Provide for a minimum cover of 18 inches between the top of the pipe and the bottom of the aggregate base for all pressure and non-pressure piping installed under asphaltic concrete or concrete paving.
 - b. Piping located under areas where asphalt or concrete paving will be installed shall be bedded with sand (a layer 6" below pipe and 6" above pipe).
 - c. Compact backfill material in 6" lifts per geotechnical engineer's recommendations.
 - d. Set in place, cap, and pressure test all piping under paving, in presence of Owner prior to backfilling and paving operations.
 - e. Piping under existing walks or concrete pavement shall be done by jacking, boring, or hydraulic driving, but where cutting or breaking of walks and/or concrete is necessary, it shall be done and replaced at not cost to Owner. Obtain permission to cut or break walks and/or concrete from Owner.
23. Flushing: After piping, risers, and valves are in place and connected, but prior to installation of sprinkler heads, quick coupler assemblies, and hose valves, thoroughly flush piping system under full head of water pressure from dead end fittings. Maintain flushing for 5 minutes through furthest valves. Cap risers

after flushing.

24. Testing: Conduct mainline pressure test in presence of Consultant. Arrange for presence of Consultant/Owner 48 hours in advance of testing. Supply force pump and all other test equipment.
 - a. After backfilling, and installation of all control valves, fill pressure supply line with water, and pressurize to 40 PSI over the designated static pressure or 120 PSI, whichever is greater, for a period of 2 hours.
 - b. Leakage, Pressure Loss - Test is acceptable if no loss of pressure is evident during the test period.
 - c. Leaks - Detect and repair leaks.
 - d. Retest system until test pressure can be maintained for duration of test.
 - e. Before final acceptance, pressure supply line shall remain under pressure for a period of 48 hours.
25. Walk-Through for Substantial Completion:
 - a. Arrange for Consultant's presence 48 hours in advance of walk-through.
 - b. Entire system shall be completely installed and operational prior to scheduling of walk-through.
 - c. Operate each zone in its entirety for Consultant at time of walk-through and additionally, open all valve boxes if directed.
 - d. Generate a list of items to be corrected prior to Final Completion.
 - e. Furnish all materials and perform all work required to correct all inadequacies of coverage due to deviations from Contract Documents.
 - f. During walk-through, expose all drip emitters under operations for observation by Consultant to demonstrate that they are performing and installed as designed, prior to placing of all mulch material. Schedule separate walk-through if necessary.
26. Walk-Through for Final Completion:
 - a. Arrange for Consultant's presence 48 hours in advance of walk-through.
 - b. Show evidence to Consultant that Owner has received all accessories, charts, record drawings, and equipment as required before Final Completion walk-through is scheduled.
 - c. Operate each zone, in its entirety for Consultant at time of walk-through to insure correction of all incomplete items.
 - d. Items deemed not acceptable by Consultant shall be reworked to complete satisfaction of Consultant.
 - e. If, after request of Consultant for walk-through for Final Completion of irrigation system, Consultant finds items during walk-through which have not been properly adjusted, reworked, or replaced as indicated on list of incomplete items from previous walk-through, Contractor shall be charged for all subsequent walk-throughs. Funds will be withheld from final payment and/or retainage to Contractor, in amount equal to additional time and expenses required by Consultant to conduct and document further walk-through's as deemed necessary to insure compliance with Contract Documents.
 - f. Submit Maxi-dollar receipts for all Rain Bird installed equipment prior to final acceptance.
27. Adjusting: Upon completion of installation, "fine-tune" entire system by regulating valves, adjusting patterns and break-up arms, and setting pressure reducing valves at proper and similar pressure to provide optimum and efficient coverage. Flush and adjust all sprinkler heads for optimum performance and to prevent overspray onto walks,

roadways, and buildings as much as possible. Heads of same type shall be operating at same pressure $\pm 7\%$.

- a. If it is determined that irrigation adjustments will provide proper coverage, and improved water distribution as determined by Consultant, contractor shall make such adjustments prior to Final Acceptance, as directed, at no additional cost to Owner. Adjustments may also include changes in nozzle sized, degrees of arc, and control valve throttling.
 - b. All sprinkler heads shall be set perpendicular to finish grade unless otherwise designated.
 - c. Areas which do not conform to designated operation requirements due to unauthorized changes or poor installation practices shall be immediately corrected at no additional cost to the Owner.
28. Water Source shall be from potable domestic service unless Grey Water is available in the vicinity.

PART 2 – PRODUCTS

A. ACCEPTABLE MATERIALS:

1. General Piping:
 - a. Pressure Supply Line (from point of connection through backflow prevention unit) - Type "k" Hard Copper.
 - b. Pressure Supply Lines {downstream of backflow prevention units) - Class 200 PVC BE (1" - 2 1/2") and Class 160 PVC RT (3" and larger).
 - c. Non-pressure Lines - Class 200 PVC BE.
 - d. PVC Sleeving - Class 160 PVC.
 - e. Drip Tubing - Toro Dura-Pol EHO 1645 3/4" with .050 inch wall thickness.
 - f. Emitter Tubing - As recommended by emitter manufacturer.
2. Copper Pipe and Fittings:
 - a. Copper Pipe - Type K, hard tempered.
 - b. Fittings - Wrought copper, pro-press.
 - c. Joints – Pro-press only.
3. Brass Pipe and Fittings:
 - a. Brass Pipe - 85% red brass, ANSI Schedule 40 screwed pipe.
 - b. Fittings - Medium brass, screwed 125 pound class.
4. Plastic Pipe and Fittings:
 - a. Identification Markings:
 - Identify all pipe with following indelible markings:
 - Manufacturer's name.
 - Nominal pipe size.
 - Schedule of class.
 - Pressure rating.
 - NSF (National Sanitation Foundation) seal of approval.
 - Date of extrusion.
 - b. Solvent Weld Pipe: Manufactured from virgin polyvinyl chloride (PVC) compound in accordance with ASTM D2241 AND ASTM 1784; cell classification 12454-8, Type 1, Grade 1.
 - Fittings: Standard weight, Schedule 40, injection molder PVC; complying with ASTM 01784 and 02466, cell classification 12454-B.
 - Threads: Injection molded type (where required).
 - Tees and ells: Side gated.

- Threaded Nipples - ASTM D2464, Schedule 80 with molded threads.
 - Joint cement and Primer - Type as recommended by manufacturer of pipe and fittings.
- c. Gasketed End Pipe: Manufactured from virgin Polyvinyl Chloride compound in accordance with ASTM D2241 and ASTM D1784; cell classification 1254-B, Type 1, Grade 1.
- Fittings 2" and larger need to be **Leemco Self-Restrained Ductile iron fittings**
 - Gaskets: Factory installed in pipe and fittings, having a metal or plastic support within gasket or a plastic retainer ring for gasket.
 - Lubricant: As recommended by manufacturer of pipe fittings.
- d. Flexible Plastic Pipe - Manufactured from virgin polyethylene in accordance with ASTM D2239, with a hydrostatic design stress of 630 psi and designated as PE **(only to be used on drip)**.
- Fittings - Insert type manufactured in accordance with ASTM D2609; PVC Type 1 cell classification 12454-B.
 - Clamps - All stainless steel clamps or manufacturer recommended fasteners.
5. Gate Valves:
- a. Gate Valves for 3/4 inch through 2-1-1/2 Inch Pipe - Brass construction, solid wedge, IPS threads, and non-rising stem with wheel operating handle.
- b. Gate Valves for 3 Inch and Larger Pipe - Iron body, resilient wedge AWWA gate valves with a clear waterway equal to full nominal diameter of valve; rubber gasket or mechanical joint-type only. Valves shall be able to withstand a continuous working pressure of 150 psi and be equipped with a square operating nut.
6. Quick Coupling Valves: Brass two-piece body designed for working pressure of 125 PSI; operable with quick coupler. Equip quick coupler with locking rubber cover. Key size and type as shown on Drawing.
7. Valve Boxes:
- a. Gate Valves and Wire Stub Box: **Carson Jumbos** or approved equal box as detailed.
- b. 3/4 inch through 2 inch Control Valves: **Carson Jumbos** 12 or approved equal box as detailed.
8. Electrical Control Wiring:
- a. Low Voltage:
- Electrical Control Wire: AWG UFUL approved No. 14 direct burial copper wire or larger, if required to operate system as designed.
 - Wire Colors:
 - Control Wires - Red.
 - Common Wires - White.
 - Master Valve Wires - Blue.
 - Spare Control Wires - Black.
 - Spare Common Wires - Yellow.
 - If multiple controllers are utilized, and wire paths of different controllers cross each other, both common and control wires from each controller shall be different colors approved by Consultant.
 - Control Wire connections and splices shall be made with 3M direct bury dry splice connectors, or similar dry splice method.
- b. High Voltage: Type required by local codes and ordinances, of proper size to

- accommodate needs of equipment serviced.
9. Automatic Controller: Calsense controller (size and type as required).
 10. Electric Control Valves: Rain Bird PE Series electric control valves.
 11. Size and type as required having manual flow adjustment (except drip valves) and manual bleed nut.
 12. Sprinkler Heads:
 - a. Rain Bird
 - Pop-ups 1800-Series with U-Series nozzles.
 - Rotor Heads 8005 Series (for large areas).
 - Rotor Heads 5000+ SERIES
 13. Backflow Preventer: Febco size and type as required, Brass construction with 150 psi working pressure.
 14. Booster Pump: Size and type as required. Variable Frequency Drive unless owner deems not required for application. Verify manufacturer with Owner.
 15. Central Control System: **Calsense** with the following features:
 - a. Stainless Steel Enclosure (with dedicated phone line connection extended from building to inside enclosure).
 - Flow Sensing Ability. (**NETAFIM HYDROMETER**). To cover both flow and master valve duties (Normally Open)
 - Weather Card.
 - Grounding as per Manufacturer specs.
 - Rain-gauge
 16. Drip Irrigation Systems:
 - a. Drip Tubing - Manufactured of flexible vinyl chloride compound conforming to ASTM D1248, Type 1, Class C, Category 4, P14 and ASTM 03350 for PE 122111C.
 - b. Fittings - Type and diameter recommended by tubing manufacturer.
 - c. Drip Valve Assembly – **Rain Bird Drip Valve assembly**. Type and size shown on Drawings.
 - Wye Strainer - Plastic construction with 150 mesh nylon screen and 1/2 inch blowout assembly.
 - Control Valve - 2 way, solenoid pilot operated type made of synthetic, non-corrosive material; diaphragm activated and slow closing. Include freely pivoted seat seal; retained (mounted) without attachment to diaphragm.
 - Pressure Reducing Valve - Plastic construction as detailed.
 - d. Emitters - Single port, pressure compensating, press on type.
 - e. In-line Emitters - Single port, pressure compensating.

329200 - LANDSCAPING

NOTE: THIS SECTION COMBINES AND SUPERCEDES:

02921 - FINE GRADING AND SOIL PREPARATION

02933 - SEEDING

02935 - SODDING

02950 - TREES, SHRUBS & GROUND COVER

PART 1 - GENERAL

A. Summary - this Section includes the following:

1. Trees.
2. Shrubs.
3. Ground covers.
4. Soil Preparation and Amendments.
5. Fertilizers and mulches.
6. Stakes and guys.
7. Landscape edging.

B. Submittals

1. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
2. Delivery tickets for all bulk materials with Owner's Representative's approval or acknowledgment that materials were received in satisfactory condition.
3. Product certificates signed by manufacturers certifying that their products comply with specified requirements.
4. Manufacturer's certified analysis for standard products, where applicable.
5. Analysis for other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.
6. Label data and cut sheets substantiating that landscape materials, including all soil amendments, herbicides, and pesticides, comply with specified requirements.
7. Certification of grass seed from seed vendor for each grass-seed mixture stating the botanical and common name and 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.
8. Certification of each seed mixture for sod, identifying sod source, including name and telephone number of supplier.

C. Samples of each of the following:

1. One cubic foot of fir fiber mulch and rock mulch in labeled plastic bags, boxes, or buckets.
 - a. Edging materials and accessories.
 - b. Weed Barrier.
 - c. Soil amendments.
 - d. Staking and guying materials.
 - e. All items requested by Contractor for Substitution or as an Approved Equal.
2. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
3. Material test reports from qualified independent testing agency indicating and interpreting test results relative to compliance of the following materials with requirements indicated.
 - a. Analysis of existing surface soil for planting suitability.
 - b. Analysis of imported soil amendment for planting suitability.
4. Planting schedule indicating anticipated dates and locations for each type of planting.
5. Three (3) sets maintenance instructions recommending procedures to be established by Owner for maintenance of landscaping during an entire year. Submit before expiration of required maintenance periods.
6. Three (3) copies of a written warranty stating all items included in the warranty, conditions of the warranty, and beginning and ending of warranty period(s).

D. Quality Assurance

1. Installer Qualifications: Engage an experienced installer who has completed landscaping work similar in material, design, and extent to that indicated for this Project and with a record of successful landscape establishment.
2. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on the Project site during times that landscaping is in progress.

Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate to Landscape Architect's satisfaction, based on evaluation of agency- submitted criteria conforming to ASTM E 699, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

3. Provide quality, size, genus, species, and variety of trees and shrubs indicated, complying with applicable requirements of ANSI Z 60.1 "American Standard for Nursery Stock", and all applicable state and local rules and regulations.
4. Inspection: Landscape Architect may inspect plants either at place of growth or at site before planting, for compliance with requirements for name, variety, size and quality. Notify the Landscape Architect at least 5 working days in advance.
5. The Landscape Architect reserves the right to reject at any time or place prior to final acceptance all plant materials which in the Landscape Architect's opinion fail to meet specifications. Inspection of materials is primarily for quality, size, and variety, but other requirements are not waived even though visual inspection results in approval. Plants may be inspected where available; however, inspection at the places of supply shall not preclude the right of rejection at the site or at a later time prior to final acceptance. Rejected material shall be removed from the site within 24 hours.
6. The Contractor shall schedule inspection of the plants, at either the supplier or on site, to be completed in one visit. Any further inspection required due to plants being unavailable or rejected as not meeting specifications shall be charged to the Contractor at the current hourly rate for Landscape Architect's personnel performing the inspection.
7. Topsoil Analysis: The Contractor shall furnish a soil analysis made by a qualified independent soil-testing agency stating percentages of organic matter, inorganic matter (silt, clay and sand), deleterious material, pH, salts, and mineral and plant-nutrient content of topsoil.
8. Report suitability of existing topsoil for growth of applicable planting material. State recommended quantities of nitrogen, phosphorus, and potash nutrients and any limestone, aluminum sulfate, or other soil amendments to be added to produce a satisfactory topsoil.
9. Measurements: Measure trees and shrubs according to ANSI Z 60.1 with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches (150 mm) above ground for trees up to 4-inch (100 mm) caliper size, and 12 inches (300 mm) above ground for larger sizes. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip-to-tip.
10. Pre-installation Conference: Contractor shall attend pre-installation conference at locations specified by Owner's Representative.
11. U.S. Department of Agriculture Rules and Regulations under the Federal Seed Act: Quality Standards for Certified Seed.

E. Delivery, Storage and Handling

1. Packaging Materials: Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery and while stored at site. The Landscape Architect reserves the right to inspect containers before or after installation to verify compliance with Specifications.
2. Seed: Deliver seed in original sealed, labeled, and undamaged containers. The Landscape Architect reserves the right to inspect containers before or after installation to verify compliance with Specification
3. Sod: Harvest, deliver, store and handle sod according to the requirements of the American Sod Producers Association's (ASPA) "Specifications for Turfgrass Sod Materials and Transplanting/Installing". Protect sod from drying and breaking.

Trees and Shrubs: Deliver nursery stocked or freshly dug trees and shrubs. Do not prune before delivery, except as approved by Landscape Architect. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping and other handling and typing damage. Do not bend or bind-tie trees and shrubs in such a manner as to destroy natural shape. Provide protective covering during delivery. Plant materials delivered without protective covering may be rejected. Do not drop trees and shrubs during delivery. Label at least one (1) tree and one (1) shrub of each variety with a securely attached waterproof tag bearing a legible plant name. Remove all tags and flagging as directed by Landscape Architect.

4. Handle balled and burlapped stock by the root ball.
5. Deliver trees, shrubs, ground covers and plants after preparations for planting have been completed and install immediately. If planting is delayed more than 6 hours after delivery, set planting materials in shade, protect from weather and mechanical damage, and keep roots moist. Provide delivery notification to Owner's Representative at least 5 working days in advance.
6. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
 - a. Do not remove container-grown stock from containers before time of planting.
 - b. Water root systems of trees and shrubs stored on site with a fine mist spray.
 - c. Water as often as necessary to maintain root systems in a moist condition.

F. Project Conditions

1. Utilities: Determine location of above grade and underground utilities and perform work in a manner which will avoid damage. Hand excavate, as required. Maintain grade stakes until removal is mutually agreed upon by parties concerned. Contractor shall be responsible for utility locating, repair of utilities damaged by Contractor, and establishment of grade controls.
2. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Landscape Architect before planting.
3. Clearing and Grubbing: Applies to all contract work areas which have vegetation or weed growth of 2 inch height or greater, and which are designated to be topsoiled, amended, seeded, sodded and/or planted under this Contract.

G. Coordination and Scheduling

1. Coordinate installation of planting materials during normal planting seasons for each type of plant material required.

2. Seeding shall be restricted according to the following schedule unless otherwise approved by Owner:
 - a. Below 6000' elevation: Spring seeding shall occur between spring thaws to June 15th. Fall seeding shall occur between September 1st until consistent ground freeze.
 - b. Spring thaw shall be defined as the earliest date in a calendar year in which seed can be buried ½ inch into the topsoil thru normal drill seeding methods.
 - c. Consistent ground freeze shall be defined as that time during fall months in which the topsoil, due to freeze conditions, prevents burying seed ½ inch thru normal drill seeding operations.
 3. Do not lay sod on frozen ground or during months when the irrigation system is shut down. Do not lay sod during summer restriction periods of local jurisdictions. Obtain all necessary sodding and watering permits before installation.
 4. Plant trees and shrubs after final grades have been accepted and prior to planting turf and native grasses, unless authorized by Owner's Representative.
 5. Contractor shall stake locations of all trees for review by the Owner's Representative prior to planting. Make all adjustments to locations as directed by the Owner's Representative.
- H. Warranty
1. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
 2. Special Warranty: Warrant the following living planting materials for a period of one (1) year after date of Final Acceptance, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, or incidents that are beyond Contractor's control.
 - a. Trees.
 - b. Shrubs.
 - c. Seeded Areas.
 - d. Sodded Areas.
 3. Replace planting materials that are excessively pruned, more than 25 percent dead, or in an unhealthy or declining condition immediately upon notice from the Owner's Representative. The Contractor shall prune all plants that have less than 25% dead branches at the end of the Warranty Period.
 4. All plants shall be true to name and meet all conditions of these specifications. Any plant which is not true to name as indicated by form, leaf, flower or fruiting characteristics shall be replaced at the Contractor's expense.
 5. Seeded areas shall be accepted on the basis of having uniform grass growth over all the seeded areas. Acceptable uniform grass growth shall be defined as when scattered bare spots, not greater than one square foot, do not exceed 5% of the seeded area.
 6. Inadequate or improper maintenance by the Owner shall not be cause for replacement, provided the Contractor shall have submitted a letter or report to the Owner on improper or inadequate maintenance practices and recommended remedial actions.
 7. The warranty shall not be enforced should any plant die due to vandalism after Final Acceptance.
 8. At the end of the warranty period the Contractor shall remove all stakes and guy materials and trim dead branches from all trees. Depending on time of year the Contractor shall also remove tree wrapping.

- I. Tree, Shrub, Ground Cover and Plant Maintenance
 - 1. Maintain trees, shrubs, ground covers and plants by pruning, cultivating, watering, winter watering, weeding, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease. Restore or replace damage tree wrappings. Maintain trees and shrubs for the following period:
 - a. Maintenance Period: Through plant warranty period.
- J. Sod Turf Grass Maintenance
 - 1. Begin maintenance of sodded turf grasses immediately after each area is planted and continue until acceptable turf is established, but for not less than the following period:
 - a. Maintenance Period: Until Final Acceptance.
 - b. Contractor shall provide a minimum of two (2) mowings of sodded areas during the Maintenance Period.
 - 2. Contractor shall not allow sodded grass height to exceed 5" before mowing. Do not remove more than 2" per mowing. Rake and remove clippings that accumulate in dense masses. Maintain and establish lawns by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade and replant bare or eroded areas and remulch to produce a uniformly smooth turf.
- K. Native Grass and Turf Seed Maintenance
 - 1. Maintain irrigated native grass and turf seeded areas by weeding, watering, re-grading, reseeding, and mulching as required to insure erosion control and complete seed coverage. Begin maintenance of grasses immediately after each area is planted and continue maintenance for not less than the following periods:
 - a. Maintenance Period: 90 days following Substantial Completion of all landscape work or until a healthy, uniform stand of grass is established. See H. Warranty, 5. for basis of acceptability. (Contingent upon Owner acceptance, irrigated seeded areas will be turned over to the Owner for maintenance).
 - b. Contractor shall provide a minimum of one (1) mowing of irrigated native grass and turf seeded areas during the Maintenance Period.
 - c. Weeding during the Maintenance Period shall be by herbicide method approved in advance by the Owners Representative. Do not apply herbicide while grass seed is in germination period or when rain is expected within 24 hours. Schedule irrigation system with timing of herbicide application to avoid wash off. Do not allow weeds to develop to maturity with woody stems. Schedule herbicide application prior to mowing. Do not mow until herbicide has taken effect.
 - d. Where feasible and if required by local jurisdictions seeded areas without permanent irrigation may be manually watered during the maintenance period from quick couplers on the irrigation system. The Owner shall approve manual watering on a project by project basis.
- L. Restrictions/Critical Criteria
 - 1. Planting Soil Preparation
 - a. Clean topsoil of roots, plants, sod, stones, lumps and other material harmful to plant growth and the appearance of a smooth finish grade.
 - b. Mechanically rip or till amendments into existing subsoil at a minimum depth of 6".

- c. Spread amendments and fertilizers at rates indicated:
 - d. Mechanically and evenly spread amendments in all areas to be sodded and seeded and shrub beds. Provide not less than the following quantities of specified amendments:
 - A-1 Organics Premium 3 soil amendment: 4 Cubic Yards/1000 SF
 - Commercial Fertilizer: (20-10-5): 10 lbs./1000 SF
 - Superphosphate: 10 lbs./1000 SF
2. Seeding Application
- a. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage. Deliver seed to job site in the original unopened containers and submit the certified labels to the Landscape Architect.
 - b. Mechanical Application: Seed by mechanical landscape type drills. Drill seed with approximately ½" inch of cover. Seed 50% in one direction and 50% at a 90 degree angle.
 - c. Broadcast Application: Seed by broadcast method only when areas are inaccessible to drilling equipment.
3. Erosion Control Netting
- a. Coordinate timing of soil preparation, fine grading and seeding on steep slopes and other locations subject to erosion such as swales with installation of erosion control netting (blanket). Netting should be installed after all finish landscape work of this section is complete. Netting will not be installed in areas to be sodded.
 - b. Netting will remain in place until grass is established. See civil drawings for erosion control netting requirements.
 - c. Maintain erosion control measures by repairing and replacing until Final Acceptance.
4. Extent of Bluegrass Sod shall be limited to athletic fields that can not be converted to synthetic turf. Other lawn areas should be seeded with drought tolerant grasses and provided with permanent irrigation.
5. Excavation for Trees and Shrubs
- a. Planting Pits: Excavate with vertical sides and with bottom of excavation slightly raised at center to assist drainage. Roughen sides of planting pit.
 - b. Balled and Burlapped Trees: Excavate approximately 2 times as wide as ball diameter. The depth of the plant pit shall be 2 inches less than the depth of the ball in well drained soils and 4 inches less than the ball depth in poorly drained soils.
 - c. Container-Grown Shrubs: Excavate approximately 2 times as wide as ball diameter. The depth of all plant pits shall be 1 inch less than depth of ball.
 - d. Where drain tile is shown or required under planted areas, excavate to top of porous backfill over tile.
 - e. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavation.
 - f. Drainage: Notify Owner's Representative if subsoil conditions evidence water seepage or retention in tree or shrub pits.
 - Fill all tree pits with water and allow it to completely drain before planting occurs.
 - If water does not drain out of pit within 24 hours, notify Owner's Representative.
 - All tree pits that fail to drain within 24 hours shall be mitigated at no additional cost to the Owner. Mitigation shall consist of over excavation of the pit and installation of a gravel sump with drain pipe as shown on the drawing detail.

6. Tree and Shrub Guying and Staking
 - a. Upright Staking and Tying: Stake trees of 2- through 5- inch (50 through 125 mm) caliper and Evergreen trees up to 8 foot height. Stake trees of less than 2 inch (50 mm) caliper only as required to prevent wind tip-out. Use a minimum of 2 stakes of length required to penetrate at least 18 inches (450 mm) below bottom of backfilled excavation and to extend at least 72 inches (1800 mm) above grade. Set vertical stakes and space to avoid penetrating balls or root masses. Support trees with 2 strands of tie wire fed through white PVC pipe and tree collar grommets. Allow enough slack to avoid rigid restraint of tree. Twist ends of wire and trim off excess.
 - b. Guying and Staking: Guy and stake evergreen trees exceeding 8 feet and deciduous trees more than 5 inch caliper unless otherwise indicated. Securely attach no fewer than 3 guys to stakes 48 inches long, driven into ground. Stakes shall be 12" above grade with approved plastic safety caps. Feed guy wire through white PVC pipe to hose chafing guard.
 - c. Cover all exposed steel stake ends with approved protective plastic caps.
 - d. Remove tree stakes and guys at the end of the warranty period as directed by the Owner's Representative
7. Tree Wrapping
 - a. Wrap trees with trunk-wrap tape. Start at base of trunk and spiral cover trunk to height of first branch. Overlap wrap, exposing half the width, and securely attach without causing girdling. Inspect tree trunks for injury, improper pruning, and insect infestation and take corrective measures required before wrapping.
 - a. No tree shall be wrapped after May 21 nor before November 1.
 - b. All deciduous trees shall be wrapped by November 15. Remove tree wrap by May 15.
 - c. Contractor shall be responsible for wrapping and unwrapping trees during the warranty period.
8. Plant Selection
 - a. Landscape plantings should be selected for drought tolerance (xeric) and should not be palatable to wildlife.

PART 2 - PRODUCTS

- A. Plant Materials
 1. General: Furnish nursery-grown trees and shrubs conforming to ANSI Z 60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully-branched, healthy, vigorous stock free of disease, insects, eggs, larvae, girdling, and defects such as sun scald, injuries, abrasions and disfigurement.
 2. Grade: Provide trees and shrubs of sizes and grades conforming to ANSI Z 60.1 for types of trees and shrubs required. Trees and shrubs of any larger size may be used if acceptable to Landscape Architect with a proportionate increase in size of roots and balls.
 3. Label each plant with securely attached waterproof tag bearing legible designations of botanical and common name.
 4. Label at least one (1) plant each variety and caliper with a securely attached waterproof tag bearing legible designation of botanical and common name.
 5. All plants shall be the species designated on the Drawings. No substitutions will be accepted without the prior written approval of the Landscape Architect. Contractor must provide proof of non-availability.

B. Trees

1. Shade Trees: Single-stem trees with straight trunk, well-balanced crown, and intact leader, of height and caliper indicated, conforming to ANSI Z 60.1 or type of trees required.
2. Branching Height: 1/2 of tree height.
3. Small Trees: Small upright or spreading type, branched or pruned naturally according to species and type, and with relationship of caliper, height, and branching recommended by ANSI Z 60.1, and stem form as designated on Drawings.
4. Evergreen Trees: Specimen XXX quality, well-balanced, coniferous evergreens, of type, height, spread, and shape required, conforming to ANSI Z 60.1.
5. Provide balled and burlapped trees.
6. All deciduous trees of one species used in formal rows or groupings shall exhibit cultural uniformity, i.e. "matched" in height, crown width and shape, height to first branch, and trunk taper. For this reason it is desired that these trees be produced by a single grower.

C. Shrubs

1. Form and Size:
 - a. Deciduous shrubs with not less than the minimum number of canes required by and measured according to ANSI Z 60.1 for type, shape, and height of shrub. Root development shall be sufficient to hold soil in the shape of the container when removed, but without visible circling roots.
 - b. Normal quality, well-balanced, broadleaf evergreens, of type, height, spread, and shape required, conforming to ANSI Z 60.1.
2. Provide container-grown shrubs.

D. Grass Materials

1. Grass Seed: Fresh, clean, dry, new crop seed complying with the Association of Official Seed Analysts "Rules for Testing Seeds" for purity and germination tolerances.
2. Seed Mixture: Provide seed of grass species and varieties, proportions by weight, and minimum percentages of purity and germination as indicated:

- a. Low Grow Mix - Sown over all irrigated native seed areas. Distributed by Arkansas Valley Seeds at (303) 320-7500.

Species	% P.L.S./Acre
Ephraim Crested Wheatgrass	30%
Dwarf Perennial Ryegrass	25%
SR3200 Blue Fescue	20%
Reubens Canada Bluegrass	15%
Chewings Fescue	10%
TOTAL	100%

- b. City of Aurora Mix - Sown over all non-irrigated reclamation seed areas
See City of Aurora erosion control requirements for approved seeding mix and application rates.
 - c. Pro-Sports Turf Mix - Sown over all athletic fields not sodded. Distributed by Arkansas Valley Seeds at (303) 320-7500.

Species	% P.L.S./Acre
Odyssey Kentucky Bluegrass (Midnight Type)	25%
SR2100 Kentucky Bluegrass (Shamrock Type)	25%
SR4600 Perennial Ryegrass	25%
Manhattan 4 Perennial Ryegrass	25%
TOTAL	100%
 - d. Seeding Rate:
40 lbs. per acre irrigated areas
20-25 lbs. Per acre in non irrigated areas
3. Quantity of bulk seed required to provide the specified PLS shall be calculated from purity and germination percentage rates listed on the lot tag of seed actually purchased, using the following formulas:
- a. Purity % multiplied by Germination % = PLS %
 - b. Lbs. PLS specified/1000 sf= Bulk Lbs., req./1000 sf PLS%
4. Sod: Certified turfgrass sod complying with ASPA specifications for machine-cut thickness, size, strength, moisture content, mowed height, and free of weeds and undesirable native grasses. Provide viable sod of uniform density, color and texture of at least 3 improved varieties of bluegrass and perennial rye, strongly rooted, and capable of vigorous growth and development when planted.
- a. Sod at general areas shall be GVT 2000 Kentucky Bluegrass Blend, as supplied by Green Valley Turf Co., Littleton, Colorado 303-798-6764 or approved equal.
 - b. Sod at athletic field area shall be GVT Sports Kentucky Bluegrass Blend #1, as supplied by Green Valley Turf Co., Littleton, Colorado 303-798-6764 or approved equal.

Sod which has dried out, or with soil which breaks, tears, or crumbles away will not be accepted. Sod shall be kept moist, protected from the sun, heat or wind, in transport and after delivery. Prior to cutting, the sod shall be evenly mowed for a blade length of at least 1 inch but not more than 2 inches.
 - c. Sod for sports fields and large areas shall be ordered in big rolls.

E. Soil Amendments

1. Compost: Organic material for soil preparation shall be a mixture of 100% Premium 3 Compost and shall be free from subsoil, stones, and plants or their roots, sticks, weed stolons and seeds, high salt contents and other materials harmful to plant life. The Compost shall be coarsely ground and thoroughly mixed together to ensure an even composition. The mix shall meet the following mechanical analysis:

	Passing%	Retained%
2-inch screen	100%	0
1-inch screen	90- 100	0 -10
1/2-inch screen	50-80	20-50
No. 100 mesh sieve	0-15	85-100

2. Upon the request of the Landscape Architect, the Contractor shall provide test results showing mixture composition and analysis.
 3. Compost: Shall be Premium 3 Compost, as produced by A-1 Organics, (800) 776-1644 or approved equal.
- F. Planting Pit Backfill
1. Planting Pit Backfill: Soil backfill for planting pits shall consist of the following mixture:
 - a. One part A-1 Organics Premium 3 soil amendment.
 - b. Four parts native soil from pit excavation.
 - c. Materials to be thoroughly blended.
- G. Fertilizer
1. Superphosphate: Commercial, phosphate mixture, soluble; minimum of 20 percent available phosphoric acid.
 2. 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-form, phosphorous, and potassium in the following composition:
 - a. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency. Cost of fertilizer will be paid on a direct time and materials basis.
 3. Slow-Release Fertilizer: Granular fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 - a. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency. Cost of fertilizer will be paid on a direct time and materials basis.
- H. Mulches
1. Organic Mulch: Organic mulch, free from deleterious materials and suitable as a top dressing for tree planting pits in sod and seed areas only, consisting of one of the following:
 - a. Type: Fir Fiber Mulch as supplied by Front Range Materials, Arvada, Colorado, 303-425-9992
 2. Fiber Mulch (hydromulch): Biodegradable green dyed-wood cellulose-fiber mulch, nontoxic, free of plant growth- or germination-inhibitors, with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.
 - a. Non-asphaltic Tackifier: Organic derivative vegetative gum tackifier recommended by fiber-mulch manufacturer for slurry application, nontoxic and free of plant growth- or germination-inhibitors.
 3. Rock Mulch: Hard, durable stone, washed free of loam, sand, clay and other foreign substances, of following type, size range, and color:
 - a. Type: ¾" diameter crushed mountain granite, natural color range of greys, browns and reds as supplied by Front Range Materials, Arvada, Colorado, 303-425-9992
- I. Weed Control Barriers
1. Non-woven Fabric: Spunbound Polyester fabric, 3.7 oz per sq. yd., minimum permeability of 160 gal. Per min. ft./2; Polyspun XL supplied by Direct Landscape Supply, Englewood, Colorado, 303-781-2270, or an approved equal.

J. takes and Guys

1. Upright Stakes: Green 8 foot x 2 inch diameter wolmanized lodge pole pine.
2. Guy and Tie Wires: 12 gauge galvanized wire. All guy and tie wires shall be covered with inch diameter PVC pipe, white.
3. Tree Collar Strap: Minimum 2 inch wide non-stretch webbing with grommets for attachment of wire between strap and stake.
4. Evergreen trees that are 8 feet tall or taller shall have wire guys threaded through rubber hose sections which are looped around the tree trunk and secured to 30 inch long metal tee posts. Fabric tree collar strap will not be acceptable on evergreen trees taller than 8 feet.

K. Landscape Edging

1. Steel Edging: Ryerson steel edging, 4 inch depth, 3/16 inch thick, with line stakes and splicer stakes as recommended by manufacturer.

L. Miscellaneous Materials

1. 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 instructions.
2. Pre-Emergent Herbicide: Treflan as manufactured by Elanco Company, or an approved substitution.
3. Trunk-Wrap Tape: Two (2) layers of crinkled paper cemented together with bituminous material, 4 inches (102 mm) wide minimum, with stretch factor of 33 percent.
4. Herbicides and Pesticides: EPA registered and approved, of type recommended by manufacturer.