

SECTION 312513 PERMANENT EROSION CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Erosion blankets and netting.
- B. Slope protection
- C. protection (non-rip rap)

1.02 RELATED SECTIONS

- A. Section 015713 - Temporary Erosion Controls
- B. Section 312200 - Grading
- C. Section 311000 - Site Clearing.
- D. Section 312316 - Excavation.
- E. Section 312323 - Fill: Filling and compaction.
- F. Section 329219 - Seeding: Finish ground cover.

1.03 REFERENCES

- A. Kentucky Erosion Prevention and Sediment Control Field Guide by Kentucky Division of Conservation. Refer to these guidelines for construction and maintenance of erosion control items.
- B. Kentucky Division of Water (www.water.ky.gov)

1.04 SUBMITTALS

- A. Erosion Control Material Data: Include manufacturer, product and design calculations for each product used.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Kentucky, Highway Department standards.

1.06 PROJECT CONDITIONS

- A. Protect above- and below-grade utilities that remain.
- B. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from installation equipment and vehicular traffic.

PART 2 PRODUCTS

2.01 MATERIALS

- A. High Velocity Erosion-Control Blankets: Coconut-fiber mat enclosed in a double-net, UV stabilized polypropylene mesh with a minimum 36-month design life. Include manufacturer's recommended biodegradable stakes, 6 inches (150 mm) long. Acceptable products are:
 - 1. Curlex III by American Excelsior Company
 - 2. C125 by North American Green
 - 3. ECC-2 by East Coast Erosion Blankets
 - 4. Enviroscope C4000
- B. Long-Term Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a double-net, photo-degradable woven mesh with a minimum 1-year design life. Include manufacturer's recommended biodegradable stakes, 6 inches long. Acceptable products are:

1. Curlex II by American Excelsior Company
 2. S150 by North American Green
 3. ECS-2 and ECX-2 by East Coast Erosion Blankets
 4. Enviroscope S2000
- C. Short-Term Erosion-Control Blankets: Biodegradable twisted jute or spun-coir mesh in a single-net product with straw or coconut-fiber fill. Include manufacturer's recommended steel wire staples, 6 inches long. Acceptable products are:
1. Curlex I by American Excelsior Company
 2. S75 by North American Green
 3. ECS-1 by East Coast Erosion Blankets
 4. Enviroscope S1000
- D. Other Materials: See Section 312323.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that finish grading and intended elevations for the Work are as indicated and that all debris and rock fragments larger than 1/2-inch have been removed from the area to be covered.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Identify and mark areas to receive erosion controls.

3.03 INSTALLATION

- A. Protect areas to be seeded as follows:
1. Ditches and drainage swales are to receive high-velocity erosion-control blankets.
 2. Slopes 4:1 (H:V) or greater are to receive long-term erosion-control blankets.
 3. Slopes between 4:1 and 6:1 are to receive short-term erosion-control blankets.
 4. If drawings indicate installation of flexible concrete erosion controls, the flexible concrete erosion controls are to be installed over the erosion control blankets and not as a substitute.
- B. Roll out erosion controls beginning at the bottom of the slope or the lowest end of the ditch line.
- C. Overlap ends of the controls a minimum of 24-inches or per the manufacturers recommendation, whichever is larger.
- D. Overlap the edges of the controls a minimum of 12-inches or per the manufacturers recommendation, whichever is larger.
- E. Install biodegradable anchors per the manufacturers recommendation. If erosion controls begin to pull up, slide or otherwise come loose, install additional anchors as needed for proper installation.
- F. Sod can be used for all slopes identified above (not drainage swales or ditches) as a substitute for the listed erosion controls. Sod is to be laid perpendicular to the slope and staked to prevent slipping.

3.04 CLEANING AND PROTECTION

- A. Leave site clean and raked, ready to receive landscaping.

END OF SECTION

**SECTION 313116
TERMITE CONTROL****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Chemical soil treatment.

1.02 RELATED REQUIREMENTS**1.03 REFERENCE STANDARDS**

- A. Title 7, United States Code, 136 through 136y - Federal Insecticide, Fungicide and Rodenticide Act; 1947 (Revised 2001).

1.04 SUBMITTALS

- A. See Division 1 Sections for submittal procedures.
- B. Product Data: Indicate toxicants to be used, composition by percentage, dilution schedule, intended application rate.
- C. Test Reports: Indicate regulatory agency approval reports when required.
- D. Manufacturer's Instructions: Indicate caution requirement.
- E. Manufacturer's Certificate: Certify that toxicants meet or exceed specified requirements.
- F. Record and document moisture content of soil before application.
- G. Maintenance Data: Indicate re-treatment schedule .
- H. Warranty: Submit warranty and ensure that forms have been completed in Owner's name.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing this type of work and:
 - 1. Having minimum of three (3) years documented experience.
 - 2. Approved by manufacturer of treatment materials.
 - 3. Licensed in the State in which the Project is located.

1.06 REGULATORY REQUIREMENTS

- A. Conform to applicable code for requirements for application, and comply with EPA regulations.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of toxicants.

1.07 SEQUENCING

- A. Apply toxicant 12 hours prior to installation of vapor barrier under slabs-on-grade.

1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year installer's warranty against damage to building caused by termites.
 - 1. Inspect annually and report in writing to Owner. Provide inspection service for twelve months from Date of Substantial Completion.

PART 2 PRODUCTS**2.01 CHEMICAL SOIL TREATMENT**

- A. Toxicant Chemical: EPA (1) approved; synthetically color dyed to permit visual identification of treated soil.

- B. Manufacturers: Subject to compliance with requirements, manufacturers offering the following products that may be incorporated into the work include;
 - 1. BASF: Product: Termidor 80 WG: www.basf.com
 - 2. Bayer Environmental Science Corp: www.backedbybayer.com/pest-management/#sle.
 - 3. FMC Professional Solutions; Product Baseline: www.fmcprosolutions.com.
 - 4. Syngenta Professional Products: www.syngentaprofessionalproducts.com/#sle.
- C. Toxicant Chemical: EPA (1) approved; synthetically color dyed to permit visual identification of treated soil.
- D. Diluent: Recommended by toxicant manufacturer.

2.02 MIXES

- A. Mix toxicant to manufacturer's instructions.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that soil surfaces are unfrozen, sufficiently dry to absorb toxicant, and ready to receive treatment.
- B. Verify final grading is complete.

3.02 APPLICATION - CHEMICAL TREATMENT

- A. Comply with requirements of U.S. EPA and applicable state and local codes.
- B. Spray apply toxicant in accordance with manufacturer's instructions.
- C. Apply toxicant at following locations:
 - 1. Under Slabs-on-Grade.
 - 2. At Both Sides of Foundation Surface.
 - 3. Soil Within 10 feet of Building Perimeter For a Depth of 1' foot.
- D. Under slabs, apply toxicant immediately prior to installation of vapor barrier.
- E. At foundation walls, apply toxicant immediately prior to finish grading work outside foundations.
- F. Apply extra treatment to structure penetration surfaces such as pipe or ducts, and soil penetrations such as grounding rods or posts.
- G. Re-treat disturbed treated soil with same toxicant as original treatment.
- H. If inspection or testing identifies the presence of termites, re-treat soil and re-test.

3.03 PROTECTION

- A. Do not permit soil grading over treated work.

END OF SECTION

SECTION 313700**RIPRAP****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Riprap .

PART 2 PRODUCTS**2.01 MATERIALS**

- A. Riprap: Provide in accordance with State of Kentucky Highways standards.
- B. Geotextile Fabric: Non-biodegradable polypropylene, non-woven, and needle punched with 6oz minimum weight.

PART 3 EXECUTION**3.01 PLACEMENT**

- A. Spray subgrade with weed control.
- B. Place geotextile fabric over substrate, lap edges and ends.
- C. Place riprap at headwall outlets as indicated.
- D. Place Riprap into position. Knead or ram riprap to conform to contours as identified on the plans.
- E. Installed Thickness: 12 inch average.
- F. Place rock evenly and carefully to minimize voids, do not tear fabric, place riprap in one consistent operation to preclude disturbance or displacement of substrate.

END OF SECTION

**SECTION 321123
AGGREGATE BASE COURSE****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Aggregate base course.
- B. Paving aggregates.

1.02 RELATED REQUIREMENTS

- A. Section 312200 - Grading: Preparation of site for base course.
- B. Section 312323 - Fill: Compacted fill under base course.
- C. Section 321216 - Asphalt Paving: Finish and binder asphalt courses.
- D. Section 321313 - Concrete Paving: Finish concrete surface course.
- E. Section 334913 - Storm Drainage Manholes, Frames and Covers: Manholes and frames.

1.03 REFERENCE STANDARDS

- A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses; 1965 (2004).
- B. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; 2010.
- C. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2014.
- D. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2012.
- E. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2012.
- F. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- G. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.
- H. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2010.
- I. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2010.

1.04 SUBMITTALS

- A. See Division 1 Sections for submittal procedures.
- B. Materials Sources: Submit name of imported materials source.
- C. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- D. Compaction Density Test Reports.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. Aggregate Storage, General:
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS**2.01 MATERIALS**

- A. Coarse Aggregate Type #2 Crushed Limestone: Coarse aggregate, conforming to State of Kentucky Highway Department standard.
- B. Blended Aggregate Type DGA: Pug DGA conforming to State of Kentucky Highway Department standard.
- C. Herbicide: In accordance with State of Kentucky Highway Department Standards .

2.02 SOURCE QUALITY CONTROL

- A. See Division 1 for Quality Requirements for testing and analysis of aggregate materials.
- B. Where aggregate materials are specified using ASTM D2487 classification, test and analyze samples for compliance before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.
- D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that survey bench marks and intended elevations for the work are as indicated.
- B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.
- C. Proof-roll areas to receive aggregate base course material and have proof-roll approved by the soils testing agent.
- D. Due to the type of soils encountered on the site, proof-rolling during wet periods or when the existing soils are above optimum moisture content will not be acceptable. All proof-rolling will need to be done during dry conditions.

3.02 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.03 INSTALLATION

- A. Under Bituminous Concrete Paving:
 - 1. Place Blended Aggregate Type DGA to thickness identified on the drawings.
 - 2. Compact to 95 percent of maximum dry density.
- B. Under Portland Cement Concrete Paving:
 - 1. Place Blended Aggregate Type DGA to a total compacted thickness identified on the drawings.
 - 2. Compact to 95 percent of maximum dry density.

- C. Place aggregate in maximum 4 inch layers and roller compact to specified density.
- D. Level and contour surfaces to elevations and gradients indicated.
- E. Add small quantities of fine aggregate to coarse aggregate as appropriate to assist compaction.
- F. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.
- G. Use mechanical tamping equipment in areas inaccessible to compaction equipment.
- H. Apply herbicide to finished surface.

3.04 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Scheduled Compacted Thickness: Within 1/4 inch.

3.05 FIELD QUALITY CONTROL

- A. See Division 1 Sections for general requirements for field inspection and testing.
- B. Compaction density testing will be performed on compacted aggregate base course in accordance with ASTM D1556, ASTM D2167, or ASTM D6938.
- C. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with AASHTO T 180, ASTM D698 ("standard Proctor"), or ASTM D1557 ("modified Proctor").
- D. If tests indicate work does not meet specified requirements, remove work, replace and retest.
- E. Frequency of Tests: One (1) test for every 2000 sq. ft. or less of paved area per lift, but in no case fewer than two (2) tests per lift.
- F. Proof roll compacted aggregate at surfaces that will be under slabs-on-grade.

3.06 CLEANING

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION

**SECTION 321216
ASPHALT PAVING****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Double course bituminous concrete paving.

1.02 RELATED REQUIREMENTS

- A. Section 312200 - Grading: Preparation of site for paving and base.
- B. Section 312323 - Fill: Compacted subgrade for paving.
- C. Section 321123 - Aggregate Base Course: Aggregate base course.
- D. Section 330513 - Manholes and Structures: Manholes, including frames; gutter drainage grilles, covers, and frames for placement by this section.

1.03 REFERENCE STANDARDS

- A. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; 1997.
- B. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction; 2009a.

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Kentucky Highways standard.
- B. Mixing Plant: Conform to State of Kentucky Highways standard.
- C. Obtain materials from same source throughout.

1.05 FIELD CONDITIONS

- A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.
- B. Place bitumen mixture when temperature is not more than 15 F degrees below bitumen supplier's bill of lading and not more than maximum specified temperature.

PART 2 PRODUCTS**2.01 MATERIALS**

- A. Asphalt Cement: ASTM D946.
- B. Aggregate for Base Course: In accordance with State of Kentucky Highways standards.
- C. Aggregate for Binder Course: In accordance with State of Kentucky Highways standards.
- D. Aggregate for Wearing Course: In accordance with State of Kentucky Highways standards.
- E. Fine Aggregate: In accordance with State of Kentucky Highways standards.
- F. Tack Coat: Homogeneous, medium curing, liquid asphalt in accordance with Kentucky Transportation Cabinet Standard Specifications Section 406.

2.02 ASPHALT PAVING MIXES AND MIX DESIGN

- A. Use dry material to avoid foaming. Mix uniformly.
- B. Asphalt Pavement:
 - 1. Binder Course: State of Kentucky Highways standards for CL2 BASE 0.75 D PG 64-22.

- 2. Wearing Course: State of Kentucky Highways standards for CL2 SURF 0.38 D PG 64-22.
- C. Recycled Asphalt Pavement (RAP): In accordance with State of Kentucky Highway Department Section 409 with a maximum of 15 percent RAP for PG 64-22.
- D. Submit proposed mix design of each class of mix for review prior to beginning of work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.
- C. Asphalt Pavement may be placed between November 15th and April 1st if the ambient temperature requirements are met or if approved by the architect/engineer.

3.02 BASE COURSE

- A. Place and compact base course.

3.03 PREPARATION - TACK COAT

- A. Apply tack coat in accordance with manufacturer's instructions.
- B. Comply with provisions in KTC Standard Specifications Section 406
- C. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of 1/3 gal/sq yd.
- D. Coat surfaces of storm and sanitary sewer structure frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.04 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

- A. Place asphalt binder course within 24 hours of applying primer or tack coat.
- B. Place binder course to compacted thickness identified on the contract drawings.
- C. Place wearing course within 72 hours of placing and compacting binder course. If the wearing course is placed more than 72 hours after the binder course, the binder course is to be cleaned and a tack coat installed prior to the wearing course installation.
- D. Place wearing course to compacted thickness identified on the contract drawings.
- E. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- F. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.
- G. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent.

3.05 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
- B. Compacted Thickness: Within 1/4 inch of specified or indicated thickness.
- C. Variation from True Elevation: Within 1/2 inch.
- D. Texture: Surface is to have a tight, smooth, uniform finish. Areas that have an abundance of exposed aggregate or porous texture, as determined by the Architect, shall be re-compacted or replaced as required by the Architect.

3.06 FIELD QUALITY CONTROL

- A. See Division 1 Sections for general requirements for testing and inspections.
- B. Provide field inspection and testing. Take samples and perform tests in accordance with AI MS-2.

3.07 PROTECTION

- A. Immediately after placement, protect pavement from mechanical injury for 2 days or until surface temperature is less than 140 degrees F.
- B. All pavements that are soiled or otherwise dirty are to be pressure washed and rinsed upon completion of the construction and landscaping work.

END OF SECTION

SECTION 321313 CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete sidewalks.

1.02 RELATED REQUIREMENTS

- A. Section 031000 - Concrete Forming and Accessories.
- B. Section 312200 - Grading: Preparation of site for paving and base and preparation of subsoil at pavement perimeter for planting.
- C. Section 312323 - Fill: Compacted subbase for paving.
- D. Section 321123 - Aggregate Base Course: DGA base course.
- E. Section 321726 - Tactile Warning Surfacing: Plastic tactile and detectable warning tiles for pedestrian walking surfaces.
- F. Section 321373 - Joint Sealers: Sealant for joints.
- G. Section 321613 - Concrete Curb and Gutters

1.03 REFERENCE STANDARDS

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).
- B. ACI 301 - Specifications for Structural Concrete; 2010 (Errata 2012).
- C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000.
- D. ACI 305R - Hot Weather Concreting; 2010.
- E. ACI 306R - Cold Weather Concreting; 2010.
- F. ASTM A36 - Steel plate for plate dowel systems.
- G. ASTM A185/A185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.
- H. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.
- I. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.
- J. ASTM B633 Type II - Electroplated zinc for plate dowel systems
- K. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2013.
- L. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2015a.
- M. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.
- N. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.
- O. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2014.
- P. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.

- Q. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.
- R. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2013.
- S. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2014.
- T. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2013).
- U. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2004a (Reapproved 2013).

1.04 SUBMITTALS

- A. See Division 1 Sections for submittal procedures.
- B. Product Data: Provide data on joint filler, admixtures, curing compound, and fiber reinforcement.
- C. Installer qualifications using Macro Fiber reinforcement in finished, exterior concrete pavement.
- D. Design Data: Indicate pavement thickness, designed concrete strength, reinforcement, and typical details.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Form Materials: As specified in Section 031000, conform to ACI 301.
- B. Joint Filler: Preformed; non-extruding bituminous type (ASTM D1751) or sponge rubber or cork (ASTM D1752).
 - 1. Thickness: 3/8 inch.
 - 2. Product:

2.02 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, Grade 80 (80,000 psi) yield strength; deformed billet steel bars; unfinished.
- B. Steel Welded Wire Reinforcement: Plain type, ASTM A1064/A1064M; in flat sheets; unfinished.
- C. Plate Dowels: Light and Medium Duty Concrete - ASTM A36 steel plates with electroplated zinc coating meeting ASTM B633 Type II. Plate sizes and spacing to meet specified concrete thickness.

2.03 CONCRETE MATERIALS

- A. Obtain cementitious materials from same source throughout.
- B. Concrete Materials: Provide in accordance with State of Kentucky Highways standards.
- C. Cement: ASTM C150/C150M, Normal - Type I Portland cement, gray color.
- D. Fine and Coarse Mix Aggregates: ASTM C33/C33M.
- E. Water: Clean, and not detrimental to concrete.
- F. Fiber Reinforcement: Shrinkage crack control, micro synthetic, fibrillated, polypropylene fibers shown to have long-term resistance to deterioration when in contact with alkalis and moisture; 3/4 to 1 inch length and designed to reduce shrinkage cracking of concrete.
 - 1. Acceptable Products:
 - a. PSI FIBERSTRAND F by Euclid Chemical

- b. Procon F-E by Nycon Corporation
 - c. Fibermesh 300 by Propex Operating Company
 - d. Econo-Net by Forta Corporation
 - e. MasterFiber M 100 by BASF
- G. Air-Entraining Admixtures: ASTM C260/C260M.
- H. Chemical Admixtures: ASTM C494/C494M, Type A - Water Reducing.
 - 1. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

2.04 ACCESSORIES

- A. Curing Compound: ASTM C309, Type 1, Class A.
- B. Curing Compound:
 - 1. Sonneborn's Sonosil
 - 2. L&M's L&M Cure
 - 3. Dayton Superior's Day Chem Sil-Cure (J-13)
- C. Joint Sealer: Type as specified in Section 321373.

2.05 CONCRETE MIX DESIGN

- A. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.
- B. Micro Fiber Reinforcement: Add to mix at rate of 1.5 pounds per cubic yard, or as recommended by manufacturer for specific project conditions. Fiber is to be added at the plant after all other materials have been added, and have a minimum mix time of 5-minutes..
- C. Concrete Properties:
 - 1. Compressive strength (prior to fiber), when tested in accordance with ASTM C39/C39M at 28 days; 4500 psi. Testing of the concrete mix prior to adding fiber and again after fiber has been added is required to set the compressive strength requirement for fiber reinforced concrete. This should be done for the first pour of each mix design and the results used to confirm future pours.
 - 2. Cement Content: Minimum 600 lb per cubic yard.
 - 3. Water-Cement Ratio: Maximum 0.44 percent by weight.
 - 4. Total Air Content: 6 percent +/- 1%, determined in accordance with ASTM C 173/C 173M.
 - 5. Maximum Slump: 4 inches using base design, 5 inches when using fiber and mid-range water reducer, 6 inches when using a mid-range water reducer, +/- 1-inch.
 - 6. Maximum Aggregate Size: 1 inch.

2.06 MIXING

- A. Transit Mixers: Comply with ASTM C94/C94M.
- B. Do not add water to the mix once the truck has left the concrete plant.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.

3.02 SUBBASE

- A. See Section 321123 for construction of base course for work of this Section.

3.03 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Coat surfaces of manhole frames with oil to prevent bond with concrete pavement.
- C. When using Macro Fiber reinforcement, a representative of the fiber manufacturer must be on-site during the first pour and finishing process.

3.04 FORMING

- A. Place and secure forms to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.05 REINFORCEMENT

- A. Place reinforcement as indicated and per the manufacturers recommendations.
- B. Provide doweled joints at all isolation joints with one end of dowel set in capped sleeve to allow longitudinal movement.

3.06 COLD AND HOT WEATHER CONCRETING

- A. Follow recommendations of ACI 305R when concreting during hot weather.
- B. Follow recommendations of ACI 306R when concreting during cold weather.
- C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

3.07 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Do not add water to concrete.
- C. Ensure reinforcement, inserts, embedded parts, formed joints and concrete form work are not disturbed during concrete placement.
- D. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- E. Place concrete to indicated pattern.

3.08 JOINTS

- A. Align curb, gutter, and sidewalk joints.
- B. Place 3/8 inch wide isolation joints at 20 foot intervals and to separate paving from vertical surfaces and other components and in pattern indicated.
 - 1. Form joints with joint filler extending from bottom of pavement to within 1/2 inch of finished surface.
 - 2. Secure to resist movement by wet concrete.
- C. Provide tooled contraction control joints:
 - 1. In pattern shown on drawings.

3.09 FINISHING

- A. Area Paving: Light broom, texture perpendicular to pavement direction.

- B. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius. Remove tooling marks to prevent a picture frame effect.
- C. Remove "slop" created by the concrete finishing from all joints and edges.
- D. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.10 JOINT SEALING

- A. See Section 321373 for joint sealer requirements.

3.11 TOLERANCES

- A. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.
- B. Maximum Variation From True Position: 1/4 inch.

3.12 FIELD QUALITY CONTROL

- A. Allow the independent testing agency to perform field quality control tests, as specified in Division 1.
 - 1. Provide free access to concrete operations at project site and cooperate with appointed firm.
 - 2. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
 - 3. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
- B. Compressive Strength Tests: ASTM C39/C39M; for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.
 - 1. Test fiber reinforced concrete prior to the addition of fiber and again after fiber has been added to set the baseline for the fiber reinforced compressive strength, slump and air content. This is to be done for the first pour of each mix design, and the results used for later pour strength requirements.
 - 2. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
 - 3. Perform one slump test and one air content test for each set of test cylinders taken.
- C. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken. All test reports are to be typed.
- D. Any tests or time limits that do not meet the specified requirements are to be reported to the Contractor and that concrete shall be considered unacceptable.

3.13 PROTECTION

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
- B. Do not permit pedestrian traffic over pavement for 2 days minimum after finishing.
- C. Do not permit vehicular traffic over pavement until 75 percent design strength of concrete has been achieved.
- D. All pavements that are soiled or otherwise dirty are to be pressure washed and rinsed upon completion of the construction and landscaping work.

END OF SECTION

SECTION 321373 PAVEMENT JOINT SEALANTS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Expansion and contraction joints within cement concrete pavement.
 - 2. Joints between cement concrete and asphalt pavement.
 - 3. Joints between cement concrete or asphalt pavement and adjacent structures.
 - 4. Joints between concrete banding and detectable warning pavers.
- B. Related Sections include the following:
 - 1. Section 321313 - Concrete Paving: constructing joints in concrete pavement.
 - 2. Section 321613 - Concrete Curbs and Gutters

1.02 SUBMITTALS

- A. Product Data: For each joint sealant product indicated.
- B. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- C. Qualification Data: For Installer.
- D. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.03 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- B. Preconstruction Compatibility and Adhesion Testing: Submit to joint sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. Use ASTM C 1087 or manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - 2. Submit not fewer than eight pieces of each type of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.
 - 3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 4. For materials failing tests, obtain joint sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
 - 5. Testing will not be required if joint sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.
- C. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing of current sealant products within a 36-month period preceding the Notice to Proceed with the Work.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 for testing indicated, as documented according to ASTM E 548.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.05 PROJECT CONDITIONS

- A. All expansion, isolation and cold joints, including those in concrete curbs, are to receive joint sealant.
- B. Do not proceed with installation of joint sealants under the following conditions:
 - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
 - 2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F (4.4 deg C), whichever is higher.
 - 3. When joint substrates are wet or covered with frost.
 - 4. Where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
 - 5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Products: Subject to compliance with requirements, provide one of the products listed in other Part 2 articles.

2.02 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.03 COLD-APPLIED JOINT SEALANTS

- A. Type S, Grade NS, Class 25 Polyurethane Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag urethane sealant complying with ASTM C920
 - 1. Sikaflex-1a
 - 2. Bostik Seal 'N' Flex FC
 - 3. Tremco Vulkem 116

2.04 JOINT SEALANT BACKER MATERIALS

- A. General: Provide joint sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint sealant manufacturer based on field experience and laboratory testing.
- B. Backer Strips for Cold- and Hot-Applied Sealants: ASTM D 5249; Type 2; of thickness and width required to control sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

2.05 PRIMERS

- A. Primers: Product recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealant substrate tests and field tests.

PART 3- EXECUTION

3.01 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealant manufacturer, based on preconstruction joint sealant substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.03 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install backer materials of type indicated to support sealants during application and at position required to produce cross sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of backer materials.
 - 2. Do not stretch, twist, puncture, or tear backer materials.
 - 3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses provided for each joint configuration.
 - 3. Produce uniform, cross sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 - 1. Remove excess sealants from surfaces adjacent to joint.
 - 2. Use tooling agents that are approved in writing by joint sealant manufacturer and that do not discolor sealants or adjacent surfaces.
- F. Provide joint configuration to comply with joint sealant manufacturer's written instructions, unless otherwise indicated.
- G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.04 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.05 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.
- B. Apply clean, white, silica sand dusting to the finished tooled surface of the joint sealant to help prevent tracking of the material.

END OF SECTION

**SECTION 321613
CONCRETE CURBS AND GUTTERS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Concrete header curbs.
- B. Concrete for fence bands.

1.02 RELATED REQUIREMENTS

- A. Section 312200 - Grading: Preparation of site for paving and base and preparation of subsoil at pavement perimeter for planting.
- B. Section 312323 - Fill: Compacted subbase for paving.
- C. Section 321123 - Aggregate Base Courses: DGA base course.
- D. Section 321373 - Joint Sealers: Sealant for joints.

1.03 REFERENCE STANDARDS

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2002).
- B. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2005.
- C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.
- D. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 1999.
- E. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 1988 (Reapproved 2002).
- F. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2007.
- G. ASTM C 33 - Standard Specification for Concrete Aggregates; 2007.
- H. ASTM C 39/C 39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2005.
- I. ASTM C 94/C 94M - Standard Specification for Ready-Mixed Concrete; 2007.
- J. ASTM C 150 - Standard Specification for Portland Cement; 2007.
- K. ASTM C 173/C 173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2008a.
- L. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete; 2006.
- M. ASTM C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2007.
- N. ASTM C 494/C 494M - Standard Specification for Chemical Admixtures for Concrete; 2008a.
- O. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2008a.
- P. ASTM C 685/C 685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2007.

- Q. ASTM D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2008).
- R. ASTM D 1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction; 2004a (Reapproved 2008).

1.04 SUBMITTALS

- A. See Division 1 Sections for submittal procedures.
- B. Product Data: Provide data on joint filler, admixtures, curing compound, and fiber reinforcement.
- C. Installer qualifications using Macro Fiber reinforcement in finished, exterior concrete.
- D. Design Data: Indicate curb/gutter thickness, designed concrete strength, reinforcement, and typical details. Separate mix designs are required for conventionally formed concrete and machine placed or slip-formed concrete.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Form Materials: Conform to ACI 301 and as follows.
- B. Steel forms with self-aligning joints designed to withstand the lateral and vertical loads associated with the concrete placement. Form sections are to be a minimum of 10-feet in length for runs that are 10-feet or longer in length.
- C. Joint Filler: Preformed; non-extruding bituminous type (ASTM D 1751) or sponge rubber or cork (ASTM D 1752).
 - 1. Thickness: 3/8 inch.

2.02 REINFORCEMENT

- A. Reinforcing Steel: ASTM A 615/A 615M Grade 40 (280); deformed billet steel bars; unfinished finish.
- B. Steel Welded Wire Reinforcement: Plain type, ASTM A 185/A 185M; in flat sheets; unfinished.
- C. Dowels: ASTM A 615/A 615M Grade 40 (280); deformed billet steel bars; unfinished finish.

2.03 CONCRETE MATERIALS

- A. Obtain cementitious materials from same source throughout.
- B. Concrete Materials: Provide in accordance with State of Kentucky Highways standards.
- C. Cement: ASTM C 150 Air Entraining - Type IA portland type, grey color.
- D. Fine and Coarse Mix Aggregates: ASTM C 33.
- E. Fly Ash: ASTM C 618, Class F - Optional for mixes used for slip forming of curb and gutter, or slip forming of concrete pavements. Fly ash is not to be used in concrete that is not slip formed or extruded..
- F. Water: Clean, and not detrimental to concrete.
- G. Fiber Reinforcement: Structural, macro synthetic, fibrillated, polypropylene fibers shown to have long-term resistance to deterioration when in contact with alkalis and moisture; 1.5 to 2 inch length and manufactured to provide post-cure concrete strength and increase freeze/thaw resistance.
 - 1. Acceptable Products:
 - a. TUF-STRAND SF by Euclid Chemical
 - b. Nycon-XL200 by Nycon Corporation

- c. Fibermesh 650 by Propex Operating Company
 - d. Forta-Ferro by Forta Corporation
- H. Air Entrainment Admixture: ASTM C 260.
- I. Chemical Admixtures: ASTM C 494/C 494M, Type A - Water Reducing.
 - 1. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

2.04 ACCESSORIES

- A. Curing Compound: ASTM C 309, Type 1, Class A.
- B. Joint Sealer: Type as specified in Section 321373.

2.05 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
- B. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended by manufacturer.
- C. Macro Fiber Reinforcement: Add to mix at rate of 7 pounds per cubic yard, or as recommended by manufacturer for specific project conditions. Fiber is to be added at the plant after all other materials have been added, and have a minimum mix time of 5-minutes. Fiber reinforcement is only to be used when slip forming of concrete is performed.
- D. Concrete Properties:
 - 1. Compressive Strength (prior to adding fiber), when tested in accordance with ASTM C 39/C 39M at 28 days: 4500 psi. Testing of the concrete mix prior to adding fiber and again after fiber has been added is required to set the compressive strength requirement for fiber reinforced concrete. This should be done for the first pour of each mix design and the results used to confirm future pours.
 - 2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
 - 3. Cement Content: Minimum 639 lb per cubic yard.
 - 4. Water-Cement Ratio: Maximum 0.44 percent by weight.
 - 5. Total Air Content: 6 percent +/- 1%, determined in accordance with ASTM C 173/C 173M.
 - 6. Maximum Slump: 4 inches using base design, 5 inches when using fiber and mid-range water reducer, 6 inches when using a mid-range water reducer, +/- 1-inch.
 - 7. Maximum Aggregate Size: 1 inch.

2.06 MIXING

- A. Transit Mixers: Comply with ASTM C 94/C 94M.
- B. Do not add water to the mix once the truck has left the concrete plant.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify compacted subgrade is acceptable and ready to support imposed loads.
- B. Verify gradients and elevations of base are correct.

3.02 SUBBASE

- A. See Section 321123 for construction of base course for work of this Section.

3.03 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.

- B. Coat surfaces of storm structure frames with oil to prevent bond with concrete curb/gutter.
- C. Notify Architect minimum 24 hours prior to commencement of concreting operations. Architect is to review and approve sample pours prior to installation of permanent concrete.

3.04 FORMING

- A. Place and secure forms to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.
- D. Slip forming can be used for curb and gutter combinations. The slip form machine shall be self-propelled and designed to place, consolidate and finish the concrete in one pass, and be adjustable to install gutter lines that slope away from the curb where required.

3.05 REINFORCEMENT

- A. Place reinforcement as indicated.
- B. Use fiber reinforcement for all concrete.
- C. Provide doweled joints as indicated with one end of dowel set in capped sleeve to allow longitudinal movement.

3.06 COLD AND HOT WEATHER CONCRETING

- A. Follow recommendations of ACI 305R when concreting during hot weather.
- B. Follow recommendations of ACI 306R when concreting during cold weather.
- C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

3.07 PLACING CONCRETE

- A. Place concrete in accordance with ACI 304R.
- B. Do not place concrete when base surface is wet.
- C. Concrete can be placed using the slip form technique. If slip forming is used, fiber-reinforced concrete shall be used.
- D. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.
- E. Place concrete continuously over the full length of the run and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- F. Place expansion joints at the beginning and ending of each pour.
- G. Place expansion joints at the beginning and ending of each pour. Place control joints concrete to indicated pattern.

3.08 JOINTS

- A. Align curb, gutter, and sidewalk joints.
- B. Place 3/8 inch wide expansion joints at 40 foot intervals and to separate curb and gutter from adjacent sidewalks, vertical surfaces and other components .
 - 1. Form joints with joint filler extending from bottom of pavement to within 1/2 inch of finished surface.
 - 2. Secure to resist movement by wet concrete.

- C. Provide sawcut contraction control joints every 8-feet. Where the curb is adjacent to a sidewalk, install contraction joints that align with the sidewalk joints with spacing between 8-feet and 10-feet.
- D. Provide tooled contraction joints between curbs/gutters and adjacent traffic duty pavements.
- E. At 90-degree curb corners, the contraction joint is to be cut parallel to the traffic lane. Diagonal cuts at 90-degree corners are not acceptable.

3.09 FINISHING

- A. Curbs: Uniform float finish and round edges. Correct all honeycombed areas by filling with mortar. Do not plaster. Finish the top and face while the concrete is plastic by wetting and rubbing with a carborundum brick. Finish the face of header curbs to 4-inches below the finished ground line. Provide uniform texture and color.
- B. Remove "slop" created by the concrete finishing from all joints and edges.
- C. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.
- D. Exposed macro fibers are to be removed using a propane torch and stiff brush after a minimum of 56-days curing of the concrete. Care should be taken to not overheat the concrete and cause it to be discolored, damaged or lose strength.

3.10 JOINT SEALING

- A. All expansion joints are to be sealed. See Section 321373 for joint sealer requirements.

3.11 TOLERANCES

- A. Maximum Variation of Surface Flatness and Face Alignment: 1/4 inch in 10 ft.
- B. Maximum Variation From True Position: 1/4 inch.

3.12 FIELD QUALITY CONTROL

- A. Allow an independent testing agency to perform field quality control tests, as specified in Division 1.
 - 1. Provide free access to concrete operations at project site and cooperate with appointed firm.
 - 2. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
 - 3. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.
- B. Compressive Strength Tests: ASTM C 39/C 39M. For each test, mold and cure four concrete test cylinders. Obtain test samples for every 25 cu yd or less of each class of concrete placed.
 - 1. Test fiber reinforced concrete prior to the addition of fiber and again after fiber has been added to set the baseline for the fiber reinforced compressive strength, slump and air content. This is to be done for the first pour of each mix design, and the results used for later pour strength requirements.
 - 2. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
 - 3. Perform one slump test and one air content test for each set of test cylinders taken.
- C. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken. All test reports are to be typed.
- D. Any tests or time limits that do not meet the specified requirements are to be reported to the Contractor and that concrete shall be considered unacceptable.

3.13 PROTECTION

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
- B. Do not permit pedestrian traffic into curb/gutter area for 2 days minimum after finishing.
- C. Do not permit vehicular traffic into curb/gutter area until 75 percent design strength of concrete has been achieved.
- D. All concrete curb/gutter that is soiled or otherwise dirty are to be pressure washed and rinsed upon completion of the construction and landscaping work.

END OF SECTION

SECTION 321823.29 ARTIFICIAL TURF

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Synthetic Turf System includes, but is not limited to, the following:
 - 1. Infill Type Competition Game Field Turf System consisting of both polyethylene monofilament fiber and polyethylene slit film fiber (full height), specifically designed, manufactured, and installed for the intended sport of baseball and softball.
 - a. The extent of synthetic turf work is shown on the drawings.
 - 2. Infill System
 - 3. Vertical draining base materials
 - 4. Artificial Turf Grooming and Maintenance Equipment
 - 5. Grooming, Maintenance and Annual Deep Cleaning
 - 6. G-Max and Performance Testing
- B. The synthetic turf, and drainage base and pipe work is to be directly supervised in the field by an ASBA Certified Field Builder (CFB).

1.02 RELATED REQUIREMENTS

- A. Section 116833.23 - Athletic Equipment - Field
- B. Section 321613 - Concrete Curbs and Gutters
- C. Section 334600- Subdrainage

1.03 REFERENCE STANDARDS

- A. ASTM D 5823 - Standard Test Method for Pile Height of Yarn
- B. ASTM D 5848 - Standard Test Method for Mass Per Unit Area of Pile Yarn Floor Coverings (pile weight, primary and secondary backing, and total weight)
- C. ASTM D 5739 - Standard Test Method for Stitch Gauge
- D. ASTM D 1335 - Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings
- E. ASTM F 2765-09 - Standard Specification for Total Lead Content in Synthetic Turf Fibers
- F. ASTM F1015-03(2009) - Standard Test Method for Relative Abrasiveness of Synthetic Turf Playing Surfaces
- G. ASTM F 2898-11 - Standard Test Method for Permeability of Synthetic Turf Sports Field Base Stone and Surface System by Non-confined Area Flood Test Method
- H. EN 12616 - European Standards for Water permeability
- I. ASTM F355a - Standard Test Method for Shock-Absorbing Properties of Playing Surface systems and Materials
- J. ASTM F 1936-10 - Standard Specification for Impact Attenuation of Turf Playing Systems as Measured in the Field (g-Max)
- K. ASTM F 3189-17 - Standard Test Method for Measuring Force Reduction, Vertical Deformation, and Energy Restitution of Synthetic Turf Systems Using the Advanced Artificial Athlete
- L. EN 1969 - Surfaces for Sports Areas, Determination of Thickness of Synthetic Sports Surfaces, Infill Depth
- M. EN 12616 - European Standards for Planarity

1.04 DEFINITIONS

- A. Synthetic Turf Manufacturer: company that makes and brands the synthetic turf carpet used for the project including any inlays and logos.
- B. Synthetic Turf Contractor: company responsible for the construction of the synthetic turf system including the base preparation, subdrainage system, drainage base and fabric, leveling stone, shock pad/underlayment pad, synthetic turf carpet and infill and inlays (including control and supervision of the Synthetic Turf Installer), and field/turf amenities including but not limited to bases, plates, and pitching rubbers.
- C. Synthetic Turf Installer - group responsible for the installation of the synthetic turf carpet, pad, infill and all inlays and logos.

1.05 SUBMITTALS

- A. Submit the following within 48 hours of bid opening:
 - 1. Certificate for Certified Field Builder (CFB) proposed for the project.
 - 2. One (1) copy of most recent installation/reference list for all projects of similar scope to this project completed in the last three years.
 - 3. One (1) copy of the resume of proposed installation foreman. Installation crew must meet or exceed all requirements outlined in this Section.
 - 4. One (1) copy of a manufacturers sample warranty.
 - 5. A list from the turf manufacturer of all turf fiber and turf backing failures experienced and reported in the past 10 years regardless of whether the turf was replaced under warranty or not. The list is to include the name, location, phone number and other contact data of the Owner.
- B. Submit the following as part of the shop drawing process and prior to ordering materials:
 - 1. One (1) copy of a manufacturers seam layout plan, striping plan and any details of construction which deviate from the plans and specifications.
 - 2. Material Certificates: Three (3) copies for each material from material producer that will be used for this project. Each material certificate must be stamped and checked as approved by the Synthetic Turf Contractor before submittal to the Architect. Required material certificates include but are not limited to the following:
 - a. A statement of origin, composition, and manufacturer of all aggregate materials to be used, including testing information supporting that the proposed aggregates meet or exceed these specifications.
 - b. A statement of origin, composition, and manufacturer of all infill materials to be used, including testing information supporting that the proposed infill meets or exceeds these specifications.
 - c. Supplier's material certification for aggregate.
 - d. Suppliers material certification for concrete.
 - e. Product data sheets on all drainage pipe, fittings, and geotextiles fabrics.
 - 3. Provide a colored striping plan detailing lines, logos and mowing pattern layout. Coordinate with Owner or Owner's Representative and Architect to get final approval of all designated colors, dimensions, mowing pattern and logo designs.
 - 4. Test reports for testing done within the past two (2) years verifying that the proposed turf meets the specifications for tuft binds, final tuft height, yarn size and thickness, face weight, total weight, and backing. If acceptable test data cannot be provided, then two (2) 24" x 24" samples of proposed synthetic turf carpet are to be provided and sent to an independent testing agency by the Contractor to be tested for tuft binds, final tuft height, yarn size and thickness, face weight, total weight and backing.
 - 5. Three (3) color yarn samples, 10-feet long for each color used.
 - 6. One (1) five (5) gallon bucket of each type of drainage stone.
 - 7. One(1) two (2) gallon bucket of each type of infill material.
 - 8. Two (2) 12" x 12" samples of non-woven filter fabric.

9. One (1) copy of product data and testing documents demonstrating that proposed product meets or exceeds all specified requirements.
 10. Copies of independent laboratory test reports on system or components:
 - a. ASTM D 792 Specific Gravity
 - b. ASTM D 1335 Tuft Bind
 - c. ASTM D 5034 Grab Breaking Strength
 - d. ASTM D 5793 Stitch Gauge
 - e. ASTM D 418 Pile Height
 - f. ASTM D 5848 Face, Backing (primary and secondary) and Total Weights
 - g. ASTM D 2859 Flammability (Pill test)
 - h. ASTM F 1551 Shoe Traction
 - i. ASTM F 1551 Water Permeability
 - j. ASTM F 1015 Abrasive Index
 - k. Lead Compliance testing showing that the turf and infill materials meet all applicable standards of the Consumer Product Safety Commission (CPSC) requirements.
 11. Product data on the turf maintenance equipment that is to be provided by the Contractor.
- C. Submit the following after the materials have been delivered to the site:
1. Provide to the Architect materials samples of the following: one (1) gallon each of rubber or combination of rubber and sand infill material,
 2. Eight (8) 24" x 24" samples of synthetic turf carpet cut from delivered rolls as selected by the Architect. These will be sent to an independent testing agency by the owner to be tested for tuft binds, final tuft height, yarn size and thickness, face weight and backing.
 3. One (1) five (5) gallon bucket of each type of drainage stone.
- D. Prior to Final Acceptance of the finished product, the Synthetic Turf Contractor shall submit to the owner three (3) copies of their maintenance manuals. These manuals will include all necessary instructions for the proper care and maintenance of the newly installed synthetic turf system.

1.06 QUALITY ASSURANCE

- A. The synthetic turf manufacturer shall meet the following criteria:
1. Operations:
 - a. The synthetic turf manufacturer is to provide proof that they have been in business under the same name for a minimum of five (5) years.
 2. Experience:
 - a. The synthetic turf manufacturer must have a minimum of one (1) successful Power Five NCAA game or practice field installation and must provide documentation of such.
 - b. The synthetic turf manufacturer must be experienced in the manufacturing of this type of artificial turf system and provide project references of the synthetic grass system being installed at ten (10) similar exterior sites in the last three (3) years, a minimum of 60,000 square feet each.
 - c. A letter from the turf manufacturer stating that the installation crew and foreman are manufacturer certified must be submitted and approved prior to the start of turf installation.
- B. The synthetic turf contractor shall meet the following criteria:
1. Operations:
 - a. The synthetic turf contractor is to provide proof that they have been in business under the same name for a minimum of ten (10) years.
 - b. The synthetic turf contractor must provide competent workmen skilled in this type of artificial turf installation. The designated Supervisory personnel on the project must be approved in writing by the turf manufacturer as competent in the installation of this material, including gluing and sewing seams and proper installation of the infill

mixture. The synthetic turf manufacturer shall have a qualified inspector certify the installation and warranty compliance.

- c. The synthetic turf installer must provide a qualified installation foreman to coordinate and review the component parts of the synthetic turf system. Submit a resume of experience for Architects approval prior to starting work.
- d. The turf, pad, infill, drainage layer, subdrainage installation and all laser grading activities must be directly supervised by a American Sports Builders Association (ASBA) Certified Field Builder (CFB).

2. Experience:

- a. The synthetic turf contractor must specialize in athletic field projects and the associated drainage and fine grading to tight tolerances.
- b. The synthetic turf installer must provide factory-trained technicians skilled in the installation of athletic-caliber infilled synthetic turf systems to undertake the placement of the turf.
- c. The synthetic turf installation crew shall have installed a minimum of six (6) similar exterior rubber or rubber and sand filled synthetic turf systems of 60,000 square feet or greater in the past three (3) years.

C. Warranties:

- 1. Turf Manufacturer's Warranty: this warrants the usability and playability of the artificial turf fiber and backing system for its intended uses for a minimum of an eight (8) year period commencing with the date of Substantial Completion. Pitching Mounds, Batters Boxes, Catchers Boxes, and Baselines (including bullpen areas) shall be warrantied for a minimum of a two (2) year period commencing with the date of Substantial Completion. The warranty coverage shall not be prorated nor place limits on the amount of the fields usage, and should include, but not be limited to the following:
 - a. Include unusual wear and damage caused from UV degradation as determined by tensile strength decreasing by 50% or more. The warranty shall specifically exclude vandalism and acts of God beyond the control of the manufacturer or installer.
 - b. Assure the availability of exact or substantially the same replacement materials for the artificial turf installed for the full warranty period.
- 2. Contractor's Warranty: this warrants the field installation including, but not limited to the turf seams, infill, stone base, subdrainage, and subgrade, and is held by the General Contractor for the project. The warranty must have the following characteristics and cover all items :
 - a. Provide full system coverage including any settlement, stone base migration, turf seams and edge attachment.
 - b. Warrant materials and workmanship of the infill, drainage base, drainage piping system, and sub-base. If sub-base work and drainage base are installed by separate sub-contractors, the General Contractor shall still provide full warranty for all work as described in these documents.
 - c. Warrant that the infill, drainage stone, piping and filter fabric materials installed meet or exceed the product specifications.
 - d. Cover defects in the installation and workmanship. Assure the installation was done in accordance with both the manufacturer's recommendations and any written directives of the manufacturer's on-site representative.
 - e. Shall be limited to repair or replacement of the affected areas, (unless the field fails to meet the required G-Max rating in which case a full field renovation or replacement will be required) at the option of the manufacturer, and shall include all necessary materials, labor, transportation costs, etc. to complete said repairs.
 - f. The installed synthetic turf system's drainage capability shall allow water flow through the system at a rate of not less than ten (10) inches per hour upon completion of the installation, and not drop below eight (8) inches per hour for the duration of the warranty period.
 - g. A copy of this warranty shall be provided to the Owner.

3. The Synthetic Turf Contractor may be required upon the request of the owner to provide a list of three clients that they have completed work for after the sale warranty.
- D. All designs, game markings, and layouts shall conform to all currently applicable National Federation State High School Association or KHSAA rules and regulations, or league specific requirements, depending on what applies.
- E. All components and their installation method shall be designed and manufactured for use on outdoor athletic fields. The materials as hereinafter specified, shall withstand full climatic exposure in the location of the field, be resistant to insect infestation, rot, fungus and mildew; it shall also withstand ultra-violet rays and extreme heat, it shall allow the free flow of water horizontally to perimeter areas and vertically to the gravel blanket and into the field drainage system below the surface.
- F. The turf seams of all system components shall provide a permanent, tight, secure, and hazard free athletic playing surface. All inlaid markings (game lines, logos, etc.) shall remain in place throughout the duration of the full, 8 year warranty period.

PART 2 - PRODUCTS

2.01 ARTIFICIAL TURF MATERIALS

- A. Infill Type Competition Game Field Turf System - Dual Fiber Monofilament and Slit Film Synthetic Grass:
 1. Face Pile Weight:
 - a. Baseball Infield and Infield Boundary, and Outfield Green Turf Areas: 55 oz/sy minimum.
 - b. Baseball/Softball Skinned & Warning Track Areas: 55 oz/sy minimum.
 - c. Baseball/Softball Mound and Batters Box Areas: 80 oz/sy minimum. Area of 80oz/sy turf shall be for the entire mound circle area and the entire batters box circle area.
 2. Face Yarn Type: Yarns are to be manufactured in the United States or Europe. No Chinese yarns or yarns with lead are allowed:
 - a. Baseball Infield, Infield Boundary, and Outfield Green Turf Areas: Polyethylene parallel-long slit fiber and monofilament fiber. The use of nylon or polypropylene thatch is acceptable.
 - b. Baseball/Softball Skinned & Warning Track Areas: Polyethylene parallel-long slit fiber. The use of nylon or polypropylene thatch is acceptable.
 - c. Baseball/Softball Mound and Home Plate Areas: Polyethylene parallel-long slit fiber with nylon or polypropylene thatch.
 3. Yarn Size/Ends:
 - a. 7,500 - 10,000 denier (8 ends/1250 denier per end) minimum
 - b. 4,000 denier minimum thatch
 4. Yarn Thickness: 100 microns (min) slit film, 300 microns (min) mono
 5. Pile Height (Finished):
 - a. Baseball/Softball Infield and Infield Boundary Areas: 1-3/4" inches (+/- 1/8")
 - b. Baseball/Softball Skinned & Warning Track Areas: 1-3/4 inches (+/- 1/8")
 - c. Baseball/Softball Mound Areas: 1-3/4 inches (+/- 1/8")
 6. Construction: Broadloom tufted
 7. Tufting Gauge: 1/4" - 3/8"
 8. Tuft Bind: 10 lbs (minimum)
 9. Primary Backing: dimensionally stable 1-part (3 components) polypropylene, polyester and fiber backing, 6 oz/sy minimum, perforated for drainage
 10. Secondary Backing: 20 oz/sy (minimum) urethane, full coverage of primary backing
 11. Total Product Weight:
 - a. Baseball/Softball Infield and Infield Boundary Areas: 81 oz/sy minimum (+/- 2 oz/sy)
 - b. Baseball/Softball Skinned & Warning Track Areas: 81 oz/sy minimum (+/- 2 oz/sy)

- c. Baseball/Softball Mound and Home Plate Areas: 106 oz/sy minimum (+/- 2 oz/sy)
- 12. Finished Roll Width: 15 feet
- 13. Finished Roll Length: Up to 220 feet
- 14. Perforation (Outdoors): 3/16" holes on staggered 4" (approximate) centers
- 15. Permeability: 20" +/- per hour.
- 16. Average Abrasive Index (ASTM F1015): Less than 30.
- B. Field Colors:
 - 1. Baseball Field Areas:
 - a. Infield: Two colors of Green yarn tufted at different ratios to establish a "mowed/rolled field" look, alternating every 5-feet. Colors are to be chosen from manufacturer's full range of colors.
 - b. Outfield: Two colors of Green yarn tufted at different ratios to establish a "mowed/rolled field" look, alternating every 7.5-feet. Colors are to be chosen from manufacturer's full range of colors.
 - c. Skinned, Mound and Warning Track: One color of turf to be chosen from manufacturer's full range of colors.
 - 2. Softball Field Areas:
 - a. Skinned Infield and Warning Track: One color of turf to be chosen from manufacturer's full range of colors.
 - b. Outfield: Two colors of Green yarn tufted at different ratios to establish a "mowed/rolled field" look, alternating every 7.5-feet. Colors are to be chosen from manufacturer's full range of colors.
 - 3. Field markings: White
 - 4. Striping:
 - a. Baseball: White
 - b. Softball: White
 - c. Football: White
 - d. Soccer: Black
 - e. Lacrosse: Navy
 - 5. Logos: Logos as indicated on the drawings. (Colors to be matched to Owner requirements).
- C. Provide all game markings for KHSAA high school football, soccer, lacrosse, baseball, and softball as well as identified markings on the drawings. All school logo graphics and other related markings not identified to be factory tufted into the rolls shall be cut in and glued in accordance with manufacturer's recommendations.
- D. Provide school logo(s) per the design drawings. Logos and any field sponsor graphics are to be factory tufted in their entirety or water jet cut and assembled off-site so that they are not pieced together in the field. The only exception is when a logo/graphic exceeds 15-feet in both length and width dimensions, in which case the logo/graphic can be done in minimum 15-foot wide sections.
- E. Baseball/Softball Resilient Under Pad for Mound and Boxes for the Main Competition Field Areas and Bull Pens.
 - 1. Refer to Specification Section 116833.23 for Mound and Bullpen Forming Systems.
 - 2. High density SBR rubber pad with drainage perforations, slots/grooves or self draining void space in the material. Material is to be 3/4" thick (minimum), and the mound pad is to have a textured surface to help prevent slipping of the turf and pad.
- F. Resilient Infill Composition:
 - 1. A resilient infill system, consisting of a specially formulated mixture of SBR crumb rubber and rounded or non-angular silica sand engineered to provide the look, feel, footing, and shock absorption of a natural grass field in ideal conditions.
 - a. SBR Rubber. Granules shall contain minimal dust or contaminants and shall be derived from the ambient processing form of recycled passenger car tires (truck or equipment tires are not permitted). Color shall be substantially black.

- 1) The clean, uniformly sized particles shall be consistent in shape and particle size distribution.
 - 2) The particles shall resist abrasion in high traffic and excessive wear applications and provide stability to synthetic sports turf applications.
 - 3) The particles shall be processed and sized under rigid specifications and manufacturers' statistical and quality control assurance program.
 - 4) Particles shall be structurally pure and consistently uniform in size distribution for predictable performance.
 - 5) The particles cannot be from another field or have been used for any other purpose, and must be "first use" from the tire recycling facility.
- b. Sand Particulate. The sand provided as a component of the infill mixture shall be rounded or non-angular so as to minimize abrasion to the athlete and synthetic grass fibers.

2.02 VERTICAL DRAINAGE BASE MATERIALS

- A. Excavation: Existing natural grass field shall be excavated to the depth required to establish the finished elevations designed by the architect and as shown on the excavation plan. The subgrade shall be shaped to achieve a minimum of 0.5% (one-half of one percent) slope from the center of the field to each sideline in order to mirror the grade of the finished synthetic turf surface. The sub grade shall also be compacted and proof rolled to a minimum of a 95% Proctor within 2% of optimum moisture.
- B. Geotextile Filter Fabric: Water pervious type, black non-woven, needle punched, polypropylene, 6oz minimum weight.
- C. Perforated Drainage Pipe Network: Minimum drainage pipe size shall be 4" diameter and minimum collector pipe size shall be 8" diameter unless indicated larger on the on the drawings. Refer to drawings for location and configuration of drainage pipes and collector pipes. Refer to Section 334600 Subdrainage.
- D. Stone Base Courses:
1. The free-draining base aggregate base layer shall consist of a consistent 4.5-inch (minimum) depth of open graded material. Base drainage aggregate used must achieve a minimum 95% standard Proctor within 2% optimum moisture. The open graded aggregate material shall conform to the following criteria:

- a. Base Aggregate:

Grading Requirements for Base Aggregate - Open Graded Stone, Washed

Size	Sieve	Percent Passing
2"		100
3/4"		92
3/8"		58
No. 4		25
No. 16		9.2

- E. Choker Stone Course:
1. The choker material (stone dust) shall be a 1.5-inch (minimum) layer of porous, free draining material, number 1 stone sand or similar material, that will provide a minimum 95% Proctor within 2% of optimum moisture.

- a. Choker Material:

Grading Requirements for Choker Material - Porous Stone Sand

Size	Sieve	Percent Passing
3/8"		100
No. 4		96.8

No. 8	72
No. 16	45
No. 30	25
No. 50	13
No. 100	5
No. 200	2

- F. Other Stone: The Contractor can submit an alternate stone gradation for the Base Stone and Choker Stone for review by the Architect if the Synthetic Turf Manufacturers recommended gradation requirements differ from that identified above as long as the full system warranty will apply.

2.03 OTHER MATERIALS

- A. Nailer boards are to be dimensional lumber made of recycled plastic (no wood fiber allowed) and suitable for direct bury. Acceptable materials include Markstaar Recycled Plastic Lumber (www.markstaar.com), and Menards Dimensional Plastic Lumber (www.menards.com).
- B. Adhesives for bonding tufted synthetic turf shall be heat activated so as to provide a "welded" seam or laminate, or moisture cured urethane based and designed specifically for the installation of synthetic turf systems. Seam tape is to be used for all glued or welded seams.
- C. Sewn seams: All long seams are to be sewn with high quality cord/thread as recommended by synthetic turf manufacturer.

2.04 NEW GROOMING EQUIPMENT

- A. Provide two (2) turf groomer (pull behind or self propelled) equipped with fixed brushes and adjustable tines to be used for normal maintenance of the turf and fill material as approved and recommended by the turf manufacturer.
1. GreensGroomer WorldWide, 4555 W. Bradbury Ave, Suite 1, Indianapolis, IN 46241, 9 (888) 298-8852, www.GreensGroomer.com
 2. Other manufacturers of equal systems may be submitted for review and approval by Architect by addendum during the bidding phase.
- B. Provide two (2) turf sweeper (pull behind or self propelled) to be used for normal maintenance of the turf and fill material as approved and recommended by the turf manufacturer. Sweeper is to have a rotating broom that will lift debris into a screening system that will separate debris from the infill materials while allowing the infill to return to the field surface.
1. Approved Products:
 - a. TurfCare TCA1400 as manufactured by SMG Equipment, 2002 West Valley Highway #200, Auburn, WA 98001, p (253) 350-8803, www.SMGEquipment.com
 - b. Other manufacturers of equal systems may be submitted for review and approval by Architect by addendum during the bidding phase.
- C. Provide two (2) Stihl or Shindaiwa power groomers.
- D. Provide four (4) hand operated synthetic turf rakes, 18" width with aluminum or fiberglass handles.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Ensure that all work is coordinated with other trades.
- B. Verify that the subgrade is dry and ready to support the construction loads, and that all gradients and elevations of the subgrade are correct.

- C. The subgrade is to be surveyed by a Licensed Land Surveyor to ensure that it is within a tolerance of 0.5-inches total (+/- 1/4") within a 25-foot grid. The surveyor is to provide a PDF and AutoCad drawing of the actual survey locations and elevations.
- D. Coordinate installation of the fence posts and ensure that they are properly aligned and foundations are level and at the correct height for the finished field surface.

3.02 JOB SITE CONDITIONS

- A. Synthetic Turf installation (or any of it's components) shall not occur if ambient air temperature is below 32 degrees F., materials are below 32 degrees F, rain is falling or pending and/or conditions exist or are pending, that will be unsuitable to the installation.
- B. Synthetic Turf Installation shall not occur if excessive rainy or wet conditions have occurred, which would adversely affect the application and cure of any adhesives.

3.03 PRE-INSTALLATION CONFERENCES

- A. Subgrade Pre-Installation Conference
 - 1. Occurs after subgrade is prepared and surveyed.
 - 2. The Architect and Owner will review the subgrade and survey.
 - 3. Construction procedures will be reviewed with the Contractor of the perimeter curb, subdrainage, geotextile fabric, and stone base.
- B. Artificial Turf Pre-Installation Conference.
 - 1. Occurs after stone choker course is installed and surveyed.
 - 2. The Architect and Owner will review the choker stone course and survey.
 - 3. Construction procedures will be reviewed with the Contractor of the artificial turf and infill material.

3.04 INSTALLATION

- A. Field layout shall be as shown on the approved shop drawings.
- B. The Synthetic Turf Contractor and Installer shall strictly adhere to the installation procedures outlined under this section. Any variance from these requirements must be accepted in writing, by the manufacturer's on-site representative, and submitted to the Architect/Owner, verifying that the changes do not in any way affect the warranty.

3.05 PERIMETER ATTACHMENT

- A. Concrete header curb/fence bands: The synthetic turf perimeter fastening structure shall be installed before the drainage aggregate in areas identified to receive new curb.
 - 1. The concrete header curb shall be installed in accordance with the Drawings and/or Shop Drawings and these Specifications. The foundation of the concrete header curb shall be a compacted free-draining aggregate. Future water entering the foundation shall have a free-draining path directly to the perimeter collector pipe.

3.06 VERTICALLY DRAINING BASE

- A. Trenching: All piping shall be as specified and connected by manufacturer's couplers, plugs etc.
 - 1. The base grade shall be shaped to mirror the finished grade, or be steeper and have additional drainage stone installed, and approved by the Architect and/or Owner's Representative. The Contractor shall begin layout and trenching for the drainage network as indicated on the drainage plan and all details that apply. Trenching progress shall work upward in elevation to allow for immediate discharge of water from the entire field in the event of a rainfall.
 - 2. No trenches, with or without pipe, shall be permitted, to remain unfilled overnight and/or while crews are not progressively working on site.
 - 3. All perimeter trenches must be dug in accordance with the field drainage plan details.

4. Traffic plates are to be used for crossing over any trenches that have pipe installed but have not had the stone drainage blanket installed.
- B. Install geotextile fabric over excavated, graded and prepared sub-grade. Provide a 12" minimum overlap at all long seams, shingled in the direction of water flow, and 18" minimum overlap at roll ends. Fabric shall first be installed in the drainage trenches prior to installation of perimeter collector lines. After backfilling of all trenches is complete, the entire field shall be covered with fabric prior to the base aggregate application.
- C. Drainage Pipe Installation and Backfilling
1. Collector lines shall be connected to discharge outlet at the onset of operations.
 2. Collector lines shall be installed before lateral lines and shall begin with the deepest elevations.
 3. After all collector and lateral lines have been installed, the Contractor shall repair any sub grade undulations prior to installing geotextile fabric.
- D. Base Drainage Aggregate: The installation of the base drainage aggregate shall only begin after the drainage pipe installation has been inspected and approved by Owner's Representative. Installation of the Free-Draining Base Aggregate shall follow procedures that protect the base grade soils and drainage pipe. The drainage pipe network and its existing elevations shall not be disrupted through ground pressures from trucks, dozers or by any other means.
1. The base grade subsoil shall be dry before undertaking the placement of base aggregate.
 2. Delivery trucks shall enter the field only from the designated entrance point. Base course stone shall be dumped closest to the entrance first and continuously worked towards the furthest point of the field. Extreme care must be taken not to disturb sub grade or drainage network.
 3. Low earth pressure track-type dozers shall push out the stone from behind the pile onto and toward the field center. Dozers shall only traffic the aggregate they are spreading.
 4. Bulldozer blades shall be equipped with a laser-guided hydraulic system. Care shall be taken not to disturb or contact the base grade soils with the dozer blades or tracks. All equipment trafficking over the drainage aggregate shall insure there is a minimum depth of 4" of aggregate between the geotextile fabric and the dozer track ground contact position.
 5. When the aggregate spreading is completed, the surface shall be further firmed by a 5-ton roller. Static vibration shall not be part of this process.
 6. The stone shall be left firm, but not over-compacted as to protect the porosity and drainage capabilities of the aggregate profile.
 7. After the drainage stone has been uniformly spread throughout the surface, the surface shall receive a final laser finished grade. This process shall be accomplished using a turf-type tractor, or lightweight grader, equipped with high flotation tires and a hydraulically controlled laser blade capable of the required tolerance.
 8. The free-draining base course must be installed to a depth of 4.5 inches and shall be independently tested for an overall compaction rate of 95% of Proctor at a moisture content within 2% of optimum in accordance with ASTM D1557.
- E. Choker Levels: The base drainage stone final elevations shall mirror the proposed choker layer final grade material. Care shall be taken not to allow the coarser aggregate to surface into the profile or finished grade of the choker layer.
1. The choker layer shall be applied using high flotation grading equipment. The choker material shall be evenly spread throughout the proposed field surface to the final pre-pad or pre-turf elevations.
 2. After the choker material has been uniformly spread throughout the surface by the described method, the surface shall receive a final laser finish grade. This process shall be accomplished using a turf-type tractor, or lightweight grader, equipped with high flotation tires and a hydraulically controlled laser blade capable of meeting the required tolerance.
 3. Care shall be taken throughout the installation not to force the choker material into the porosity of the base aggregate below.

4. Final choker layer of stone must be laser graded to a tolerance of $\pm \frac{1}{4}$ " from the required elevation based on a 25-foot grid with a maximum deviation of no more than $\frac{1}{4}$ ". The laser grading equipment is to be turf tired with automatic laser guiding. The Contractor is to have a licensed land surveyor perform a topographical survey of the finished choker surface on a 25-foot grid over the full synthetic surface area. The surveyor is to provide a stamped and signed certification drawing to the Architect to ensure that the above requirements are met."
 5. Final layer of stone must be installed at a depth of 1.5 inches. Finished aggregate base must be proof rolled by means of 2 to 5 ton roller. The finished aggregate base must achieve an overall compaction rate of 95% Proctor at a moisture content within 2% of optimum in accordance with ASTM D1557. It shall also be flush with top of the turf nailer board.
- F. Base Acceptance: The Architect and/or Owner's Representative must jointly approve the base before turf installation can begin.

3.07 SYNTHETIC TURF AND INFILL

- A. Synthetic Turf and Infill Materials
1. After a final inspection of the drainage base by the Contractor and the Owner's Representative, the synthetic turf installation shall begin. The first roll shall begin with the longest perpendicular cross-field distance. No head seams shall be permitted in the inbound playing surface.
 2. The rolls of turf shall be rolled out a minimum of one hour prior to starting seaming procedures and allowed to relax/expand.
 - a. All visible wrinkles shall be stretched out before seaming.
 - b. Seams shall be flat, tight and permanent with no separation or fraying.
 - c. Synthetic turf yarn fabric that is trapped between seams shall be freed from the seams by hand or other approved method to an upright position prior to the commencement of brushing and top dressing procedures.
 - d. All synthetic turf seams shall be assembled as follows: The full width rolls shall be laid out across the field. Utilizing standard state of the art sewing and welding/gluing procedures, each roll shall be attached to the next.
 - e. When all of the rolls of the playing surface have been installed, the sideline areas shall be installed perpendicular to the playing field in the same method as above.
 3. Tufted and Inlaid Lines
 - a. Layout and descriptions of tufted and inlaid lines shall be as indicated on final shop drawings.
 - b. Inlaid lines and field markings shall be cut in using heat welded or urethane adhesive seaming methods recommended by the Synthetic Turf Contractor.
 4. Baseball/Softball Pad Locations
 - a. Install $\frac{3}{4}$ " thick rubber pads under both batters boxes and catchers box, extending 6 inches beyond the box lines. This is to include Bullpen areas as well.
 - b. Install $\frac{3}{4}$ " thick rubber pads under the pitching mound stride area from the front of the pitching rubber to the edge of mound (5' wide). This is to include Bullpen areas as well.
 - 1) Refer to Specification Section 116833.23 for Pitching Mound and Bull Pen Mound Forming Systems.
 - c. Pads are to be installed flush with the compacted drainage stone surface so there is no lip or depression. Mound pad is to be anchored to prevent slippage of the pad on the slope of the mound.
- B. Infill Materials: After all seaming is completed and inlaid lines, logos and lettering have been installed and the adhesive cured; the infill materials shall be spread evenly, using a drop spreader or top dresser.
1. For infield/infield boundary, outfield, skinned, and warning track areas within the competition field, a mixture of crumb rubber and sand shall be applied at a uniform rate of 6lbs/s.f. and to a depth resulting in no more than 1/2-inch of turf fiber being exposed above

the top of the infill. For warning track areas, a mixture of crumb rubber and sand shall be applied at a minimum uniform rate of 4.3 lbs/s.f. and to a depth resulting in no more than 1/2-inch of turf fiber being exposed above the top of the infill. For the mound and home plate areas, a mixture of crumb rubber and sand shall be applied at a uniform rate of 5lbs/s.f. and to a depth resulting in no more than 1/2-inch of turf fiber being exposed above the top of the infill. The crumb rubber and sand shall be applied at a uniform rate in multiple applications until the specified infill depth is achieved. Infill ratios (by weight) shall be as follows:

- a. Baseball/Softball Skinned areas: 80 percent sand, 20 percent rubber.
 - b. Baseball Green Grass areas: 70 percent sand, 30 percent rubber.
 - c. Warning track: 30 percent sand (maximum), 70 percent rubber (minimum).
 - d. Baseball/Softball Mound and Home Plate Areas: 80 percent sand, 20 percent rubber.
2. Infill material shall be brushed between infill applications with a motorized rotary broom and pull-type groomer brush simultaneously.
 3. After the infill has been installed and the field groomed, the field is to be watered at a rate equivalent to 1-inch of rain.
 4. After the infill has been completed and the field watered for settlement, the infield depth is to be checked to ensure that the infill depth is at least 75% of the pile height for each turf type. If infill is shown to be low, additional infill is to be installed per the required ratio until the required depth is reached.
 5. Upon verification of the infill depths, the baseball and softball coaches are to perform an evaluation of ball bounce and roll. If additional infill material is required to adjust the bounce, roll or speed of the turf system, those materials are to be supplied and installed.

3.08 PERIMETER ATTACHMENT

- A. After final trimming of the turf, the turf shall be screwed into the nailer board system as per the turf manufacturers recommendations, or as follows:
 1. Where concrete curbs, slabs or walls are present, install a 2" x 4" nailer board to the slab/wall/curb so that the top of the turf infill will be flush with the top of the concrete curb or at the designed elevation, by means of concrete screws, such as Tapcon, set every 12 inches. This shall be the responsibility of the Synthetic Turf Contractor. See synthetic turf edge attachment detail on the drawings.
 2. Where no concrete curbs, slabs or walls are present, install 2" x 6" nailer board in the subgrade with the appropriate anchors that will keep the nailer board in a stable, vertical position and prevent movement of the nailer board due to contraction/expansion of the turf or subgrade.
 3. In areas where fence post foundations are located, the 2" x 6" nailer board can be attached to the outside edge of the post foundations and pinned between post foundations using 18-inch long pins.
 4. Attached edge of turf to nailer boards using 1" (minimum) length, stainless or epoxy coated screws as recommended by the manufacturer. Install screws on 12" centers along runs, and at 6" centers at all corners for a distance of 30 inches.

3.09 TURF CLEANING

- A. Upon completion of the turf installation and prior to testing and punch by the designer, the following are to be performed by the turf installer:
 1. All inlaid areas are to be inspected for excess adhesive and trapped fibers, and all excess adhesive removed and trapped fibers released.
 2. The entire turf area is to be checked for installation pins/spikes using a metal detector to ensure that all pins/spikes have been removed.
 3. All loose fibers are to be removed from the field and the field groomed.

3.10 TESTING

- A. Construction Testing

1. The Owners testing agency will perform gradation testing on random samples of the drainage and choker courses of stone to confirm compliance with the documents.
2. The Owners testing agency will observe and confirm the proper installation of the subdrainage system, backfill, filter fabric and other materials. If at any time the testing agency observes improper materials or techniques, the Contractor is to cease the work and remediate any items necessary to meet the project requirements.
3. Random samples of the turf materials delivered to the site will be sampled and sent to a testing laboratory for compliance testing. Any materials that do not meet the requirements of the specifications or the manufacturers stated properties shall be removed and replaced with materials that conform to the specifications.

B. G-MAX Testing

1. The Contractor is to hire an independent testing laboratory to perform a G-Max test (ASTM-F355A, F1936 methods) to verify that the shock attenuation properties of the field meet the requirements set forth in this specification. The Contractor is to coordinate the schedule for the testing and provide the testing agency necessary access. Each set of tests are to include a minimum of twelve (12) test locations across each field with at least 4 tests in the skinned areas and two in the warning track.
2. Football/Soccer/Lacrosse Field:
 - a. At the time of substantial completion, the average G-Max rating must be between 90 and 135 for the system. The average G-Max must not exceed 150 for the system at any time during the life of the warranty. The Owner reserves the right to have the field tested for shock attenuation at its own cost at anytime it deems necessary. If at anytime during the 8 year warranty period the G-Max ranges reach unacceptable levels, it is the responsibility of the turf contractor to bring the field back into the required ranges at no cost to the Owner.
3. Baseball/Softball Infields and Bullpens:
 - a. At the time of substantial completion, the maximum G-Max rating of 195 for all synthetic turf areas is required. The average G-Max must not exceed 195 for synthetic turf areas at any time during the life of the warranty. The Owner reserves the right to have the field tested for shock attenuation at its own cost at any time it deems necessary. If at any time during the 8-year warranty period the G-Max ranges reach unacceptable levels not pertaining to infill maintenance by the Owner, it is the responsibility of the turf contractor to bring the field back into the required ranges at no cost to the Owner.

C. Infiltration Testing

1. The Owners independent testing laboratory will perform a minimum of four (4) field infiltration tests with at least one located in each quadrant of the field both during and after construction as follows:
 - a. Test permeability of the stone choker and drainage blanket upon completion of the final grading of the choker course and immediately before installation of the turf. The testing to be performed is ASTM F2898-11, Standard Test Method for Permeability of Synthetic Turf Sports Field Base Stone and Surface System by Non-confined Area Flood Test Method. Minimum water permeability rate must exceed twenty (20) inches per hour.
 - b. Confirm the permeability of the infill and turf per ASTM D3385, Standard Test Method for Infiltration Rate of Soils in Field using the double-ring infiltrometer. Minimum water permeability rate must exceed twenty (20) inches per hour.

D. Performance Testing

1. The Owner will pay to have an independent testing laboratory as approved by the Architect perform the following testing:
 - a. prEN16717:2014, ASTM 3189 Shock Absorption
 - b. prEN16717:2014, ASTM 3189 Vertical Deformation
 - c. prEN16717:2014 Energy Restitution

d. EN15301:2007 Rotational Resistance

3.11 ANNUAL TESTING AND MAINTENANCE

- A. The Synthetic Turf Contractor shall provide a total of eight (8) deep cleanings and groomings to be scheduled on an annual basis over the 8 year warranty life. The exact dates of the deep cleaning and grooming shall be coordinated with the Owner; it is anticipated that the services would be scheduled before the first home game of each year.
- B. The Synthetic Turf Contractor shall provide a total of eight (8) G-MAX testing (ASTM-F355A, F1936 method) trips to be scheduled on an annual basis over the 8 year warranty life. The exact date of the G-MAX testing shall be coordinated with the Owner it is anticipated that the services would be scheduled before the first home game in the spring of each year. Each testing trip will include G-MAX testing at a minimum of 12 locations.

3.12 CLOSEOUT

- A. The Synthetic Turf Contractor must verify that a qualified representative has inspected the installation and that the finished field surface conforms to the manufacturer's requirements.
- B. The Synthetic Turf Contractor must provide the Owner with the maintenance equipment as outlined in this specification section.
- C. The Synthetic Turf Contractor must submit three (3) copies of its maintenance manual to the Owner.
- D. Demonstration and Owner Training Session
 - 1. Synthetic Turf Contractor must train Owner's designated field personnel in proper grooming and care procedures. This includes training field personnel how to properly use grooming equipment as well as cleaning and making minor repairs if acceptable with the warranty. All training is to be video taped for later use.
 - 2. Synthetic Turf Contractor shall include training for infill additions, gum removal, seed removal, and normal trash/sweeper equipment operation.
 - 3. Synthetic Turf Contractor shall provide to the Owner in written format a sample of a typical maintenance log to be kept by the Owner.
 - 4. All testing and training shall be completed by the contractor with the Owner prior to substantial completion of the project.
- E. Extra materials:
 - 1. Provide to the Owner three (3) super sacks each of rubber granules and sand. One super sack of each material is to be stored at each field.
 - 2. Provide to the Owner the following turf replacement pieces for high use areas:
 - a. Two complete batters and catchers box areas with Velcro attached to the replacement pieces.
 - b. Two complete pitching mound stride areas (5' wide from 18-inches behind the pitching rubber to front edge of mound) with Velcro attached to the replacement pieces.
 - c. Two complete second base and third base slide areas (7.5' wide by 15' long X 4) with Velcro attached to the replacement pieces.
 - d. Two complete first base leadoff areas (7.5' wide by 15' long) with Velcro attached to the replacement pieces.
 - 3. All salvageable pieces of turf that are or wider (up to one full roll length of each color used) should be left with the Owner.

3.13 CLEAN UP

- A. Contractor shall provide the labor, supplies and equipment as necessary for final cleaning of surfaces and installed items.

- B. During the contract and at intervals as directed by the Architect and as synthetic turf installation is completed, clear the site of all extraneous materials, rubbish, or debris and leave the site in a clean, safe, well draining, neat condition.
- C. Surfaces, recesses, enclosures, etc. shall be cleaned as necessary to leave the work area in a clean, immaculate condition ready for immediate occupancy and use by the Owner.

END OF SECTION

**SECTION 323113
CHAIN LINK FENCES AND GATES****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Fence Framework, fabric, Posts, rails, and accessories.
- B. Concrete.
- C. Manual gates and related hardware.
- D. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete anchorage for posts.
- B. Section 337900 - Site Grounding.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2015.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.
- C. ASTM A428/A428M - Standard Test Method for Weight (Mass) of Coating on Aluminum-Coated Iron or Steel Articles; 2010 (Reapproved 2014).
- D. ASTM A491 - Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric; 2011.
- E. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.
- F. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2015.
- G. ASTM F567 - Standard Practice for Installation of Chain-Link Fence; 2011.
- H. ASTM F1043 - Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework; 2014.
- I. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures; 2013.
- J. CLFMI CLF 2445 - Product Manual; 1997.

1.04 SUBMITTALS

- A. See Division 1 Sections for submittal procedures.
- B. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.
- C. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components. See CLFMI CLF-SFR0111 for planning and design recommendations.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

- B. Installer Qualifications: Company specializing in installation of products specified in this section with not less than three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Chain Link Fences and Gates:
 1. Master-Halco, Inc.: www.masterhalco.com.
 2. Merchants Metals: www.merchantsmetals.com.
 3. Stephens Pipe and Steel: www.spsfence.com
 4. Capitol Wholesale: www.capitolwholesale.com
 5. Substitutions: See Section 016000 - Product Requirements.

2.02 MATERIALS AND COMPONENTS

- A. Materials and Components: Conform to CLFMI CLF 2445.

2.03 MATERIALS

- A. See Finishes Section for additional coatings/finish information
- B. Posts, Rails, and Frames: ASTM F1083 Schedule 40 hot-dipped galvanized steel pipe, welded construction, minimum yield strength of 30 ksi.
- C. Posts, Rails and Frames: Formed from hot-dipped galvanized steel sheet, ASTM A653/A653M, HSLAS, Grade 50, with G90 (Z275) zinc coating.
- D. Line Posts: Type I round in accordance with FS RR-F-191/1D.
- E. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round in accordance with FS RR-F-191/1D.
- F. Wire Fabric: ASTM A491 aluminum coated steel chain link fabric.:
- G. ASTM F668 polymer-coated steel chain link fabric.
- H. Concrete: Type specified in Section 321613:
- I. Type specified in Section 033000.

2.04 COMPONENTS

- A. Line Posts:
 1. 6'-0" height fencing - 2-inch O.D.
 2. 8'-0" height fencing - 2-1/2-inch O.D.
- B. Corner and Terminal Posts:
 1. 6'-0" height fencing - 4-inch O.D.
 2. 8'-0" height fencing - 4-inch O.D.
- C. Gate Posts: 4- inch diameter.
- D. Top, Bottom, Middle and Brace Rail: 1.625 inch diameter, plain end, sleeve coupled.
- E. Gate Frame: 2- inch diameter for welded fabrication.
- F. Fabric: 2 inch diamond mesh interwoven wire, 6 gage thick, top selvage knuckle end closed, bottom selvage knuckle end closed. All fabric to be Aluminum - Coated Steel Fabric (Aluminized): ASTM A491.

2.05 ACCESSORIES

- A. Caps: Cast steel galvanized; sized to post diameter, set screw retainer.

- B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.
- C. Hardware for Single Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates; fork latch with gravity drop and padlock hasp; keeper to hold gate in fully open position.
- D. Hardware for Double Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches high, 3 for taller gates; drop bolt on inactive leaf engaging socket stop set in concrete, active leaf latched to inactive leaf preventing raising of drop bolt, padlock hasp; keepers to hold gate in fully open position.

2.06 FINISHES

- A. Posts, Rails, Components and Fabric: Vinyl coated over coating of 1.8 oz/sq ft galvanizing.
- B. Accessories: Same finish as framing.
- C. PVC Vinyl Coating Color(s): To be selected by Architect from manufacturer's full range of colors.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install framework, fabric, accessories and gates in accordance with ASTM F567.
- B. Place fabric on outside of posts and rails.
- C. Fabric on fencing adjacent to the playground space shall be placed on the inside (playground side) of the posts.
- D. Set intermediate posts plumb, in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.
- E. Line Post Footing Depth Below Finish Grade: ASTM F567.
- F. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567.
- G. Brace each gate and corner post to adjacent line post with horizontal center brace rail. Install brace rail one bay from end and gate posts.
- H. Provide top rail through line post tops and splice with 6 inch long rail sleeves.
- I. Install center brace rail on corner gate leaves.
- J. Do not stretch fabric until concrete foundation has cured 28 days.
- K. Position bottom of fabric 2 inches above finished grade.
- L. Fasten fabric to top rail, line posts, braces, and bottom tension wire with tie wire at maximum 15 inches on centers.
- M. Attach fabric to end, corner, and gate posts with tension bars and tension bar clips.
- N. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.
- O. Re-Install Existing Salvaged Top Rail Cover for all permanent Fencing adjacent to competition softball and baseball field areas as identified on the plans. Attach rail cover per manufacturer's recommendations. Overlap rail covers a minimum of 3-inches for complete coverage.

3.02 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch.
- B. Maximum Offset From True Position: 1 inch.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Layout: Verify that fence installation markings are accurate to design, paying attention to gate locations, underground utilities, and property lines.

3.04 CLEANING

- A. Leave immediate work area neat at end of each work day.
- B. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.
- C. Clean fence with mild household detergent and clean water rinse well.
- D. Remove mortar from exposed posts and other fencing material using a 10 percent solution of muriatic acid followed immediately by several rinses with clean water.
- E. Touch up scratched surfaces using materials recommended by manufacturer. Match touched-up paint color to factory-applied finish.

END OF SECTION

SECTION 329219 SEEDING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preparation of subsoil.
- B. Placing topsoil.
- C. Hydroseeding, mulching and fertilizer.
- D. Maintenance.

1.02 RELATED REQUIREMENTS

- A. Section 015713- Temporary Erosion and Sediment Control
- B. Section 312200 - Grading: Topsoil material.
- C. Section 31 2200 - Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this section.
- D. Section 312323 - Fill: Topsoil material.
- E. Section 312513 - Permanent Erosion Controls:

1.03 DEFINITIONS

- A. Weeds: Include Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.04 SUBMITTALS

- A. Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer; and watering instructions.
- B. Hydroseed product and maintenance data including a hydroseed physical sample. Submit dry hydroseed material in one gallon bag.
- C. If hydroseeding is to be used in combination with other seeding methods, the contractor is to submit plan for areas to receive each type of seeding method.

1.05 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable. Deliver seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.
- B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.
- A. Furnish maintenance of seeded areas for three months after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 SEED MIXTURE

- A. Seed Mixture:

1. Tall Fescue Grass Type: 40 percent. (Firecracker LS, Aggressor, Falcon IV, Col-M, 3rd Millennium or similar to be approved by the Landscape Architect).
2. Fine Fescue Grass Type: 30 percent. (Reliant IV, Firefly, Epic, Fortitude, Finelawn Petite or similar to be approved by the Landscape Architect)
3. Kentucky Blue Grass Type: 20 percent. (Freedom III, Blue Velvet, Midnight, Barrister, Nu Destiny, Quantum Lelap, Brilliant, Everglade or similar to be approved by the Landscape Architect).
4. Perennial Rye: 10 percent.
 - a. Approved Varieties:
 - 1) Manhattan 5
 - 2) Divine
 - 3) Secretariat II

2.02 SOIL MATERIALS

- A. Topsoil: Type as specified in Section 312200.

2.03 ACCESSORIES

- A. Hydraulic Mulch: Fully biodegradable hydraulic mulch composed of 100% recycled wood fibers, cellulose fibers and wetting agents (including high-viscosity colloidal polysaccharides). The hydraulic mulch is to be sanitized, free from plastic netting, and upon application forms an intimate bond with the soil subsurface to create a porous, absorbent and flexible erosion resistant blanket that allows for rapid germination and accelerated plant growth.
 1. Basis of design: SoilCover Blend with Tack by Profile Products, 750 Lake Cook Road, Suite 440, Buffalo Grove, IL 60089. p:800-508-8681, www.profileproducts.com.
- B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:
 1. Composition: Recommendations per the soil test.
- C. Water: Clean, fresh and free of substances or matter that could inhibit vigorous growth of grass.

2.04 TESTS

- A. Analyze to ascertain percentage of nitrogen, phosphorus, potash, percentage inorganic matter soluble salt content, organic matter content, and pH value.
- B. Submit minimum 10 oz sample of topsoil proposed. Forward sample to approved testing laboratory in sealed containers to prevent contamination.
- C. Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that prepared soil base is ready to receive the work of this Section.
- B. For areas that are graded with slopes less than 6:1, hydroseeding may be used in lieu of seed and mulch.

3.02 PREPARATION

- A. Prepare subgrade in accordance with Section 312200.
- B. Place topsoil in accordance with Section 312200.

3.03 FERTILIZING

- A. Apply fertilizer as recommended in the soil testing results.
- B. Apply after smooth raking of topsoil and prior to roller compaction.
- C. Do not apply fertilizer at same time or with same machine as will be used to apply seed.
- D. Mix thoroughly into upper 3 inches of topsoil.
- E. Lightly water to aid the dissipation of fertilizer.

3.04 HYDROSEEDING

- A. Apply seed at a rate of 7 lbs per 1000 sq ft or as recommended by the seed producer and/or soil testing, evenly in two directions. Rake in lightly.
- B. Do not seed areas in excess of that which can be mulched on same day.
- C. Apply 2000 lbs of hydraulic mulch with tack per acre or as recommended by the hydroseed manufacturer. Maintain clear of shrubs and trees. Contractor is to submit bill of materials to architect for quantity of materials delivered to site. Contractor is to have a manufacturer representative present on site during the first day of installation of hydraulic mulch.
- D. Contractor is to water hydroseeded area once every 7-days after hydroseeding for that area is complete or as recommended by the manufacturer.
- E. Following germination, immediately re-seed areas without germinated seeds that are larger than 4 by 4 inches.

3.05 PROTECTION

- A. Identify seeded areas with stakes and string around area periphery. Set string height to 18 inches. Space stakes at 30 inches.
- B. Protect seeded areas in accordance with Section 312513 - Permanent Erosion Controls

3.06 MAINTENANCE

- A. Provide maintenance at no extra cost to Owner; Owner will pay for water.
- B. See Division 1 Sections for additional requirements relating to maintenance service.
- C. Provide maintenance of seeded areas for three months from Date of Substantial Completion.
- D. Mow grass at regular intervals to maintain at a maximum height of 4 inches. Do not cut more than 1/3 of grass blade at any one mowing.
- E. Neatly trim edges and hand clip where necessary.
- F. Immediately remove clippings after mowing and trimming.
- G. Water to prevent grass and soil from drying out.
- H. Roll surface to remove minor depressions or irregularities.
- I. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.
- J. Immediately reseed areas that show bare spots.
- K. Protect seeded areas with warning signs during maintenance period.

END OF SECTION

SECTION 334100 SUBDRAINAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Filter aggregate and fabric and bedding.
- B. Synthetic turf athletic field subdrainage systems.

1.02 RELATED REQUIREMENTS

- A. Section 312316 - Excavation: Excavating for subdrainage system piping and surrounding filter aggregate.
- B. Section 312316.13 - Trenching: Excavating and backfilling for site subdrainage systems.
- C. Section 312323 - Fill: Backfilling over filter aggregate, up to subgrade elevation.

1.03 REFERENCE STANDARDS

- A. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2011.
- B. AASHTO M 252M AND M 294M - Corrugated PE Drainage Pipe and Fittings.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate dimensions, layout of piping, high and low points of pipe inverts, gradient of slope between corners and intersections, and connections to the storm water system.
- C. Product Data: Provide data on pipe drainage products, pipe accessories, and filter fabric.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Project Record Documents: Record location of pipe runs, connections, cleanouts and principal invert elevations.

PART 2 PRODUCTS

2.01 PIPE MATERIALS

- A. Dual Walled Corrugated Plastic Pipe: Rigid type; 4 inch minimum diameter or as shown on the drawings, 10-foot or 20-foot lengths, with required fittings.
 - 1. Refer to Specification Section 334101 for approved manufacturer's.
- B. Use perforated pipe at subdrainage system; unperforated through sleeved walls.

2.02 AGGREGATE AND BEDDING

- A. Filter Aggregate and Bedding Material: Granular fill as specified in Section 312323.

2.03 ACCESSORIES

- A. Filter Fabric: Water pervious type, black non-woven, polypropylene, 6oz minimum weight.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

3.02 PREPARATION

- A. Hand trim excavations to required elevations. Correct over-excavation with pipe bedding.
- B. Remove large stones or other hard matter that could damage drainage piping or impede consistent backfilling or compaction.

3.03 INSTALLATION

- A. Install and join pipe and pipe fittings in accordance with pipe manufacturer's instructions.
- B. Place filter fabric on clean cut subsoil or top of footing as indicated.
- C. Place drainage pipe on filter fabric.
- D. Lay pipe to slope gradients noted on drawings; with maximum variation from true slope of 1/8 inch in 10 feet.
- E. Place aggregate in maximum 4 inch lifts, consolidating each lift.
- F. Refer to Section 312323 for compaction requirements. Do not displace or damage pipe when compacting.
- G. Wrap filter fabric over levelled top surface of aggregate cover with minimum of 12-inches of overlap prior to subsequent backfilling operations. In cases where retaining wall waterproofing are required, lap the loosened section of drainage panel filter fabric over the filter aggregate fabric.
- H. Connect to storm sewer system with unperforated pipe, through installed sleeves.

3.04 FIELD QUALITY CONTROL

- A. See Division 1 Sections for general requirements for testing and inspections.
- B. Request inspection prior to and immediately after placing aggregate cover over pipe.

3.05 PROTECTION

- A. Protect pipe and aggregate cover from damage or displacement until backfilling operation begins.

END OF SECTION

SECTION 334101 SITE STORM DRAINAGE PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Storm drainage piping, fittings, and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.
- B. Section 334903 - Storm Drainage Inlets and Outlets
- C. Section 334913 - Storm Drainage Manholes

1.03 DEFINITIONS

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.04 REFERENCE STANDARDS

- A. AASHTO M 252M AND M 294M - Standard Specification for Corrugated Polyethylene (PE) Drainage Pipe.
- B. ASTM F 667 - Standard Specification for Large Diameter Corrugated Polyethylene (PE) Pipe and Fittings.
- C. ASTM F 447 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- D. ASTM D 3212 - Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
- E. ASTM F 2736 and AASHTO MP-21-11 - Standard specification for Corrugated Polypropylene (PP) Drainage Pipe.
- F. ASTM F 2881 and AASHTO MP-21-11 - Standard specification for large diameter Corrugated Polypropylene (PP) Drainage Pipe.

1.05 SUBMITTALS

- A. See Section 01 3000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating pipe, pipe accessories, and fittings.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Project Record Documents:
 - 1. Record location of pipe runs, connections, catch basins, cleanouts, and invert elevations.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

- A. Corrugated PE Drainage Pipe and Fittings: Type S, dual wall with smooth waterway for coupling joints and PE sleeve with gasket material that mates with pipe and fittings to make them watertight. Approved manufacturers are:
 - 1. Advanced Drainage Systems, Inc., N-12 Pipe (www.ads-pipe.com)
 - 2. Timewell, Dual Wall Pipe (www.timewelltile.com)
 - 3. Baughman Tile Company, Dual Wall Pipe (www.baughmantile.com)
 - 4. Hancor, Blue Seal Pipe (www.hancor.com)

5. Prinsco, Goldflow WT (www.prinsco.com)
 6. J.M. Eagle- product Eagle Corr Dual Wall Watertight Pipe. (www.jmeagled.com)
 7. Substitutions: As submitted for review and approved by architect by addendum during the bidding process.
- B. Corrugated HP PP Drainage Pipe and Fittings: Dual wall with smooth interior and annular exterior corrugations. Pipes shall be joined with a gasketed integral bell & spigot joint and shall be water tight.
1. Advanced Drainage Systems, Inc., N-12 HP Pipe (www.ads-pipe.com)

2.02 PIPE ACCESSORIES

- A. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required wye, bends, elbows, cleanouts, reducers, traps and other configurations required.
- B. Trace Tape: Magnetic detectable conductor, clear plastic covering, imprinted with "Storm Sewer Service " in large letters.

2.03 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in Section 312316.13.
- B. Cover: As specified in Section 312316.13.

PART 3 EXECUTION

3.01 TRENCHING

- A. See Section 312316.13 for additional requirements.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION - PIPE

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- B. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.
- C. Connect to building storm drainage system, foundation drainage system, and utility/municipal sewer system.
- D. Install continuous trace wire 6 to 12 inches below finish grade, above pipe line; coordinate with Section 312316.13.

3.03 FIELD QUALITY CONTROL

- A. See Division 1 Sections for general requirements for testing and inspections.
- B. Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
- C. Alignment: Piping where less than the full diameter of the inside of the pipe is not visible between structures will require replacement.
- D. Deflection Test: Piping with deflection that prevents passage of a ball or cylinder of size not less than 92.5 percent of piping diameter will require replacement.
- E. Piping that is crushed, cracked, broken or otherwise damaged will require repair or replacement as determined by the Architect.

- F. The contractor is to provide someone to remove and replace all grates or covers on storm water structures for any punch list visits that involve the storm water system.

3.04 PROTECTION

- A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

SECTION 334413.13 CATCH BASINS AND CURB INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Catch basins.
- B. Precast concrete catch basins with grates, frames and accessories .
- C. Monolithic FRP catch basins and inlets, frames, covers, anchorage, and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 015713 - Temporary Erosion and Sediment Controls for temporary inlet protection

1.03 REFERENCE STANDARDS

- A. ASTM A 48/A 48M - Standard Specification for Gray Iron Castings; 2003.
- B. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.
- C. ASTM C 913 - Standard Specification for Precast Reinforced Concrete Water Structures; 2008.
- D. ASTM C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections; 2007.
- E. ASTM C 923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals; 2007.
- F. ASTM C 923M - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals [Metric]; 2007.
- G. ASTM D 3753 - Standard Specification for Glass-Fiber-Reinforced Polyester Manholes and Wetwells; 2005.
- H. ASTM D3753 - 05e1 - Standard Specification for Glass-Fiber-Reinforced Polyester Manholes and Wetwells

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate structure identification designations, locations, elevations, piping sizes and elevations of penetrations.
- C. Product Data: Provide structure data including configuration, grates, frames, steps and other components .

1.05 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Pre-Cast Structure Sections: Reinforced precast concrete in accordance with ASTM C 478 (ASTM C 478M), with resilient connectors complying with ASTM C 923 (ASTM C 923M).
- B. Polyester Structure Sections: ASTM D 3753, glass-fiber reinforced polyester .
- C. Approved Pre-Cast Concrete Manufacturers include:

1. Oldcastle Precast
 2. Forterra (formerly Sherman-Dixie)
 3. Substitutions: As submitted for review and approved by architect by addendum during the bidding process.
- D. Approved Polyester Structure Manufacturers include:
1. Advanced Drainage Systems (ADS)
 2. HARCO
 3. Substitutions: As submitted for review and approved by architect by addendum during the bidding process.

2.02 CATCH BASIN AND CURB INLET COMPONENTS

- A. Concrete Structure Inlets:
1. Catch Basin:
 - a. Grate Design: Per the storm drainage structure schedule on the drawings.
- B. Polyester Structure Inlets:
1. Area Drains (Landscaped Areas):
 - a. Grate Design: Per the storm drainage structure schedule on the drawings. All grates must meet or exceed H-20 loading.
 - b. Approved Manufacturers include:
 - 1) Harco PVC Drain Basins and In-Line Drains
 - 2) ADS Nyloplast Drain Basins and In-Line Drains
 - 3) Substitutions: As submitted for review and approved by architect by addendum during the bidding process.

2.03 OTHER COMPONENTS

- A. Grate and Frame: ASTM A 48/A 48M, Class 30B Cast iron construction, machined flat bearing surface, removable grate, designed for H-20 loading; . Frames in pavement areas to allow for full asphalt pavement section to be located above the top of the concrete structure. Frames in landscape areas to be a minimum of 6-inches tall to allow for topsoil cover over top of concrete structure. Approved manufacturers include:
1. J.R. Hoe and Sons
 2. Neenah Foundry Co.
 3. Substitutions: As submitted for review and approved by architect by addendum during the bidding process.
- B. Inlet Structure Steps: Formed Poly-Coated Steel rungs; 3/4 inch diameter. Formed integral with structure sections.

2.04 CONFIGURATION

- A. Shape: As identified in the storm structure schedule on the drawings.
- B. Clear Inside Dimensions: as required for piping layout shown with 48 inch minimum diameter for circular structures.
- C. Design Depth: As indicated.
- D. Clear Lid Opening: 24 inches diameter.
- E. Pipe Entry: Provide openings as required.
- F. Steps: 12 inches wide, 16 inches on center vertically, set into structure wall. Steps are required for all concrete structures that are 42-inches deep or deeper from grate elevation to the bottom of the structure.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify items provided by other sections of Work are properly sized and located.
- B. Verify that built-in items are in proper location, and ready for roughing into Work.
- C. Verify excavation for structure is correct.

3.02 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.03 INSTALLATION - CATCH BASINS

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Establish elevations and pipe inverts for inlets and outlets as indicated.
- C. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.
- D. Mount grate and frame level in grout, secured to top slab to elevation indicated. Grate elevations shown on the drawings are for the highest point on the grate for combination inlets, and are the elevation where water will enter the structure for catch basins.
- E. All lift hook holes are to be grouted flush with the face of the structure using a hydraulic, non-shrink grout that will provide a finish to match that of the structure.
- F. Coordinate with other sections of work to provide correct size, shape, and location.

3.04 FIELD QUALITY CONTROL

- A. See Division 1 sections for field inspection and testing requirements.
- B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
- C. Structures and castings that are cracked, broken or otherwise damaged will require repair or replacement as determined by the Architect.
- D. The contractor is to provide someone to remove and replace all grates or covers on storm water structures for any punch list visits that involve the storm water system.

3.05 SCHEDULES

- A. Storm Sewer Structures: See contract drawings for the storm structure schedule.

END OF SECTION

SECTION 334903 STORM DRAINAGE OUTLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Precast concrete headwalls with grates and accessories .

1.02 REFERENCE STANDARDS

- A. ASTM A 48/A 48M - Standard Specification for Gray Iron Castings; 2003.
- B. ASTM C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections; 2007.
- C. ASTM C 478M - Standard Specification for Precast Reinforced Concrete Manhole Sections [Metric]; 2007.
- D. ASTM C 923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals; 2007.
- E. ASTM C 923M - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals [Metric]; 2007.

1.03 SUBMITTALS

- A. See Division 1 Sections for submittal procedures.
- B. Shop Drawings: Indicate structure identification designations, locations, elevations, piping sizes and elevations of penetrations.
- C. Product Data: Provide structure data including configuration, grates, frames, steps and other components .

1.04 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Pre-Cast Headwalls: Reinforced precast concrete in accordance with Kentucky Transportation Cabinet requirements.
- B. All headwalls are to be in compliance with Kentucky Transportation Cabinet requirements.
- C. Approved Pre-Cast Concrete Manufacturers include:
 - 1. Oldcastle Precast
 - 2. Forterra Pipe and Precast (Formerly Sherman-Dixie)
 - 3. Substitutions: As submitted for review and approved by architect by addendum during the bidding process.

2.02 HEADWALL COMPONENTS

- A. Grates: Rectangular steel bars, hot-dipped galvanized per Kentucky Transportation Cabinet standard drawings. Grates are to have security chains attaching them to the structure.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify items provided by other sections of Work are properly sized and located.

- B. Verify that built-in items are in proper location, and ready for roughing into Work.
- C. Verify excavation for structure is correct.

3.02 PREPARATION

- A. Coordinate placement of pipe required by other sections.

3.03 INSTALLATION - HEADWALLS

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Establish elevations and pipe inverts for outlets as indicated.
- C. Set grate in recessed notches formed into the headwall wing walls or bolt grate to headwall, secure to top headwall with galvanized chain of a length that will allow removal for inspection.
- D. All lift hook holes are to be grouted flush with the face of the structure using a hydraulic, non-shrink grout that will provide a finish to match that of the structure.
- E. Coordinate with other sections of work to provide correct size, shape, and location.

3.04 FIELD QUALITY CONTROL

- A. See Division 1 Sections for general requirements for testing and inspections.
- B. Structures that are cracked, broken or otherwise damaged will require repair or replacement as determined by the Architect.
- C. The contractor is to provide someone to remove and replace all grates for any punch list visits that involve the storm water system.

3.05 SCHEDULES

- A. Storm Sewer Headwalls: Refer to the storm structure schedule shown on the Contract Drawings.

END OF SECTION

SECTION 334913 STORM DRAINAGE MANHOLES, FRAMES AND COVERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Modular precast concrete manhole sections with tongue-and-groove joints covers, anchorage, and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 015713 - Temporary Erosion and Sediment Controls for temporary inlet protection

1.03 REFERENCE STANDARDS

- A. ACI 530.1/ASCE 6/TMS 602 - Specification For Masonry Structures; American Concrete Institute International; 2005.
- B. ASTM A 48/A 48M - Standard Specification for Gray Iron Castings; 2003.
- C. ASTM C 478 - Standard Specification for Precast Reinforced Concrete Manhole Sections; 2007.
- D. ASTM C 923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals; 2007.

1.04 SUBMITTALS

- A. See Division 1 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate manhole locations, elevations, piping sizes and elevations of penetrations.
- C. Product Data: Provide manhole covers, component construction, steps, features, configuration, and dimensions.

1.05 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

1.06 FIELD CONDITIONS

- A. Cold and Hot Weather Requirements: Comply with requirements of ACI 530.1/ASCE 6/TMS 602 or applicable building code, whichever is more stringent.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Manhole Sections: Reinforced precast concrete in accordance with ASTM C 478 (ASTM C 478M), with resilient connectors complying with ASTM C 923 (ASTM C 923M).

2.02 COMPONENTS

- A. Lid and Frame: ASTM A 48/A 48M, Class 30B Cast iron construction, machined flat bearing surface, removable lid, scheduled lid design; live load rating of H-20; lid molded with identifying name ;.
 - 1. Solid lids shall have the designation of "STORM" cast into the lid.
- B. Manhole Steps: #4 Bar with formed Copolymer Polypropylene Plastic coating rungs; 3/4 inch diameter. Formed integral with manhole sections.

2.03 CONFIGURATION

- A. Shaft Construction: Concentric with eccentric cone top section as required; lipped male/female joints; sleeved to receive pipe sections. Top slab opening is to be per the drawings and steps are to be aligned with the lid/grate opening.
- B. Shape: Cylindrical.
- C. Clear Inside Dimensions: As required for shown pipe sizes and configurations. Structure diameter is to remain consistent from the bottom section to the cone or top slab that supports the casting.
- D. Design Depth: As indicated.
- E. Clear Lid Opening: 24 inches diameter minimum.
- F. Steps: 12 inches wide, 16 inches on center vertically, set into manhole wall. Steps are required for all structures that are 36-inches deep or deeper from grate/lid to bottom of structure. Top manhole step is to be no more than 24-inches from the lid/grate elevation.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify items provided by other sections of Work are properly sized and located.
- B. Verify that built-in items are in proper location, and ready for roughing into Work.
- C. Verify excavation for manholes is correct.

3.02 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.03 MANHOLES

- A. Place concrete base pad, trowel top surface level.
- B. Place manhole sections plumb and level, trim to correct elevations and anchor as necessary.
- C. Cut and fit for pipe.
- D. Seal section and top joints with Conseal Sealant or approved equivalent.
- E. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.
- F. Set cover frames and covers level without tipping, to correct elevations.
- G. Coordinate with other sections of work to provide correct size, shape, and location.
- H. Grout pipes to structure.

3.04 FIELD QUALITY CONTROL

- A. See Division 1 Sections for general requirements for testing and inspections.
- B. Structures that are cracked, broken or otherwise damaged will require repair or replacement as determined by the Architect.
- C. The Contractor shall provide someone to remove and replace all grates for any punch list visits that involve the storm water system. Contractor shall also provide all required equipment needed to meet OSHA confined space requirements associated with inspecting the drainage structure.

END OF SECTION