INFORMATION FOR BIDDERS

AND

SPECIFICATIONS

FOR

Deer Creek Flood Mitigation Phase 2

BRENTWOOD, MISSOURI

Jacobs Engineering Group, Inc.
501 N. Broadway
Saint Louis, MO 63102

8-31-2020

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SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Related Contracts.
4. Work by Others.
5. Access to site.
6. Work restrictions.
7. Specification and Drawing conventions.
8. Miscellaneous provisions.

1.3 PROJECT INFORMATION

A. Project Identification: Brentwood Bound - Brentwood Flood Mitigation Phase 2 Project.

1. Project Location: Deer Creek and Black Creek, east of Breckenridge Industrial Cout and south of Manchester Road.

B. Owner: City of Brentwood, Missouri, 2348 South Brentwood Boulevard, Brentwood, Missouri 63144.

1. Owner's Representative: Navigate Building Solutions, Craig Schluter, 9920 Watson Road, St. Louis, Missouri 63126.

C. Engineer: Jacobs Engineering Group, Phillip Blonn, P.E., One Financial Plaza, 501 N. Broadway, St. Louis, Missouri 63102.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents and comprises the Deer Creek Flood Mitigation Project - Phase 2, located in the City of Brentwood, Missouri :

1. The Scope of this Work consists of demolition, trail construction, roadway construction and improvements, bridge replacement, retention facility construction,

storm sewer installation, sanitary sewer relocation, streambank stabilization, minor access improvements, and landscaping improvements along Deer Creek and Black Creek, east of Breckenridge Industrial Court and South of Manchester Road and other Work indicated in the Contract Documents.

B. Type of Contract:

1. Project will be constructed under a single prime contract.

1.5 RELATED CONTRACTS

A. The following contracts are related to this Contract. The interfacing of facilities between this Contract and related contracts shall be as generally shown on these Contract Drawings. Contractor is responsible for proper coordination and construction sequencing with the work under related contracts, whether or not such interfacing is indicated on these Contract Drawings. The Contractor shall include in their bid all costs associated with coordinating this Work with the work of related contracts executed by others.

	Contract Name	Owner
1.	Brentwood Deer Creek Flood Mitigation Project Phase 1B Demolition	City of Brentwood
2.	Brentwood Deer Creek Flood Mitigation Project Phase 1C Demolition	City of Brentwood
3.	Great Rivers Greenway Connector	City of Brentwood
4.	CSO Mary Avenue South of Manchester CSO Interceptor Elimination Phase I	MSD
5.	Lower Black Creek and Hampton Creek Sanitary Relief Phase II	MSD
6.	Manchester Road Project	MODOT

1.6 WORK BY OTHERS

A. Utility work as indicated by others on Drawings shall be performed by utilities.General: Cooperate fully with Utilities so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Utilities, including Ameren, Spire, Missouri American Water, AT&T, Spectrum, and others as required

B. All work associated with this Contract shall be completed by this Contractor, his subcontractors, or manufacturer’s representatives under the terms of Owner’s Contract with this Contractor.

C. This Contractor shall be responsible for the appropriate nature and extent of coordination, as well as the proper sequencing of construction activities, such that there are no conflicts or other adverse impacts of work by this Contractor, the Owner, or other contractors on the work of any other party.

D. Contractor will be responsible for determining Contractor’s methods and sequence of construction, within the limits of the terms of this Contract; so long as any constraints

defined in the Contract Documents are observed and Project milestones and overall Project completion time are achieved.

1.7 ACCESS TO SITE

A. General: Contractor shall have full use of Project site for construction operations during construction period. Contractor's use of Project site is limited only by Owner's right to perform work or to retain other contractors on portions of Project. Refer to Section 1.10 for further access requirements.

B. Contractor shall assume full responsibility for the protection and safekeeping of Products under this Contract, stored on the site.

1.8 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work to normal business working hours of 7:00 a.m. to 8:00 p.m., Monday through Friday, unless otherwise indicated.

1. Construction work to be done on the weekends requires prior written approval from the City’s Representative. Request for weekend work must be submitted in writing by 3 p.m. on the Thursday prior to the weekend.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or adjacent properties unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Engineer and Owner’s Representative not less than two (2) days in advance of proposed utility interruptions.
2. Obtain Engineer and Owner’s Representative written permission before proceeding with utility interruptions.

1.9 SPECIFICATION AND DRAWING CONVENTIONS

A. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

B. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations scheduled on Drawings.

3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

1.10 MISCELLANEOUS PROVISIONS

A. Specific Project Provisions

B. Breckenridge Industrial Court Shutdown and Demolition Coordination

C. Access Plan and Coordination Schedule Submittal

1. Contractor shall submit an access plan and coordination schedule for Owner and Owner's Representative approval prior to starting construction. The submittal shall include maps and schedules necessary to demonstrate the above items will be accounted for in the construction sequence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 011150 - PROTECTION OF PROPERTY AND ENVIRONMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General and Supplementary Conditions of the Contract.

1.2 PROTECTION OF PUBLIC AND PRIVATE PROPERTY

A. Contractor shall protect, shore, brace, support, and maintain all underground pipes, conduits, drains, and other underground construction uncovered or otherwise affected by his construction operations. All pavement, surfacing, driveways, curbs, walks, buildings, utility poles, guy wires, fences, and other surface structures affected by construction operations, together with all sod and shrubs in yards, parkways, and medians, shall be restored to their original condition, whether within or outside the easement or property of the Owner. All replacements shall be made with new materials.

B. No trees shall be removed by Contractor, except as specifically authorized by Owner. Hand excavation shall be employed as necessary to prevent injury to trees. Trees left standing shall be adequately protected against damage by construction operations.

C. Contractor shall be responsible for all damage to streets, roads, highways, shoulders, ditches, embankments, culverts, bridges, and other public or private property, regardless of location or character, which may be caused by transporting equipment, materials, or men to or from the work or any part or site thereof, whether by him or his Subcontractors. Contractor shall make satisfactory and acceptable arrangements with the owner of, or the agency or authority having jurisdiction over, the damaged property concerning its repair or replacement and payment of costs incurred in connection with the damage at no additional cost to the Owner.

D. All fire hydrants and water control valves shall be kept free by Contractor from obstruction and available for use at all times.

1.3 DAMAGE TO EXISTING PROPERTY

A. Contractor shall be responsible for any damage to existing structures, work, material, or equipment because of Contractor’s operations; and shall repair or replace any damaged structures, work, materials, or equipment to the satisfaction of, and at no additional cost to Owner.

B. Contractor shall protect all existing structures and property from damage and shall provide bracing, shoring, or other work necessary for such protection, at no additional cost to Owner.

1.4 TREE AND PLANT PROTECTION

A. All trees and other vegetation which must be removed to perform the work shall be removed and disposed of by Contractor; however, no trees or cultured plants shall be unnecessarily removed unless their removal is indicated on the Drawings. All trees and plants not removed shall be protected against injury from construction operations, at no additional cost to Owner.

B. Contractor shall take extra measures to protect all trees, such as erecting barricades, trimming to prevent damage from construction equipment, and installing pipe and other work by means of hand excavation or tunneling methods. Trees shall not be endangered by stockpiling excavated material or storing equipment against the trunk.

1.5 SECURITY

A. Contractor shall be responsible for protection of the site, and all work, materials, equipment, and existing facilities thereon, against vandals and other unauthorized persons. Any vandalism shall be brought to the attention of the Owner.

B. No claim shall be made against Owner by reason of any act of an employee or trespasser, and Contractor shall make good all damage to Owner's property resulting from his failure to provide security measures as specified, at no additional cost to Owner.

C. Contractor's security measures shall be at least equal to those usually provided by Owner to protect Owner's existing facilities during normal operation, but shall also include such additional security fencing, barricades, lighting, and other measures as required to protect the site, at no additional cost to Owner.

1.6 NOISE CONTROL

A. Contractor shall take reasonable measures to avoid unnecessary noise. Such measures shall be appropriate for the normal ambient sound levels in the area during working hours. All construction machinery and vehicles shall be equipped with practical sound-muffling devices, and operated in a manner to cause the least noise consistent with efficient performance of the work.

1.7 POLLUTION CONTROL

A. Contractor shall prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris, and other substances resulting from construction activities. No sanitary wastes will be permitted to enter any drain or watercourse other than sanitary sewers. No sediment, debris, or other substance will be permitted to enter sanitary sewers, and reasonable measures will be taken to prevent such materials from entering any drain or watercourse.

B. Contractor shall comply with SWPP Plan included in the Drawings.

1.8 SURFACE WATER CONTROL

A. Contractor shall coordinate, evaluate, design, construct, and maintain temporary water conveyance systems.

1. These systems shall not worsen flooding, alter major flow paths, or worsen flow characteristics during construction. Contractor is responsible to ensure that any such worsening of flooding does not occur.

2. Contractor is solely responsible for determining the methods and adequacy of water control measures.

B. At a minimum, Contractor shall be responsible for diverting the quantity of surface flow around the construction area so that the excavations will remain free of surface water for the time it takes to install these materials, and the time required for curing of any concrete or grout. Contractor is cautioned that the minimum quantity of water to be diverted is for erosion control and construction purposes and not for general protection of the construction site.

1. It shall be Contractor's responsibility to determine the quantity of water which shall be diverted to protect the Work from damage caused by stormwater.

1.9 ENVIRONMENTALLY IMPACTED SOIL MATERIALS

A. Refer to attached environmentally impacted soil requirements for information on prior soil testing completed and procedures for impacted soils encountered.

B. A soil management plan shall be submitted to Owner prior to mobilizing onsite. The plan shall provide a brief narrative regarding management of spoils from these properties.

PART 2- PRODUCTS

Not Used.

PART 3- EXECUTION

Not Used.

END OF SECTION 01015

SECTION 011170 - SAFETY DURING CONSTRUCTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General and Supplementary Conditions of the Contract.

1.2 SUMMARY

A. This Section provides specific additional information to augment the general requirements of this Contract regarding safety during construction and start-up of the work under this Contract, defined by the General and Supplementary Conditions.

1.3 RESPONSIBILITY FOR SAFETY

A. The Contractor shall do all work necessary for safety and be solely and completely responsible for safe conditions at the job site, including safety of all persons and property during the Contract period. This requirement shall apply continuously and not be limited to normal working hours.

B. Minimum standards in this specification in no way transfers the responsibility for the Contractor's health and safety requirements or procedures to the Owner. The Contractor is responsible for their own means and methods of working and their own Site Safety Plan.

C. Property, equipment, and materials left at job sites is done at the Contractor's risk and shall be stored in a manner that will not expose employees or the public to a hazard.

D. Contractor personnel including supervisors, foremen and individual workers share responsibility for the safety of personnel at work sites and shall make Safety the highest priority of day-to-day work.

E. The safety of a contractor's and any associated subcontractor employees remains the primary contractor's responsibility.

1.4 FEDERAL, STATE, AND LOCAL SAFETY REQUIREMENTS

A. Contractor's safety provisions shall conform to the Federal and State Departments of Labor, Occupational Safety and Health Act (OSHA), and all other applicable federal, state, and local laws, ordinances, codes, the requirements set forth herein, and any regulations that may be specified elsewhere in these Contract Documents. Where any of these are in conflict, the more stringent requirement shall be followed. The Contractor's failure to thoroughly familiarize himself with the aforementioned safety provisions shall not relieve him from compliance with the obligations or relieve him of the penalties set forth therein.

B. Contractor acknowledges that Contractor recognizes that OSHA Standard 1919:1200, "Hazard Communication Standard" does apply to the construction industry, and adherence to this standard is required on this job site.

C. The Contractor shall comply with all applicable State Law which requires excavators to contact appropriate underground utilities before digging, drilling, blasting etc.

1.5 SAFETY TRAINING

A. All employees of the general contractor or subcontractors having supervisory responsibilities shall have the 30-hour OSHA certified Construction Safety course (taught by an OSHA-approved instructor) or a similar program approved by the Missouri Division of Labor Standards. All other employees of the general contractor or subcontractors shall have the 10-hour OSHA certified Construction Safety course (taught by an OSHA-approved instructor) or a similar program approved by the Missouri Division of Labor Standards.

1. Submit training records of all employees before starting to work on this project.

B. If any on-site employee had not previously completed a construction safety program, Contractor shall require those on-site employees to complete a construction safety program within sixty (60) days before work on the Project commences.

C. Contractor acknowledges and agrees that any of Contractor's employees found on the Project site without documentation of the successful completion of a construction safety program shall be required to produce such documentation within twenty (20) days, or will be subject to removal from the project.

D. Contractor shall require all of its subcontractors to comply with the requirements of this Section and Section 292.675 RSMo.

E. Penalties for failure of the Contractor to provide required safety training are defined in the General Conditions sections of these Contract Documents.

1.6 NOTICE OF PENALTIES FOR FAILURE TO PROVIDE SAFETY TRAINING

A. Pursuant to Section 292.675 RSMo, contractor shall forfeit to Owner as a penalty two thousand five hundred dollars ($2,500), plus one hundred dollars ($100) for each on-site employee employed by contractor or its subcontractor, for each calendar day, or portion thereof, such on-site

B. Employee is employed without the construction safety training required in paragraph 1.5, above.

C. The penalty described in Subsection A of this Section shall not begin to accrue until the time periods described in paragraph 1.5B and 1.5C, above, have elapsed.

D. Violations of paragraph 1.5, above, and imposition of the penalty described in this Section shall be investigated and determined by the Missouri Department of Labor and Industrial Relations.

1.7 CONSTRUCTION SAFETY PROGRAM

A. The Contractor shall appoint, for the duration of this Contract, a qualified supervisory employee to develop and/or supervise a Contractor's job safety program that will

effectively implement the required safety provisions. The Contractor shall submit to the Owner, within 10 working days after the start of construction, four copies of the job safety program adopted and to be enforced by the Contractor during the performance of the work. Neither the Owner nor the Engineer shall be responsible for safety enforcement, precautions and programs in connection with the construction work.

1.8 ACCIDENT REPORTS

A. If death or serious injuries or serious damages are caused, the accident shall be reported immediately by telephone or messenger by Contractor to the Owner. In addition, the Contractor must promptly report in writing to the Owner all accidents in connection with the work, giving full details, names, and statements of witnesses. This reporting requirement is in addition to all normally required reports by federal, state, and local agencies and organizations. If a claim is made by anyone against the Contractor or any subcontractor on account of any accident, the Contractor shall promptly report the facts in writing to the Owner, giving full details of the claim.

1.9 FIRE PREVENTION AND PROTECTION

A. The Contractor shall execute all work in a fire-safe manner. Contractor shall supply and maintain on the site adequate fire-fighting equipment capable of extinguishing incipient fires. The Contractor shall comply with applicable federal, state, and local fire-prevention regulations. Where these regulations do not apply, applicable parts of the National Fire Prevention Standard for Safeguarding Building Construction Operations (NFPA No. 241) shall be followed.

1.10 WORK AREA SECURITY

A. The Contractor shall provide security surveillance for all work and storage areas as necessary, and shall erect and maintain suitable barriers and proper lighting. Lighting shall operate during periods as necessary to provide adequate security.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION 011170

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:
   1. Section 016000 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit electronic copy of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
   1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

      a. Statement indicating why specified product or fabrication or installation method cannot be provided, if applicable.
      b. Coordination of information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
      c. Detailed comparison of significant qualities of proposed substitutions with those of the Work specified. Include annotated copy of applicable

Specification Section. Significant qualities may include attributes, such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.

d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects, with project names and addresses as well as names and addresses of engineers and owners.
h. Material test reports from a qualified testing agency, indicating and interpreting test results for compliance with requirements indicated.
i. Detailed comparison of Contractor's construction schedule using proposed substitutions with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
j. Cost information, including a proposal of change, if any, in the Contract Sum.
k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents, except as indicated in substitution request, is compatible with related materials and is appropriate for applications indicated.
l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

2. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Engineer will notify Contractor of acceptance or rejection of proposed substitution within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Engineer's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Engineer does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

1.7 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than fifteen (15) days prior to time required for preparation and review of related submittals.

1. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed unless otherwise indicated.

1. Conditions: Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
b. Requested substitution does not require extensive revisions to the Contract Documents.
c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
d. Substitution request is fully documented and properly submitted.
e. Requested substitution will not adversely affect Contractor's construction schedule.
f. Requested substitution has received necessary approvals of authorities having jurisdiction.
g. Requested substitution is compatible with other portions of the Work.

h. Requested substitution has been coordinated with other portions of the Work.
i. Requested substitution provides specified warranty.
j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012500

SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

1.3 MINOR CHANGES IN THE WORK

A. Engineer will issue through the Owner’s Representative supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time.

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Engineer or Owner’s Representative will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Engineer or Owner’s Representative are not instructions either to stop work in progress or to execute the proposed change.
2. Within 20 days after receipt of Proposal Request, Contractor shall submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Engineer or Owner's Representative.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 012500 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Unit-Price Adjustment: See Section 012200 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Change Proposal Request, Engineer or Owner's Representative will issue a Change Order for signatures from Owner and Contractor on AIA Document G701.

1.7 WORK CHANGE DIRECTIVE

A. Work Change Directive: Engineer or Owner's Representative may issue a Work Change Directive on AIA Document G714 . Work Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Work Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Work Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 GENERAL

1.1 SUMMARY

A. This section includes the protection of trees that are indicated to remain but interfere with or are close to new construction, as herein specified. Trees which are to remain and must be protected are indicated on the drawings by tree protection fencing.

1.2 REFERENCE STANDARDS

A. Tree Appraisal:
   1. Guide for Plant Appraisal, 9th Edition, International Society of Arboriculture.

1.3 SUBMITTALS

A. Section 013300: Submittal Procedures

B. Schedule Submittals: Submit contractors schedule for work in areas were trees exist prior to beginning any work. This schedule will be the start of all ongoing coordination with the City of Brentwood who will be responsible for the initial placement of all tree protection fencing. This schedule will be updated and presented during regular construction meetings as work progresses.

1.4 PROJECT CONDITIONS

A. The Contractor will construct tree protection fencing along all construction boundaries as determined during the layout of all sitework. The area within the fence shall be designated a tree protection zone.

B. The protection zone shall designate the area not to be entered with construction material, equipment or personnel without prior approval of the Dir. of Parks. The Contractor shall give the City 48 hours advance notice for access into any tree protection area.

C. If it is approved to enter the tree protection zone, extreme care should be taken not to compact the earth as compaction can cause severe root damage due to the reduced air and water to the tree roots. If the area within the protection zone should be compacted by construction material, equipment or personnel, it will be necessary to aerate the soil thoroughly in the root zone immediately following compaction, as directed by the Dir. of Parks, at the expense of the contractor.

D. In the event any area within the protection zone is disturbed, necessary repairs shall be made immediately, as determined by the Dir. of Parks.

E. Trenching or excavation spoils should be returned to trench or excavation site within 24 hours. If the return is not possible within that time period, the spoils shall be stored away from tree root zones, unless authorized by the Dir. of Parks.

F. Do not allow exposed roots to dry out before permanent backfill is placed; provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in moist condition and temporarily support and protect from damage until permanently relocated and covered with earth.

G. Nothing should be stored within of the tree protection zone. No filling of gas tanks, cleaning of tools, repairing equipment, or parking of vehicles shall occur outside of the construction zone.

H. All chemical waste should be hauled away for proper disposal.

I. Stock piled materials should be stored off turf areas.

J. Care shall be taken with construction equipment to avoid any breaking of branches, tearing of the bark or wounding the trunk.

K. If tree limbs need to be removed for overhead clearance of machinery or to provide access or, if tree repair work is needed due to construction damage, the Dir. of Parks should be notified beforehand to review the damage and proposed repair procedure. The contractor is not permitted to prune or limb trees, until reviewed by the City.

L. Protect tree root systems from damage to noxious materials cause by run-off or spillage during mixing, placement, or storage of construction materials. Protect root systems from flooding, eroding, or excessive wetting resulting from dewatering operations.

PART 2 MATERIALS

2.1 The Contractor shall be responsible for providing all supplemental materials as required by the tree protection specification. In the event that the Contractor damages the tree protection fence beyond repair, it is the Contractor’s responsibility to provide and replace any damage or destroyed fence.

PART 3 EXECUTION

3.1 PRECONSTRUCTION MEETING

A. A pre-construction meeting shall be held on-site to include a presentation of tree protection measures to operators, construction supervisors, Contractor’s representatives, by the Contractor.

3.2 SEQUENCE

A. Grading limits shall be rough staked by Contractor with the Dir. of Parks in order to facilitate location for trenching and fencing installation. No clearing or grading shall begin in areas where tree treatment and preservation measures have not been completed.

B. The sequence of tree treatment and preservation shall be:
1. Rough stake grading limits.
2. Prune offending tree limbs and branches as designated by the Dir. of Parks. (Contractor performs work)
3. Perform root pruning where necessary and as directed by the Dir. of Parks. (Contractor performs work)
4. Install Tree Protection Fencing. (Contractor performs work)
5. Construction activities including demolition and construction begin.
6. Enforce the Protection Zones outlined by the Tree Protection Fencing specification.
7. Aerate soil and turf areas throughout the entire construction area after all construction is completed with equipment approved by the City. (Contractor performs work)

C. Above measures shall be directed in the field by the Owner's Representative with the Dir. of Parks.

D. Tree protection fencing shall be maintained and repaired by the Contractor for the duration of construction. It must not be altered without prior approval by the Dir. of Parks.

E. Access to fenced areas by equipment, materials or individuals that may cause harm to protected trees will only be permitted with the prior approval of the Dir. of Parks.

F. Trees, shrubs or undergrowth shall be removed from protected areas only when necessary and shall be performed with hand tools only.

G. Attachment of signage, fencing, etc. to any tree to be saved is prohibited.

H. After construction, all temporary barriers, fencing, debris, etc. shall be removed from the site by the Contractor.

3.3 TREE PRESERVATION WORK

A. Traffic Control:
1. Tree roots are mostly concentrated in the top 12 to 18 inches of the soil and spread two to three times the width of the branches. Protect roots within the drip line of the tree(s). The Contractor will erect a 4-ft. high fence, based on the pre-construction meeting and other field meetings between the Dir. of Parks and the Contractor, to prevent damage from excavation, soil compaction or stockpiling of soil over roots. Remove

fencing only after all construction work is done, including final grading and smoothing of site.

B. Removal of Unwanted Trees:
   1. Take care removing unwanted trees to insure that removal measures do not injure existing trees to be saved. Trees less than 2" caliper, measured 6" above ground, to be removed shall be cut with hand tools only and the stump ground out with rotary stump grinders. No tree shall be pushed over with equipment in a manner that will disrupt roots of nearby trees to be preserved. All removal shall be done under the direction of the Dir. of Parks.

C. Root Pruning:
   1. Clean cuts to roots seal off quickly and prevent disease-causing problems. Prevent ragged, rough wounds from dull or improper equipment. Avoid use of bulldozer tearing roots leaving wound that will not seal readily. Use stump grinders to root prune along lines, as directed by Dir. of Parks. Nearby excavation can occur after root pruning. This will insure clean-cut roots. Any exposed roots that appear to be ragged or torn should be cut cleanly with a sharp pruning saw. Trees shall be mulched to help wound closure and regrowth. Do not allow exposed roots to dry out. All root pruning to be performed only under the supervision of the Dir. of Parks.

D. Tunneling:
   1. Tunneling shall occur at the locations shown on the drawings. Tunneling should occur at a depth of at least two feet below ground. Tunneling in locations other than those shown shall only occur with approval of the Dir. of Parks.

E. Soil Compaction Prevention/Soft Access:
   1. Use temporary wood chip mulch, gravel or bridges to prevent soil compaction around roots when fencing to prevent compaction traffic is not possible. Place wood chips or gravel 6 to 12 inches deep on top of a geotextile landscape fabric placed over the root zone of the trees to be protected. Place one-inch plywood over the mulch to accommodate large truck traffic (cranes, drilling rigs, etc.).

F. Grade Changes:
   1. Maintain existing grade within drip line of trees. Cutting soil or filling soil from a tree will change the root system and moisture level. Limit cuts or fill within the drip line. Any cuts or fill over 3" must be approved by the Dir. of Parks.

G. Raising Grades:
   1. Minor Fills: Where existing grade is 6" or less below elevation of finish grade shown, use topsoil fill material specified. Place in single layer and do not compact; hand grade to required finish elevations.
   2. Moderate Fills: Where existing grade is more than 6" and less than 12" below grade elevation, carefully place 2" above finish grade elevation and

extend not less than 18” from tree trunk on all sides. For balance of area within drip line perimeter, place drainage fill to an elevation 6” below grade and complete fill with a layer of topsoil to finish grade elevation. Do not compact drainage fill or topsoil layers; hand grade to required elevations.

H. Lowering Grades:
1. Where existing grade is above new finish grade shown around trees, gradually slope grade away from trees, as recommended by Dir. of Parks. Do not reduce grade within drip line, unless directed by Dir. of Parks.

3.4 PENALTY FOR PROTECTION VIOLATION

A. Contractor shall be aware that the Owner will assess a $1,000 (One Thousand Dollar) penalty for each and every violation of the following list of required tree protection items:
1. Parking over the tree root zone.
2. Noxious materials run-off spilled on tree root zone, including concrete wash-out.
3. Removal of tree protection fence before completion of construction. Owner must be notified prior to removal.
4. Failure to mark trenches within root zone for Dir. of Parks review before trenching.
5. Storage of materials over tree root zone area.
6. Failure to prevent sediment build-up within tree root zone.
7. Burning under or adjacent to trees.
8. Failure to use hand demolition and/or excavation within root zone.
9. Cutting of roots over one-inch in diameter in trenches when root is not crossing at same elevation as pipe or conduit.
10. Failure to use proper fill procedures when filling within a tree protection zone.

3.5 PENALTY FOR IRREPARABLE HARM OR DEATH

A. Should the tree be irreparably harmed or killed by damage caused by the Contractor, the Contractor shall reimburse the City of Brentwood the value of the tree as determined by the International Society of Arboriculture tree valuation methodology.

PART 4 METHOD OF MEASUREMENT

A. Measurement will be the verification of installation of all tree protection fence, tunneling and all other tree protection work items as described on the drawings and specifications.

PART 5 BASIS OF PAYMENT

A. The accepted quantity of tree protection work will be paid for at the lump sum price required by the contract.

END OF SECTION 012639

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:
   1. Section 012200 "Unit Prices" for administrative requirements governing the use of unit prices.
   2. Section 012600 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
   3. Section 013200 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 PAYMENT

A. The sum of all the Contract Unit Prices multiplied by the respective Work Item units of measure successfully completed shall constitute full payment to the Contractor for work performed under this Contract. When applicable, and when authorized by Owner, additional work will be paid for as mutually agreed between Owner and Contractor in an executed Change Order.

1.4 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Engineer and Owner’s Representative and paid for by Owner.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

   1. Submit draft copy of Application for Payment seven (7) days prior to due date for review by Engineer and Owner’s Representative.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

1. Other Application for Payment forms proposed by the Contractor shall be acceptable to Engineer and Owner. Submit forms for approval with initial submittal of unit price items.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Engineer will return incomplete applications without action.

1. Entries shall match data on the unit prices and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

E. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

    a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
    b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
    c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

F. Transmittal: Submit signed and notarized original copies of each Application for Payment to Engineer and Owner’s Representative electronically. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

G. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Contractor's construction schedule (preliminary if not final).
3. Products list (preliminary if not final).
4. Schedule of unit prices.
5. Submittal schedule (preliminary if not final).
6. List of Contractor's staff assignments.
7. List of Contractor's principal consultants.
8. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
9. Initial progress report.
10. Report of preconstruction conference.
11. Certificates of insurance and insurance policies.
12. Performance and payment bonds.
13. Data needed to acquire Owner's insurance.

I. Application for Payment at Substantial Completion: After Engineer and Owner’s Representative issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

J. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. Contractor’s Affidavit of Payment of Debts and Claims (AIA Document G706).
5. Contractor’s Affidavit of Release of Liens (AIA Document G706A).
6. Consent of Surety to Final Payment (AIA Document G707).
7. Evidence that claims have been settled.

8. When applicable, final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final liquidated damages settlement statement.
10. Prevailing Wage Affidavit

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. RFIs.
3. Digital project management procedures.
4. Project meetings.

B. Related Requirements:
1. Section 017700 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request for Information. Request from Owner, Engineer, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within fifteen (15) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, and in web-based Project software directory where applicable. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

1.6 REQUEST FOR INFORMATION (RFI)

A. General: Immediately on discovery of the need for additional information, clarification, or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Engineer will return without response those RFIs submitted to Engineer by other entities controlled by Contractor.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. Name of Engineer and Owner’s Representative.
6. RFI number, numbered sequentially.
7. RFI subject.
8. Specification Section number and title and related paragraphs, as appropriate.
9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: AIA Document G716 or similar acceptable to Engineer and Owner's Representative.

1. Attachments shall be electronic files in PDF format.

D. Engineer's or Owner's Representative Action: Engineer and Owner's Representative will review each RFI, determine action required, and respond. Allow seven (7) working days for Engineer's response for each RFI. RFIs received by Engineer or Owner's Representative after 1:00 p.m. will be considered as received the following working day.

1. The following Contractor-generated RFIs will be returned without action:

a. Requests for approval of submittals.
b. Requests for approval of substitutions.
c. Requests for approval of Contractor's means and methods.
d. Requests for coordination information already indicated in the Contract Documents.
e. Requests for adjustments in the Contract Time or the Contract Sum.
f. Requests for interpretation of Engineer's actions on submittals.
g. Incomplete RFIs or inaccurately prepared RFIs.

2. Engineer's action may include a request for additional information, in which case Engineer's time for response will date from time of receipt by Engineer or Owner's Representative of additional information.
3. Engineer's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Section 012600 "Contract Modification Procedures."

a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Engineer and Owner's Representative in writing within ten (10) days of receipt of the RFI response.

E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log monthly and include the following:

1. Project name.
2. Name and address of Contractor.
3. Name and address of Engineer and Owner's Representative.
4. RFI number including RFIs that were returned without action or withdrawn.
5. RFI description.
6. Date the RFI was submitted.
7. Date Engineer's and Owner's Representative response was received.
8. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

F. On receipt of Engineer's and Owner's Representative's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and

notify Engineer and Owner's Representative within seven (7) days if Contractor disagrees with response.

1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES

A. Use of Engineer's Digital Data Files: Digital data files of Engineer's CAD Drawings will be provided by Engineer in PDF format for Contractor's use during construction.

1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
2. Engineer makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings.
3. Digital Drawing Software Program: Contract Drawings are available in PDF format.

B. PDF Document Preparation: Where PDFs are required to be submitted to Engineer, prepare as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.
3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate on where indicated.

1.8 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site, City Hall, or other appropriate location.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Engineer of scheduled meeting dates and times a minimum of 5 working days prior to meeting.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Owner's Representative, and Engineer, within three (3) days of the meeting.

B. Preconstruction Conference: Engineer and Owner's Representative will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Engineer, but no later than fifteen (15) days after execution of the Agreement.

1. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other

concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Discuss items of significance that could affect progress, including the following:

    a. Responsibilities and personnel assignments.
    b. Tentative construction schedule.
    c. Phasing.
    d. Critical work sequencing and long lead items.
    e. Designation of key personnel and their duties.
    f. Lines of communications.
    g. Procedures for processing field decisions and Change Orders.
    h. Procedures for RFIs.
    i. Procedures for testing and inspecting.
    j. Procedures for processing Applications for Payment.
    k. Distribution of the Contract Documents.
    l. Submittal procedures.
    m. Preparation of Record Documents.
    n. Use of the premises.
    o. Work restrictions.
    p. Working hours.
    q. Procedures for disruptions and shutdowns.
    r. Construction waste management and recycling.
    s. Parking availability.
    t. Office, work, and storage areas.
    u. Equipment deliveries and priorities.
    v. First aid.
    w. Security.
    x. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Engineer, but no later than sixty (60) days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Engineer, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

    a. Preparation of Record Documents.
    b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
    c. Submittal of written warranties.

d. Preparation of Contractor's punch list.
e. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
f. Submittal procedures.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

D. Progress Meetings: Conduct progress meetings at regular intervals. Additional meetings may be scheduled as necessary by Owner, Engineer, or Contractor to support performance of the work

1. Attendees: In addition to representatives of Owner and Engineer, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site use.
8) Progress cleaning.
9) Quality and work standards.
10) Status of correction of deficient items.
11) Field observations.
12) Status of RFIs.
13) Status of Proposal Requests.
14) Pending changes.
15) Status of Change Orders.
16) Pending claims and disputes.
17) Documentation of information for payment requests.

3. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

    a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's Construction Schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Material location reports.
6. Site condition reports.
7. Unusual event reports.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file, where indicated.
2. PDF file.

B. Startup construction schedule.

C. Construction Schedule Updating Reports: Submit with Applications for Payment.

D. Daily Construction Reports: Submit at weekly intervals.

E. Site Condition Reports: Submit at time of discovery of differing conditions.

F. Unusual Event Reports: Submit at time of unusual event.

1.5 COORDINATION

A. Coordinate Contractor's Construction Schedule with the submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

1.6 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

B. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Phasing: Arrange list of activities on schedule by phase.
2. Work Restrictions: Show the effect of the following items on the schedule:
    a. Uninterruptible services.
    b. Seasonal variations.
    c. Environmental control.

3. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Sample testing.
    e. Deliveries.
    f. Installation.
    g. Tests and inspections.
    h. Adjusting.
    i. Curing.
    j. Startup and placement into final use and operation.
    k. Commissioning.

4. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

    a. Demolition.
    b. Major Grading.
    c. Creek Restoration and Bank Stabilization.
    d. Roadway Improvements.
    e. Bridge Construction
    f. Sewer Facilities.
    g. Landscaping.
    h. Trail Construction.
    i. Site Restoration
    j. Substantial Completion.

D. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.

1. See Section 012900 "Payment Procedures" for cost reporting and payment procedures.

E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and the Contract Time.

F. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule at each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

G. Recovery Schedule: When periodic update indicates the Work is fourteen (14) or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.

H. Distribution: Distribute copies of approved schedule to Engineer, Owner's Representative, Owner, and other parties identified by Contractor with a need-to-know schedule responsibility.

1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.7 STARTUP CONSTRUCTION SCHEDULE

A. Gantt-Chart Schedule: Submit startup, horizontal, Gantt-chart-type construction schedule within fourteen (14) calendar days after being awarded the Contract.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first ninety (90) days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

1.8 GANTT-CHART SCHEDULE REQUIREMENTS

A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's Construction Schedule within fourteen (14) calendar days after being awarded the Contract.

1. Base schedule on the startup construction schedule and additional information received since the start of Project.

1.9 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. Approximate count of personnel at Project site.
3. Equipment at Project site.
4. Material deliveries.
5. High and low temperatures and general weather conditions, including presence of rain or snow.
6. Testing and inspection.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events.
10. Stoppages, delays, shortages, and losses.
11. Emergency procedures.
12. Orders and requests of authorities having jurisdiction.
13. Change Orders received and implemented.

14. Work Change Directives received and implemented.
15. Services connected and disconnected.
16. Equipment or system tests and startups.
17. Partial completions and occupancies.
18. Substantial Completions authorized.

B. Unusual Event Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, responses by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

1. Submit unusual event reports directly to Owner within one (1) day of an occurrence. Distribute copies of report to parties affected by the occurrence.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013200

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for the following:

1. Preconstruction photographs.
2. Preconstruction video recordings.
3. Construction webcam.

B. Related Requirements:
1. Section 024119 "Selective Demolition" for photographic documentation before selective demolition operations commence.
2. Section 311000 "Site Clearing" for photographic documentation before site clearing operations commence.

1.3 INFORMATIONAL SUBMITTALS

A. Digital Photographs: Submit image files within seven days of taking photographs.

1. Submit photos on thumb-drive or web-based sharefile site.
2. Identification: Provide the following information with each image description:

a. Date photograph was taken.
b. Description of location, vantage point, and direction as necessary.

B. Video Recordings: Submit video recordings within seven days of recording.

1. Submit video recordings on thumb drive or web-based sharefile site.
2. Identification: With each submittal, provide the following information:

a. Date video recording was recorded.
b. Description of vantage point, indicating location, and direction as necessary.

1.4 QUALITY ASSURANCE

A. Construction Webcam Service Provider: A firm specializing in providing photographic equipment, web-based software, and related services for construction projects, with record of providing satisfactory services similar to those required for Project.

1.5 FORMATS AND MEDIA

A. Digital Photographs: Provide color images in JPG format, produced by a digital camera with minimum sensor size of 12 megapixels, and at an image resolution of not less than 3200 by 2400 pixels. Use flash in low light levels or backlit conditions.

B. Digital Video Recordings: Provide high-resolution, digital video in MPEG format, produced by a digital camera with minimum sensor resolution of 12 megapixels and capable of recording in full high-definition mode. Provide supplemental lighting in low light levels or backlit conditions.

C. Digital Images: Submit digital media as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.

D. Metadata: Record accurate date and time from camera.

E. File Names: Name media files with Project area and sequential numbering suffix.

1.6 CONSTRUCTION PHOTOGRAPHS/VIDEO RECORDINGS

A. General: Take photographs with maximum depth of field and in focus.

B. Preconstruction Photographs/Video Recordings: Before starting construction, take photographs and/or video recordings of existing Project site and surrounding properties, including existing items to remain during construction, from different vantage points.

1. Flag construction limits before taking construction photographs/videos.
2. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

C. Narration: Describe scenes on video recording. Include description of items being viewed, recent events, and planned activities. At each change in location, describe vantage point, location, and direction (by compass point).

1. Confirm date and time at beginning and end of recording.
2. Begin each video recording with Project location.

1.7 CONSTRUCTION WEBCAM

A. Webcam: Provide two (2) fixed-location camera(s) with weatherproof housing, mounted to provide unobstructed view of construction site from location approved by Owner's Representative, with the following characteristics:

1. The camera system shall be accessible through a web browser (IE, Chrome, etc.) on any online device. Camera access is restricted by secure login requirements. The web interface shall use SSL encryption for data security.
2. Provide Solar power package with battery backup to provide 5+ days of backup power via solar-rechargeable battery.
3. The system shall include 4G LTE cellular service to connect the camera to the internet.
4. The camera system shall provide live images upon request to any number of simultaneous users. The system shall provide live video upon request, if the location's cellular bandwidth is sufficient.
5. Customizable time-lapse scheduling. The system shall be able to capture any number of simultaneous time-lapses. Time-lapses may be watched or downloaded at any time.
6. Image sharing features, including email sharing and image markup.
7. The ability to save images locally and to a hosted photo album.
8. Camera user statistics.
9. Live weather conditions and historical weather data.
10. The camera shall record 24/7 video on a 7-day loop and allow the Owner to view or download segments of this video footage from the web interface.
11. An embeddable version of the interface shall be available for use on client-owned web pages.
12. Camera data such as images and time-lapse videos shall be available for download directly within the web interface. Client and past-client logins shall never expire, granting access to this data in perpetuity.
13. The vendor shall offer free 24/7 customer support.
14. The vendor shall provide all necessary mounting hardware. The Contractor shall provide a fixed pole (capable of mounting the camera a minimum of 40 feet above the ground surface) or secure to a nearby structure as per the vendor's requirements.
15. Relocate each camera up to 2 times at new locations approved by the Owner's Representative.
16. The Contractor shall provide all service and maintenance, including cleaning, of the camera system throughout the life of the project.
17. At the end of the project the cameras, mounting hardware, and solar package shall become the property of the City of Brentwood.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Submittal schedule requirements.
2. Administrative and procedural requirements for submittals.

B. Related Requirements:
1. Section 013100 "Project Management and Coordination" for submitting coordination drawings and subcontract list and for requirements for web-based Project software.
2. Section 014000 "Quality Requirements" for submitting test and inspection reports, and schedule of tests and inspections.
3. Section 017700 "Closeout Procedures" for submitting closeout submittals and maintenance material submittals.
4. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Engineer’s and Owner’s Representative’s responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Engineer’s and Owner’s Representative’s responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.4 SUBMITTAL FORMATS

A. Submittal Information: Include the following information in each submittal:

1. Project name.
2. Date.

3. Name of Engineer.
4. Name of Owner's Representative.
5. Name of Contractor.
6. Name of firm or entity that prepared submittal.
7. Names of subcontractor, manufacturer, and supplier.
8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
9. Category and type of submittal.
10. Submittal purpose and description.
11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
12. Drawing number and detail references, as appropriate.
13. Indication of full or partial submittal.
14. Location(s) where product is to be installed, as appropriate.
15. Other necessary identification.
16. Remarks.
17. Signature of transmitter.

B. Options: Identify options requiring selection by Engineer.

C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Engineer and Owner's Representative on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.

D. PDF Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal number.

1.5 SUBMITTAL PROCEDURES

A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Email: Prepare submittals as PDF package, and transmit to Engineer and Owner's Representative by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Engineer.

    a. Engineer and Owner's Representative will return annotated file. Annotate and retain one copy of file as a digital Project Record Document file.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.

3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of submittals for related parts of the Work specified in different Sections so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Engineer and Owner's Representative reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's and Owner's Representative's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow ten (10) days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer and Owner's Representative will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow ten (10) days for review of each resubmittal.

D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are approved.

E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Engineer and Owner's Representative.

1.6 SUBMITTAL REQUIREMENTS

A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.

3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams that show factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.

B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Identification of products.
    b. Schedules.
    c. Compliance with specified standards.
    d. Notation of coordination requirements.
    e. Notation of dimensions established by field measurement.
    f. Relationship and attachment to adjoining construction clearly indicated.
    g. Seal and signature of professional engineer if specified.

C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Permanently attach label on unexposed side of Samples that includes the following:

    a. Project name and submittal number.
    b. Generic description of Sample.
    c. Product name and name of manufacturer.
    d. Sample source.
    e. Number and title of applicable Specification Section.
    f. Specification paragraph number and generic name of each item.

3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.

    a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
    b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

4. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

    a. Number of Samples: Submit two (2) sets of Samples. Engineer and Owner’s Representative will retain one (1) Sample set; remainder will be returned.

        1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
        2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three (3) sets of paired units that show approximate limits of variations.

D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of engineers and owners, and other information specified.

E. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.

F. Certificates:

1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

G. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

    a. Name of evaluation organization.
    b. Date of evaluation.
    c. Time period when report is in effect.
    d. Product and manufacturers' names.
    e. Description of product.
    f. Test procedures and results.
    g. Limitations of use.

1.7 CONTRACTOR'S REVIEW

A. Action Submittals and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark as approved prior to submittal to Engineer and Owner’s Representative.

B. Contractor's Approval: Indicate Contractor's approval for each submittal. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

1. Engineer and Owner’s Representative will not review submittals received from Contractor that do not have Contractor's review and approval.

1.8 ENGINEER’S AND OWNER’S REPRESENTATIVE REVIEW

A. Action Submittals: Engineer and Owner’s Representative will review each submittal, indicate corrections or revisions required.

1. PDF Submittals: Engineer and Owner’s Representative will indicate, via markup on each submittal, the appropriate action.

B. Informational Submittals: Engineer and Owner’s Representative will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer and Owner’s Representative will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer and Owner’s Representative.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Engineer and Owner’s Representative will disregard submittals received from sources other than Contractor.

F. Submittals not required by the Contract Documents will be returned by Engineer without action.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 013300

SECTION 013700 - SCHEDULE OF VALUES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. General and Supplementary Conditions of the Contract.

1.2 SUMMARY

A. For lump sum Contracts, Contractor shall submit to the Owner and Owner's Representative a Schedule of Values allocated to the various portions of the Work, per CSI Masterspec guidelines, within the time period stipulated by the Owner.

B. Upon request of the Owner, Contractor shall provide written support for the values claimed, with data which will substantiate their correctness.

C. The Schedule of Values, unless objected to by the Owner, shall be used as the basis for the Contractor's Applications for Payment.

1.3 FORM AND CONTENT OF SCHEDULE OF VALUES

A. Contractor shall type schedule of values on 8-1/2 in. x 11 in. white paper; Contractor's standard forms and automatic printout will be considered for approval by the Owner upon the Contractor's request. Contractor shall identify schedule with:

1. Title of Project and location.
2. Engineer and Project number.
3. Name and address of Contractor.
4. Contract designation.
5. Date of submission.

B. Schedule shall list the completed value of the parts of the Work in sufficient detail to serve as a basis for computing values for progress payments during construction.

C. For each major line item, Contractor shall list subvalues of operations under the item.

D. For the various portions of the Work, each item shall include a directly proportional amount of the Contractor's overhead and profit.

E. The sum of all values listed in the schedule shall equal the total Contract lump sum price.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION 013700

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and quality-control requirements for individual work results are specified in their respective Specification Sections. Requirements in individual Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
3. Requirements for Contractor to provide quality-assurance and quality-control services required by Engineer, Owner, Owner’s Representative, or authorities having jurisdiction are not limited by provisions of this Section.
4. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five (5) previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

B. Field Quality-Control Tests: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

C. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

E. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Tests: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.

G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

H. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

I. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor's quality-control services do not include contract administration activities performed by Engineer or Owner’s Representative.

1.4 CONFLICTING REQUIREMENTS

A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for direction before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data: For Contractor's quality-control personnel.

C. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

D. Schedule of Tests and Inspections: Prepare in tabular form and include the following:

1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

E. Reports: Prepare and submit certified written reports and documents as specified.

F. Permits, Licenses, and Certificates: For Owner's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.6 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, telephone number, and email address of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.

12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, telephone number, and email address of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

1.7 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to ASTM E329; and with additional qualifications specified in

individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

E. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

F. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

1. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Engineer and Owner's Representative, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

1.8 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Engage a qualified testing agency to perform quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least twenty-four (24) hours in advance of time when Work that requires testing or inspection will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

D. Testing Agency Responsibilities: Cooperate with Engineer, Owner's Representative, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Engineer, Owner's Representative, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the locations from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform duties of Contractor.

E. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300 "Submittal Procedures."

F. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

G. Associated Contractor Services: Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.

7. Security and protection for samples and for testing and inspection equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.9 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Engineer and Owner's Representative and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Engineer and Owner's Representative with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Engineer.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Engineer's reference during normal working hours.

1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 017300 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Engineer. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and

effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. The information in this list is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. AABC - Associated Air Balance Council; www.aabc.com.
2. AAMA - American Architectural Manufacturers Association; www.aamanet.org.
3. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
4. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
5. AATCC - American Association of Textile Chemists and Colorists; www.aatcc.org.
6. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
7. ABMA - American Boiler Manufacturers Association; www.abma.com.
8. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
9. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
10. AEIC - Association of Edison Illuminating Companies, Inc. (The); www.aeic.org.
11. AF&PA - American Forest & Paper Association; www.afandpa.org.
12. AGA - American Gas Association; www.aga.org.
13. AHAM - Association of Home Appliance Manufacturers; www.aham.org.
14. AHRI - Air-Conditioning, Heating, and Refrigeration Institute (The); www.ahrinet.org.
15. AI - Asphalt Institute; www.asphaltinstitute.org.
16. AIA - American Institute of Architects (The); www.aia.org.
17. AISC - American Institute of Steel Construction; www.aisc.org.
18. AISI - American Iron and Steel Institute; www.steel.org.
19. AITC - American Institute of Timber Construction; www.aitc-glulam.org.
20. AMCA - Air Movement and Control Association International, Inc.; www.amca.org.
21. ANSI - American National Standards Institute; www.ansi.org.
22. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
23. APA - APA - The Engineered Wood Association; www.apawood.org.
24. APA - Architectural Precast Association; www.archprecast.org.
25. API - American Petroleum Institute; www.api.org.
26. ARI - Air-Conditioning & Refrigeration Institute; (See AHRI).
27. ARI - American Refrigeration Institute; (See AHRI).
28. ARMA - Asphalt Roofing Manufacturers Association; www.asphaltroofing.org.
29. ASCE - American Society of Civil Engineers; www.asce.org.

30. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
31. ASHRAE - American Society of Heating, Refrigerating and Air-Conditioning Engineers; www.ashrae.org.
32. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
33. ASSE - American Society of Safety Engineers (The); www.asse.org.
34. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
35. ASTM - ASTM International; www.astm.org.
36. ATIS - Alliance for Telecommunications Industry Solutions; www.atis.org.
37. AWEA - American Wind Energy Association; www.awea.org.
38. AWI - Architectural Woodwork Institute; www.awinet.org.
39. AWMAC - Architectural Woodwork Manufacturers Association of Canada; www.awmac.com.
40. AWPA - American Wood Protection Association; www.awpa.com.
41. AWS - American Welding Society; www.aws.org.
42. AWWA - American Water Works Association; www.awwa.org.
43. BHMA - Builders Hardware Manufacturers Association; www.buildershardware.com.
44. BIA - Brick Industry Association (The); www.gobrick.com.
45. BICSI - BICSI, Inc.; www.bicsi.org.
46. BIFMA - BIFMA International; (Business and Institutional Furniture Manufacturer's Association); www.bifma.org.
47. BISSC - Baking Industry Sanitation Standards Committee; www.bissc.org.
48. BWF - Badminton World Federation; (Formerly: International Badminton Federation); www.bissc.org.
49. CDA - Copper Development Association; www.copper.org.
50. CE - Conformite Europeenne; http://ec.europa.eu/growth/single-market/ce-marking/.
51. CEA - Canadian Electricity Association; www.electricity.ca.
52. CEA - Consumer Electronics Association; www.ce.org.
53. CFFA - Chemical Fabrics and Film Association, Inc.; www.chemicalfabricsandfilm.com.
54. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
55. CGA - Compressed Gas Association; www.cganet.com.
56. CIMA - Cellulose Insulation Manufacturers Association; www.cellulose.org.
57. CISCA - Ceilings & Interior Systems Construction Association; www.cisca.org.
58. CISPI - Cast Iron Soil Pipe Institute; www.cispi.org.
59. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
60. CPA - Composite Panel Association; www.pbmdf.com.
61. CRI - Carpet and Rug Institute (The); www.carpet-rug.org.
62. CRRC - Cool Roof Rating Council; www.coolroofs.org.
63. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.
64. CSA - CSA Group; www.csagroup.com.
65. CSA - CSA International; www.csa-international.org.
66. CSI - Construction Specifications Institute (The); www.csinet.org.
67. CSSB - Cedar Shake & Shingle Bureau; www.cedarbureau.org.
68. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
69. CWC - Composite Wood Council; (See CPA).

70. DASMA - Door and Access Systems Manufacturers Association; www.dasma.com.
71. DHI - Door and Hardware Institute; www.dhi.org.
72. ECA - Electronic Components Association; (See ECIA).
73. ECAMA - Electronic Components Assemblies & Materials Association; (See ECIA).
74. ECIA - Electronic Components Industry Association; www.eciaonline.org.
75. EIA - Electronic Industries Alliance; (See TIA).
76. EIMA - EIFS Industry Members Association; www.eima.com.
77. EJMA - Expansion Joint Manufacturers Association, Inc.; www.ejma.org.
78. ESD - ESD Association; (Electrostatic Discharge Association); www.esda.org.
79. ESTA - Entertainment Services and Technology Association; (See PLASA).
80. ETL - Intertek (See Intertek); www.intertek.com.
81. EVO - Efficiency Valuation Organization; www.evo-world.org.
82. FCI - Fluid Controls Institute; www.fluidcontrolsinstitute.org.
83. FIBA - Federation Internationale de Basketball; (The International Basketball Federation); www.fiba.com.
84. FIVB - Federation Internationale de Volleyball; (The International Volleyball Federation); www.fivb.org.
85. FM Approvals - FM Approvals LLC; www.fmglobal.com.
86. FM Global - FM Global; (Formerly: FMG - FM Global); www.fmglobal.com.
87. FRSA - Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc.; www.floridaroof.com.
88. FSA - Fluid Sealing Association; www.fluidsealing.com.
89. FSC - Forest Stewardship Council U.S.; www.fscus.org.
90. GA - Gypsum Association; www.gypsum.org.
91. GANA - Glass Association of North America; www.glasswebsite.com.
92. GS - Green Seal; www.greenseal.org.
93. HI - Hydraulic Institute; www.pumps.org.
94. HI/GAMA - Hydronics Institute/Gas Appliance Manufacturers Association; (See AHRI).
95. HMMA - Hollow Metal Manufacturers Association; (See NAAMM).
96. HPVA - Hardwood Plywood & Veneer Association; www.hpva.org.
97. HPW - H. P. White Laboratory, Inc.; www.hpwhite.com.
98. IAPSC - International Association of Professional Security Consultants; www.iapsc.org.
99. IAS - International Accreditation Service; www.iasonline.org.
100. ICBO - International Conference of Building Officials; (See ICC).
101. ICC - International Code Council; www.iccsafe.org.
102. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
103. ICPA - International Cast Polymer Alliance; www.icpa-hq.org.
104. ICRI - International Concrete Repair Institute, Inc.; www.icri.org.
105. IEC - International Electrotechnical Commission; www.iec.ch.
106. IEEE - Institute of Electrical and Electronics Engineers, Inc. (The); www.ieee.org.
107. IES - Illuminating Engineering Society; (Formerly: Illuminating Engineering Society of North America); www.ies.org.
108. IESNA - Illuminating Engineering Society of North America; (See IES).
109. IEST - Institute of Environmental Sciences and Technology; www.iest.org.
110. IGMA - Insulating Glass Manufacturers Alliance; www.igmaonline.org.
111. IGSHPA - International Ground Source Heat Pump Association; www.igshpa.okstate.edu.

112. ILI - Indiana Limestone Institute of America, Inc.; www.iliai.com.
113. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
114. ISA - International Society of Automation (The); (Formerly: Instrumentation, Systems, and Automation Society); www.isa.org.
115. ISAS - Instrumentation, Systems, and Automation Society (The); (See ISA).
116. ISFA - International Surface Fabricators Association; (Formerly: International Solid Surface Fabricators Association); www.isfanow.org.
117. ISO - International Organization for Standardization; www.iso.org.
118. ISSFA - International Solid Surface Fabricators Association; (See ISFA).
119. ITU - International Telecommunication Union; www.itu.int/home.
120. KCMA - Kitchen Cabinet Manufacturers Association; www.kcma.org.
121. LMA - Laminating Materials Association; (See CPA).
122. LPI - Lightning Protection Institute; www.lightning.org.
123. MBMA - Metal Building Manufacturers Association; www.mbma.com.
124. MCA - Metal Construction Association; www.metalconstruction.org.
125. MFMA - Maple Flooring Manufacturers Association, Inc.; www.maplefloor.org.
126. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
127. MHIA - Material Handling Industry of America; www.mhia.org.
128. MIA - Marble Institute of America; www.marble-institute.com.
129. MMPA - Moulding & Millwork Producers Association; www.wmmpa.com.
130. MPI - Master Painters Institute; www.paintinfo.com.
131. MSS - Manufacturers Standardization Society of The Valve and Fittings Industry Inc.; www.mss-hq.org.
132. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
133. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
134. NADCA - National Air Duct Cleaners Association; www.nadca.com.
135. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
136. NBGQA - National Building Granite Quarries Association, Inc.; www.nbgqa.com.
137. NBI - New Buildings Institute; www.newbuildings.org.
138. NCAA - National Collegiate Athletic Association (The); www.ncaa.org.
139. NCMA - National Concrete Masonry Association; www.ncma.org.
140. NEBB - National Environmental Balancing Bureau; www.nebb.org.
141. NECA - National Electrical Contractors Association; www.necanet.org.
142. NeLMA - Northeastern Lumber Manufacturers Association; www.nelma.org.
143. NEMA - National Electrical Manufacturers Association; www.nema.org.
144. NETA - International Electrical Testing Association; www.netaworld.org.
145. NFHS - National Federation of State High School Associations; www.nfhs.org.
146. NFPA - National Fire Protection Association; www.nfpa.org.
147. NFPA - NFPA International; (See NFPA).
148. NFRC - National Fenestration Rating Council; www.nfrc.org.
149. NHLA - National Hardwood Lumber Association; www.nhla.com.
150. NLGA - National Lumber Grades Authority; www.nlga.org.
151. NOFMA - National Oak Flooring Manufacturers Association; (See NWFA).
152. NOMMA - National Ornamental & Miscellaneous Metals Association; www.nomma.org.
153. NRCA - National Roofing Contractors Association; www.nrca.net.
154. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.

155. NSF - NSF International; www.nsf.org.
156. NSPE - National Society of Professional Engineers; www.nspe.org.
157. NSSGA - National Stone, Sand & Gravel Association; www.nssga.org.
158. NTMA - National Terrazzo & Mosaic Association, Inc. (The); www.ntma.com.
159. NWFA - National Wood Flooring Association; www.nwfa.org.
160. PCI - Precast/Prestressed Concrete Institute; www.pci.org.
161. PDI - Plumbing & Drainage Institute; www.pdionline.org.
162. PLASA - PLASA; (Formerly: ESTA - Entertainment Services and Technology Association); www.plasa.org.
163. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
164. RFCI - Resilient Floor Covering Institute; www.rfci.com.
165. RIS - Redwood Inspection Service; www.redwoodinspection.com.
166. SAE - SAE International; www.sae.org.
167. SCTE - Society of Cable Telecommunications Engineers; www.scte.org.
168. SDI - Steel Deck Institute; www.sdi.org.
169. SDI - Steel Door Institute; www.steeldoor.org.
170. SEFA - Scientific Equipment and Furniture Association (The); www.sefalabs.com.
171. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
172. SIA - Security Industry Association; www.siaonline.org.
173. SJI - Steel Joist Institute; www.steeljoist.org.
174. SMA - Screen Manufacturers Association; www.smainfo.org.
175. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
176. SMPTE - Society of Motion Picture and Television Engineers; www.smpte.org.
177. SPFA - Spray Polyurethane Foam Alliance; www.sprayfoam.org.
178. SPIB - Southern Pine Inspection Bureau; www.spib.org.
179. SPRI - Single Ply Roofing Industry; www.spri.org.
180. SRCC - Solar Rating & Certification Corporation; www.solar-rating.org.
181. SSINA - Specialty Steel Industry of North America; www.ssina.com.
182. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
183. STI - Steel Tank Institute; www.steeltank.com.
184. SWI - Steel Window Institute; www.steelwindows.com.
185. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
186. TCA - Tilt-Up Concrete Association; www.tilt-up.org.
187. TCNA - Tile Council of North America, Inc.; www.tileusa.com.
188. TEMA - Tubular Exchanger Manufacturers Association, Inc.; www.tema.org.
189. TIA - Telecommunications Industry Association (The); (Formerly: TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance); www.tiaonline.org.
190. TIA/EIA - Telecommunications Industry Association/Electronic Industries Alliance; (See TIA).
191. TMS - The Masonry Society; www.masonrysociety.org.
192. TPI - Truss Plate Institute; www.tpinst.org.
193. TPI - Turfgrass Producers International; www.turfgrasssod.org.
194. TRI - Tile Roofing Institute; www.tileroofing.org.
195. UL - Underwriters Laboratories Inc.; www.ul.com.
196. UNI - Uni-Bell PVC Pipe Association; www.uni-bell.org.
197. USAV - USA Volleyball; www.usavolleyball.org.
198. USGBC - U.S. Green Building Council; www.usgbc.org.

199. USITT - United States Institute for Theatre Technology, Inc.; www.usitt.org.
200. WA - Wallcoverings Association; www.wallcoverings.org.
201. WASTEC - Waste Equipment Technology Association; www.wastec.org.
202. WCLIB - West Coast Lumber Inspection Bureau; www.wclib.org.
203. WCMA - Window Covering Manufacturers Association; www.wcmanet.org.
204. WDMA - Window & Door Manufacturers Association; www.wdma.com.
205. WI - Woodwork Institute; www.wicnet.org.
206. WSRCA - Western States Roofing Contractors Association; www.wsrca.com.
207. WWPA - Western Wood Products Association; www.wwpa.org.

B. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up to date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.
2. CPSC - Consumer Product Safety Commission; www.cpsc.gov.
3. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
4. DOD - Department of Defense; www.quicksearch.dla.mil.
5. DOE - Department of Energy; www.energy.gov.
6. EPA - Environmental Protection Agency; www.epa.gov.
7. FAA - Federal Aviation Administration; www.faa.gov.
8. FG - Federal Government Publications; www.gpo.gov/fdsys.
9. GSA - General Services Administration; www.gsa.gov.
10. HUD - Department of Housing and Urban Development; www.hud.gov.
11. LBL - Lawrence Berkeley National Laboratory; Environmental Energy Technologies Division; www.eetd.lbl.gov.
12. OSHA - Occupational Safety & Health Administration; www.osha.gov.
13. SD - Department of State; www.state.gov.
14. TRB - Transportation Research Board; National Cooperative Highway Research Program; The National Academies; www.trb.org.
15. USDA - Department of Agriculture; Agriculture Research Service; U.S. Salinity Laboratory; www.ars.usda.gov.
16. USDA - Department of Agriculture; Rural Utilities Service; www.usda.gov.
17. USDOJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
18. USP - U.S. Pharmacopeial Convention; www.usp.org.
19. USPS - United States Postal Service; www.usps.com.

C. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.

1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
2. DOD - Department of Defense; Military Specifications and Standards; Available from DLA Document Services; www.quicksearch.dla.mil.
3. DSCC - Defense Supply Center Columbus; (See FS).
4. FED-STD - Federal Standard; (See FS).

5. FS - Federal Specification; Available from DLA Document Services; www.quicksearch.dla.mil.

    a. Available from Defense Standardization Program; www.dsp.dla.mil.
    b. Available from General Services Administration; www.gsa.gov.
    c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org.

6. MILSPEC - Military Specification and Standards; (See DOD).
7. USAB - United States Access Board; www.access-board.gov.
8. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 015000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Section 011000 "Summary" for work restrictions and limitations on utility interruptions.
2. Section 312000 "Earth Moving" for disposal of ground water at Project site.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities engaged in the Project to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces**,** Engineer, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Contractor shall pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Contractor shall pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Contractor shall pay electric-power-service use charges for electricity used by all entities for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. Implementation and Termination Schedule: Within fifteen (15) days of date established for commencement of the Work, submit schedule indicating implementation and termination dates of each temporary utility.

C. Project Identification and Temporary Signs: Show fabrication and installation details, including plans, elevations, details, layouts, typestyles, graphic elements, and message content.

D. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

PART 2 - PRODUCTS

2.1 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

2.2 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.

PART 3 - EXECUTION

3.1 TEMPORARY FACILITIES, GENERAL

A. Conservation: Coordinate construction and use of temporary facilities with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

3.2 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Section 011000 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.3 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.

C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Temporary Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.

1. Install electric power service unless otherwise indicated.

G. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements.

3.4 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area as approved by Owner that is noncombustible according to ASTM E136. Comply with NFPA 241.
2. Maintain support facilities until Engineer schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas as necessary.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Temporary Use of Planned Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.

1. Coordinate elevations of temporary roads and paved areas with permanent roads and paved areas.
2. Prepare subgrade and install subbase and base for temporary roads and paved areas according to Section 312000 "Earth Moving."
3. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
4. Delay installation of final course of permanent hot-mix asphalt pavement until immediately before Substantial Completion. Repair hot-mix asphalt base-course pavement before installation of final course according to Section 321216 "Asphalt Paving."

D. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

E. Parking: Provide temporary parking areas for construction personnel.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
1. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

a. Provide temporary, directional signs for construction personnel and visitors.

2. Maintain and touch up signs so they are legible at all times.

3.5 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 011000 "Summary."

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to Stormwater Pollution Prevention Plan Drawings or authorities having jurisdiction, whichever is more stringent.

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Comply with requirements specified in Section 012639 "Temporary Tree and Plant Protection."

F. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel.

G. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each workday.

H. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

I. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

J. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary

facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

END OF SECTION 015000

SECTION 015723 - TEMPORARY STORM WATER POLLUTION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Temporary stormwater pollution controls.

1.3 STORMWATER POLLUTION PREVENTION PLAN

A. The Stormwater Pollution Prevention Plan (SWPPP) is part of the Contract Documents and is bound into this Project Manual.

1.4 INFORMATIONAL SUBMITTALS

A. EPA authorization under the EPA's "2017 Construction General Permit (CGP)."

B. Stormwater Pollution Prevention (SWPP) Training Log: For each individual performing Work under the SWPPP.

C. Inspection reports.

1.5 QUALITY ASSURANCE

A. Stormwater Pollution Prevention Plan (SWPPP) Coordinator: Experienced individual or firm with a record of successful water pollution control management coordination of projects with similar requirements.

1. SWPPP Coordinator shall complete and finalize the SWPPP form.
2. SWPPP Coordinator shall be responsible for inspections and maintaining of all requirements of the SWPPP.

B. Installers: Trained as indicated in the SWPPP.

PART 2 - PRODUCTS

2.1 TEMPORARY STORMWATER POLLUTION CONTROLS

A. Provide temporary stormwater pollution controls as required by the SWPPP.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with all best management practices, general requirements, performance requirements, reporting requirements, and all other requirements included in the SWPPP.

B. Locate stormwater pollution controls in accordance with the SWPPP.

C. Conduct construction as required to comply with the SWPPP and that minimize possible contamination or pollution or other undesirable effects.

1. Inspect, repair, and maintain SWPPP controls during construction.

a. Inspect all SWPPP controls not less than every seven days, and after each occurrence of a storm event, as outlined in the SWPPP.

D. Remove SWPPP controls at completion of construction and restore and stabilize areas disturbed during construction.

END OF SECTION 015723

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:
   1. Section 012500 "Substitution Procedures" for requests for substitutions.
   2. Section 014200 "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

   1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
   2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
   3. Comparable Product: Product that is demonstrated and approved by Engineer through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a single manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation. In addition to the basis-of-design product description, product attributes and characteristics may be listed to establish the significant qualities related to type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other special features and requirements for purposes of evaluating comparable products of additional manufacturers named in the specification.

C. Subject to Compliance with Requirements: Where the phrase "Subject to compliance with requirements" introduces a product selection procedure in an individual Specification Section, provide products qualified under the specified product procedure. In the event that a named product or product by a named manufacturer does not meet the other requirements of the specifications, select another named product or product from another named manufacturer that does meet the requirements of the specifications. Submit a comparable product request, if applicable.

1.4 ACTION SUBMITTALS

A. Comparable Product Request Submittal: Submit request for consideration of each comparable product. Identify basis-of-design product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
2. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within seven (7) days of receipt of a comparable product request. Engineer will notify Contractor of approval or rejection of proposed comparable product request within fifteen (15) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.

    a. Form of Engineer's Approval of Submittal: As specified in Section 013300 "Submittal Procedures."
    b. Use product specified if Engineer does not issue a decision on use of a comparable product request within time allocated.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 013300 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

B. Identification of Products: Except for required labels and operating data, do not attach or imprint manufacturer or product names or trademarks on exposed surfaces of products or equipment that will be exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on a concealed surface, or, where required for observation following installation, on a visually accessible surface that is not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on a visually accessible

but inconspicuous surface. Include information essential for operation, including the following:

a. Name of product and manufacturer.
b. Model and serial number.
c. Capacity.
d. Speed.
e. Ratings.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
5. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 017700 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Owner reserves the right to limit selection to products with warranties meeting requirements of the Contract Documents.
2. Where products are accompanied by the term "as selected," Engineer will make selection.
3. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
4. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

a. Submit additional documentation required by Engineer and Owner’s Representative in order to establish equivalency of proposed products. Evaluation of "or equal" product status is by the Engineer, whose determination is final.

B. Product Selection Procedures:

1. Sole Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience may not be considered.

2. Sole Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration of Comparable Products: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer may return requests without action, except to record noncompliance with these requirements:

1. Evidence that proposed product does not require revisions to the Contract Documents, is consistent with the Contract Documents, will produce the indicated results, and is compatible with other portions of the Work. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant product qualities include attributes such as type, function, in-service performance and physical properties, weight, dimension, durability, visual characteristics, and other specific features and requirements.
2. Evidence that proposed product provides specified warranty.
3. List of similar installations for completed projects with project names and addresses and names and addresses of engineers and owners, if requested.
4. Samples, if requested.

B. Submittal Requirements: Approval by the Engineer of Contractor's request for use of comparable product is not intended to satisfy other submittal requirements. Comply with specified submittal requirements.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.

B. Related Requirements:

1. Section 011000 "Summary" for limits on use of Project site.
2. Section 013300 "Submittal Procedures" for submitting surveys.
3. Section 017700 "Closeout Procedures" for recording of Owner-accepted deviations from indicated lines and levels, replacing defective work, and final cleaning.
4. Section 024119 "Selective Demolition" for demolition and removal.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of subsequent work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of subsequent work.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For professional land surveyor.

B. Certificates: Submit certificate signed by professional land surveyor certifying that location and elevation of improvements comply with requirements.

1.5 QUALITY ASSURANCE

A. Land Surveyor Qualifications: A professional land surveyor who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing land-surveying services of the kind indicated.

B. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Engineer for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 PREPARATION

A. Existing Utility Information: Furnish information to local utility that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Engineer according to requirements in Section 013100 "Project Management and Coordination."

3.2 CONSTRUCTION LAYOUT

A. Verification: Before proceeding to lay out the Work, verify layout information shown on Drawings, in relation to the property survey and existing benchmarks. If discrepancies are discovered, notify Engineer and Owner's Representative promptly.

B. General: Engage a professional land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.
3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Notify Engineer and Owner's Representative when deviations from required lines and levels exceed allowable tolerances.
7. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

C. Site Improvements: Locate and lay out site improvements, including pavements, grading, fill and topsoil placement, utility slopes, and rim and invert elevations.

D. Sewer Improvements: Stakes set at 25-foot intervals for control of alignment and grades. If laser system is utilized, construction stakes will be set at each structure, 25 feet upstream, and continuing at 100-foot intervals. Cut sheets are required and must be prepared by a Licensed Land Surveyor or Professional Engineer of Missouri.

E. Stake all ROW and easements as required for construction improvements.

F. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Engineer and Owner's Representative.

3.3 FIELD ENGINEERING

A. Identification: Contractor will identify existing benchmarks, control points, and property corners.

B. Reference Points: Locate existing permanent benchmarks, control points, and similar reference points before beginning the Work. Preserve and protect permanent benchmarks and control points during construction operations.

1. Do not change or relocate existing benchmarks or control points without prior written approval of Engineer and Owner's Representative. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to

relocate permanent benchmarks or control points to Engineer and Owner's Representative before proceeding.

2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

C. Benchmarks: Establish and maintain a minimum of two (2) permanent benchmarks on Project site, referenced to data established by survey control points. Comply with authorities having jurisdiction for type and size of benchmark.

1. Record benchmark locations, with horizontal and vertical data, on Project Record Documents.
2. Where the actual location or elevation of layout points cannot be marked, provide temporary reference points sufficient to locate the Work.
3. Remove temporary reference points when no longer needed. Restore marked construction to its original condition.

3.4 INSTALLATION

A. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

B. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

C. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

D. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

E. Tools and Equipment: Where possible, select tools or equipment that minimize production of excessive noise levels.

F. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other portions of the Work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

G. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

H. Repair or remove and replace damaged, defective, or nonconforming Work.

1. Comply with Section 017700 "Closeout Procedures" for repairing or removing and replacing defective Work.

3.5 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F (27 deg C).
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean the entire work area or use street sweeper, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways.

3.6 STARTING AND ADJUSTING

A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

B. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Manufacturer's Field Service: Comply with qualification requirements in Section 014000 "Quality Requirements."

3.7 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 017300

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:
1. Section 017839 "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.

1.3 ACTION SUBMITTALS

A. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

B. Certified List of Incomplete Items: Final submittal at final completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of ten (10) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Engineer. Label with manufacturer's name and model number.

5. Submit testing, adjusting, and balancing records.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of ten (10) days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Complete startup and testing of systems and equipment.
3. Perform preventive maintenance on equipment used prior to Substantial Completion.
4. Advise Owner of changeover in utility services.
5. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
6. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of ten (10) days prior to date the Work will be completed and ready for final inspection and tests. On receipt of request, Engineer and Owner’s Representative will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Engineer, that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.6 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Engineer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Engineer. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit final completion photographic documentation.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Engineer and Owner’s Representative will either proceed with inspection or notify Contractor of unfulfilled requirements. Engineer will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.
1. Include the following information at the top of each page:

a. Project name.
b. Date.
c. Name of Engineer and Owner’s Representative.
d. Name of Contractor.
e. Page number.

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Engineer for designated portions of the Work where warranties are indicated to commence on dates other than date of Substantial Completion, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

C. Warranty Electronic File: Provide warranties and bonds in PDF format. Assemble complete warranty and bond submittal package into a single electronic PDF file with bookmarks enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair, or remove and replace, defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

END OF SECTION 017700

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:
1. Section 017700 "Closeout Procedures" for general closeout procedures.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:
1. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:
1) Submit PDF electronic files of scanned record prints
2) Submit record digital data files.
3) Engineer will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit three (3) paper-copy sets of marked-up record prints.
2) Submit PDF electronic files of scanned record prints and three (3) sets of prints.
3) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

1.4 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Change Directive.
k. Changes made following Engineer's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Engineer and Owner’s

Representative. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Same digital data software program, version, and operating system as the original Contract Drawings.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Engineer for resolution.
4. Engineer will furnish Contractor with one set of digital data files of the Contract Drawings for use in recording information.

    a. See Section 013100 "Project Management and Coordination" for requirements related to use of Engineer's digital data files.
    b. Engineer will provide data file layer information. Record markups in separate layers.

C. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Record Prints: Organize record prints into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
2. Format: Annotated PDF electronic file.
3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
4. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Engineer and Owner’s Representative.
    e. Name of Contractor.

1.5 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. Note related Change Orders and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file or scanned PDF electronic file(s) of marked-up paper copy of Specifications.

1.6 RECORD PRODUCT DATA

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders and record Drawings where applicable.

C. Format: Submit record Product Data as annotated PDF electronic file or scanned PDF electronic file(s) of marked-up paper copy of Product Data.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

1.7 MAINTENANCE OF RECORD DOCUMENTS

A. Maintenance of Record Documents: Store record documents in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Engineer’s and Owner’s Representative for reference during normal working hours.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 017839

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Demolition and abandonment of sanitary sewers and manholes.

B. Related Requirements:

1. Section 011000 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 012639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
3. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements not part of selective demolition.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.

B. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor to be properly disposed of at no additional cost to Owner.

1.5 INFORMATIONAL SUBMITTALS

A. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, and for dust control. Indicate proposed locations and construction of barriers.

B. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's and adjacent property owner’s on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.

1.6 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.7 FIELD CONDITIONS

A. Property owners will occupy portions of buildings immediately adjacent to selective demolition area. Conduct selective demolition so property owner’s operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Engineer of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. If suspected hazardous materials are encountered, do not disturb; immediately notify Engineer and Owner’s Representative. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

1.8 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Steel Tendons: Locate tensioned steel tendons and include recommendations for de-tensioning.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utility services and mechanical/electrical systems serving areas to be selectively demolished.

1. Contractor shall arrange to shut off indicated services/systems.
2. Arrange to shut off utilities with utility companies.
3. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems.

3.3 PROTECTION

A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area.

B. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

C. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
3. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
4. Dispose of demolished items and materials promptly.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Engineer, items may be removed to a suitable, protected storage location during selective demolition and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

B. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn demolished materials.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.8 SELECTIVE DEMOLITION SCHEDULE

A. Remove: Removal as indicated on Drawings including existing structures and utilities such as sewer, water, gas, electric; and existing pavements and bridge.

B. Existing to Remain: As indicated on Drawings including existing utilities and pavement.

3.9 DEMOLITION AND ABANDONMENT OF SANITARY SEWER SYSTEMS

A. Existing sewers and structures to be removed: Locations and requirements as indicated on Drawings.

B. Existing sewers and structures to be abandoned: Locations and requirements as indicated on Drawings.

END OF SECTION 024119

SECTION 033100 - ANTIMICROBIAL ADDITIVE FOR PRECAST AND CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes antimicrobial additive for all sanitary cast in place and precast concrete structures.

B. Related Requirements

1. Section 332000 – Sewer Facilities

1.3 SUBMITTALS

A. The liquid antimicrobial additive shall be an EPA registered material and the registration number shall be submitted for approval prior to use in the project.

1.4 QUALITY ASSURANCE

A. The antimicrobial additive shall be used by factory certified precast concrete plants, ready-mix plants, and contractors.

B. Testing Agency Qualifications: An independent bacteriological laboratory experienced in testing for the presence of the antimicrobial additive using ASTM D4783, Standard Test Methods for Resistance of Adhesive Preparations in Container to Attack by Bacteria, Yeast, and Fungi.

1.5 REQUIRED LOCATIONS

A. Antimicrobial additive shall be included in all sanitary precast and cast-in-place structures.

PART 2 – PRODUCTS

2.1 MATERIALS

A. The antimicrobial additive ConmicShield® as manufactured by ConShield Technologies, Inc. of Atlanta, Georgia; ConBlock MIC as manufactured by ConSeal Concrete Sealants, Inc. of New Carlisle, Ohio; or Engineer approved

equal shall be used to render the concrete uninhabitable for bacteria growth for all concrete pipe on this Project.

B. The amount to be used shall be 1 gallon per cubic yard of concrete, or a higher amount if recommended by the manufacturer of the antimicrobial additive. This amount shall be added in the total water content of the concrete mix design. The additive shall be added into the concrete mix water to insure even distribution of the additive throughout the concrete mixture. The mixing time is a minimum of seven minutes.

C. The liquid antibacterial additive shall be an EPA registered material and the registration number shall be submitted for approval prior to use in the project.

D. The additive shall be added into the concrete mix water to insure even distribution of the additive throughout the concrete mixture.

E. The ready-mix supplier shall submit a letter of certification to the project owner stating that the correct amount and correct mixing procedure were followed for all antimicrobial concrete.

F. Acceptance shall be a letter of certification from the precaster or concrete provider to the Engineer stating that the correct amount and correct mixing procedure was followed for all antimicrobial concrete.

PART 3 – EXECUTION

3.2 PREPARATION

A. The ready-mix supplier shall retain two cured samples per batch of concrete made with antimicrobial additive. The samples must have a minimum dimension of two square inches and be uniform. The specimens shall be placed in plastic baggies and clearly labeled with the date, batch number, pipe or manhole dimension and specific project.

B. One set of samples shall be retained by the precast producer or ready-mix supplier, or contractor until project closeout. The second sample shall be delivered to Owner or Owner's Representative along with delivery receipt stating amount of antimicrobial additive received with the project name and date clearly marked on receipt.

1. At Owner's option, one or more random samples may be sent to an independent testing lab for testing according to ASTM D4783 for the presence of Antimicrobial additive.

2. If reports show negative presence of Antimicrobial, at the discretion of Owner, the structure shall be removed and replaced at no addition cost to the Owner.

3.3 INSTALLATION

A. Each piece of pipe shall be plainly stenciled with the name of the antimicrobial additive on the interior and exterior.

B. Field repairs to the cast-in place concrete shall be made using ConmicShield® Joint Set Grout pre-portioned and factory packaged that requires the addition of no other components. This repair grout may be used for filling joints, lift holes, damaged areas, benches and similar.

END OF SECTION 033100

SECTION 042420 - PRECAST MODULAR BLOCK RETAINING WALL

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes furnishing all materials and labor required for the design and construction of a precast concrete modular block (PMB) retaining wall with or without geosynthetic reinforcement. Precast modular block retaining wall blocks under this section shall be cast utilizing a wet-cast concrete mix and exhibit a final handling weight in excess of 1,000 pounds (450 kg) per unit.

B. Scope of Work: The work shall consist of furnishing materials, labor, equipment and supervision for the construction of a precast modular block (PMB) retaining wall structure in accordance with the requirements of this section and in acceptable conformity with the lines, grades, design and dimensions shown in the project site plans.

1.2 REFERENCES

A. Where the specification and reference documents conflict, the Owner's designated representative will make the final determination of the applicable document.

B. Definitions:

1. Precast Modular Block (PMB) Unit – machine-placed, "wet cast" concrete modular block retaining wall facing unit.
2. Geotextile – a geosynthetic fabric manufactured for use as a separation and filtration medium between dissimilar soil materials.
3. Geogrid – a geosynthetic material comprised of a regular network of tensile elements manufactured in a mesh-like configuration of consistent aperture openings. When connected to the PMB facing units and placed in horizontal layers in compacted fill, the geogrid prevents lateral deformation of the retaining wall face and provides effective tensile reinforcement to the contiguous reinforced fill material.
4. Drainage Aggregate – clean, crushed stone placed within and immediately behind the precast modular block units to facilitate drainage and reduce compaction requirements immediately adjacent to and behind the precast modular block units.
5. Unit Core Fill – clean, crushed stone placed within the hollow vertical core of a precast modular block unit. Typically, the same material used for drainage aggregate as defined above.
6. Foundation Zone – soil zone immediately beneath the leveling pad and the reinforced zone.
7. Retained Zone – soil zone immediately behind the drainage aggregate and wall infill for wall sections designed as modular gravity structures. Alternatively, in the case of wall sections designed with geosynthetic soil reinforcement, the retained zone is the soil zone immediately behind the reinforced zone.
8. Reinforced Zone – structural fill zone within which successive horizontal layers of geogrid soil reinforcement have been placed to provide stability for the retaining wall face. The reinforced zone exists only for retaining wall sections that utilize geosynthetic soil reinforcement for stability.
9. Reinforced Fill – structural fill placed within the reinforced zone.

10. Leveling Pad – hard, flat surface upon which the bottom course of precast modular blocks are placed. The leveling pad may be constructed with crushed stone or cast-in-place concrete. A leveling pad is not a structural footing.
11. Wall Infill – the fill material placed and compacted between the drainage aggregate and the excavated soil face in retaining wall sections designed as modular gravity structures.

C. Reference Standards

1. Design
   a. AASHTO LRFD Bridge Design Specifications, 7th Edition, 2014.
   b. Minimum Design Loads for Buildings and Other Structures – ASCE/SEI 7-10.
   c. International Building Code, 2012 Edition.
   d. FHWA-NHI-10-024 Volume I and GEC 11 Design of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes.
   e. FHWA-NHI-10-025 Volume II and GEC 11 Design of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes.
2. Precast Modular Block Units
   a. ACI 201 – Guide to Durable Concrete
   b. ACI 318 – Building Code Requirements for Structural Concrete
   c. ASTM C33 – Standard Specification for Concrete Aggregates
   d. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
   e. ASTM C94 – Standard Specification for Ready-Mixed Concrete.
   f. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   g. ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete.
   h. ASTM C150 – Standard Specification for Portland Cement
   i. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
   j. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.
   k. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.
   l. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
   m. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
   n. ASTM C666 – Standard Test Method for Concrete Resistance to Rapid Freezing and Thawing.
   o. ASTM C845 - Standard Specification for Expansive Hydraulic Cement.
   p. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
   q. ASTM C989 - Standard Specification for Slag Cement for Use in Concrete and Mortars.
   r. ASTM C1116 – Standard Specification for Fiber-Reinforced Concrete.
   s. ASTM C1157 - Standard Performance Specification for Hydraulic Cement.
   t. ASTM C1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
   u. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
   v. ASTM C1611 – Standard Test Method for Slump Flow of Self-Consolidating Concrete.

w. ASTM C1776 – Standard Specification for Wet-Cast Precast Modular Retaining Wall Units.
x. ASTM D6638 – Standard Test Method for Determining Connection Strength Between Geosynthetic Reinforcement and Segmental Concrete Units (Modular Concrete Blocks).
y. ASTM D6916 – Standard Test Method for Determining Shear Strength Between Segmental Concrete Units (Modular Concrete Blocks).

3. Geosynthetics
a. AASHTO M 288 – Geotextile Specification for Highway Applications.
b. ASTM D3786 – Standard Test Method for Bursting Strength of Textile Fabrics Diaphragm Bursting Strength Tester Method.
c. ASTM D4354 – Standard Practice for Sampling of Geosynthetics for Testing.
d. ASTM D4355 – Standard Test Method for Deterioration of Geotextiles
e. ASTM D4491 – Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
f. ASTM D4533 – Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
g. ASTM D4595 – Standard Test Method for Tensile Properties of Geotextiles by the Wide- Width Strip Method.
h. ASTM D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
i. ASTM D4751 – Standard Test Method for Determining Apparent Opening Size of a Geotextile.
j. ASTM D4759 – Standard Practice for Determining Specification Conformance of Geosynthetics.
k. ASTM D4833 – Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
l. ASTM D4873 – Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.
m. ASTM D5262 – Standard Test Method for Evaluating the Unconfined Tension Creep and Creep Rupture Behavior of Geosynthetics.
n. ASTM D5321 – Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method.
o. ASTM D5818 – Standard Practice for Exposure and Retrieval of Samples to Evaluate Installation Damage of Geosynthetics.
p. ASTM D6241 – Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.
q. ASTM D6637 – Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method.
r. ASTM D6706 – Standard Test Method for Measuring Geosynthetic Pullout Resistance in Soil.
s. ASTM D6992 – Standard Test Method for Accelerated Tensile Creep and Creep-Rupture of Geosynthetic Materials Based on Time-Temperature Superposition Using the Stepped Isothermal Method.

4. Soils
    a. AASHTO M 145 – AASHTO Soil Classification System.
    b. AASHTO T 104 – Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.
    c. AASHTO T 267 – Standard Method of Test for Determination of Organic Content in Soils by Loss of Ignition.
    d. ASTM C33 – Standard Specification for Concrete Aggregates.
    e. ASTM D422 – Standard Test Method for Particle-Size Analysis of Soils.
    f. ASTM D448 – Standard Classification for Sizes of Aggregates for Road and Bridge Construction.
    g. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. (12,400 ft-lbf/ft (2,700 kN-m/m)).
    h. ASTM D1241 – Standard Specification for Materials for Soil-Aggregate Subbase, Base and Surface Courses.
    i. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
    j. ASTM D1557 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort. (56,000 ft-lbf/ft (2,700 kN-m/m)).
    k. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
    l. ASTM D2488 – Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
    m. ASTM D3080 – Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions.
    n. ASTM D4254 – Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
    o. ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
    p. ASTM D4767- Test Method for Consolidated-Undrained Triaxial Compression Test for Cohesive Soils.
    q. ASTM D4972 – Standard Test Method for pH of Soils.
    r. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Aggregate by Nuclear Methods (Shallow Depth).
    s. ASTM G51 – Standard Test Method for Measuring pH of Soil for Use in Corrosion Testing.
    t. ASTM G57 – Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method.
5. Drainage Pipe
    a. ASTM D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
    b. ASTM F2648 – Standard Specification for 2 to 60 inch [50 to 1500 mm] Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Preconstruction Meeting. As directed by the Owner, the General Contractor shall schedule a preconstruction meeting at the project site prior to commencement of retaining wall construction. Participation in the preconstruction meeting shall be required of the General Contractor, Retaining Wall Design Engineer, Retaining Wall Installation Contractor, Grading Contractor and Inspection Engineer. The General Contractor shall provide notification to all parties at least 10 calendar days prior to the meeting.

1. Preconstruction Meeting Agenda:
    a. The Retaining Wall Design Engineer shall explain all aspects of the retaining wall construction drawings.
    b. The Retaining Wall Design Engineer shall explain the required bearing capacity of soil below the retaining wall structure and the shear strength of in-situ soils assumed in the retaining wall design to the Inspection Engineer.
    c. The Retaining Wall Design Engineer shall explain the required shear strength of fill soil in the reinforced, retained and foundation zones of the retaining wall to the Inspection Engineer.
    d. The Retaining Wall Design Engineer shall explain any measures required for coordination of the installation of utilities or other obstructions in the reinforced or retained fill zones of the retaining wall.
    e. The Retaining Wall Installation Contractor shall explain all excavation needs, site access and material staging area requirements to the General Contractor and Grading Contractor.

1.4 SUBMITTALS

A. Product Data. At least 14 days prior to construction, the General Contractor shall submit a minimum of six (6) copies of the retaining wall product submittal package to the Owner's Representative for review and approval. The submittal package shall include technical specifications and product data from the manufacturer for the following:

1. Precast Modular Block System brochure
2. Precast Modular Block concrete test results specified in paragraph 2.1, subparagraph B of this section as follows:
    a. 28-day compressive strength
    b. Air content
    c. Slump or Slump Flow (as applicable)
3. Drainage Pipe
4. Geotextile
5. Geosynthetic Soil Reinforcement (if required by the retaining wall design). The contractor shall provide certified manufacturer test reports for the geosynthetic soil reinforcement material in the manufactured roll width specified. The test report shall list the individual roll numbers for which the certified material properties are valid.

B. Samples. Provide adequate number of samples required for texture and color selection.

C. Installer Qualification Data. At least 14 days prior to construction, the General Contractor shall submit the qualifications of the business entity responsible for installation of the retaining wall, the Retaining Wall Installation Contractor, per paragraph 1.6, subparagraph A of this section.

D. Retaining Wall Design Calculations and Construction Shop Drawings. At least 14 days prior to construction, the General Contractor shall furnish six (6) sets of construction shop drawings and six (6) copies of the supporting structural calculations report to the Owner for review and approval. This submittal shall include the following:
   1. Signed, sealed and dated drawings and engineering calculations prepared in accordance with these specifications.
   2. Qualifications Statement of Experience of the Retaining Wall Design Engineer as specified in paragraph 1.7, subparagraph B of this section.
   3. Certificate of Insurance of the Retaining Wall Design Engineer as specified in paragraph 1.6, subparagraph B of this section.

1.5 CONSTRUCTION SHOP DRAWING

A. Shop drawings that shall include all details, dimensions, quantities, ground profiles, and cross-sections necessary to construct the precast modular block retaining wall. This includes but is not limited to block type, location of geotextiles, backfill and foundation materials, allowable bearing pressures and drainage features. The Contractor shall verify the limits of the wall and ground survey data before preparing the shop drawings. The working drawings shall be prepared to the Owner's standards. The Owner's Engineer will approve or reject the Contractor's submittals within 14 calendar days of the receipt of the complete submission. Approval of the Construction Plans does not relieve the Contractor of his responsibility for the successful completion of the work. The Contractor shall not begin construction or incorporate materials into the work until the submittal requirements are satisfied and found acceptable to the Owner's Engineer.

B. The shop set of drawings should be signed and sealed by an Engineer Licensed to practice in the State of Missouri. A copy of any calculations used for development of the shop drawings should also be submitted with the drawings.

C. The contractor shall provide scaled photographs or block sample to the owner for approval prior to production.

1.6 QUALITY ASSURANCE

A. Retaining Wall Installation Contractor Qualifications. In order to demonstrate basic competence in the construction of precast modular block walls, the Retaining Wall Installation Contractor shall document compliance with the following:

   1. Experience.
      a. Construction experience with a minimum of 30,000 square feet (2,800 square meters) of the proposed precast modular block retaining wall system.
      b. Construction of at least ten (10) precast modular block (large block) retaining wall structures within the past three (3) years.
      c. Construction of at least 50,000 square feet (4,650 square meters) of precast modular block (large block) retaining walls within the past three (3) years.
   2. Retaining Wall Installation Contractor experience documentation for each qualifying project shall include:

a. Project name and location
b. Date (month and year) of construction completion
c. Contact information of Owner or General Contractor
d. Type (trade name) of precast modular block system built
e. Maximum height of the wall constructed
f. Face area of the wall constructed

3. In lieu of the requirements set forth in items 1 and 2 above, the Retaining Wall Installation Contractor must be a certified Precast Modular Block Retaining Wall Installation Contractor as demonstrated by satisfactory completion of a certified precast modular block retaining wall installation training program administered by the precast modular block manufacturer.

B. The Owner reserves the right to reject the design services of any engineer or engineering firm who, in the sole opinion of the Owner, does not possess the requisite experience or qualifications.

1.7 QUALITY CONTROL

A. The Owner's Representative shall review all submittals for materials, design, Retaining Wall Design Engineer qualifications and the Retaining Wall Installation Contractor qualifications.

B. The City shall retain the services of an Inspection Engineer who is experienced with the construction of precast modular block retaining wall structures to perform inspection and testing. The cost of inspection shall be the responsibility of the City. Inspection shall be continuous throughout the construction of the retaining walls.

C. The Inspection Engineer shall perform the following duties:

1. Inspect the construction of the precast modular block structure for conformance with construction shop drawings and the requirements of this specification.
2. Verify that soil or aggregate fill placed and compacted in the reinforced, retained and foundation zones of the retaining wall conforms with paragraphs 2.4 and 2.5 of this section and exhibits the shear strength parameters specified by the Retaining Wall Design Engineer.
3. Verify that the shear strength of the in-situ soil assumed by the Retaining Wall Design Engineer is appropriate.
4. Inspect and document soil compaction in accordance with these specifications:
   a. Required dry unit weight
   b. Actual dry unit weight
   c. Allowable moisture content
   d. Actual moisture content
   e. Pass/fail assessment
   f. Test location – wall station number
   g. Test elevation
   h. Distance of test location behind the wall face
5. Verify that all excavated slopes in the vicinity of the retaining wall are bench-cut as directed by the project Geotechnical Engineer.
6. Notify the Retaining Wall Installation Contractor of any deficiencies in the retaining wall construction and provide the Retaining Wall Installation Contractor a reasonable opportunity to correct the deficiency.

7. Notify the General Contractor, Owner and Retaining Wall Design Engineer of any construction deficiencies that have not been corrected timely.
8. Document all inspection results.
9. Test compacted density and moisture content of the retained backfill with the following frequency:
    a. At least once every 1,000 square feet (in plan) per 9-inch (vertical lift, and
    b. At least once per every 18 inches of vertical wall construction.

D. The General Contractor's engagement of the Inspection Engineer does not relieve the Retaining Wall Installation Contractor of responsibility to construct the proposed retaining wall in accordance with the approved construction shop drawings and these specifications.

E. The Retaining Wall Installation Contractor shall inspect the on-site grades and excavations prior to construction and notify the Retaining Wall Design Engineer and General Contractor if on-site conditions differ from the elevations and grading conditions depicted in the retaining wall construction shop drawings.

1.8 DELIVERY, STORAGE AND HANDLING

A. The Retaining Wall Installation Contractor shall inspect the materials upon delivery to ensure that the proper type, grade and color of materials have been delivered.

B. The Retaining Wall Installation Contractor shall store and handle all materials in accordance with the manufacturer's recommendations as specified herein and in a manner that prevents deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, UV exposure or other causes. Damaged materials shall not be incorporated into the work.

C. Geosynthetics
1. All geosynthetic materials shall be handled in accordance with ASTM D4873. The materials should be stored off the ground and protected from precipitation, sunlight, dirt and physical damage.

D. Precast Modular Blocks
1. Precast modular blocks shall be stored in an area with positive drainage away from the blocks. Be careful to protect the block from mud and excessive chipping and breakage. Precast modular blocks shall not be stacked more than three (3) units high in the storage area.

E. Drainage Aggregate and Backfill Stockpiles
1. Drainage aggregate or backfill material shall not be piled over unstable slopes or areas of the project site with buried utilities.
2. Drainage aggregate and/or reinforced fill material shall not be staged where it may become mixed with or contaminated by poor draining fine-grained soils such as clay or silt.

PART 2 – MATERIALS

2.1 PRECAST MODULAR BLOCK RETAINING WALL UNITS

A. All units shall be wet-cast precast modular retaining wall units conforming to ASTM C1776.

B. All units for the project shall be obtained from the same manufacturer. The manufacturer shall be licensed and authorized to produce the retaining wall units by the precast modular block system patent holder/licensor and shall document compliance with the published quality control standards of the proprietary precast modular block system licensor for the previous three (3) years or the total time the manufacturer has been licensed, whichever is less.

C. Concrete used in the production of the precast modular block units shall be first-purpose, fresh concrete. It shall not consist of returned, reconstituted, surplus or waste concrete. It shall be an original production mix meeting the requirements of ASTM C94 and exhibit the properties as shown in the following table:

Concrete Mix Properties

Freeze Thaw Exposure Class(1)	**Minimum 28-Day Compressive Strength(2)**	**Maximum Water Cement Ratio**	**Nominal Maximum Aggregate Size**	**Aggregate Class Designation(3)**	**Air Content(4)**
Moderate	4,000 psi	0.45	1 inch (25 mm)	3M	4.5% +/- 1.5%
Severe	4,000 psi	0.45	1 inch (25 mm)	3S	6.0% +/- 1.5%
Very Severe	4,500 psi	0.40	1 inch (25 mm)	4S	6.0% +/- 1.5%
Maximum Water-Soluble Chloride Ion (Cl^-) Content in Concrete, Percent by Weight of Cement(5,6)					0.15
Maximum Chloride as Cl^- Concentration in Mixing Water, Parts Per Million					1000
Maximum Percentage of Total Cementitious Materials By Weight (7,9) (Very Severe Exposure Class Only):					
Fly Ash or Other Pozzolans Conforming to ASTM C618					25
Slag Conforming to ASTM C989					50
Silica Fume Conforming to ASTM C1240					10
Total of Fly Ash or Other Pozzolans, Slag, and Silica Fume(8)					50
Total of Fly Ash or Other Pozzolans and Silica Fume(8)					35
Alkali-Aggregate Reactivity Mitigation per ACI 201					
Slump (Conventional Concrete) per ASTM C143(10)			5 inches +/- 1½ inches (125 mm +/- 40 mm)		
Slump Flow (Self-Consolidating Concrete) per ASTM C1611			18 inches – 32 inches (450 mm – 800 mm)		

(1)Exposure class is as described in ACI 318. “Moderate” describes concrete that is exposed to freezing and thawing cycles and occasional exposure to moisture. “Severe” describes concrete that is exposed to freezing and thawing cycles and in continuous contact with moisture. “Very Severe” describes concrete that is exposed to freezing and thawing cycles and in continuous contact with moisture and exposed to deicing chemicals. Exposure class should be specified by owner/purchaser prior to order placement.

(2)Test method ASTM C39.

(3)Defined in ASTM C33 Table 3 *Limits for Deleterious Substances and Physical Property Requirements of Coarse Aggregates for Concrete*.

(4)Test method ASTM C231.

(5)Test method ASTM C1218 at age between 28 and 42 days.

(6)Where used in high sulfate environments or where alkali-silica reactivity is an issue, water soluble chloride shall be limited to no more than trace amounts (from impurities in concrete-making components, not intended constituents.)

(7)The total cementitious material also includes ASTM C150, C595, C845, C1157 cement. The maximum percentages shall include:

(a) Fly ash or other pozzolans in type IP, blended cement, ASTM C595, or ASTM C1157.

(b) Slag used in the manufacture of an IS blended cement, ASTM C595, or ASTM C1157.

(c) Silica fume, ASTM C1240, present in a blended cement.

(8)Fly ash or other pozzolans and silica fume shall constitute no more than 25 and 10 percent, respectively, of the total weight of the cementitious materials.

(9)Prescriptive limits shown may be waived for concrete mixes that demonstrate excellent freeze/thaw durability in a detailed and current testing program.

(10)Slump may be increased by a high-range water-reducing admixture.

D. Each concrete block shall be cast in a single continuous pour without cold joints. With the exception of half-block units, corner units and other special application units, the precast modular block units shall conform to the nominal dimensions listed in the table below and be produced to the dimensional tolerances shown.

Block Type	Dimension	Nominal Value	Tolerance
28” Block	Height	18”	+/- 3/16”
	Length	46-1/8”	+/- 1/2”
	Width*	28”	+/- 1/2”
41” Block	Height	18”	+/- 3/16”
	Length	46-1/8”	+/- 1/2”
	Width*	40-1/2”	+/- 1/2”
60” Block	Height	18”	+/- 3/16”
	Length	46-1/8”	+/- 1/2”
	Width*	60”	+/- 1/2”

* Block tolerance measurements shall exclude variable face texture

E. Individual block units shall have a nominal height of 18 inches.

F. With the exception of half-block units, corner units and other special application units, the precast modular block units shall have two (2) circular dome shear knobs that are 10 inches , 7.5 inches, or 6.75 inches in diameter and 4 inches) or 2 inches (51 mm) in height. The shear knobs shall fully index into a continuous semi-cylindrical shear channel in the bottom of the block course above. The Peak interlock shear between any two (2) vertically stacked precast modular block units, with 10-inch diameter shear knobs, measured in accordance with ASTM D6916 shall exceed 6,500 lb/ft at a minimum normal load of 500 lb/ft . as well as an ultimate peak interface shear capacity in excess of 11,000 lb/ft . The peak interlock shear between any two (2) vertically stacked precast modular block units, with 7.5 inch (190 mm) or 6.75 inch diameter shear knobs, measured in accordance with ASTM D6916 shall exceed 1,850 lb/ft at a minimum normal load of 500 lb/ft as well as an ultimate peak interface shear capacity in excess of 10,000 lb/ft .Test specimen blocks tested under ASTM D6916 shall be actual, full-scale production blocks of known compressive strength. The interface shear capacity reported shall be corrected for a 4,000 psi

concrete compressive strength. Regardless of precast modular block configuration, interface shear testing shall be completed without the inclusion of unit core infill aggregate.

G. Without field cutting or special modification, the precast modular block units shall be capable of achieving a minimum radius of 14 ft 6 in .

H. The precast modular block units shall be manufactured with an integrally cast shear knobs that establishes a standard horizontal set-back for subsequent block courses. The precast modular block system shall be available in the four (4) standard horizontal set-back facing batter options listed below:

Max Facing Batter	Horizontal Set-Back/Blk. Course
3/8”	1.2°
1-5/8”	5.2°
9-3/8”	27.5°
16-5/8”	42.7°

1. The precast modular block units shall be furnished with the required shear knobs that provide the facing batter required in the construction shop drawings.

I. The precast modular block unit face texture shall be selected by the owner from the available range of textures available from the precast modular block manufacturer. Each textured block facing unit shall be a minimum of 5.76 square feet with a unique texture pattern that repeats with a maximum frequency of once in any 15 square feet of wall face.

J. The block color shall be selected by the owner from the available range of colors available from the precast modular block manufacturer.

K. All precast modular block units shall be sound and free of cracks or other defects that would interfere with the proper installation of the unit, impair the strength or performance of the constructed wall. PMB units to be used in exposed wall construction shall not exhibit chips or cracks in the exposed face or faces of the unit that are not otherwise permitted. Chips smaller than 1.5” in its largest dimension and cracks not wider than 0.012” and not longer than 25% of the nominal height of the PMB unit shall be permitted. PMB units with bug holes in the exposed architectural face smaller than 0.75” (19 mm) in its largest dimension shall be permitted. Bug holes, water marks, and color variation on non-architectural faces are acceptable. PMB units that exhibit cracks that are continuous through any solid element of the PMB unit shall not be incorporated in the work regardless of the width or length of the crack.

L. Preapproved Manufacturers.
1. Manufacturers of Redi-Rock Retaining Wall Systems as licensed by Redi-Rock International, LLC, 05481 US 31 South, Charlevoix, MI 49720 USA; telephone (866) 222-8400; website www.redi- rock.com.

M. Substitutions. Technical information demonstrating conformance with the requirements of this specification for an alternative precast modular block retaining wall system must be submitted for preapproval at least 14 calendar days prior to the bid date. Acceptable alternative PMB retaining wall systems, otherwise found to be in conformance with this specification, shall be approved in writing by the owner 7 days prior to the bid date. The Owner’s Representative reserves the right

to provide no response to submissions made out of the time requirements of this section or to submissions of block retaining wall systems that are determined to be unacceptable to the owner.

N. Value Engineering Alternatives. The owner may evaluate and accept systems that meet the requirements of this specification after the bid date that provide a minimum cost savings of 20% to the Owner. Construction expediency will not be considered as a contributing portion of the cost savings total.

2.2 GEOTEXTILE

A. Nonwoven geotextile fabric shall be placed as indicated on the retaining wall construction shop drawings. Additionally, the nonwoven geotextile fabric shall be placed in the v-shaped joint between adjacent block units on the same course. The nonwoven geotextile fabric shall meet the requirements Class 3 construction survivability in accordance with AASHTO M 288.

B. Preapproved Nonwoven Geotextile Products

1. Mirafi 140N
2. Propex Geotex 451
3. Carthage Mills FX-40HS

2.3 DRAINAGE AGGREGATE AND WALL INFILL

A. Drainage aggregate shall be a durable crushed stone conforming to No. 57 size per ASTM C33 with the following particle-size distribution requirements per ASTM D422:

U.S. Standard Sieve Size	% Passing
1-½" (38 mm)	100
1" (25 mm)	95-100
½" (13 mm)	25-60
No. 4 (4.76 mm)	0-10
No. 8 (2.38 mm)	0-5

2.4 BACKFILL

A. Material used as reinforced backfill material in the reinforced zone (if applicable) shall be a granular fill material meeting the requirements of USCS soil type GW, GP, SW or SP per ASTM D2487 or alternatively by AASHTO Group Classification A-1-a or A-3 per AASHTO M 145. The backfill shall exhibit a minimum effective internal angle of friction, ϕ = 34 degrees at a maximum 2% shear strain and meet the following particle-size distribution requirements per ASTM D422.

U.S. Standard Sieve Size	% Passing
3/4" (19 mm)	100
No. 4 (4.76 mm)	0-100
No. 40 (0.42 mm)	0-60
No. 200 (0.07 mm)	0-15

B. The reinforced backfill material shall be free of sod, peat, roots or other organic or deleterious matter including, but not limited to, ice, snow or frozen soils. Materials passing the No. 40 (0.42 mm) sieve shall have a liquid limit less than 25 and plasticity index less than 6 per ASTM D4318. Organic content in the backfill material shall be less than 1% per AASHTO T-267 and

the pH of the backfill material shall be between 5 and 8.

C. Soundness. The reinforced backfill material shall exhibit a magnesium sulfate soundness loss of less than 30% after four (4) cycles, or sodium sulfate soundness loss of less than 15% after five (5) cycles as measured in accordance with AASHTO T-104.

D. Reinforced backfill shall not be comprised of crushed or recycled concrete, recycled asphalt, bottom ash, shale or any other material that may degrade, creep or experience a loss in shear strength or a change in pH over time.

2.5 LEVELING PAD

A. The precast modular block units shall be placed on a leveling pad constructed from crushed stone. The leveling pad shall be constructed to the dimensions and limits shown on the retaining wall design drawings prepared by the Retaining Wall Design Engineer.

B. Crushed stone used for construction of a granular leveling pad shall meet the requirements of the drainage aggregate and wall infill in section 2.4 or a preapproved alternate material.

2.6 DRAINAGE

A. Drainage Pipe

1. Drainage collection pipe shall be a 4”) diameter, 3-hole perforated, HDPE pipe with a minimum pipe stiffness of 22 psi per ASTM D2412.
2. The drainage pipe shall be manufactured in accordance with ASTM D1248 for HDPE pipe and fittings.

B. Preapproved Drainage Pipe Products

1. ADS 3000 Triple Wall pipe as manufactured by Advanced Drainage Systems.

PART 3 – EXECUTION

3.1 GENERAL

A. All work shall be performed in accordance with OSHA safety standards, state and local building codes and manufacturer’s requirements.

B. The General Contractor is responsible for the location and protection of all existing underground utilities. Any new utilities proposed for installation in the vicinity of the retaining wall, shall be installed concurrent with retaining wall construction. The General Contractor shall coordinate the work of subcontractors affected by this requirement.

C. New utilities installed below the retaining wall shall be backfilled and compacted to a minimum of 98% maximum dry density per ASTM D698 standard proctor.

D. The General Contractor is responsible to ensure that safe excavations and embankments are maintained throughout the course of the project.

E. All work shall be inspected by the Inspection Engineer as directed by the Owner.

3.2 EXAMINATION

A. Prior to construction, the General Contractor, Grading Contractor, Retaining Wall Installation Contractor and Inspection Engineer shall examine the areas in which the retaining wall will be constructed to evaluate compliance with the requirements for installation tolerances, worker safety and any site conditions affecting performance of the completed structure. Installation shall proceed only after unsatisfactory conditions have been corrected.

3.3 PREPARATION

A. Fill Soil.
   1. The Inspection Engineer shall verify that reinforced backfill placed in the reinforced soil zone satisfies the criteria of this section.
   2. The Inspection Engineer shall verify that any fill soil installed in the foundation and retained soil zones of the retaining wall satisfies the specification of the Retaining Wall Design Engineer as shown on the construction drawings.

B. Excavation.
   1. The Grading Contractor shall excavate to the lines and grades required for construction of the precast modular block retaining wall as shown on the construction drawings. The Grading Contractor shall minimize over-excavation. Excavation support, if required, shall be the responsibility of the Grading Contractor.
   2. Over-excavated soil shall be replaced with compacted fill in conformance with the specifications of the Retaining Wall Design Engineer and “Division 31, Section 31 20 00 – Earthmoving” of these project specifications.
   3. Embankment excavations shall be bench cut as directed by the project Geotechnical Engineer and inspected by the Inspection Engineer for compliance.

C. Foundation Preparation.
   1. Prior to construction of the precast modular block retaining wall, the leveling pad area and undercut zone (if applicable) shall be cleared and grubbed. All topsoil, brush, frozen soil and organic material shall be removed. Additional foundation soils found to be unsatisfactory beyond the specified undercut limits shall be undercut and replaced with approved fill as directed by the project Geotechnical Engineer. The Inspection Engineer shall ensure that the undercut limits are consistent with the requirements of the project Geotechnical Engineer and that all soil fill material is properly compacted according project specifications. The Inspection Engineer shall document the volume of undercut and replacement.
   2. Following excavation for the leveling pad and undercut zone (if applicable), the Inspection Engineer shall evaluate the in-situ soil in the foundation and retained soil zones.
      a. The Inspection Engineer shall verify that the shear strength of the in-situ soil assumed by the Retaining Wall Design Engineer is appropriate. The Inspection

Engineer shall immediately stop work and notify the Owner if the in-situ shear strength is found to be inconsistent with the retaining wall design assumptions.

b. The Inspection Engineer shall verify that the foundation soil exhibits sufficient ultimate bearing capacity to satisfy the requirements indicated on the retaining wall construction shop drawings.

D. Leveling Pad.

1. The leveling pad shall be constructed to provide a level, hard surface on which to place the first course of precast modular block units. The leveling pad shall be placed in the dimensions shown on the retaining wall construction drawings and extend to the limits indicated.
2. Crushed Stone Leveling Pad. Crushed stone shall be placed in uniform maximum lifts of 6” (150 mm). The crushed stone shall be compacted by a minimum of 3 passes of a vibratory compactor capable of exerting 2,000 lb of centrifugal force and to the satisfaction of the Inspection Engineer.

3.4 PRECAST MODULAR BLOCK WALL SYSTEM INSTALLATION

A. The precast modular block structure shall be constructed in accordance with the construction drawings, these specifications and the recommendations of the retaining wall system component manufacturers. Where conflicts exist between the manufacturer’s recommendations and these specifications, these specifications shall prevail.

B. Drainage components. Pipe, geotextile and drainage aggregate shall be installed as shown on the construction shop drawings.

C. Precast Modular Block Installation

1. The first course of block units shall be placed with the front face edges tightly abutted together on the prepared leveling pad at the locations and elevations shown on the construction drawings. The Retaining Wall Installation Contractor shall take special care to ensure that the bottom course of block units are in full contact with the leveling pad, are set level and true and are properly aligned according to the locations shown on the construction drawings.
2. Backfill shall be placed in front of the bottom course of blocks prior to placement of subsequent block courses. Nonwoven geotextile fabric shall be placed in the V-shaped joints between adjacent blocks. Drainage aggregate shall be placed in the V-shaped joints between adjacent blocks to a minimum distance of 12” behind the block unit.
3. Drainage aggregate shall be placed in 9-inch maximum lifts and compacted by a minimum of three (3) passes of a vibratory plate compactor capable exerting a minimum of 2,000 lb of centrifugal force.
4. Unit core fill shall be placed in the precast modular block unit vertical core slot. The core fill shall completely fill the slot to the level of the top of the block unit. The top of the block unit shall be broom-cleaned prior to placement of subsequent block courses. No

additional courses of precast modular blocks may be stacked before the unit core fill is installed in the blocks on the course below.

5. Base course blocks for gravity wall designs (without geosynthetic soil reinforcement) may be furnished without vertical core slots. If so, disregard item 4 above, for the base course blocks in this application.
6. Nonwoven geotextile fabric shall be placed between the drainage aggregate and the retained soil (gravity wall design) or between the drainage aggregate and the reinforced fill (reinforced wall design) as required on the retaining wall construction drawings.
7. Subsequent courses of block units shall be installed with a running bond (half block horizontal course-to-course offset). With the exception of 90-degree corner units, the shear channel of the upper block shall be fully engaged with the shear knobs of the block course below. The upper block course shall be pushed forward to fully engage the interface shear key between the blocks and to ensure consistent face batter and wall alignment. Geogrid, drainage aggregate, unit core fill, geotextile and properly compacted backfill shall be complete and in-place for each course of block units before the next course of blocks is stacked.
8. The elevation of retained soil fill shall not be less than 1 block course (18”) below the elevation of the reinforced backfill throughout the construction of the retaining wall.
9. If included as part of the precast modular block wall design, cap units shall be secured with an adhesive in accordance with the precast modular block manufacturer’s recommendation.

D. Construction Tolerance. Allowable construction tolerance of the retaining wall shall be as follows:

1. Deviation from the design batter and horizontal alignment, when measured along a 10’ straight wall section, shall not exceed 3/4” .
2. Deviation from the overall design batter shall not exceed 1/2“ per 10’ of wall height.
3. The maximum allowable offset (horizontal bulge) of the face in any precast modular block joint shall be 1/2” .
4. The base of the precast modular block wall excavation shall be within 2” of the staked elevations, unless otherwise approved by the Inspection Engineer.
5. Differential vertical settlement of the face shall not exceed 1’ along any 200’ of wall length.
6. The maximum allowable vertical displacement of the face in any precast modular block joint shall be 1/2“.
7. The wall face shall be placed within 2” of the horizontal location staked.

3.5 WALL INFILL AND REINFORCED BACKFILL PLACEMENT

A. Backfill material placed immediately behind the drainage aggregate shall be compacted as follows:

1. 98% of maximum dry density at ± 2% optimum moisture content per ASTM D698 standard proctor or 85% relative density per ASTM D4254.

B. Compactive effort within 3’ of the back of the precast modular blocks should be accomplished with walk-behind compactors. Compaction in this zone shall be within 95% of maximum dry density as measured in accordance with ASTM D698 standard proctor or 80% relative density per ASTM D 4254. Heavy equipment should not be operated within 3’ of the back of the precast modular blocks.

C. Backfill material shall be installed in lifts that do not exceed a compacted thickness of 9” .

D. At the end of each work day, the Retaining Wall Installation Contractor shall grade the surface of the last lift of the granular wall infill to a 3% ± 1% slope away from the precast modular block wall face and compact it.

E. The General Contractor shall direct the Grading Contractor to protect the precast modular block wall structure against surface water runoff at all times through the use of berms, diversion ditches, silt fence, temporary drains and/or any other necessary measures to prevent soil staining of the wall face, scour of the retaining wall foundation or erosion of the reinforced backfill or wall infill.

3.6 OBSTRUCTIONS IN THE INFILL AND BACKFILL ZONES

A. The Retaining Wall Installation Contractor shall make all required allowances for obstructions behind and through the wall face in accordance with the approved construction shop drawings.

B. Should unplanned obstructions become apparent for which the approved construction shop drawings do not account, the affected portion of the wall shall not be constructed until the Retaining Wall Design Engineer can appropriately address the required procedures for construction of the wall section in question.

3.7 COMPLETION

A. For walls supporting unpaved areas, a minimum of 12” of compacted, low-permeability fill shall be placed over the granular wall infill zone of the precast modular block retaining wall structure. The adjacent retained soil shall be graded to prevent ponding of water behind the completed retaining wall.

B. For retaining walls with crest slopes of 5H:1V or steeper, silt fence shall be installed along the wall crest immediately following construction. The silt fence shall be located 3’ to 4’ behind the uppermost precast modular block unit. The crest slope above the wall shall be immediately seeded to establish vegetation. The General Contractor shall ensure that the seeded slope receives adequate irrigation and erosion protection to support germination and growth.

C. The General Contractor shall confirm that the as-built precast modular block wall geometries conform to the requirements of this section. The General Contractor shall notify

the Owner of any deviations.

END OF SECTION 042420

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Protecting existing vegetation to remain.
2. Removing existing vegetation.
3. Clearing and grubbing.
4. Removing above- and below-grade site improvements.
5. Disconnecting, capping or sealing, removing site utilities, and abandoning site utilities in place.
6. Temporary erosion and sedimentation control.

B. Related Requirements:

1. Section 013300 “Submittal Procedures”

2. Section 015000 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.

3. Section 012639 “Temporary Tree and Planting Protection”

1.3 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow.

D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated according to requirements in Section 012639 "Temporary Tree and Plant Protection."

E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 MATERIAL OWNERSHIP

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

1.5 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.

1. Use sufficiently detailed photographs or video recordings.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Contractors schedule for work in areas where trees exist prior to beginning work. This schedule will used in ongoing coordination for the placement of all tree protection fencing.

C. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.6 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner’s Representative and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed trafficways if required by Owner’s Representative or authorities having jurisdiction.

B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

C. Utility Locator Service: Notify Missouri One Call for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Tree and Plant Protection Requirements for all supplemental materials as specified in Section 012639 “Tree and Plant Protection”

B. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 012639 "Temporary Tree and Plant Protection."

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to SWPP Drawings and requirements of authorities having jurisdiction.

B. Verify that noxious materials run-off, including concrete wash-out, do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site according to requirements in Section 012639 "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 012639 "Temporary Tree and Plant Protection."

3.4 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.

1. Arrange with utility companies to shut off indicated utilities.

B. Locate, identify, and disconnect utilities indicated to be abandoned in place.

C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Owner’s Representative not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Owner Representative’s written permission.

D. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.

1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
2. Grind down stumps and remove roots larger than 2 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
3. Use only hand methods or air spade for grubbing within protection zones.
4. Chip removed tree branches and dispose of off-site.

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and necessary to facilitate new construction.

B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.

1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut along line of existing pavement to remain before removing adjacent existing pavement. Saw-cut faces vertically.

3.7 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 311000

SECTION 311311 – TEMPORARY FENCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes: requirements for temporary construction fencing.

B. Related Requirements:

1. Section 500.060 “Construction Fences” of City of Brentwood Municipal Code.
2. Section 012639 “Temporary Tree and Plant Protection”.
3. Section 024119 “Selective Demolition”
4. Section 311000 “Site Clearing”
5. Section 312000 “Earth Moving”

1.3 INFORMATIONAL SUBMITTALS

A. Site Utilization Plan: Show temporary facilities, temporary utility lines and connections, staging areas, construction site entrances, vehicle circulation, and parking areas for construction personnel.

B. The construction site plan depicting materials, temporary construction facilities, offices, storage containers, trailers, portable bathrooms, construction materials, dumpsters, access gate(s) and similar construction as submitted to and approved by the City of Brentwood Director of Planning and Development. Approval of document by the City of Brentwood Director of Planning and Development is required before any temporary fencing may be erected.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Construction grade international orange plastic-mesh fence material measuring not less than four (4) feet high.

B. Wood Enclosure Fence: Plywood measuring not less than four (4) feet and not more than six (6) feet in height.

C. Chain Link-Fencing, if deemed necessary by the City of Brentwood Director of Planning and Development shall comply with the following requirements:

1. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top and bottom rails. Provide galvanized-steel bases for supporting posts.

D. Privacy fence netting, if deemed necessary by the City of Brentwood Director of Planning and Development.

PART 3 - EXECUTION

3.1 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

1. Where access to adjacent properties is required in order to affect protection of existing facilities, obtain written permission from adjacent property owner to access property for that purpose.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 011150 "Protection of Property and Environment”.

C. Temporary Erosion and Sedimentation Control: Comply with requirements of Missouri Department of Natural Resources Land Disturbance Permit and according to SWPP Plan Drawings.

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant-protection zones.
2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established and/or as directed by the Owner’s Representative.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Comply with requirements specified in Section 012639 “Temporary Tree and Plant Protection”.

F. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

G. Site Enclosure Fence: Furnish and install site enclosure fence a maximum of 10 days prior to commencing demolition, construction or earthwork, in a manner that will prevent unauthorized access.

1. Extent of Fence: The fence shall enclose all sides of the Project Site as determined sufficient by the City of Brentwood’s Director of Planning and Development.
2. The fence shall be a minimum height of four (4) feet and a maximum of six (6) feet from grade.
3. Fence posts shall be installed at no greater than eight (8) foot intervals. Space between any two (2) posts, gates, or hardware installed side by side shall not be any greater than four (4) inches apart
4. No temporary construction fence may encroach beyond the subject property line. No temporary construction fence may encroach upon any public right-of-way without the prior written approval of the City of Brentwood Director of Planning and Development.
5. Access to the Project Site must be through a suitable "gate" to consist of a movable portion of the fence, which can be closed, fastened or otherwise secured as to emulate a continuous segment of the adjacent fencing and post configuration. Gates shall allow for two-way traffic as appropriate.
6. Gate must be fastened or secured at the end of each workday, so as to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
7. The surety of the fence and gate(s) shall be maintained for the duration of the project.

H. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish set of keys to Owner as requested.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

3.2 OPERATION, TERMINATION, AND REMOVAL

A. Duration and Removal of Temporary Fences: Construction fences are not to be erected more than ten (10) calendar days prior to demolition, but must be in place prior to commencement of any demolition, excavation, or construction.

B. If demolition or construction does not occur within the prescribed ten (10) day period then fencing must be removed and the site restored.

END OF SECTION 311311

SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for grasses and plants.
3. Excavating and backfilling for structures.
4. Excavating and backfilling trenches for utilities and pits for buried utility structures.
5. Tracer wire for irrigation water lines.

B. Excavation and backfill for sewer utilities shall be in accordance with the Metropolitan St. Louis Sewer District Standard Construction Specifications for Sewers and Drainage Facilities, unless as otherwise noted in this section.

C. Preparation of subgrades and base courses under pavement surfaces shall be in accordance with St. Louis County Standard Specifications for Road and Bridge Construction, October 1, 2018 edition or later.

D. Related Requirements:

1. Section 012639 “Temporary Tree and Plant Protection”
2. Section 311000 "Site Clearing" for site stripping, grubbing, and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
3. Section 329219 “Seeding”
4. Section 329300 "Plants" for finish grading in planting areas and tree and shrub pit excavation and planting.

1.3 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

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

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

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

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.

E. Fill: Soil materials used to raise existing grades.

F. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for excavation that cannot be removed by rock-excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:

1. Equipment for Footing, Trench, and Pit Excavation: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch-maximum-width, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,700 lbf and stick-crowd force of not less than 18,400 lbf with extra-long reach boom.
2. Equipment for Bulk Excavation: Late-model, track-mounted loader; rated at not less than 230-hp flywheel power and developing a minimum of 47,992-lbf breakout force with a general-purpose bare bucket.

G. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

H. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

I. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:

1. Classification according to ASTM D2487.
2. Laboratory compaction curve according to ASTM D698.

C. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E329 and ASTM D3740 for testing indicated.

1.5 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner's Representative and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner's Representative or authorities having jurisdiction.

B. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 311311 "Temporary Fencing" and Section 311000 "Site Clearing**"** are in place.

C. Do not commence earth-moving operations until plant-protection measures specified in Section 012639 "Temporary Tree and Plant Protection" are in place.

D. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Noxious materials run-off, including concrete wash-out.
7. Excavation or other digging unless otherwise indicated.
8. Cutting of roots over one-inch in diameter in trenches when root is not crossing at same elevation as pipe or conduit.
9. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
10. Removal of protection fence before completion of construction. Owner's Representative must be notified prior to removal.

E. Do not direct vehicle or equipment exhaust towards protection zones.

F. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: Soil Classification Groups GW, GP, GM, SW, SP, and SM according to ASTM D2487, or a combination of these groups; free of rock or gravel larger than 3

inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

1. Liquid Limit: 45 max.
2. Plasticity Index: 25 max.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
    a. Due to location of work on project, many of the site soils are anticipated to be saturated. Contractor efforts will consist of drying out soils before deeming unsatisfactory.

D. Bedding for utilities:
1. Sanitary sewer fiberglass pipe: MSD Type 3
2. Sanitary sewer PVC pipe: MSD Type 1
3. Stormwater Sewer RCP pipe: MSD Type 2
4. Irrigation PVC pipe: MSD Type 3

E. Granular Backfill for utilities:
1. MSD Type 3

F. Subgrade Replacement:
1. MSD Type 4

2.2 ACCESSORIES

A. Tracer Wire For Water Lines

1. Tracer wire shall be blue HDPE insulated single strand #12 AWG continuous copper clad steel tracer wire with minimum 380 lb break load, with minimum 30 mil insulation thickness.
2. Tracer wire shall be manufactured by Copperhead Industries, Pro-Trace, or Approved Equal.
3. Splices shall be DryConn Direct Bury Lug, SnakeBite Connector as manufactured by Copperhead Industries, TW Connector as manufactured by Pro-Trace, or Approved Equal. Twist on wire nut style connectors or taped connectors are prohibited.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Provide dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.

B. All construction activities shall be conducted in the dry by pumping all water around the construction area and/or dewatering the area using wellpoints or other groundwater dewatering methods. Pumping shall be maintained around the area/reach being constructed. During anticipated larger storm events, exposed surfaces shall be stabilized to control erosion and sediment transport. Pumping shall continue until construction is completed in the area/reach under construction. Excavations shall be protected from the entrance of surface water to the extent possible using dikes and/or covers.

C. In some instances, at the discretion of the Owner, work may be permitted without dewatering (‘in-the wet’).

D. The Contractor shall use preventative measures to stop the entrance of excessive or injurious amounts of sand and silt from surface runoff or dewatering operations into storm drains or receiving waters.

E. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

F. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

2. Reroute noxious run-off, including concrete wash-out, from protected areas.

G. Water shall be disposed of in such a manner as not to be a menace to the public health, property, and portions of work under construction or completed. Dispose of water and

sediment in a manner that avoids inconvenience to others and in accordance with applicable federal, state, and local standards and permits.

3.3 BLASTING

A. City will allow blasting in accordance with Appendix C, Section 312235 – Rock Removal.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

2. Remove rock to lines and subgrade elevations indicated to permit installation.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

B. Excavations at Edges of Tree- and Plant-Protection Zones:

1. Excavate by hand to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Section 012639 "Temporary Tree and Plant Protection."

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

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

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Sewer trenches shall be excavated and properly bedded in accordance with the Metropolitan St. Louis Sewer District Standard Details of Sewer Construction. (Pipe

bedding for 72” FRP pipe shall meet trench details for flexible pipe for 21”-48” Diameter with the minimum trench width redefined as 108 inches)

C. Additional special bedding requirements apply for 72” FRP pipe. Refer to Drawings.

D. Irrigation trenches shall be excavated and properly bedded in accordance with details found on Contract Drawings.

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

1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Section 012639 "Temporary Tree and Plant Protection."

3.8 UNSUITABLE SUBGRADE

A. If it is mutually agreed between the Owner and the Contractor that unsuitable subgrade is encountered, crushed limestone in accordance with MSD Construction Details shall be used to stabilize the soil within the pipe trench limits.

3.9 UNAUTHORIZED EXCAVATION

A. All unauthorized excavation carried beyond or below the lines and grades given by Project Plans or Specifications, together with the removal of such excess excavated materials, and the cost of refilling the space of such overdig or unauthorized excavation, shall be at the Contractor’s expense.

1. Fill unauthorized excavations under other construction, pipe, or conduit with crushed limestone as directed by Engineer.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

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

3.12 UTILITY TRENCH BACKFILL

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

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Roadways or as indicated on Drawings: Provide granular backfill.

D. Backfill voids with satisfactory soil while removing shoring and bracing.

E. Earth Backfill: Place and compact backfill of satisfactory soil. Material shall be free of debris, organic matter, perishable compressible materials, and shall contain no stones or lumps of rock fragment larger than six inches (6”) in dimension, nor be in such amount that will interfere with the consolidating properties of fill material. The upper two (2’) feet of backfill in grass or planted areas shall be free of all rocks.

F. Tracer Wire: Locator wire shall be installed continuously along all water pipe.

1. Tracer wire shall be accessible through all installed valve boxes at surface. Wire shall run on outside of valve box. A slot shall be cut near top of valve box to feed wire in. Roughly 1 to 2 feet of slack shall be provided. At valve box locations where grounding anodes are required, tracer wire shall be connected to grounding wire with an approved splice connection.
2. Grounding anode rods are to be installed at all beginning and ends of water main including all tap connections. Grounding rods shall be minimum 1.5 lb magnesium anode and installed in accordance with manufacturer’s recommendations.
3. Tracer wire shall be secured (tied/taped) to pipe at 5 foot intervals.
4. All tracer wire installations shall be located using typical low frequency (512 Hz) line tracing equipment, witnessed by the Contractor, and Owner prior to acceptance of the project. Any breaks in the circuit must be repaired by the contractor, at contractor’s expense, prior to acceptance of the water main by the Owner.

3.13 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use engineered fill.
4. Under building slabs, use engineered fill.
5. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SEWER TRENCHES

A. All trench bedding around pipes shall be mechanically compacted.

B. The 72” FRP shall be mechanically compacted the entire depth of trench between stations 26+50 and 29+00. Compaction shall be completed in 8 inch lifts.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:

1. Turf or Unpaved Areas: Plus or minus 1 inch.
2. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

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

3.19 FINAL GRADING

A. After the completion of final grading and within 5 days of seeding or planting, the Contractor shall loosen the subgrade of all areas outside the bankfull channel to be planted, by plowing or ripping, to a minimum depth of 3- to 4-inches. These areas include areas compacted by equipment and/or vehicles such as haul roads and the staging/stockpile areas. The subgrade and topsoil are to be rough graded to promote surface water storage, with depressions and organic matter spread throughout. The Contractor is to limit subgrade and finish grade preparation to areas that will be planted immediately. Preparation areas are to be moistened prior to seeding when soil is dry but care shall be taken not to create muddy conditions. Prepared areas are to be restored if eroded or otherwise disturbed after fine grading and before planting. Avoid disturbance to existing trees and other vegetation.

B. Where topsoil is to be placed, scarify surface to depth of 3- to 4-inches.

C. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 6 inches.

D. Rake surface to remove debris, branches, rocks, and other materials.

E. Take and analyze one soil sample to determine soil amendment requirements. Add fertilizer and amendments as directed by soil analysis or directed by Owner or Owner's Representative.

F. Place topsoil in areas where seeding and planting is indicated until all topsoil excavated from site is used. Dispose of excess topsoil on site in area designated by Owner or Owner's Representative. Additional topsoil imported to site may be required.

G. Place topsoil during dry weather.

H. Remove roots, weeds, rocks, and foreign material while spreading.

I. Near plants spread topsoil manually to prevent damage.

J. Lightly compact placed topsoil with tracks or bucket of equipment as directed by Owner or Owner's Representative.

3.20 SETTLEMENT

A. The Contractor shall be responsible for all settlement of backfill, fills, and embankments which may occur within one year after final acceptance of the work by the Owner.

B. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within 30 days after receipt of written notice from the Owner or Owner's Representative.

3.21 COMPACTION OF SOILS FILLS

A. Place fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Compact soil materials to not less than 95 percent maximum dry unit weight according to ASTM D698.

3.22 FIELD QUALITY CONTROL

A. Owner shall engage a qualified inspector to perform the following inspections.
   1. Determine soil fill material classification and maximum lift thickness comply with requirements.
   2. Determine during placement and compaction of soil fill, that in-place density of compacted fill complies with requirements.

B. Testing agency will test compaction of fill soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938, as applicable. Tests will be performed at following locations and frequencies.
   1. Soil Fill Areas: Each compacted fill layer, at least one test for every 2,000 sq. ft. or less.

C. When testing agency reports that fills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

END OF SECTION 312000

SECTION 313201 - STREAM STABILIZATION MATTING

PART 1 - GENERAL

1.1 SUMMARY

A. The work covered under this section includes requirements for the installation of Stream Stabilization Matting (coir fabric) and Soil Encapsulated Lifts for streambank stabilization.

B. Coir fabric stabilization matting shall be placed by the Contractor on disturbed areas at the locations shown in the Construction Drawings.

C. SELs shall be installed on banks at the locations shown in the Construction Drawings.

1.2 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. ASTM International (ASTM):
   a. D 1777
   b. D 3776
   c. D 4595

1.3 DEFINITIONS

A. Coir fabric shall be defined as a rolled, 100 percent natural coir fiber mat woven from spun mattress coir yarns used for temporary erosion control.

B. Soil Encapsulated Lift: A streambank stabilization technique used to construct a streambank with successive lifts of soil wrapped or encapsulated in coir fabric.

C. Overlap: Distance measured perpendicular from overlapping edge of one sheet to underlying edge of adjacent sheet.

D. Wood Stakes: Dead stout wooden stakes used to permanently secure coir fabric as shown on Construction Drawings.

1.4 SUBMITTALS

A. Action Submittals:

1. Certificates:

   a. Manufacturer specifications, product literature or other certification that materials meet or exceed required specifications.

2. Samples:

   a. Fabric: One-piece, minimum 18-inches long, taken across full width of roll of each type and weight of fabric furnished for

Project. Label each with brand name and furnish documentation of lot and roll number from which each sample was obtained.

B. Informational Submittals:

1. Certifications from each fabric manufacturer that furnished products have specified property values. Certified property values shall be either minimum or maximum average roll values, as appropriate, for fabrics furnished.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver each roll and SEL unit with sufficient product information attached to identify it for inventory and quality control. Provide all invoices and trip tickets for each delivery.

B. Handle products in manner that maintains undamaged condition.

C. Do not store products directly on ground. Ship and store products with suitable wrapping for protection against moisture and ultraviolet exposure. Store fabric in way that protects it from elements. If stored outdoors, elevate and protect fabric with waterproof cover.

1.6 SCHEDULING AND SEQUENCING

A. SELs are placed in conjunction with bank grading.

B. Coir fabric is placed after channel construction and grading for streambank stabilization has been completed.

C. Contractor shall backfill where necessary.

D. Notify Owner or Owner's Representative whenever SELs or coir fabric for stabilization are to be placed. Do not place materials without Owner or Owner's Representative's approval of underlying materials.

1.7 QUALITY ASSURANCE

A. Owner or Owner's Representative shall inspect materials and submittals prior to Contractor installing any materials.

B. Owner or Owner's Representative shall inspect installation of material by Contractor once complete before acceptance for payment purposes.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Coir fabric shall be RoLanka BioD-Mat™ 90 or comparable 100% biodegradable, strong and durable bristle coir woven matting that meets or exceeds the following specifications:

Property	BioD-Mat 90

Weight (oz./sq. yd.), ASTM D 3776	29
Weight (grams/sq. m.)	980
Dry Tensile Strength (lb/ft), ASTM D 4595	2,024
% Open area, Calculated	38
Thickness (inch), ASTM D 1777	0.35
Recommended slope	1:1 max
Recommended flow velocity (fps)	16
Recommended shear stress (lb/sq. ft.)	5

B. Soil Encapsulated Lift (SEL) shall be RoLanka BioD-Block™ 12-300 or comparable 100% biodegradable, strong and durable bristle coir woven blanket that meets or exceeds the BioD-Mat 70 specifications (www.rolanka.com) and contains a coir fiber block sewn into the interior of the blanket.

Property	BioD-Block 12-300
Unit Weight (lb/ft)	3.3
Block Size, Height (in),	12
Block Size, Thickness (in)	5
Block Size, Length (ft)	10
Fabric Length (in)	47
Dry Tensile Strength (lb/ft), ASTM D 4595	1,740
Fabric Length at Female End (in)	6

C. Wooden stakes shall be dead stout pine or hardwood wedges of adequate thickness and length to ensure the matting will remain in place under rapid streamflow conditions. The Contractor shall consider the soil type when selecting the stake thickness and length. Loose, sandy soils will require stakes which extend well below ground surface. The minimum stake size shall be per the Construction Drawings.

D. If proposing an alternative product, Contractor must provide product specifications with proposal for the Owner or Owner's Representative's review, consideration, and approval.

PART 3 - EXECUTION

3.1 LAYING COIR FABRIC AS STABILIZATION MATTING

A. Prior to placement of coir fabric, Owner or Owner's Representative will review the soil surface for quality assurance of design and construction. The surface on which the coir fabric is to be placed shall be graded per the Construction Drawings and the surface shall be free of loose rock and clods, holes,

depressions, projections, muddy conditions or standing or flowing water during time of placement.

B. Install coir fabric in accordance with all manufacturers' recommendations as shown on Construction Drawings after grading is completed and after installation of structures.

C. The installation of coir fabric shall be smooth and free of tension, folds, wrinkles, or creases. Orient coir fabric with long dimension of each sheet perpendicular to direction of slope and short dimension parallel with flow. Lay coir fabric pieces from downstream to upstream. The upstream coir fabric end shall overlap the downstream coir fabric by 6 inches minimum, shingling the coir fabric in the direction of flow. Stake according to Construction Drawings.

D. The coir fabric shall be in contact with the soil at all locations. Any voids beneath the coir fabric shall be eliminated by removing the stakes and coir fabric, adding and compacting appropriate soil, and reinstallation of the coir fabric.

E. If tears, punctures, or other coir fabric damage occurs during placement of overlying products, remove overlying products as necessary to expose damaged coir fabric.

F. Repair or replace torn, punctured, flawed, deteriorated, or otherwise damaged coir fabric with new unused coir fabric.

G. Repair Procedure:

1. Place patch of undamaged coir fabric over damaged area and at least 18 inches in all directions beyond damaged area, minimum of 4 square feet of coir fabric.
2. Remove interfering material as necessary to expose damaged coir fabric for repair.
3. Permanently attach repair using wood stakes.

3.2 INSTALLING SOIL ENCAPSULATED LIFTS

A. Install Soil Encapsulated Lifts in accordance with manufacturers' recommendations and as shown on Construction Drawings.

END OF SECTION 313201

SECTION 313219.16 - GEOTEXTILE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Paragraph 2.01, Geotextile.
2. Paragraph 2.02, Sewing Thread.
3. Paragraph 2.03, Securing Pins.
4. Paragraph 3.01, Laying Geotextile.
5. Paragraph 3.02, Sheet Orientation on Slopes.
6. Paragraph 3.03, Joints.
7. Paragraph 3.04, Securing Geotextile.
8. Paragraph 3.05, Placing Products over Geotextile.
9. Paragraph 3.06, In-Stream Structure Applications.
10. Paragraph 3.07, Silt Fence Applications.
11. Paragraph 3.08, Repairing Geotextile.

1.2 REFERENCES

A. The following is a list of standards that may be referenced in this Section:

1. ASTM International (ASTM):
   a. D737, Test Method for Air Permeability of Textile Fabrics.
   b. D4355, Test Method for Deterioration of Geotextiles from Exposure to Ultraviolet Light and Water (Xenon-Arc Type Apparatus).
   c. D4491, Test Methods for Water Permeability of Geotextiles by Permittivity.
   d. ASTM G21, Fungus Resistance.
   e. D4595, Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
   f. D4632, Test Method for Breaking Load and Elongation of Geotextiles.
   g. D4716, Test Method for Determining the In-Plane Flow Rate Per-Unit-Width and Hydraulic Transmissivity of a Geosynthetic Using Constant Head.
   h. D4751, Test Method for Determining Apparent Opening Size of a Geotextile.
   i. D4833, Test Method for Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
   j. D4884, Test Method for Strength of Sewn or Thermally Bonded Seams of Geotextiles.
   k. D4886, Test Method for Abrasion Resistance of Geotextiles (Sand Paper/Sliding Block Method).
   l. D6193, Practice for Stitches and Seams.
2. Missouri Department of Transportation (MODOT):
   a. Geotextile Fabric per MODOT Section 1011, Geotextile.

1.3 WORK INCLUDED

A. The Contract shall furnish all labor, equipment, and materials necessary for placing, maintenance, removal, inspection, monitoring, and reporting on the erosion and sedimentation controls for Geotextiles.

1.4 DEFINITIONS

A. Fabric: Geotextile, a permeable geosynthetic comprised solely of textiles.

B. Minimum Average Roll Value (MinARV): Minimum of series of average roll values representative of geotextile furnished.

C. Maximum Average Roll Value (MaxARV): Maximum of series of average roll values representative of geotextile furnished.

D. Nondestructive Sample: Sample representative of finished Work, prepared for testing without destruction of Work.

E. Overlap: Distance measured perpendicular from overlapping edge of one sheet to underlying edge of adjacent sheet.

F. Seam Efficiency: Ratio of tensile strength across seam to strength of intact geotextile, when tested according to ASTM D4884.

1.5 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
    a. Manufacturer material specifications and product literature.
    b. Installation drawings showing geotextile sheet layout, location of seams, direction of overlap, and sewn seams.
    c. Description of proposed method of geotextile deployment, sewing equipment, sewing methods, and provisions for holding geotextile temporarily in place until permanently secured.
2. Samples:
    a. Geotextile: One-piece, minimum 18 inches long, taken across full width of roll of each type and weight of geotextile furnished for Project. Label each with brand name and furnish documentation of lot and roll number from which each Sample was obtained.
    b. Field Sewn Seam: 5-foot length of seam, 12 inches wide with seam along center, for each type and weight of geotextile.
    c. Securing Pin and Washer: One each.

B. Informational Submittals:

1. Certifications from each geotextile manufacturer that furnished products have specified property values. Certified property values shall be either minimum or maximum average roll values, as appropriate, for geotextiles furnished.
2. Field seam efficiency test results.

3. See certification of proper installation requirement in Construction Notes on Contract Documents.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver each roll with sufficient information attached to identify it for inventory and quality control.

B. Handle products in manner that maintains undamaged condition.

C. Do not store products directly on ground. Ship and store geotextile with suitable wrapping for protection against moisture and ultraviolet exposure. Store geotextile in way that protects it from elements. If stored outdoors, elevate and protect geotextile with waterproof cover.

1.7 SCHEDULING AND SEQUENCING

A. Notify Owner whenever geotextiles are to be placed. Do not place geotextile without Owner approval of underlying materials.

PART 2 - PRODUCTS

2.1 GEOTEXTILE

A. The fabric shall consist of strong rot-proof synthetic fibers formed into a woven fabric or a nonwoven needle punched fabric meeting all applicable requirements of this section.

B. The fabric shall be free from any treatment or coating which might significantly alter its physical properties before or after installation.

C. The fabric fibers shall contain stabilizers and/or inhibitors to make the filaments resistant to deterioration resulting from ultraviolet or heat exposure.

D. The fabric shall be a pervious sheet of synthetic fibers oriented into a stable network so that the fibers retain their relative position with respect to each other.

E. The edge of the fabric shall be furnished to prevent the outer fibers from pulling away from the fabric.

F. The fabric shall be free of defects or flaws which significantly affect its physical and/or filtering properties.

G. Sheets of fabric may be sewn or bonded together with a fungus resistant material.

H. No deviation from any physical requirements will be permitted due to the presence of the seam.

I. During all periods of shipment and storage, the fabric shall be wrapped in a heavy duty protective covering to protect the fabric from direct sunlight, mud, dust, dirt, and debris. The fabric shall not be exposed to temperatures greater than 140 degrees.

J. Minimum physical property requirements for woven and non-woven geotextile and non-woven geotextile shall comply with the listed in Tables 1 and 2.

Table 1. Physical Property Requirements for Woven Geotextile

Property	Test Method	Performance Criteria
Typical Applications		Under In-stream Structures, Riprap
Apparent Opening Size	ASTM D 4751	---
Flow Rate	ASTM D4491	-- gal/min/ft^2
Grab Tensile Strength	ASTM D4632	200 lbs
Grab Elongation	ASTM D4632	10% to 35%
Bursting Strength	ASTM D 3786	500 psi
Fungus Resistance	ASTM G21	No Growth
Puncture Strength	ASTM D4833	80 lbs, MinARV
Ultraviolet Radiation Resistance	ASTM D4355	140 lbs 70 percent strength retention, MinARV after 500 hours
Minimum Roll Width		72 inches

Table 2. Physical Property Requirements for Non-Woven Geotextile

Property	Test Method	Performance Criteria
Typical Applications		Under In-stream Structures and Riprap
Flow Rate	ASTM D4491	50 - 350 gal/min/ft^2
Grab Tensile Strength	ASTM D4632	65 lbs
Grab Elongation	ASTM D4632	40%
Bursting Strength	ASTM D3786	500 psi
Fungus Resistance	ASTM G21	No Growth
Puncture Strength	ASTM D4833	30 lbs
Ultraviolet Radiation Resistance	ASTM D4355	140 lbs 70 percent strength retention, MinARV after 500 hours
Minimum Roll Width		72 inches

2.2 SEWING THREAD

A. Polypropylene, polyester, or Kevlar thread.

B. Durability: Equal to or greater than durability of geotextile sewn.

2.3 SECURING PINS

A. Steel Rods or Bars:

1. 3/16-inch diameter.
2. Pointed at one end.
3. With head on other end sufficiently large to retain washer.
4. Minimum Length: 12 inches.

B. Steel Washers for Securing Pins:

1. Outside Diameter: Not less than 1.5 inches.
2. Inside Diameter: 1/4 inch.
3. Thickness: 1/8 inch.

C. Steel Wire Staples:

1. U-shaped.
2. 10 gauge.
3. Minimum Length: 6 inches.

PART 3 - EXECUTION

3.1 LAYING GEOTEXTILE

A. Lay and maintain geotextile smooth and free of tension, folds, wrinkles, or creases.

3.2 SHEET ORIENTATION ON SLOPES

A. Orient geotextile with long dimension of each sheet parallel to direction of slope.

3.3 JOINTS

A. Unseamed Joints:

1. Overlapped such that downstream fabric is under upstream fabric (shingle in direction of water flow).
2. Overlap, unless otherwise shown:
   a. Foundation/Subgrade Stabilization: Minimum 18 inches.
   b. Riprap: Minimum 18 inches.
   c. Other Applications: Minimum 12 inches.

B. Sewn Seams: Made wherever stress transfer from one geotextile sheet to another is necessary. Sewn seams, as approved by Owner, also may be used instead of overlap at joints for applications that do not require stress transfer.

1. Seam Efficiency:
   a. Minimum 70 percent.

b. Verified by preparing and testing minimum of one set of nondestructive samples per acre of each type and weight of geotextile installed.
c. Tested according to ASTM D4884.

2. Types:
   a. Preferred: “J” type seams.
   b. Acceptable: Flat or butterfly seams.
3. Stitch Count: Minimum three to maximum seven stitches per inch.
4. Stitch Type: Double-thread chain stitch according to ASTM D6193.
5. Sewing Machines: Capable of penetrating four layers of geotextile.
6. Stitch Location: 2 inches from geotextile sheet edges, or more, if necessary to develop required seam strength.

3.4 SECURING GEOTEXTILE

A. Secure geotextile during installation as necessary with sandbags or other means approved by Owner.

B. Secure Geotextile with Securing Pins:

1. Insert securing pins with washers through geotextile.
2. Securing Pin Alignment:
   a. Midway between edges of overlaps.
   b. 6 inches from free edges.
3. Spacing of Securing Pins:

Slope	Maximum Pin Spacing
Steeper than 3:1	2 feet
3:1 to 4:1	3 feet
Flatter than 4:1	5 feet

4. Install additional pins across each geotextile sheet as necessary to prevent slippage of geotextile or to prevent wind from blowing geotextile out of position.
5. Push each securing pin through geotextile until washer bears against geotextile and secures it firmly to subgrade.

3.5 PLACING PRODUCTS OVER GEOTEXTILE

A. Before placing material over geotextile, notify Owner. Do not cover installed geotextile until after Owner provides authorization to proceed.

B. If tears, punctures, or other geotextile damage occurs during placement of overlying products, remove overlying products as necessary to expose damaged geotextile. Repair damage as specified in Article Repairing Geotextile.

3.6 IN-STREAM STRUCTURE APPLICATIONS

A. Overlap geotextile at each joint with upstream sheet of geotextile overlapping downstream sheet.

B. Sew joints where wave run-up may occur.

C. Limit Height of Stone Fall onto Geotextile to Prevent Damage:

1. Drop Height: 0 foot for greater than 200-pound rock. 2 feet for less than 200-pound rock.

3.7 SILT FENCE APPLICATIONS

A. Install geotextile in one piece, or continuously sewn to make one piece, for full length and height of fence, including portion of geotextile buried in toe trench.

B. Install bottom edge of sheet in toe trench and backfill in a way that securely anchors geotextile in trench.

C. Securely fasten geotextile to wire mesh backing and each support post in a way that will not result in tearing of geotextile when fence is subjected to service loads.

D. Promptly repair or replace silt fence that becomes damaged.

3.8 REPAIRING GEOTEXTILE

A. Repair or replace torn, punctured, flawed, deteriorated, or otherwise damaged geotextile.

B. Repair Procedure:

1. Place patch of undamaged geotextile over damaged area and at least 18 inches in all directions beyond damaged area.
2. Remove interfering material as necessary to expose damaged geotextile for repair.
3. Sew patches or secure them with heat fusion tacking or with pins and washers, as specified above in Article Securing Geotextile, or by other means approved by Owner.

3.9 REPLACING CONTAMINATED GEOTEXTILE

A. Protect geotextile from contamination that would interfere, in Owner’s opinion, with its intended function. Remove and replace contaminated geotextile with clean geotextile. See Construction Notes on Contract Documents.

END OF SECTION 313219.16

SECTION 313600 - REINFORCED SLOPE

PART 1 – GENERAL

1.1 SCOPE

A. The work covered by this section consists of furnishing all equipment, labor, materials, and incidentals, and performing all operations necessary for the product and installation requirements for the soil nails and permanent geosynthetic Turf Reinforcement Mat (TRM) combined with a woven steel wire mesh placed on a prepared surface as noted on the provided construction drawings. The work shall be performed in accordance with the Contract Plans, the required Contractor submittals, and these Specifications. The work consists of the following elements: excavating in staged lifts; drilling soil nail drill holes to the diameter and length required; installing soil nail reinforcement; grouting of soil nails; supplying and installing bearing plates, washers, nuts, and other required hardware and miscellaneous materials; and constructing the initial and final soil nail wall facing. The facing for the wall will consist of a reinforced geosynthetic face such that seeding can be performed on the face and allow vegetative growth.

1.2 REFERENCES

A. Comply with applicable Laws and Regulations, codes and standards as required by regulatory agencies having Jurisdiction over this portion of the Work. Comply with pertinent sections of the following standards:
   1. Latest version of American Society of Testing and Materials (ASTM) standards;
   2. Geosynthetics Research Institute (GRI);
   3. International Standard Organization (ISO);
   4. Federal Highway Administration (FHWA) Circular 7

1.3 SUBMITTALS

A. Personnel Experience

At least 45 calendar days before starting soil nail work, submit names of the Professional Engineer, on-site supervisors, and drill operators assigned to the project, and a summary of each individual's experience. Only those individuals designated as meeting the experience requirements shall be used for the project. The Contractor cannot substitute for any of these individuals without written approval of the Owner or the Owner's Engineer. The Owner's Engineer shall approve or reject the Contractor qualifications and staff 10 calendar days following receipt of the submission. Work shall not be started, nor materials ordered until the Contractor's qualifications have been approved by the Owner's Engineer. The Owner's Engineer may suspend the work if the Contractor substitutes unapproved personnel for approved personnel during construction. If work is suspended due to the substitution of unapproved personnel, the Contractor shall be fully liable for all additional costs resulting from the suspension of work, and no adjustment in contract time resulting from the suspension of the work shall be allowed.

B. Site Surveys

The Contractor shall be responsible for providing the necessary survey and alignment control during the excavation for each lift, locating drill holes and verifying limits of the soil nail wall installation.

C. Construction Plan

At least 30 calendar days before starting soil nail work, the Contractor shall submit a Construction Plan to the Owner's Engineer that includes the following:

1. Project start date and proposed detailed slope construction sequence.
2. Drilling and grouting methods and equipment, including the drill hole diameter proposed to achieve the specified nominal pullout resistance values shown on the Contract Drawings.
3. Nail grout mix design, including compressive strength test results (per AASHTO T106/ASTM C109) supplied by a qualified independent testing lab verifying the specified minimum 3-day and 28-day grout compressive strengths. For neat cement grout include specific gravity test results of the fresh grout used for compressive testing.
4. Nail grout placement procedures and equipment.
5. Soil nail testing methods and equipment setup.
6. Identification number and certified calibration records for each test jack, pressure gauge, dial gauge and load cell to be used. Jack and pressure gauge shall be calibrated as a unit. Calibration records shall include the date tested, the device identification number, and the calibration test results, and shall be certified for an accuracy of at least 2 percent of the applied certification loads by a qualified independent testing laboratory within 90 calendar days of submittal.
7. Manufacturer Certificates of Compliance for materials including: the tendon ultimate strength, woven steel wire mesh, , couplers, bearing plates, and epoxy coating.
8. Product information, details, and cut sheets of products to be used in this project, including, but limited to: geocomposite facing mesh, centralizers, couplers, and geotextiles.
9. Procedures and material for repairing corrosion protection coatings in the field and for applying epoxy finish coatings on end hardware.
10. Manufacturer, product name and type of turf reinforcement mat proposed for the project, chemical composition of the filaments or other pertinent information to fully describe the Turf Reinforcement Mat (TRM).
11. Information related to the ability to protect soil from rain splash and runoff, and hydraulically induced shear stresses due to increased flowrate prior to the development of vegetation
12. The performance of the TRM in encouraging vegetation growth.
13. Manufacturer recommended installation and jointing procedures for the proposed turf reinforcement mat.
14. Shop drawings that shall include all details, dimensions, quantities, ground profiles, and cross-sections necessary to construct the reinforced slope. The Contractor shall verify the limits of the wall and ground survey data before preparing the shop drawings. The working drawings shall be prepared to the Owner's standards. The Owner's Engineer will approve or reject the Contractor's submittals within 14

calendar days of the receipt of the complete submission. Approval of the Construction Plans does not relieve the Contractor of his responsibility for the successful completion of the work. The Contractor shall not begin construction or incorporate materials into the work until the submittal requirements are satisfied and found acceptable to the Owner's Engineer.

15. The wall has been geotechnically evaluated for stability. The contractor should provide signed and sealed structural calculations for the independent nails selected to support the required loading. The professional engineer must be registered in the State of Missouri.

PART 2 - PRODUCTS

2.1 FACING

A. Turf reinforcement mats with woven steel wire mesh are a combination between a synthetic mat extruded directly on top of a woven steel wire mesh.

1. The TRM shall be manufactured for the purpose of being utilized on sloped embankments for erosion control and/or on channel linings.
2. The TRM shall be made from 100% synthetic material and contain no biodegradable or photodegradable components or materials. The TRM shall be a three-dimensional matrix and maintain the three-dimensional stability without laminated or stitched layers.
3. The TRM shall not lose its structural integrity and shall not unravel or separate when TRM is cut in the field.
4. The TRM shall have a nominal/minimum thickness of 16/12 mm (ASTM D6525) and the polypropylene mat shall have a minimum mass per unit area equal to 420 g/m2; the voids index of the mat shall not be lower than 80%.
5. The TRM shall be laid according to the designer specification and in conformity to the supplier installation prescriptions. A vegetative cover and/or hydro seeding may be required to accelerate vegetation growth.
6. The composite mat will be characterized by a ground coverage ratio in the range 55-65% to ensure effective soil protection and a light penetration of 35-45% for adequate and rapid growth of vegetation (tests carried out according to ASTM D6567).
7. For rainfalls duration of 30 minutes with return time of 10 years, the C factor - cover-management factor - shall not be higher than:

   0.0028 for rainfall intensity I = 50 mm/h;
   0.012 for rainfall intensity I = 100 mm/h;
   0.032 for rainfall intensity I = 150 mm/h.
   The C factor values of the geocomposite shall be based on full scale tests reports outputs run according to ASTM D6459

B. The woven steel wire mesh shall be manufactured with a non-raveling mesh made by twisting continuous pairs of wires through three half turns (commonly called double twisted) to form a hexagonal-shaped opening. Gabions are classified according to the wire coating, which is applied prior to manufacturing the mesh. HAR polymer coated gabions are manufactured from a heavily Zinc-5 % Aluminum-Mischmetal (Zn-5Al-MM) alloy coated soft temper steel and overcoated with high abrasion resistant polymer as

per ASTM A975. Wire and wire mesh used for manufacturing gabions shall meet the following requirements:

1. The steel wire is coated prior to manufacturing the mesh. All wire testing must be performed prior to manufacturing the mesh.
    a. Tensile Strength: The wire used for the mesh and lacing wire, shall have a maximum tensile strength of 70,000 psi (485 MPa), in accordance with ASTM A856/A856M.
    b. Elongation: The test shall be carried out on a sample at least 12 in. (300 mm) long, and the elongation shall not be less than 12%, in accordance with ASTM A370
    c. Metallic Coating: The minimum quantities of Zn-5Al-MM alloy shall be according to the ASTM A856/A856M, Class III soft temper coating.
    d. Adhesion of zinc coating: The adherence of the Zn-5Al-MM alloy coating to the wire shall be such that, when the wire is wrapped six turns around a mandrel having four times the diameter of the wire, it does not flake or crack when rubbing it with the bare fingers, in accordance with ASTM A856/A856M.
2. The technical characteristics and ageing resistance of the High Abrasion Resistant (HAR) polymer coating comply with EN 10245-1.
    a. Resistance to UV radiation: the tensile strength and elongation at break of the base compound after 2,500 hours of exposure to QUV-A (ISO 4892-3 mode 1) do not change more than 25% from the initial test results.
    b. Chemical resistance: the HAR polymer resists the chemical agents in concentrations that are representative of soil and water normally found in civil works.
    c. Outwearing accelerated ageing test in salt spray: when the HAR polymer coated wire mesh is subjected to the neutral salt spray test (ASTM B117) after 6,000 hours of exposure the mesh does not show more than 5% of DBR (Dark Brown Rust).
    d. Resistance to abrasion: the HAR polymer coating does not expose metal wire when tested in accordance with procedure described in par. 4.1.2.1 of EN 60229:2008, after 100,000 cycles with a vertical force of the steel angle of 20N (4.5 lbf).
3. Woven Mesh dimensions and wire diameters shall meet the following criteria:

Mesh Characteristics and Minimum Strength	
Mesh Type	8x10/ HAR Polymer Coated
Mesh Opening, D	3.25 in. (83 mm)
Mesh Tensile Strength	3,425 lb/ft (50.0 kN/m)
Punch Test Resistance	5,300 lb (23.6 kN)
Connection Strength	1,200 lb/ft (17.5 kN/m)

Standard Wire Diameters for 8x10 mesh			
	Lacing Wire, Cross tie/Stiffener wire	Mesh Wire	Selvedge Wire/Preformed Stiffeners
Wire Diameter Int Ø in (mm)	0.087 (2.20)	0.106 (2.70)	0.134 (3.40)
Wire Tolerance (±) Ø in (mm)	0.004 (0.10)	0.004 (0.10)	0.004 (0.10)
Min. Zn-5Al-MM Alloy Qty. oz/ft² (g/m²)	0.70 (214)	0.8 (244)	0.85 (259)
Wire + Polymer Diameter in. (mm)	0.127 (3.20)	0.146 (3.70)	0.174 (4.40)

C. Fastening Systems

A combination of high tensile fasteners or lacing wire shall be used for installation of the TRM with double twisted steel wire mesh.

1. High Tensile Ring Fasteners (stainless steel):
   Diameter = 0.120 in. (3.05 mm) (Type 302, Class I - ASTM A313)
   Tensile strength: 222,000 to 253,000 psi (1530-1744 MPa) (Table 5 - ASTM A313)
2. High Tensile Ring Fasteners Installation:
   High tensile fasteners shall have a nominal spacing of 4 in (100 mm) not to exceed 6 in (150 mm) for all installation. Spacing of the rings shall be in accordance with ASTM A975, minimum strength requirements mesh and connections.

2.2 SOIL NAILS

A. Soil Nail Solid Bar (Tendon)

1. Tendons shall meet the requirements of AASHTO M31/ASTM A615 for Grade 60 or 75 steel bars (Grade 420 or 520 in SI Units), and ASTM A722 for Grade 150 steel (Grade 1035 in SI Units). Tendons shall be continuous without splices or welds, new, straight, undamaged, bare, epoxy coated, galvanized, or encapsulated as shown on the Contract Drawings. The length of the threaded portion of the bar at the wall anchorage shall be as needed to allow proper attachment of the bearing plate and nut. If threads are cut into a tendon, the contractor shall verify that the bar meets the minimum capacity required at the threaded section.

B. Bar Couplers

1. Bar couplers shall develop the full nominal tensile capacity of the tendon as certified by the manufacturer.

C. Fusion-Bonded Epoxy Coating

1. Fusion-bonded epoxy coating shall meet the requirements of ASTM A775 and have a minimum thickness of 12 mils (12 thousandths of an inch) up to a maximum of 17 mils as applied electrostatically. Bend test requirements are waived. The coating at the wall anchorage end of epoxy-coated bars may be omitted over the length provided for threading the nut against the bearing plate.

D. Zinc Coating

1. Zinc galvanized coating shall meet the requirements of Article 11.10.6.4.2a (AASHTO 2014 or current edition) and have a minimum of 2.0 oz/ft2 or 3.4 mil thickness applied in accordance with ASTM A123 for bars and structural steel shapes, and ASTM A153 for nuts, plates, and other hardware.

2.3 OTHER SOIL NAIL COMPONENTS

A. Centralizers

1. Centralizers shall be manufactured from Schedule 20 or 40 PVC pipe or other materials not detrimental to the soil nail steel bar. Wood shall not be used. Centralizers shall be securely attached to the tendon and shall be sized to allow: (i) positioning of the soil nail bar within 1 in. of the center of the drill hole; (ii) tremie pipe insertion to the bottom of the drill hole; and (iii) grout to freely flow up the drill hole. They shall be installed at regular intervals not to exceed 10 ft along the length of the nail and a distance of 1.5 ft from each end of the nail.

B. Grout

1. Grout shall be neat cement or sand/cement mixture with a minimum 3-day compressive strength of 1,500 psi and a minimum 28-day compressive strength of 3,000 psi, meeting the requirements of AASHTO T106/ASTM C109. The specific gravity of the freshly prepared neat cement grout shall range between 1.8 and 1.9.

C. Sand

1. Sand for grout shall meet the requirements of AASHTO M6/ASTM C33.

D. Portland Cement

1. Portland cement for grout shall meet the requirements of AASHTO M85/ASTM C150, Types I, II, III, V, or Type I/II and shall be the product of one manufacturer. If the brand or type of cement is changed during the project, additional grout mix tests shall be conducted to ensure consistency of quality and performance in situ.

E. Admixtures

1. If admixtures are used, they shall meet the requirements of AASHTO M194/ASTM C494. Admixtures shall be compatible with the grout and mixed in accordance with the manufacturer’s recommendations. Accelerators shall not be permitted. Expansive admixtures shall not be permitted except where the grout is used as part of corrosion protecting encapsulation.

2.4 CONNECTION COMPONENTS

A. Bearing Plates

1. Bearing plates shall meet the requirements of AASHTO M183/ASTM A36 or ASTM A572 Grade 50 (Grade 350 in SI Units).

B. Nuts

1. Nuts shall meet the requirements of AASHTO M291/ASTM A563, Grade B, hexagonal, and fitted with beveled washer or spherical seat to provide uniform bearing.

C. Shear Connectors

1. Shear connectors of the soil nail head shall consist of headed-studs or anchor bolts.

2.5 STORAGE AND HANDLING

A. Soil nail bars shall be stored and handled in a manner to avoid damage or corrosion. Soil nail bars exhibiting abrasions, cuts, welds, weld splatter, corrosion, or pitting shall be replaced. Bars exhibiting damage to encapsulation or epoxy coating shall be repaired or replaced at no additional cost. Repaired epoxy coating areas shall have a minimum 12-mil. thick coating. Damaged galvanization shall be repaired by coating the damaged area with a field grade, zinc-rich paint.

PART 3 - EXECUTION

3.1 SOIL NAILS

A. Excavation

1. The height of the exposed unsupported final excavation face cut shall be established by the Contractor and shall not exceed the vertical nail spacing plus two feet or the short-term stand-up height of the ground, whichever is less. Excavation to the final wall excavation line shall be completed in the same work shift, unless otherwise approved by the Owner's Engineer.

2. Excavation of the next-lower lift shall not proceed until soil nail installation is complete, nail testing has been performed and accepted, TRM mat is extended and anchored by means of the attachment of the bearing plates and nuts, and in the current lift. Nail grout shall have cured for at least 72 hours, or attained the specified 3-day compressive strength, but not lesser than 1,500 psi before excavating the next underlying lift

B. Soil Nail Installation

1. The soil nail length and drill hole diameter necessary to develop the load capacity and to satisfy the acceptance criteria for the design load required shall be provided, but not less than the lengths or diameters shown in the Contract Drawings.

2. Drill holes for the soil nails shall be drilled at the locations, elevations, orientations, and lengths shown on the Contract Drawings. The drilling equipment and methods shall be selected to be suitable for the ground conditions and in accordance with the accepted installation methods submitted by the Contractor. If caving ground is encountered, cased drilling methods or other suitable means shall be used to support the sides of the drill holes. Soil nail bars shall be provided as shown in the Contract Drawings.

3. Centralizers shall be provided and sized to position the soil nail bars to within 1 in. of the center of the drill hole. Centralizers shall be positioned as shown on the

Contract Drawings so that their maximum center-to-center spacing does not exceed 10 ft and shall be located to within 1.5 ft from each end of the nail bar.

C. Grouting

1. The drill hole shall be grouted after installation of the soil nail bar and within 2 hours of completion of drilling. The grout shall be injected at the lowest point of each drill hole through a grout tube, casing, hollow-stem auger, or drill rods. The outlet end of the conduit shall deliver grout below the surface of the grout as the conduit is withdrawn to prevent the creation of voids. The drill hole shall be filled in one continuous operation. Cold joints in the grout column shall not be allowed except at the top of the test bond length of proof-tested production nails. The space above the bottom elevation of the inclined drill hole opening, called a “bird’s beak” due to its shape, shall be filled up with additional grout after a temporary cover is placed in front of the drill hole.

3.2 FACING INSTALLATION

Turf Reinforcement Mat (TRM) is placed from the crest to toe of the slope parallel to the slope face. The following sections provide installation recommendations for the subject slope.

A. Preparation of the site:

1. All vegetation and any loose debris shall be removed from the slope face. It is recommended that all vegetation located within 10 feet (3m) of the crest of the slope also be removed.
2. The surface to receive the TRM shall be prepared to relatively smooth conditions free of obstructions, depressions, debris and soft or low-density pockets of material. The material shall be capable of supporting a vegetative cover.
3. Erosion features such as rills, gullies, etc. must be graded out of the surface before TRM deployment. Smooth roll drum compaction may be required before deploying TRM to make sure the TRM makes immediate contact with the soil.

B. TRM Panels

1. TRM panels should be draped across all exposed slope surfaces within the designated zone.
2. Adjacent panel sections shall be connected using ring fasteners, in accordance with the manufacturer’s recommendations.

C. TRM Panel Cutting

1. To accommodate slope dimensions, TRM panels shall be cut on the jobsite. Prior to ordering, consideration should be given to non-uniform slopes with contours that may require overlapping panels to achieve complete coverage of the slope face. The TRM must be cleanly cut and surplus either folded back or overlapped so that it can be securely fastened together with lacing wire or fasteners.

D. TRM Panel Connections

1. TRM Panel to Panel Vertical Seaming: Use lacing high tensile ring fasteners to seam the panels to each other along vertical seams. For vertical seaming of adjacent panels, the panels are connected to one another by butt-jointing the selvedge wires together and securing them with lacing wire or ring fasteners.

2. TRM Panel to Panel Horizontal Seaming at Mid-Slope: Panels are overlapped minimum 2 ft and connected with 4 rows of lacing wire or ring fasteners, as per manufacturer splicing connection recommendation.
3. TRM Panels to Support Cables: The panels are overlapped 18 inches minimum and connected with 3 rows of lacing wire or ring fasteners, as per manufacturer splicing connection recommendation.

E. Lacing Procedures
1. Proper installation of high tensile fasteners shall have a nominal spacing of 4 in. (100 mm) not to exceed 6 in (150 mm) for all assemblies. A properly formed ring fastener before clamping is 1 ½ inch (44 mm) across after clamping diameter is 3/4 inch (20 mm) with a nominal overlap of 1in. (25 mm) after closure.
2. Connections from ring fasteners shall have a minimum resistance of 1,400 lb/ft (20.4 kN/m) when tested in accordance with ASTM A975.

F. TRM to Soil Nail Connection
1. The TRM should be placed over the end of the soil nail extending through the TRM facing and secured with a bearing plate and nut. Top and bottom of the TRM shall be secured to the soil anchors with a cable running through the anchors and securely folded TRM.

PART 4 - QUALITY CONTROL

4.1 TURF REINFORCEMENT MAT (TRM)

Manufacturing Quality Control: Testing shall be in compliance with the manufacturers Quality Policy. Quality Control testing shall be at a frequency that complies with recommendations of ASTM D 4354, “Practice for Sampling of Geosynthetics for Testing.”

4.2 SOIL NAIL TESTING

The Contractor shall perform both verification and proof testing of designated test soil nails. Verification tests on sacrificial test nails shall be conducted at locations shown on the Contract Drawings. Proof tests on production nails shall be conducted at locations selected by the Owner’s Engineer. Testing of any nail shall not be performed until the nail grout have cured for at least 72 hours, or attained their specified 3-day compressive strength, or at least 1,500 psi. Shotcrete may be applied to the slope facing within 2 feet of any nail subjected to proof testing, prior to TRM placement and testing, as a means of providing reaction bearing for the jack. Do not apply loads greater than 80 percent of the minimum guaranteed ultimate tensile strength of the tendon for Grade 150 bars, or 90 percent of the yield strength of the tendon for Grade 60 or 75 bars.

A. Equipment

Testing equipment shall include dial gauges, dial gauge support, jack and pressure gauge, load cell, and a reaction frame. The pressure gauge shall be graduated in 50 psi increments or less. The dial gauges shall be supported by a frame that is independent from the jacking and wall. Nail head movement shall be measured with a minimum of 2 dial gauges capable of measuring to 0.001 in.

B. Verification Testing

The Contractor shall perform a number of verification tests on sacrificial soil nails as established in the Contract Drawings. Verification testing shall be conducted prior to installation of production soil nails on sacrificial soil nails to confirm the appropriateness of the Contractor's drilling and installation methods, and to verify the required nail pullout resistance.

1. Methods

The verification tests shall be conducted on nails of the same design and constructed with the same construction methods to be used on production nails.

Soils nails in verification tests shall have both a bonded length and an unbonded length. The nail bar shall not be grouted along the unbonded length. Fully grouted soil nails shall not be used for load testing. The unbonded length shall be at least 3 ft within the drill hole.

The bonded length in verification tests, LB VT, shall be selected as follows:

A. Select LB VT max
For Grades 60 and 75 and other mild steel in accordance with ASTM A615, the maximum length, LB VT max, is defined as:

$$L_{BVY\,max} = \frac{A_t * f_y * C_{RTY}}{r_{PO}}$$

Where:

C_{RTY} = reduction coefficient for mild-grade steel = 0.9
A_t = cross-sectional area of the test tendon
f_y = nominal yield resistance of the test tendon (mild steel)
f_u = minimum ultimate tensile strength of the test tendon (high-strength steel)
r_{PO} = nominal pullout resistance (per unit length) of soil nail = π × qu × DDH
q_u = ultimate bond strength provided on construction drawings
D_{DH} = drill hole diameter

B. If LB VT max > 10 ft

Select LB VT to be 10 ft ≤ LB VT ≤ LB VT max.

C. If LB VT max < 10

Select LB VT = 10 ft, increase the test tendon size as needed, and recalculate LB VT max until LB VT max > 10 ft.
The maximum load during the verification test is defined as the Verification Test Load (VTL), and shall be calculated as follows:

$$VTL = L_{BVT} * r_{PO}$$

2. Schedule

Verification tests shall be conducted by incrementally loading the verification test nails to pullout or a maximum test load VTL in accordance with the loading schedule presented below.

The Contractor shall record soil nail movements at each load increment and at each time step. Dial gauges shall be set to “zero” after the alignment (AL) load has been applied.

Load levels beyond VTL are optional. Following application of VTL, the maximum load shall be reduced to the AL and the permanent set shall be recorded. Each load increment shall be held for at least 10 minutes.

The verification test nail shall be monitored for creep at a load of 0.75 VTL. Nail movements shall be measured and recorded during the creep portion of the test in increments of 1 minute, 2, 3, 5, 6, 10, 20, 30, 50, and 60 minutes. The load shall be maintained during the creep test to within 2 percent of the intended load by use of a load cell. Repump jack as needed to maintain load during hold times.

Load	Hold Time (minutes) (2)
AL(1)	1
0.13 VTL	10 (record soil nail movement at 1, 2, 5, 10)
0.25 VTL	10 (record soil nail movement at 1, 2, 5, 10)
0.38 VTL	10 (record soil nail movement at 1, 2, 5, 10)
0.50 VTL	10 (record soil nail movement at 1, 2, 5, 10)
0.63 VTL	60 (record soil nail movement at 1, 2, 5, 10, 20, 30, 50, 60)
0.88 VTL	10
1.00 VTL	10
AL	1(3)

Notes: (1) Alignment load shall be 0.025 VTL.
(2) Measure soil nail movement after each load increment has been achieved and at each time step indicated above.
(3) Record permanent soil nail movement.

Stepped unloading is optional. Consider between 1 to 7 intermediate steps in stepped unloading. If stepped unloading is conducted, hold each load step until the readings in gauges are stable.

C. Proof Testing

Successful proof testing shall be demonstrated on at least 5 percent of production soil nails in each nail row or a minimum of one per row. The Owner’s Engineer shall determine the locations and number of proof tests prior to nail installation in each row. Verification tests shall not be counted towards the minimum of 5 percent of production nails.

1. Methods

Proof test nails shall have a bonded length and a temporary unbonded length. The temporary unbonded length in proof tests shall be at least 3 ft within the drill hole.

The bonded length in proof tests, $L_{B\,PT}$, shall be selected such that $L_{B\,PT}$ is 10 ft or $L_{B\,PT\ max}$, whichever is smaller.

For Grade 75 and other mild steel in accordance with ASTM A615, the maximum length, LB PT max, is defined as:

$$L_{BPT\,max} = \frac{A_t * f_y * C_{RTY}}{r_{PO} * 0.75}$$

Production proof test nails that are shorter than 12 ft may be tested with less than the minimum 10-ft bond length. Fully grouted test nails shall not be proof tested. The maximum load in proof tests is defined as the Proof Test Load (PTL) and shall be calculated as follows:

$$PTL = L_{BVT} * r_{PO} * 0.75$$

2. Schedule

Proof tests shall be conducted by incrementally loading the proof test nail according to the test loading schedule shown below

Load	Hold Time (minutes) (2)
AL(1)	1
0.17 PTL	Until Movement Stabilizes
0.33 PTL	Until Movement Stabilizes
0.50 PTL	Until Movement Stabilizes
0.67 PTL	Until Movement Stabilizes
0.83 PTL	Until Movement Stabilizes
1.00 PTL(2)	10 (record soil nail movement at 1, 2, 5, 10)
AL	1

Notes: (1) Alignment load shall be 0.025 VTL.
(2) If the nail movement measured between 1 and 10 minutes exceeds 0.04 in., PTL shall be maintained for 50 more minutes and movements shall be recorded at 20, 30, 50, and 60 minutes. Record permanent soil movement.
(3) Measure times after the target load has been attained in each increment.
(4) If the soils reinforced with nails are relatively susceptible to deformation or creep, it is recommended to hold each load increment for 10 minutes and to record the soil nail movement at 1, 2, 5, and 10 minutes Measure soil nail movement after each load increment has been achieved and at each time step indicated above.

Hold each load increment until stabilized and record soil nail movements at each load increment and time interval shown in the schedule. All load increments shall be maintained to within 5 percent of the intended load. Repump jack as needed to maintain load during hold times. Dial gauges shall be set to “zero” after the alignment load has been applied. Perform creep tests at 1.00 PTL. Creep testing shall start as soon as PTL is applied. Soil nail movement shall be measured and recorded at 1 minute, 2, 3, 5, 6 and 10 minutes. If the nail movement measured between 1 minute and 10 minutes exceeds 0.04 in., the maximum test load shall be maintained for 50 additional minutes, and soil nail movements shall be recorded at 20 minutes, 30, 50, and 60 minutes.

END OF SECTION 313600

SECTION 313700 - RIPRAP

PART 1 – GENERAL

1.1 SUMMARY

A. SECTION INCLUDES:

Section	Title
3.1	Riprap Construction

1.2 REFERENCES

A. Drawings and general provisions of the Contract, including general and supplementary conditions and Division 1 Specification Sections, apply to this section.

B. MODOT Standard Specification Section 609.

1.3 WORK INCLUDED

A. The Contractor shall furnish all labor, equipment, and materials necessary for hauling and properly placing stone riprap at the locations and to the limits indicated on the Documents or as directed by Owner.

1.4 DEFINITIONS

A. Riprap

1. Type 1 Riprap – “Type 1 Rock Ditch Liner” aggregate stone used in applications which meet requirements of the Missouri Department of Transportation Standard Specifications for Highway Construction, Section 609.
2. Type 2 Riprap – “Type 2 Rock Ditch Liner” aggregate stone used in applications which meet requirements of the Missouri Department of Transportation Standard Specifications for Highway Construction, Section 609.
3. Type 3 Riprap – “Type 3 Rock Ditch Liner” aggregate stone used in applications which meet requirements of the Missouri Department of Transportation Standard Specifications for Highway Construction, Section 609.
4. Type 4 Riprap – “Type 4 Rock Ditch Liner” aggregate stone used in applications which meet requirements of the Missouri Department of Transportation Standard Specifications for Highway Construction, Section 609.

1.5 SUBMITTALS

A. The Contractor shall submit for approval to Owner, all working drawings and schedules of materials and methods proposed to follow in the execution of the Work under this item.

B. Submittals shall show in detail the type, size, and location of all riprap, bedding and accessories to be used in construction.

C. Bedding stone submittals shall be provided for approval to Owner where required per Missouri Department of Transportation Standard Specifications for Highway Construction, Section 609.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 RIPRAP CONSTRUCTION

A. Prepare the ground surface where the riprap will be placed to conform to the correct lines and grades before beginning the placement. Ground surface should be smooth and free from obstructions, depressions, or debris.

B. Place bedding to a uniform thickness as required by Missouri Department of Transportation Standard Specifications for Highway Construction, Section 609.

C. Place riprap to a uniform thickness as specified in the Construction Drawings. If no thickness is specified, place riprap to a minimum thickness equal to twice the predominant rock size of the specified riprap type.

END OF SECTION 313700

319000 - REVETMENT SCOUR MAT

PART 1 - GENERAL

1.1 SUMMARY

A. This section specifies a revetment scour transition mat for the pond overflow as shown on the Drawings. The product is used in hydraulic applications, such as high flow ditches and channels, pipe outlets and outfalls, stream banks, and shorelines, where erosive forces may exceed the limits of natural, unreinforced vegetation or in areas where limited vegetation establishment is anticipated.

1.2 SUBMITTALS

A. Product Testing: Manufacturer must submit the appropriate information as requested in this specification. Alterations to the specified testing standards will not be accepted.

B. Certifications: Manufacturer shall submit a letter of certification stating the Product meets or exceeds all physical properties, performance requirements, and packaging requirements.

1.3 DELIVERY, STORAGE AND HANDLING

A. Product shall be delivered in packaging which protects the scour mats from damage. Store and handle the Product in strict compliance with manufacturer’s instructions and recommendations.

PART 2 - MATERIALS

2.1 ACCEPTABLE SUPPLIER & MANUFACTURER

A. Manufacturer shall be Western Green, 4609 E. Boonville-New Harmony Rd, Evansville IN 47725, Phone: 800-772-2040.

2.2 MATERIALS

A. Provide a scour transition mat that consists of a resilient rubber mat with surface texture and multi-nib backing. It shall have a large hole drainage system with aperture openings approximately 1.25 in (3.18 cm) in diameter. The scour transition mat should be used as biotechnical replacement for hard armor. The scour transition mat should be mechanically anchored and is flexible matting. The scour transition mat shall provide erosion control in highly erosive areas, including shorelines, and can be used in conjunction with rolled erosion control products.

Table 1. Minimum Requirements for Scour Transition Mats

Property	**Test Method**	
UV resistance	ASTM D 4355	90-100% @1000 hrs
Tensile Strength	ASTM D 6818	600 lbs/ft
Permanent Thickness	ASTM D6525	0.75 in
Specific Gravity	ASTM D792	>1.0
Unvegetated Shear Stress[1]	ASTM D 6460	8.5 lbs/ft^2
Vegetated Shear Stress[1]	ASTM D 6460	12.0 lbs/ft^2
Approved Product (e.g.)		ShoreMax

[1] Required minimum shear stress an unvegetated or fully vegetated Scour Transition Mat system with turf reinforcement mat (TRM) underlayment can sustain without physical damage or excess erosion (> 0.5 in soil loss) during a 30-minute flow event in large-scale testing using ASTM D6460.

2.3 QUALITY ASSURANCE

A. Ensure that the Scour Transition Mat meets the requirements of the standards given in this specification. The scour transition mat acceptance is granted based on the manufacturers' certification and testing with the American Association of State Highway and Transportation Officials (AASHTO) National Transportation Product Evaluation Program (NTPEP) for Erosion Control Products (ECP).

B. Ensure that the Scour Transition Mat is covered by a manufacturer warranty for project performance for a minimum of 5 years.

PART 3 - EXECUTION

3.1 GENERAL

A. Utilize the Product as packaged by the manufacturer to help assure material performance. Comply with the manufacturer's installation instructions.

B. Prepare seedbed in compliance with:

1. Section 312000 – Earth Moving
2. Section 329219 – Seeding

END OF SECTION 319000

SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. St. Louis County Standard Specifications for Road and Bridge Construction, October 1, 2018 edition or later. Hereafter referred to as "County Highway Specifications".

1.2 SUMMARY

A. This Section includes the following:

1. Cold milling of existing hot-mix asphalt pavement.
2. Hot-mix asphalt paving.
3. Asphalt surface treatments.
4. Pavement-marking paint.
5. Asphalt traffic calming devices.

1.3 DEFINITIONS

A. Hot-Mix Asphalt Paving Terminology: Refer to County Highway Specifications.

1.4 SYSTEM DESCRIPTION

A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of standard specifications in accordance with County Highway Specifications.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.

B. Job-Mix Designs: Certification, in accordance with County Highway Specifications.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer, in accordance with County Highway Specifications.

B. Testing Agency Qualifications: In accordance with County Highway Specifications. See Section 014000.

C. Regulatory Requirements: Comply with County Highway Specifications for asphalt paving work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Apply asphalt materials in accordance with County Highway Specifications.

B. Pavement-Marking Paint: Proceed with pavement marking in accordance with County Highway Standards.

C. Prime and Tack Coats: Apply in accordance with County Highway Specifications.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations in accordance with County Highway Specifications.

B. The material to be used in the aggregate shall be Type 5 Aggregate, unless otherwise directed by the Owner.

1. The gradation is subject to Owner review and approval and no later than fourteen (14) days prior to first use. Any change in the mix design shall require Owner approval.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: In accordance with County Highway Specifications.

B. Asphalt Cement: In accordance with County Highway Specifications.

C. Prime Coat: ASTM D 2027, medium-curing cutback asphalt, MC-30 in accordance with County Highway Specifications.

D. Tack Coat: Type SS-1 H Liquid Asphalt in accordance with County Highway Specifications.

E. Seal Coat: In accordance with Section 409, County Highway Specifications.

2.3 AUXILIARY MATERIALS

A. Joint Sealant: Material shall be hot-pour elastic (rubberized) type filler for asphalt pavement.

1. The crack filler material must have a quick cure time and characteristics that will not allow bleeding or tracking in higher temperatures.

2. The crack filler must be compatible with asphalt sealer products.

B. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with County Highway Standards.

2.4 MIXES

A. Hot-Mix Asphalt: In accordance with County Highway Specifications.

1. Base Course: Section 405, Type X Bituminous Pavement.
2. Surface Course: Section 405, Type C Bituminous Pavement.

PART 3 - EXECUTION

3.1 EXAMINATION

A. In accordance with County Highway Specifications.

3.2 SURFACE PREPARATION

A. In accordance with County Highway Specifications.

B. All paved surfaces to receive asphaltic concrete courses shall be cleaned and free of all deleterious material to inhibit proper bonding. Surfaces to receive a subsequent course of asphaltic concrete in which more than 24 hours has elapsed between courses shall be cleaned using a vacuum type street sweeper.

C. Sealer or Paint should not be applied during rainy or wet weather, or when rain is anticipated within 8 hours after application.

D. Sealer applied in temperatures above 90˚ should first have the surface cooled with clean water.

E. Remove all vegetation and debris from cracks prior to beginning any sealing or striping work.

3.3 COLD MILLING

A. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Remove existing asphalt pavement by cold milling to grades and cross sections indicated.

1. Mill to a depth of 2 inches.
2. Mill to a uniform finished surface free of excessive gouges, grooves, and ridges.
3. Control rate of milling to prevent tearing of existing asphalt course.
4. Repair or replace utility risers, and other construction damaged during cold milling.
5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled hot-mix asphalt.
6. Transport milled hot-mix asphalt to an asphalt recycling facility.
7. Keep milled pavement surface free of loose material and dust.

3.4 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.

1. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving per County Specifications.

1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Patching: Fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.5 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than1 inch in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Rubberized Crack and Joint Filling:

1. All cracks to be filled shall be cleaned of debris, vegetation and failed previous fillers that will impede the bonding of the new crack filler. Compressed air at a minimum of 80psi shall be used for final cleaning prior to filling.

2. In wide cracks, the contractor shall insert backer rod material to maintain the width to depth ratio of the sealant.

3. Crack filler shall be applied per manufacturer instruction. The cracks should be overfilled per product requirements. All cracks which settle more than ¼" below the pavement must be refilled as needed.

3.6 AGGREGATE BASE PLACING

A. In accordance with County Highway Specifications.

B. Top surface of the compacted aggregate base course shall be finished by blading or with automated equipment especially designed for the purpose and rolled with a self- propelled steel-wheeled roller weighing not less than 10 tons under asphalt surfaces and 5 tons under concrete surfaces. Addition of thin layers of fine materials to the top of the base course to meet the grade will not be acceptable.

3.7 HOT-MIX ASPHALT PLACING

A. In accordance with County Highway Specifications.

B. The use of an Automatic Screed Control Paver and rollers will be required for all asphaltic concrete paving as specified in the County Highway Specifications. In addition, the paver shall be equipped with wheel chocks to lock and propel asphalt delivery trucks during paving operation.

C. Tack Coat shall be applied between the new Type "X" Asphaltic Concrete Pavement course and the new Type "C" Asphaltic Concrete Pavement course.

D. Butt joints shall be provided where existing pavement meets new pavement. Pavement shall be sawcut by the Contractor as directed by the Owner. The Contractor will be required to apply a finish coat of tack coat and sand to all completed butt joints in order to provide a finished, sealed pavement joint. No separate payment will be made for the construction of butt joints.

3.8 JOINTS

A. In accordance with County Highway Specifications.

3.9 COMPACTION

A. In accordance with County Highway Specifications.

3.10 ASPHALT TRAFFIC-CALMING DEVICES

A. Construct hot-mix asphalt speed bumps over compacted pavement surfaces. Apply a tack coat unless pavement surface is still tacky and free from dust. Spread mix at minimum temperature of 250 deg F.

1. Tack Coat Application: Apply uniformly to surfaces of existing pavement in accordance with County Highway Specifications.
2. Asphalt Mix: Same as pavement surface-course mix.
3. Before installation, mill pavement that will be in contact with bottom of traffic-calming device. Mill to a depth of 1 inch from top of pavement to a clean, rough profile.

B. Place hot-mix asphalt to cross section indicated, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after hot-mix asphalt has cooled.

3.11 INSTALLATION TOLERANCES

A. In accordance with County Highway Specifications.

B. Aggregate:

1. Aggregate shall be placed on the subgrade in layers of uniform thickness not exceeding 4 inches in compacted depth. The aggregates for each course shall be handled and spread in a manner that will prevent segregation of sizes. A greater layer thickness may be considered if it can be clearly demonstrated that the desired compaction can be obtained for the entire layer thickness.

2. Each layer shall be cleaned of loose and foreign matter before the subsequent layer is placed. Water content of the material shall be maintained during placement. Moisture content shall be maintained at +-2 percent of optimum.

3. The aggregate shall be compacted to not less than 100 percent of the maximum laboratory density as determined by the Standard Proctor Test AASHTO T -99 (ASTM d-698)

4. Surfaces of the completed aggregate base shall not deviate more than 1/2 inch when tested with a 1 a-foot straightedge. The completed compacted thickness of any course shall be within plus 1/2 inch and minus 1/2 inch of indicated thickness, and the average thickness shall not be less than the design thickness.

C. Hot Mix Asphalt

1. Completed paving shall have a density equal to or greater than 95 percent of the density of laboratory specimen of the approved job mix formula.

2. Spreading and finishing shall be in accordance with Section 404.9 of the County Highway Specifications.

D. Tack Coat

1. Application rate shall be 0.1 gallons per square yard.

E. Seal Coat

1. Notify Owner 48 hours in advance of work. Provide barricade protection to sealed areas as needed to restrict traffic.

2. Clean and air sweep blacktop surfaces to be seal coated removing all loose and foreign debris.

3. Degrease pavement oil spots with PERMAPRIME Oil Spot Primer or equal prior to seal coating.

4. Prime areas as needed for proper seal coat adhesion.

5. Apply two coats of PERMASEAL or equal coal tar emulsion asphalt sealer according to manufacturer's recommendations to surfaces to be seal coated. Heavy-duty coal tar emulsion will be mixed with PERMATUFF or equal coal tar latex additive and silica sand.

   The minimum application rate for both coats combined will be .30 gallons of sealant per square yard of surface area. Coal tar emulsion shall meet or exceed Federal specification RP355E.

   First coat to be applied with a squeegee onto surface. Second coat may be sprayed on. Contractor to protect vertical surfaces (Walls, poles, etc.) from overspray.

6. Furnish and provide in writing a one-year warranty against seal coated areas showing premature wear, lifting, or peeling.

3.12 PAVEMENT MARKING

A. In accordance with County Highway Specifications.

B. Layout and repaint all previously existing surface traffic markings with commercial grade acrylic latex traffic paint. Striping to include marking of adjacent concrete curbs.

3.13 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

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

3.14 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow excavated materials to accumulate on-site.

END OF SECTION 321216

SECTION 321313 – CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. St. Louis County Standard Specifications for Road and Bridge Construction, October 1, 2018 edition or later. Hereafter referred to as "County Highway Specifications".

1.2 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:

1. Roadways.
2. Curbs.
3. Walkways.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, expansive hydraulic cement, fly ash and other pozzolans, and ground granulated blast-furnace slag and silica fume.

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

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

C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated, based on comprehensive testing of current materials:

D. Material Certificates: Signed by manufacturers certifying that each of the following materials complies with requirements:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.

8. Joint fillers.
9. Pavement marking materials.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed pavement work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

1. Manufacturer must be certified in accordance with County Highway Specifications.

C. Testing Agency Qualifications: See Section 014000.

D. Source Limitations: In accordance with County Highway Specifications.

E. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

F. Concrete Testing Service: See Section 014000.

1.6 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: In accordance with County Highway Specifications.

B. Form-Release Agent: In accordance with County Highway Specifications.

2.2 STEEL REINFORCEMENT

A. In accordance with County Highway Specifications.

2.3 CONCRETE MATERIALS

A. In accordance with County Highway Specifications.

2.4 ADMIXTURES

A. In accordance with County Highway Specifications.

B. The use of admixtures not herein specified is prohibited unless prior approval is granted by the Owner.

2.5 FIBER REINFORCEMENT

A. In accordance with County Highway Specifications.

2.6 CURING MATERIALS

A. In accordance with County Highway Specifications.

2.7 RELATED MATERIALS

A. Expansion- and Isolation-joint-Filler Strips:

1. In accordance with County Highway Specifications.

2. Expansion joint material shall be *2* inch thick pre-molded expansion joint filler.

B. Expansion- and Isolation-joint-Filler Strips: In accordance with County Highway Specifications.

C. Pavement-Marking Paint: In accordance with County Highway Specifications.

D. Glass Beads: In accordance with County Highway Specifications.

E. Joint Sealants: In accordance with County Highway Specifications.

2.8 CONCRETE MIXTURES

A. Prepare design mixtures in accordance with County Highway Specifications.

B. All concrete shall be 6 1/2 sack (611 lbs.) per cubic yard. All concrete shall be Class B, Gradation D, with Type 1 cement.

C. Course Aggregate shall be Crushed Limestone, Aggregate No.3.

D. Fine Aggregate shall be Class A, with aggregate containing lignite prohibited.

E. Air-entrained concrete shall be used for all construction, with 5 % air content (by volume) specified. A tolerance of +- 1 % (by volume) will be permitted. The Owner may request and shall receive adjustments to the air content, in order to affect the serviceability of the concrete. All concrete shall have a minimum slump of four inches (4") per ASTM C-143. The maximum water per sack shall be five and one- quarter (5.25) gallons.

F. No water shall be added to the concrete mix once it leaves the batch plant without the Owner's approval.

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: In accordance with County Highway Specifications.

B. Project-Site Mixing: In accordance with County Highway Specifications.

PART 3 - EXECUTION

3.1 PREPARATION

A. In accordance with County Highway Specifications.

B. All existing joints and exposed concrete surfaces shall be thoroughly cleaned prior to placing of any concrete.

3.2 EDGE FORMS AND SCREED CONSTRUCTION

A. In accordance with County Highway Specifications.

3.3 STEEL REINFORCEMENT

A. General: In accordance with County Highway Specifications.

3.4 JOINTS

A. General: In accordance with County Highway Specifications.

B. All pre-molded expansion joints shall extend the full width and depth of the improvements and must be flush with the top of concrete surface. Expansion joint material shall be placed on all sides around catch basins, driveways, curbs and sidewalk intersections.

C. Joint sealants shall be applied in accordance with County Highway Specifications.

3.5 CONCRETE PLACEMENT

A. In accordance with County Highway Specifications.

B. Concrete shall be placed on the prepared sub-base in a manner to avoid segregation and contamination. Concrete vibrators of an internal type shall be used in compacting and consolidating all concrete mixtures. The units shall be capable of providing a minimum of 4,500 impulses per minute.

C. All concrete surfaces shall be broom-finished in a direction transverse to traffic with a long, soft bristle brush.

3.6 CONCRETE FINISHING

A. General: In accordance with County Highway Specifications.

3.7 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Curing Methods: Cure concrete in accordance with County Highway Specifications.

C. Immediately after finishing operations have been completed and as soon as marring of the concrete will not occur, the entire surface of the newly-placed concrete shall be covered and cured in accordance with the following method. The concrete shall not be left exposed for more then one-half hour during the curing period. After the free water has left the pavement surface, the entire surface shall be sealed by hand or machine spraying with a uniform application of clear membrane curing material. The Contractor shall provide satisfactory equipment to ensure uniform coverage of curing material, without loss, on the pavement at the rate of one gallon for each 150 square feet. If rain falls on the newly-coated pavement before the film has dried sufficiently to resist damage, or if the film is damaged in any other way, the Contractor will be required to apply additional curing material to the affected surface.

3.8 PAVEMENT TOLERANCES

A. Comply with tolerances in accordance with County Highway Specifications.

B. All work included under this item shall be placed within a tolerance of one-half inch, plus or minus, of the lines and grades shown on the plans except in critical areas of less than 1 % slope where the Work shall be within a tolerance of one-quarter inch, plus or minus.

C. Concrete shall have a minimum compression strength of 3,000 psi at seven (7) days and a minimum compressive strength of 4,000 psi at twenty-eight (28) days. Compressive strength will be determined from samples prepared and tested by the Owner and in accordance with ASTM C31-86 and ASTM C39-86.

D. The Owner shall take concrete test samples as necessary to ensure proper strength concrete is being placed.

3.9 PAVEMENT MARKING

A. Apply pavement-marking in accordance with County Highway Specifications.

3.10 CURB

A. All joints shall be placed at right angles to, or radial to the centerline of the pavement unless directed otherwise by the Owner. All edges shall be finished with an edging tool having a radius of 1/4". Control joints shall be provided in curb and gutter sections at ten (10) foot intervals or as directed otherwise by the Owner. Metal vertical curb and gutter hangers shall be used to control joints to properly space at batter forms. No additional payment shall be made for metal vertical curb and gutter hangers.

B. No slip forming will be allowed on vertical curb and curb and gutter.

3.11 SIDEWALKS

A. After finishing the surface of sidewalks, all edges and joints of the sidewalk shall be finished with an edging tool having a radius of 1/4 inch.

B. Expansion joints shall be at twenty-five foot (25') intervals for the full width and depth with control joints at five foot (5') intervals or as directed by the Owner. Contractor shall submit a jointing plan to the Owner and Engineer for review and approval.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Specifications. Testing will be performed Owner in accordance with County Highway Specifications.

3.13 REPAIRS AND PROTECTION

A. Remove and replace concrete pavement that is broken, damaged, or defective or does not meet requirements in this Section in accordance with County Highway Specifications.

B. Test and repair areas in accordance with County Highway Specifications when necessary to determine magnitude of cracks or defective areas.

C. Protect concrete from damage.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material.

END OF SECTION 321313

SECTION 323113 - CHAIN LINK FENCES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section covers the 6 feet tall chain link fencing. Fencing shall be provided in the alignment indicated on the Drawing. Refer to Drawings for gate details.

1.2 REFERENCES

A. Chain Link Fence Manufacturer's Institute (CLFMI) – Voluntary Standard for Chain Link Fence Installation.

B. ASTM A120 – Pipe, Steel, Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses.

C. ASTM C94 – Ready-Mixed Concrete.

D. FS RR-F-00191 – Fencing, Wire and Post, Metal (Chain-Link Fence Fabric).

1.3 SHOP DRAWINGS AND PRODUCT DATA

A. Clearly indicate plan layout, grid, spacing of components, accessories, fittings, and anchorage.

B. Submit manufacturer's installation instructions and procedures, including standard details of fence installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Framework: ASTM A120; Schedule 40, butt weld, standard weight, hot dip galvanized to 2.0 oz/sq. ft. coating.

2.2 CONCRETE MIX

A. Concrete: ASTM C94, Type I Portland cement, 3,000 psi at 28 days, 2 to 3 inch slump.

2.3 COMPONENTS

A. Line Posts: 2.38-inch diameter.

B. Corner and Terminal Posts: 3.5-inch diameter.

C. Top and Brace Rail: 1.66-inch diameter, plain end, sleeve coupled.

D. Caps: Cast or pressed steel, or malleable iron, hot dip galvanized, sized to post dimension, set screw retained.

E. Fittings: Sleeves, bands, clips, rail ends, tension bars, truss rod, fasteners and fittings, steel galvanized.

F. Tension Bars: Length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Fabric: Six feet tall, 2 inches diamond mesh, interwoven, 9 gage, zinc coated ASTM A392, Class I, top selvage twisted tight, bottom selvage knuckle end closed.

H. Bottom Tension Wire: 6 gage steel single strand, galvanized.

2.4 FENCE GROUNDING

A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Copper.
2. Material on or below Finished Grade: Copper.
3. Bonding Jumpers: Braided copper tape, 1 inch wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

B. Connectors and Grounding Rods: Comply with UL 467.

1. Connectors for Below-Grade Use: Exothermic welded type.
2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches.

C. Lightning Protection System: Maximum grounding-resistance of 25 ohms under normal dry conditions.

PART 3 - EXECUTION

3.1 CHAIN-LINK FENCE INSTALLATION

A. Install line posts, corner posts, top rails, post caps, fabric and gates, to provide a rigid structure for fence of height as indicated on drawings. Use manufacturer’s standard fittings, fasteners, and hardware.

B. Maximum spacing of posts: 10’-0”.

C. Install line, corner, and terminal posts plumb, set in concrete footings 12” thick by 36” in depth.

1. Follow proper soil erosion control methods when digging footings.

D. Set post to within 3 inches from bottom of concrete footing. Slope top of concrete for water runoff.

E. Pass top rail through line post tops to form continuous bracing. Install 7-inch long couplings midspan at pipe ends.

F. Brace each gate and corner post back to adjacent line post with horizontal center brace rail. Install brace rail, one bay from end posts.

G. Install center and bottom brace rail on corner and gate leaves.

H. Fasten fabric to top rail, line posts, braces, and bottom tension wire with wire ties on maximum 24-inch centers.

I. Attach fabric to end, corner and gate posts with tension bars and tension bar clips.

J. Stretch fabric between terminal posts or at intervals of 100 ft. maximum whichever is the least dimension.

3.2 GROUNDING AND BONDING

A. Fence Grounding: Install at maximum intervals of 1500 feet except as follows:

1. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet.
   a. Gates and Other Fence Openings: Ground fence on each side of opening.
      (1) Bond metal gates to gate posts.
      (2) Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 below finished grade.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet (45 m) on each side of crossing.

C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.

D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location, including the following:

E. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

F. Connections: Make connections to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

END OF SECTION 323113

SECTION 329219 - SEEDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Preparation of subsoil.
2. Placing topsoil.
3. Seeding.
4. Mulching.
5. Soil testing and fertilizer.
6. Maintenance Until Final Acceptance.
7. Inspections.
8. Insurance.

B. Related Sections:
1. 329300 – Plants
2. 329400B – Invasive Species Management
3. 329700 – Establishment Maintenance

1.2 REFERENCES

A. American Society for Testing and Materials:
1. ASTM C602 - Standard Specification for Agricultural Liming Materials.

B. Current State seed laws.

1.3 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.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for seed mix including third party pure Live Seed (PLS) results, fertilizer, mulch and hydroseeding information.

C. Test Reports: Complete a soil test which includes six (6) soil samples taken from locations that are evenly distributed throughout the project site. Indicate topsoil nutrient and pH levels with a customized soil amendment program with recommended soil supplements and application rates.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 CLOSEOUT SUBMITTALS

A. Section 017300 – Execution Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Include maintenance instructions, cutting method and maximum grass height; types, application frequency, and recommended coverage of fertilizer.

1.6 QUALITY ASSURANCE

A. Provide seed mixture in containers showing percentage of seed mix, germination percentage, inert matter percentage, weed percentage, year of production, net weight, date of packaging, and location of packaging.

1.7 QUALIFICATIONS

A. Seed Supplier: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum 5 years documented experience, approved by manufacturer.

1.8 INSURANCE

A. The contractor shall provide insurance to cover “Acts of God” for flood events, to cover the replacement and installation of seeding lost as a result of a flood in the project area. The period of coverage shall conclude at Final Acceptance by the Owner.

B. The contractor shall provide an insurance certificate for the above-mentioned insurance and the City of Brentwood shall be listed on the certificate as additional insured.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver seed mixture in sealed containers. Seed in damaged packaging is not acceptable.

B. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

1.10 COORDINATION

A. Section 013100 – Project Management and Coordination: Requirements for coordination.

1.11 INITIAL MAINTENANCE

A. Zone 1 – SEL: Maintain native seeded areas immediately after placement until plants are well established and exhibit vigorous growing conditions acceptable to Owner.
   1. Scattered bare spots will be allowed up to a maximum of 20% of any seeded area.
   2. A minimum of 80% coverage is required as part of substantial completion.
   3. Use a cover crop to hold soil when bare spots develop outside ideal native seed installation times.
   4. Refer to Section 3.8 for maintenance requirements until final acceptance.
   5. Warranty: Include coverage for one continuous growing season. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

B. Zone 2 – Creek Edge (25’ Buffer) Planting: Maintain native seeded areas immediately after placement until plants are well established and exhibit vigorous growing conditions acceptable to Owner.
   1. Scattered bare spots will be allowed up to a maximum of 20% of any seeded area.
   2. A minimum of 80% coverage is required as part of substantial completion.
   3. Use a cover crop to hold soil when bare spots develop outside ideal native seed installation times.
   4. Refer to Section 3.8 for maintenance requirements until final acceptance.
   5. Warranty: Include coverage for one continuous growing season. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

C. Zone 4 – Channel Side Slope Planting: Maintain native seeded areas immediately after placement until plants are well established and exhibit vigorous growing conditions acceptable to Owner.
   1. Scattered bare spots will be allowed up to a maximum of 20% of any seeded area.
   2. A minimum of 80% coverage is required as part of substantial completion.
   3. Use a cover crop to hold soil when bare spots develop outside ideal native seed installation times.
   4. Refer to Section 3.8 for maintenance requirements until final acceptance.
   5. Warranty: Include coverage for one continuous growing season. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

D. Zone 3 – Turf Seeding: Maintain seeded areas immediately after placement until grass is well established and exhibits vigorous growing condition for two cuttings. Scattered bare spots, no larger than one square foot, will be allowed up to a maximum of 5% of any planted area. A minimum of 80% coverage is required as

part of substantial completion. Refer to Section 3.8 for maintenance requirements until final acceptance.

E. Storage Pond Seeding – Maintain native seeded areas immediately after placement until plants are well established and exhibit vigorous growing conditions acceptable to Owner.
   1. Scattered bare spots will be allowed up to a maximum of 20% of any seeded area.
   2. A minimum of 80% coverage is required as part of substantial completion.
   3. Use a cover crop to hold soil when bare spots develop outside ideal native seed installation times.
   4. Refer to Section 3.8 for maintenance requirements until final acceptance.
   5. Warranty: Include coverage for one continuous growing season. Replacements: Plants of same size and species as specified, planted in the next growing season, with a new warranty commencing on date of replacement.

PART 2 PRODUCTS

2.1 SEED MIXTURE

A. Suppliers: Suppliers shall be from within a 300-mile radius of the project site at a location with similar climate conditions to the project site. Approved local suppliers:
   1. Genesis Nursery, Inc. 23200 Hurd Rd., Tampico, IL 61283, (877) 817-5325, www.genesisnurseryinc.com.
   2. Pure Air Natives, 4630 W Florissant Ave., Saint Louis, MO. 63115, (636) 357-6433., www.pureairnatives.com.

B. Zone 1 – SEL: Streambank Stabilization Seed Mix, modified for local ecotype or approved equal. Seed mix provider: Genesis Nursery, Inc. 23200 Hurd Rd., Tampico, IL 61283, (877) 817-5325, www.genesisnurseryinc.com. Cover Crop: A cover crop is included in the Streambank Stabilization seed mix.

C. Zone 2 – Creek Edge Planting: Streambank Stabilization Seed Mix, modified for local ecotype or approved equal. Seed mix provider: Genesis Nursery, Inc. 23200 Hurd Rd., Tampico, IL 61283, (877) 817-5325, www.genesisnurseryinc.com. Cover Crop: A cover crop is included in the Streambank Stabilization seed mix.

D. Zone 4 – Channel Side Slope Planting: Lo Pro Mesic Prairie w/ Flowers Seed Mix, modified for local ecotype or approved equal. Seed mix provider: Genesis Nursery, Inc. 23200 Hurd Rd., Tampico, IL 61283, (877) 817-5325, www.genesisnurseryinc.com. Cover Crop: Utilize a cover crop appropriate for installation timing. Fall/Winter: Winter Wheat installed at 30lbs./acre, Late Winter/Early Spring: Spring oats installed at 30 lbs./acre.

E. Zone 3 – Turf Seeding:

1. Standard Seed Mixture (including all Flood Bench turf seeding areas) : Turf-type tall fescue mixture shall contain fresh, clean, new-crop seed with a minimum germination of 85%. The seed mixture (by weight) shall be 75% improved turf-type tall fescue containing a five-way blend varieties, in equal amounts of equal color and texture, containing acceptable varieties, including Arid, Bonanza, Mustang, Olympic, Falcon, Jaguar, Rebel II, or approved equal, 10% improved Kentucky Bluegrass containing acceptable varies, including Adelphi, America, Baron, Majestic, Ram, Touchdown, Nassau, or approved equal, and 15% 50/50 blend of annual and perennial rye.

2. Shade Seed Mixture:

   Heavy Shade: Provide certified grass-seed blends or mixes, proportioned by weight, as follows:

Proportion	Name	Min. Pct. Germ.	Min. Pct. Pure Sd.	Max. Pct. Weed Sd.
65 pct.	Chewings Red Fescue (Festuca rubra) - Approved Varieties from list below: Florentine II, Flyer or approved equal.	85	98	0.50
25 pct.	Kentucky Bluegrass (Poa pratensis) - Approved Varieties from list below: Adelphi, America, Baron, Majestic, Ram, Touchdown, Nassau or approved equal.	80	85	1.00
10 pct.	Redtop (Agrostis alba) Approved Variety	85	92	1.00

F. Storage Pond Seeding: Native Diverse Detention Seed Mix, modified for local ecotype or approved equal. Seed mix provider: Genesis Nursery, Inc. 23200 Hurd Rd., Tampico, IL 61283, (877) 817-5325, www.genesisnurseryinc.com. Cover Crop: Utilize a cover crop appropriate for installation timing. Fall/Winter: Winter Wheat installed at 30lbs./acre, Late Winter/Early Spring: Spring oats installed at 30 lbs./acre.

2.2 SEEDING RATES

A. Zone 1 – SEL: Streambank Stabilization Seed Mix, or approved equal: 76 lbs./acre, Cover crop is included in this seed mix.

B. Zone 2 – Creek Edge Planting: Streambank Stabilization Seed Mix, or approved equal: 76 lbs./acre, Cover crop is included in this seed mix.

C. Zone 3 – Turf Seeding: Standard (including all Flood Bench turf seeding areas) and Shade Seed Mix: 350 lbs./acre.

D. Zone 4 – Channel Side Slope Planting: Lo Pro Mesic Prairie w/ Flowers Seed Mix, or approved equal: 13 lbs./acre, Cover crop as specified above.

E. Storage Pond Seeding: Native Diverse Detention Seed Mix, or approved equal: 16 lbs./acre, Cover crop as specified above.

2.3 SOIL MATERIALS

A. Topsoil:
   1. Excavated from site and free of weeds if available.
   2. Topsoil: Imported from approved, local sources.
      a. Provide loam topsoil, friable, free of weeds and other materials deleterious to plant growth and rocks larger than 1/2-inch diameter.
      b. Acceptable sources include but are not limited to the following:
         1) Fick Supply Company, Wildwood, MO (636) 532-4978
         2) Kirkwood Material Supply, Kirkwood, MO (314) 822-9644
         3) Brentwood Material Company, St. Louis, MO (314) 968-0184
         4) St. Louis Composting, St. Louis, MO (314) 868-1612
      c. Topsoil shall be medium textured soil complying with UDSA soil texture triangle values for loam to sandy loam topsoil with the following neutral to medium acid pH ranges:
      d. Topsoil for lawns areas - 6.5 to 7.5 pH
      e. Add pH modifiers to topsoil as required to meet the above pH ranges based on soil test results.
      f. Customized soil amendments based on soil test results to address site specific issues.

2.4 ACCESSORIES

A. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.

B. Fertilizer: Grade recommended for grass, of proportion necessary to eliminate deficiencies of topsoil, as indicated in analysis. Apply only if recommended by and at rates identified in soil test results.

C. Lime: ASTM C602, Class T agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.

D. Amendment for Existing Topsoil: Amendment for existing topsoil shall be Black Gold Compost or approved equal, available from St. Louis Composting, 39 Old Elam Ave., Valley Park, MO Phone: (636) 861-3344.

E. Water: Clean, fresh and free of substances or matter capable of inhibiting vigorous growth of grass.

F. Erosion Control Fabric: BioD-Mat 90 by RoLanka International, Inc. 155 Andrew Drive, Stockbridge, GA 30281, USA, Phone:770-506-8211, E-mail: rolanka@rolanka.com or approved equal.

G. Herbicide: As recommended by soil test.

H. Stakes: Softwood lumber, chisel pointed.

I. String: Inorganic fiber.

J. Hydroseeding Mulch: Mulch shall be composed of cellulose or wood fiber products with no growth or germination inhibiting substances, and shall be manufactured in such a manner that when thoroughly mixed with seed, fertilizer, organic stabilizer, and water, in the proportions specified, will form homogeneous slurry which is capable of being sprayed to form a porous mat. The fibrous mulch in its air-dry state shall contain no more than 15% by weight of water. The fiber shall have a temporary green dye and shall be accompanied by a certificate of compliance stating that the fiber conforms to these specifications.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 014000 - Quality Requirements: Verification of existing conditions before starting work.

B. Verify prepared soil base is ready to receive the Work of this section.

3.2 PREPARATION OF SUBSOIL

A. Prepare sub-soil to eliminate uneven areas and low spots. Maintain lines, levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated sub-soil.

C. Scarify subsoil to depth of 3 inches where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.

3.3 PLACING AND AMENDING TOPSOIL

A. Spread topsoil to minimum depth of 4 inches over area to be seeded. Rake until smooth.

B. Amend topsoil by tilling Black Gold Compost, or approved equal, into top 2 inches of topsoil.

C. Place topsoil during dry weather and on dry unfrozen subgrade.

D. Remove vegetable matter and foreign non-organic material from topsoil while spreading.

E. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

3.4 FERTILIZING

A. Apply fertilizer at application rate recommended by soil analysis.

B. Apply after smooth raking of topsoil and prior to roller compaction, as needed.

C. Do not apply fertilizer at same time or with same machine used to apply seed.

D. Mix fertilizer thoroughly into upper 2 inches of topsoil.

E. Lightly water soil to aid dissipation of fertilizer. Irrigate top level of soil uniformly.

3.5 SEEDING

A. Apply seed mixtures at the rate indicated on the drawings evenly in two intersecting directions. Rake in lightly.

B. Allowable seeding methods are: drill or hydroseed. Broadcast seeding is only permitted in small areas of less than 100 square feet.

C. Do not seed areas in excess of that which can be mulched on same day.

D. Planting Season: March 15 through May 30 and August 15 through October 15.

E. Do not sow immediately following rain, when ground is too dry, or when winds are over 12 mph.

F. Roll seeded area with roller not exceeding 112 lbs./linear foot.

G. Immediately following seeding and compacting, apply mulch to thickness of one inch. Maintain clear of shrubs and trees.

H. Apply water with fine spray immediately after each area has been mulched. Saturate to 4 inches of soil.

3.6 SEED PROTECTION

A. Identify seeded areas with stakes and string around area periphery. Set string height to 24 inches. Space stakes at 48 inches.

B. Cover seeded slopes where grade is 4 inches per foot or greater with erosion control fabric. For areas were grade is less than 4 inches per foot, seeded areas can be covered with mulching material as indicated above. All seeded areas within Zones 1 - 4 shall be covered with erosion control fabric regardless of grade or slope. Roll fabric onto slopes without stretching or pulling.

C. Lay fabric smoothly on surface, bury top end of each section in 6-inch-deep excavated topsoil trench. Overlap edges and ends of adjacent rolls minimum 12 inches. Backfill trench and rake smooth, level with adjacent soil.

D. Secure outside edges and overlaps at 36-inch intervals with stakes.

E. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.

F. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches.

3.7 HYDROSEEDING

A. Hydroseeding Preparation: Do all slurry preparation at the job site:
1. Water, mulch, fertilizer, binder and other ingredients shall be added to the tank simultaneously so that the finished load is a homogenous mix of the specified ingredients.
2. Seed shall be added last and shall be discharged within 2 hours.
3. Loads held over 2 hours will be recharged with ½ the seed rate before application.
4. Once fully loaded, the complete slurry shall be agitated for 3-5 minutes to allow for uniform mixing.

B. General
1. All hydroseed applications are to be applied in a sweeping motion to form a uniform application and form a mat.
2. Unused Loads: If mixture remains in tank for more than 8 hours it shall be removed from the job site at contractor’s expense.

3.8 TEMPORARY SEEDING

A. The work of temporary seeding and protection of erosive earth areas shall be done promptly, where needed.

B. Timing: Temporary seeding and protection shall be done under the following conditions:
1. When it is impossible or impractical to bring an area to final line, grade and finish so that permanent seeding and protection work can be performed without subsequent serious disturbance by additional grading.
2. When soil erosion occurs or is considered to be a potential problem on areas where construction operations are temporarily suspended.
3. When an immediate cover would be desirable to minimize erosion, siltation or pollution of any area.

3.9 MAINTENANCE UNTIL FINAL ACCEPTANCE

A. Zones 1, 2 and 4 – Riparian Mix Seeded Areas and Storage Pond Seeded Areas:
1. Maintain seed areas for a period of one growing season including mowing, spotseeding/plugging and weed control, including spot herbicide application to establish a stand of native plants complying with coverage requirements specified in Initial Maintenance and final acceptance by the Owner.
2. Mow native plants at 12 inches high a maximum of three (3) times during the growing season covered by the maintenance period as recommended by seed manufacturer to reduce weed competition. Storage Pond Seeded Areas should only be mowed one (1) time during the growing season
3. Recommended timing: April, June & August. Recommended timing for Storage Pond Seeded Areas: August.
4. Selective weeding shall be done manually as recommended by seed manufacturer and/or industry standards for establishing native plants.

B. Zone 3 – Turf Seeded Areas:
1. Maintenance shall begin immediately after planting. The seed shall be protected and maintained by watering, mowing, fertilizing and replanting until final acceptance by the owner.
2. Mow grass at regular intervals to maintain at maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at each mowing. Perform first mowing when seedlings are 40 percent higher than desired height.
3. Immediately remove clippings after mowing and trimming. Do not let clippings lay in clumps.
4. Water to prevent grass and soil from drying out.
5. Control growth of weeds. Apply herbicides when necessary to inhibit excessive weed growth. Remedy damage resulting from improper use of herbicides.
6. Immediately reseed areas showing bare spots.
7. Repair washouts or gullies.
8. Protect seeded areas with warning signs during maintenance period.

9. The maintenance of the seeded turf areas shall be the Contractor's responsibility until final acceptance by the Owner. Contractor shall protect seeded areas by watering, fertilizing, applying weed killer, and replanting as necessary, for a uniform stand of established grass and until approved by the Owner's Representative. Scattered bare spots, no larger than one square foot, will be allowed up to a maximum of 5% of any planted area.

3.10 INSPECTIONS

A. Final Project Acceptance
1. The Contractor shall notify the Owner's Representative for final inspection. The request shall be in written form and received at least ten (10) calendar days before the anticipated date of inspection.
2. Based on the sole judgment of the Owner's Representative, he shall certify in writing as to the satisfaction and substantial completion of the project, which shall be deemed final acceptance. Final acceptance is defined as when all punch list items have been determined to be complete by either the Owner or the Owner's Representative and the Contractor is authorized to submit the final pay application.

B. End of Initial Maintenance Until Final Acceptance
1. The Contractor shall notify the Owner's Representative for final inspection and turnover of maintenance activities. The request shall be in written form and received at least ten (10) calendar days before the anticipated date of inspection.
2. Based on the sole judgment of the Owner's Representative, he shall certify in writing as to the satisfaction and substantial completion of the Initial Maintenance Until Final Acceptance, which shall be deemed final acceptance. Final acceptance is defined as when all punch list items have been determined to be complete by either the Owner or the Owner's Representative and the Contractor is authorized to submit the final pay application. Establishment Maintenance shall begin when Initial Maintenance is complete and Final Acceptance of the project by the Owner is complete.

PART 4 METHOD OF MEASUREMENT

4.1 Confirmation that the entire area to be seeded is complete.

PART 5 BASIS OF PAYMENT

5.1 The accepted quantity of seeding will be paid for at the contract lump sum price required by the contract. No direct payment will be made for incidentals related to seeding such as liming, fertilizing, establishment watering, spreading of topsoil, seedbed preparation, or installation of erosion control fabric. No direct payment will be made for additional work and seed required when seeding during the months of June, July, October and

November. Costs for insurance shall be considered incidental and be included in the contract lump sum price.

END OF SECTION 329219

SECTION 329223 - SODDING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Preparation of subsoil.
   2. Placing topsoil.
   3. Fertilizing.
   4. Sod installation.
   5. Maintenance.

1.2 REFERENCES

A. American Society for Testing and Materials:
   1. ASTM C602 - Standard Specification for Agricultural Liming Materials.

B. Turfgrass Producers International:
   1. TPI - Guideline Specifications to Turfgrass Sodding.

1.3 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.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Product Data: Submit data for sod grass species and any other amendments to soil for sod growth.

C. Test Reports: Complete a soil test which includes six (6) soil samples taken from locations that are evenly distributed throughout the project site. Indicate topsoil nutrient and pH levels with a customized soil amendment program with recommended soil supplements and application rates.

D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Sod: Root development capable of supporting its own weight without tearing, when suspended vertically by holding upper two corners.

1.6 QUALIFICATIONS

A. Sod Producer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing work of this section with minimum three years documented experience, approved by sod producer.

1.7 INSURANCE

A. The contractor shall provide insurance to cover “Acts of God” for flood events, to cover the replacement and installation of seeding lost as a result of a flood in the project area. The period of coverage shall conclude at Final Acceptance by the Owner.

B. The contractor shall provide an insurance certificate for the above-mentioned insurance and the City of Brentwood shall be listed on the certificate as additional insured.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver sod on pallets. Protect exposed roots from dehydration. Place sod in shaded areas, where feasible.

B. Do not deliver more sod than can be laid within 24 hours.

1.9 COORDINATION

A. Coordinate with installation of landscape plantings.

1.10 MAINTENANCE SERVICE

A. The maintenance of sodded turf area shall be the Contractor’s responsibility until final acceptance by the Owner. The first mowing will not be attempted until the sod is securely in place, uniform in appearance, and the turf blades have reached a height of 4 inches.

1.11 WARRANTY

A. Contractor shall warrant that all sodded lawns and reconditioned lawns planted under this Contract will be healthy and in a condition of greater than 80 percent active growth one (1) year from date of Substantial Completion.

B. Any delay in completion of sodding operations which extends the planting into more than one planting season shall extend the Warranty Period correspondingly.

PART 2 PRODUCTS

2.1 MATERIALS

A. Sod:

1. Sod shall be nursery grown, of high quality, and free of disease nematodes, and soil-borne insects. Sod shall be free of noxious weeds, including but not limited to Common Bermuda Grass, Quack Grass, Johnson Grass, Poison Ivy, Yellow Nutsedge, Nibblewill, Canadian or Russian Thistle, Bindweed, Bentgrass, Wild Garlic, Ground Ivy, Perennial Sorel, Wild Violet, and Bromegrass. Sod shall be considered free of other weed types if less than 5 weed plants are found per 100 square feet of area.
2. All sod should have two full seasons' growth before harvesting. Sod with less than two seasons' growth is subject to rejection.
3. All sod shall be stripped at a uniform solid thickness of approximately one-inch, plus or minus ¼". Measurement for thickness shall exclude top growth and thatch, and shall be determined at the time of field cutting. Sod thatch, uncompressed shall not exceed ½".
4. Root development shall be such that standard size pieces will support their own weight and retain their shape, when suspended vertically from a firm grasp on the uppermost 10% of area, or when rolled and unrolled three times.
5. Before stripping, the sod shall be mowed uniformly at a height of 2 to 2-1/2 inches.
6. Sod shall not be harvested or transplanted when moisture content (excessively dry or wet) may adversely affect survival of the sod.
7. Sod shall be harvested, delivered, and installed within a period of 24 hours. Sod not transplanted within this period shall be inspected and subject to rejection.
8. Sod shall be a 90% : 10%, turf-type Fescue/Kentucky Bluegrass blend, containing a mixture of equal parts by weight of three improved varieties of the turf-type Fescue.

2.2 SOIL MATERIALS

A. Topsoil: Excavated from site and free of weeds.

2.3 ACCESSORIES

A. Fertilizer: Commercial grade; recommended for grass, with fifty percent of elements derived from organic sources; of proportion necessary to eliminate deficiencies of topsoil to the following proportions: nitrogen 20 percent, phosphoric acid 20 percent, soluble potash 20 percent.

B. Lime: ASTM C602, Class T agricultural limestone containing a minimum 80 percent calcium carbonate equivalent. Apply only if recommended by and at rates identified in soil test results.

C. Water: Clean, fresh, and free of substances or matter capable of inhibiting vigorous growth of grass.

D. Wood Pegs: Softwood, sufficient size, and length to anchor sod on slope.

E. Herbicide: As recommended by sod installer and approved by Owner's Representative.

2.4 HARVESTING SOD

A. Machine cut sod and load on pallets in accordance with TPI standards.

B. Cut sod in area not exceeding one sq.yd., with minimum ½ inch and maximum 1-inch topsoil base.

2.5 SOURCE QUALITY CONTROL

A. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.

B. Provide recommendation for fertilizer and lime application rates for specified sod grass species as result of testing.

C. Testing is not required when recent tests are available for imported topsoil. Submit these test results to testing laboratory. If recent test results are unavailable, contractor is to provide a soil test. Indicate, by test results, information necessary to determine suitability.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 014000 - Quality Requirements: Verification of existing conditions before starting work.

B. Verify prepared soil base is ready to receive the Work of this section.

3.2 PREPARATION OF SUBSOIL

A. Turf areas shall be tilled to a minimum depth of 6 inches. After tilling, the area shall be regraded to a smooth and even grade. The top 4 inches of soil shall be free of existing turf, weeds, trash, rocks larger than one-inch diameter, concentrations of crushed rock, scraps of waste concrete and asphalt, and other deleterious materials prior to sod placement. In areas where tree roots exist, care should be used during tilling operations to minimize disturbance of roots.

3.3 FERTILIZING

A. Prepare the sod bed by uniformly applying 12 pounds of 12N-12P-12K slow release fertilizer per 1,000 square feet of turf grass area to be planted. The fertilizer shall be thoroughly incorporated into the top six inches of soil with a mechanical tiller, or other approved method. Sod bed shall be in a firm, but uncompacted condition with a firm texture prior to laying of sod.

B. Fertilizer: As approved by Owner's Representative, to be used in limited quantities, as needed. Do not allow direct leeching of material into adjacent stream or water bodies.

C. Apply fertilizer after smooth raking of topsoil and prior to installation of sod.

D. Apply fertilizer no more than 48 hours before laying sod.

E. Lightly water soil to aid dissipation of fertilizer.

3.4 LAYING SOD

A. Sod areas indicated on drawings, or as defined in related specifications sections.

B. The sodding operation shall not commence until site conditions are satisfactory. Sodding shall not be done when the ground is excessively wet, frozen, or untillable.

C. All areas to be sodded shall be fine graded before sodding and be free of deleterious materials, including weeds, existing grasses, tree branches, stones greater than one-inch diameter, concentrations of crushed rock, mortar, and other debris. Grades for the flow lines of swales and ditches, shall be carefully established. Sod shall be placed so that it is level and even with the thatch surface of the sod.

D. Sod shall be installed in tightly abutted parallel rows with the lateral joints staggered at a minimum distance equal to the width of the sod slab. Voids between sod strips will not be accepted. Any netting used to hold the sod in place during transportation shall be removed before laid.

E. For sloping surfaces, sod shall be laid beginning at the base of the slope, with staggered joints and at right angles to the flow of water. Sod placed on 3:1 slopes or steeper, and in ditch flow lines, shall be staked with 6 stakes per square yard or roll of sod. Stakes shall be wood, ½" by 1" by 12" and shall be driven into the ground, leaving approximately ½" of the top above the sod line. Stakes should be set sufficiently in the ground to permit mowing.

F. The sod shall be watered immediately after installation. Prevent sod from drying during progress of work. After sodding is completed in any one section, the entire area shall be thoroughly irrigated to at least one-inch depth below the new

sod pad. Subsequent watering should maintain moisture to a depth of at least 4 inches.

G. All sodded areas should be staked.

3.5 MAINTENANCE

A. Maintenance shall begin immediately after planting. The sod shall be protected and maintained by watering, mowing, fertilizing, and replanting for as long as it is necessary to establish a uniform stand of grass. Any sod not surviving prior to its first mowing shall be replaced with new sod from the same source. Mowing of the sod will be the responsibility of the Contractor until final acceptance by the Owner.

B. Mow grass at regular intervals to maintain at maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at each mowing.

C. The maintenance of the sodded turf area shall be the Contractor's responsibility until final acceptance by the Owner. Until the first mowing, the Contractor shall apply the herbicide bromoxynil, or approved equal, at the label rate, to kill any broadleaf weeds. Contractor shall protect sodded areas by watering, fertilizing, applying weed killer, and replanting as necessary, for a uniform stand of established grass and until approved by the Owner's Representative. Scattered bare spots, no larger than one square foot, will be allowed up to a maximum of 5% of any planted area.

D. Neatly trim edges and hand clip where necessary.

E. Immediately replace sod on areas showing deterioration or bare spots.

F. Protect sodded areas with warning signs during maintenance period.

3.6 INSPECTIONS

A. The Contractor shall notify the Owner's Representative for final inspection. The request shall be in written form and received at least ten (10) calendar days before the anticipated date of inspection.

B. Based on the sole judgment of the Owner's Representative, he shall certify in writing as to the satisfaction and substantial completion of the project, which shall be deemed final acceptance.

END OF SECTION 329223

SECTION 329300 – PLANTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Preparation of subsoil and topsoil.
2. Topsoil bedding.
3. Trees, plants, and plugs, ground cover.
4. Mulch.
5. Fertilizer.
6. Pruning.
7. Maintenance Until Final Acceptance.
8. Insurance.

1.2 REFERENCES

A. American National Standards Institute:
1. ANSI A300 - Tree Care Operations - Tree, Shrub and Other Woody Plant Maintenance - Standard Practices. (Most current versions)
2. ANSI Z60.1 - Nursery Stock. (2004)

1.3 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, Brome Grass and any plant life not specified.

B. Plants: Living trees, plants, and ground cover specified in this Section, and described in ANSI Z60.1.

1.4 SUBMITTALS

A. Product Data:
1. Erosion Control Fabric

B. Samples:
1. Erosion Control Fabric
2. Mulch: At least three pint-bags of mulch of the type to be used on this project.

C. Photographs of Plants Photographs of Plants taken at the Nursery Source: Provide representative images of plants prior to scheduling tagging trips and as the basis for the Contracting Officer to select plants.

1. Contractor shall label each photograph with the plant species botanical name, nursery name, and date of photograph.
2. Photographs shall include images showing the full range of characteristics of each plant including detailed photographs of the bark, the base of the tree (rootball crown), leaves if present, branching structure, form, and habit.
3. Images shall include a scale figure or measuring device to indicate true size.
4. Photographs may be transmitted electronically but the title of electronic files must bear the plant name, nursery, and date.
5. For container plants, also provide close up photographs of the rootball with the container removed.
    a. Quantity: 10% of the total number specified.

D. Installer Qualifications: In addition to requirements of Section 013300 “Submittal Procedures,” provide qualifications for the Project Manager and Foreman/Site Supervisor showing years of experience, and a minimum of three project references. For each reference list client, design or engineering professional hired by the client, type, cost and duration of project and role of personnel.

E. Plant Species and Source List: The Contractor shall maintain an up-to-date plant species and source list indicating the plant botanical and common name, size, quantity, form, rootball, identification of fall dig hazards, limb height (if applicable), nursery source, including contact information.
1. Plant list shall clearly indicate deviations from the specified plant list and any proposed substitutions.
2. Contractor shall confirm nursery source prior to scheduling tagging trip.
3. As the project progresses and plants are located and sealed, revise and re-submit the plant list submittal.

1.5 CLOSEOUT SUBMITTALS

A. Section 017300 - Execution Requirements: Requirements for submittals.

B. Operation and Maintenance Data: Include pruning objectives, types and methods; types, application frequency, and recommended coverage of fertilizer.

1.6 QUALITY ASSURANCE

A. Tree Pruning: ANSI A300 Pruning Standards for Woody Plants.

B. One copy of the landscape plans and specifications shall be kept on site throughout the work of this section.

1.7 QUALIFICATIONS

A. Nursery: Company specializing in growing and cultivating plants with three years’ documented experience.

B. Installer: Company specializing in installing and planting plants with five years' documented experience.

C. Arborist: Company specializing in performing work of this section. Pruner shall be from the same company as the installer.

D. Maintenance Services: Performed by installer.

1.8 INSURANCE

A. The contractor shall provide insurance to cover "Acts of God" for flood events, to cover the replacement and installation of plant material (trees, live stakes, and shrubs and seeding) lost as a result of a flood in the project area. The period of coverage shall conclude at Final Acceptance by the Owner.

B. The contractor shall provide an insurance certificate for the above-mentioned insurance and the City of Brentwood shall be listed on the certificate as additional insured.

1.9 PRE-INSTALLATION MEETINGS

A. Notify Owner's Representative a minimum of 48 hours prior to installing phases of the work for in field plant placement verification for no more than a total of two such meetings. Some minor location adjustment may occur.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Mark plants for identification. Securely attach legible labels to at least 25 percent of each species and variety of separate plants in any shipment before delivery to the site. Each perennial plant shall be labeled individually.

B. Handle plants from bottom of ball. Protect plant roots and tops from sun or drying winds until final planting. Plants with cracked, broken or loosely wrapped balls will be rejected.

C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer. Fertilizer to be Osmocote or Owner approved equal.

D. Protect and maintain plant life until planted.

E. Deliver and install plant life materials within a 72-hour period. Keep plant containers and root balls moist throughout planting process. Proof of moisture must be found within top two inches of soil. Live stake material shall be maintained in a moist condition until planted. If not installed within 48 hours of harvesting, lie stake material shall be refrigerated until installed.

F. Plant material damaged as a result of delivery, storage or handling will be rejected and replaced at no cost to the Owner.

G. Spray deciduous plants in foliage with an anti-desiccant immediately after digging to prevent dehydration. Dig, pack, transport and handle plants with care to ensure protection against injury. Protect all plants from drying out. If plants cannot be planted immediately upon delivery, properly protect them with soil, wet peat moss, or in a manner acceptable to the Owner's Representative. Water heeled-in plantings daily. Only use anti-desiccant if forecast during planting and for two (2) weeks afterward is for temperatures over 80 degrees Fahrenheit.

H. Cover plants transported on open vehicles with a protective covering to prevent wind burn.

I. Live stakes shall be buried to a depth of at least 2 inches in wet mulch until five to seven days prior to installation at which time they shall be soaked in clear water.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Do not install plant life when ambient temperatures may drop below 35 degrees F or rise above 90 degrees F for greater than 24 hours.

B. Do not install plant life when wind velocity exceeds 30 mph.

1.12 COORDINATION

A. Coordinate work with other trades on site.

1.13 WARRANTY

A. Furnish one-year warranty for trees, plants, and ground cover. Warranty period should start at the end of the period of Maintenance Until Final Acceptance.

B. If dormancy of plants requires verification of viability during the next growing season, the Warranty Period for those plants will commence following such verification.

C. For any delay in completion of planting operations that extends the planting into more than one planting season, the Warranty Period for all plantings shall begin when Final Acceptance is granted unless otherwise indicated.

D. Any plants that are 25 percent or more dead shall be considered dead and shall be replaced at no charge. A tree shall be considered dead when the main leader has died back or 25 percent or more of the crown is dead.

E. Contractor shall not be held responsible for failures due to vandalism, during Warranty Period. Contractor shall be responsible to protect installed plantings from damage by animals. Contractor shall monitor condition of plantings regularly (once per month minimum) and report such occurrences to Owner in writing within 5 calendar days of observation. If Contractor does not notify Owner

in writing of such conditions, Contractor shall be responsible for replacement of dead landscape plantings.

1.14 INITIAL MAINTENANCE UNTIL FINAL ACCEPTANCE

A. Maintain plant life immediately after placement and through final acceptance by the Owner.

B. Initial Maintenance Until Final Acceptance includes:
1. Cultivation and weeding plant beds and tree pits.
2. Applying herbicides for weed control. Remedy damage resulting from use of herbicides.
3. Remedy damage from use of insecticides.
4. Watering sufficient to saturate root system. Contractor shall thoroughly water installed plants within 24 hours of installation. Installed plants shall be watered sufficient to saturate root system at least once each week during construction unless otherwise instructed by the Owner's Representative. Plants that are installed during the spring planting period shall be watered once a week during the following summer months of May, June, July and August. Plants that are installed during the fall planting period shall be watered once a week during the following spring months of March, April and May only if there is less than 1" of rain during each week, and once a week during the following summer months of June, July and August regardless of rainfall. Weeks shall be measured 12:00 a.m. Monday to 12:00 a.m. Monday.
5. Pruning, including removal of dead or broken branches.
6. Disease control.
7. Maintaining wrapping, guys, turnbuckles, and stakes. Adjust turnbuckles to permit sway and movement of trunk and limbs. Repair or replace accessories when required.
8. Replacement of mulch, except in events as a result of an act of God or vandalism.
9. Contractor shall monitor plantings on a regular basis for damage due to waterfowl. Any damage shall be reported to the Owners Representative along with a recommendation for reducing future damage.
10. Due to the susceptibility of live stake plant materials to be damaged from a variety of conditions until establishment, the live stake installations shall be inspected more frequently. Plant materials missing or damaged should be replaced as soon as possible at no additional cost to the Owner.

PART 2 PRODUCTS

2.1 SELECTION AND INSPECTION OF PLANTS

A. The Owners Representative will review plant materials at the nursery source and/or at the Owners Representative's discretion, through photographs provided by the Contractor prior to selection. All plants brought to the site will have been

reviewed in this manner. Plants that do not have the Contracting Officer's approval shall be removed from the site.

1. Tagging: At least three weeks prior to the expected planting date, request, in writing, the Owners Representative's inspection of plant material at the nursery. Provide photograph beforehand if requested by the Owners Representative.
    a. The Owners Representative will make his/her own travel arrangements to the nursery.
    b. Tags placed on the selected plants at the nursery shall remain on the plants until Final Acceptance of the work.
2. The Contracting Officer's basis of plant selection will include:
    a. Conformance with specified genus, species, variety, size, form, rootball and quality.
    b. The visual characteristics of the plants.
    c. Plant health.
    d. Adherence of the nursery to cultural practices and maintenance procedures that are at or above industry standard.
3. On-Site Inspection:
    a. The Contractor shall permit the Owner to inspect plants upon their arrival to the project site and at any time prior to planting. The Owner will inspect the plant materials for size and condition of rootballs and/or root systems, insects, injuries, defoliation, wind burn and latent defects. The Contractor shall remove plant material that is unsatisfactory or defective and replace the plants at no additional cost to the Owner.
    b. The Owner may reject a specific nursery source and associated plants if he/she determines before, during or after receipt of plants, any of the following:
        1) The nursery stock does not meet health standards set forth herein, including disease and infestation.
        2) The nursery stock does not meet the requirements of the Owner's basis of selection as stated herein. The nursery cannot supply the specified plant(s) or an acceptable substitute cultivar or species.

B. Substitutions
1. In the event that the Contractor is unable to obtain the plant material specified, either because of unavailability or the failure of the plant material to meet the quality requirements of this Section, the Contractor shall provide substitute plants of equal size, quality and value to the plant originally specified. The substitute plants shall conform to all requirements of this Section.

2.2 DIGGING SEASON

A. Plants shall be delivered freshly dug. Plants that have been pre-dug the previous season shall not be accepted.
1. Spring Dig: Plants shall be dug as early as possible and as determined by the nursery owner, and no later than bud break.

a. Do not transport plants within 14 days after bud break.

2. Fall Dig: Plants shall be dug following leaf senescence.
   a. Fall Dig Hazard: Many species of trees or shrubs are considered "Fall Transplanting Hazards" by the nursery trade. Fall Transplanting Hazards are to be transplanted only during the spring digging season. The Contractor shall identify Fall Transplanting Hazards from the plant schedule and factor the proper handling of these trees into the overall sequencing of construction. The Contractor shall notify the Contracting Officer of any conflicts arising from this analysis of the plant list. Fall Dig Hazards are listed on the Drawings.

2.3 TREES, PLANTS, AND GROUND COVER

A. Planting Stock:
   1. Species: In accordance with Standardized Plant Names, official code of American Joint Committee on Horticulture Nomenclature.
   2. Identification: Label individual plants or each bundle of plants when tied in bundles.
   3. Plants: No. 1 Grade conforming to "American Standard for Nursery Stock" of American Association of Nurserymen (AAN); well-branched, vigorous and balanced root and top growth; free from disease, injurious insects, mechanical wounds, broken branches, decay and other defects.
   4. Trees: Furnish with reasonably straight trunks, free of disease and pest damage with well-balanced tops, and single leader. No trees with co-dominant leaders will be accepted.

B. Trees, Plants, and Ground Cover:
   1. Species and size identifiable in plant schedule, grown in climatic conditions similar to those in locality of the Work.
   2. Species with a "Y" shaped trunk or no main leader may be rejected if this is not true to species.
   3. RPM Trees: S3-3 Conservation Grade Bare Root trees, 3-5' tall (from root flare to top of tree), ½" caliper, with white tree guard. Available from Forrest Keeling Nursery, 88 Forrest Keeling Lane, 88 Forrest Keeling Lane, Elsberry, MO 63343, or approved equal.

C. Live Stake Materials:
   1. Live stakes shall be ½ to 2 inches in diameter and consist of the species listed in the Planting Plans on the Project Construction Plans. At no point along the entire length of the live stake shall the diameter be less than ½ inch or greater than 2 inches. The stakes shall be a minimum of 4 feet in length unless specified otherwise in the Planting Plans on the Project Construction Plans. Side branches shall be cleanly removed, and bark shall be intact. The stakes shall be free of scars, canker, rot or other signs of disease or infestation. The basal end shall be cut at an angle. The top shall be cut square.

2. Cuttings must not be allowed to dry out and must be kept covered and moist during transport and storage. The plant materials shall be installed within 48 hours after initial preparation unless refrigerated.

2.4 SOIL MATERIALS

A. Topsoil: For landscape planting beds and all other areas, topsoil to be provided and installed by Contractor.

2.5 SOIL AMENDMENT MATERIALS

A. When soil tests indicate soil amendment, apply soil conditioners or fertilizers to amend soil to specified conditions.
1. Tree Fertilizer: Containing fifty percent of elements derived from organic sources; of proportion necessary to eliminate deficiencies of topsoil, as indicated in analysis.

B. Peat Moss: Shredded, loose, sphagnum moss; free of lumps, roots, inorganic material or acidic materials; minimum of 85 percent organic material measured by oven dry weight, pH range of 4 to 5; moisture content of 30 percent.

C. Lime: Ground limestone, dolomite type, minimum 95 percent carbonates.

D. Water: Clean, fresh, and free of substances or matter capable of inhibiting vigorous growth of plants.

E. Herbicide: As recommended by landscape contractor and verified by owner's representative. Any application deemed necessary must be applied by a person with a valid applicators license which should be submitted and approved prior to any application.

F. Pesticide: As recommended by landscape contractor and verified by owner's representative. Any application deemed necessary must be applied by a person with a valid applicators license which should be submitted and approved prior to any application.

G. Rooting Hormone: Use for all live stake plant material. A product, such as Rhizopon AA#3 manufactured by Phytotronics, Inc., or equal, containing synthetic auxin plant hormone (IBA) or comparable ingredient and specifically formulated to promote root formation in hardwood cuttings.

H. Fertilizer: For individual plants, provide fertilizer as described below:
1. Each Installed Quart/Plug Size Plant:
a. Installed in an oversized, mechanically dug hole with adequate loose soil around the root zone.
b. Root pruned prior to planting to promote vigorous rooting response.
c. One (1) Osmocote 15-8-11 slow release plant tab per plant pit.

d. Immediate watering to saturation to settle plant into plant pit & prevent air pockets/root desiccation.

2. Each Installed Container Size Plant:
   a. Installed in an oversized, mechanically dug hole with adequate loose soil around the root zone.
   b. Root pruned prior to planting to promote vigorous rooting response.
   c. Two (2) Osmocote 15-8-11 slow release plant tabs per plant pit.
   d. Immediate watering to saturation to settle plant into plant pit & prevent air pockets/root desiccation.
3. Each Installed Shrub:
   a. Installed in an oversized, manually dug hole with adequate loose soil around the root zone.
   b. Root pruned prior to planting to promote vigorous rooting response.
   c. Four (4) Osmocote 15-8-11 slow release plant tabs per plant pit.
   d. Immediate watering to saturation to settle plant into plant pit & prevent air pockets/root desiccation.
4. Each Installed Non Live Stake Tree:
   a. Installed in an oversized, manually dug hole with adequate loose soil around the root zone.
   b. Root pruned prior to planting to promote vigorous rooting response.
   c. Six (6) Osmocote 15-8-11 slow release plant tabs per plant pit.
   d. Immediate watering to saturation to settle plant into plant pit & prevent air pockets/root desiccation.

2.6 MULCH MATERIALS

A. Mulching Material: Composted, shredded hardwood bark, dark brown in color, free of weeds and other organic matter and matter detrimental to plant life.

B. Hay or chopped cornstalks are not acceptable.

2.7 ACCESSORIES

A. Wrapping Materials: Natural Burlap.

B. Stakes: As indicated.

C. Cable: Non-corrosive, of sufficient strength to withstand wind pressure and resulting movement of plant life. Gauge as indicated.

D. Plant Protectors: Arbor Tie to protect plant stems, trunks, and branches.

E. Plant Pot: Typical black corrugated plastic.

F. Wrapping: Waterproof fabric.

G. Erosion Control Fabric: BioD-Mat 90 by RoLanka International, Inc. 155 Andrew Drive, Stockbridge, GA 30281, USA, Phone:770-506-8211, E-mail: rolanka@rolanka.com or approved equal.

2.8 PLANT SOIL MIX

A. Plant Soil Mix:
1. Planting Beds: 25% Peat Moss and 75% Topsoil
2. Tree Pits: 50% Existing Soil and 50% Topsoil
3. Flood Bench Planting Beds: Must be free of weeds, rocks, gravel and construction debris.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify the location of all utilities prior to beginning work to avoid conflicts during digging.

B. Verify prepared subsoil is at specified line and grade and is ready to receive work.

C. Saturate soil with water to test drainage. Notify owner's representative if a "hardpan" condition exists which may affect drainage and plant viability.

D. Plant quantities and spacing shown on the Drawings are for Contractor information only. Fill all areas on plans shown to be planted. Verify quantities and spacing of all plant material shown on the plans. All ground cover, perennial, and live stake beds are to be filled at the specified spacing. Notify Owner's Representative of discrepancies.

E. Verify that a required water source is available, in proper location, and ready for use. Verify the location of all utilities to avoid conflict during digging.

3.2 PREPARATION OF SUBSOIL

A. Prepare subsoil to eliminate uneven areas. Maintain profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

B. Remove foreign materials, weeds and undesirable plants and their roots. Remove contaminated subsoil.

C. Scarify subsoil to a minimum depth of 3 inches where plants are to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted subsoil.

D. Dig pits and beds two times wider than plant root system.

3.3 PLACING TOPSOIL/PLANTING SOIL MIX

A. Spread topsoil to minimum depth of 6”, over area to be planted. Rake smooth and to indicated tolerances.

B. Place topsoil during dry weather and on dry unfrozen subgrade.

C. Remove vegetable matter and foreign non-organic material from topsoil while spreading.

D. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage.

E. Install topsoil/plant soil mix into pits and beds intended for plant root balls, as shown on the drawings.

3.4 FERTILIZING

A. Apply Osmocote or Owner approved equal fertilizer at rate recommended by manufacturer.

B. Apply after initial raking of topsoil.

C. Mix thoroughly into upper 2 inches of topsoil, soil mix or after tree planting.

D. Lightly water soil to aid dissipation of fertilizer.

3.5 PLANTING

A. Place plants for best appearance for review and final orientation by Owner’s Representative.

B. Set plants vertical, where possible.

C. Remove non-biodegradable root containers.

D. Set plants in pits or beds, partly filled with prepared plant mix, at minimum depth as indicated on Drawings under each plant.

E. Saturate soil with water when pit or bed is half full of topsoil and again when full.

F. For Perennial, Ground Cover Planting: Set out and space plants in even rows with triangular spacing. Use planting soil mix with any recommendations for amendments. Dig holes large enough to allow spreading of roots. For rooted cutting plants supplied in flats or as plugs, plant each in a manner that will minimally disturb the root system but to a depth not less than two nodes. Work soil around roots to eliminate air pockets and leave a slight indentation around plants to hold water. Water thoroughly after planting, taking care not to cover plant crowns with wet soil. Protect plants from hot sun and wind; remove

protection if plants show evidence of recovery from transplanting shock. For flood bench plantings, plants will be installed through cleanly cut slits in the erosion control blanket. Slits shall be generally parallel to the direction of flow in the stream. Portions of the erosion control blanket shall not be removed.

G. For Live Stake Planting:

1. Live stakes may be installed any time during their dormant period when the ground is not frozen. Live stakes shall not be installed after dormancy is broken and the leaves have appeared. LIVE STAKES SHALL ONLY BE INSTALLED BETWEEN DECEMBER 1 THROUGH MARCH 31. The Owner's Representative may determine if the stakes are likely to break dormancy prior to that date and may require that installation be completed earlier. Prior to installation, live stakes shall be soaked in clear water for five to seven days. Live stakes shall be removed from the water no more than 1 hour before planting and shall be kept moist until installation. Live stakes, other than willows, shall be treated with rooting hormone in accordance with manufacturer's recommendation as approved by the Owner's Representative. Live stakes shall be tamped into soil to a depth as shown on the Project Construction Plans. The basal (end cut on an angle) end of the stake must be tamped into the ground, not the growing tip or bud end. Stakes inserted upside down shall not be accepted and shall be replaced. In no case shall more than 1 foot of live stake remain above ground. The tops of the live stakes shall not be cut off without the consent of the Owner's Representative. When installing through openings in rock, the basal end of the stake shall extend into the soil beneath the rock to a depth of at least 1 foot. A steel rod or hydraulic probe may be used to prepare a hole through the rock. The diameter of the rod or probe shall not exceed the diameter of the smallest stake so that the stakes fit snugly into the soil. The live stakes shall be oriented perpendicular to the slope with growing tips protruding no more than 6 inches from the face of the rock. Stakes shall be oriented at a slight downstream angle. Stakes oriented upstream shall not be accepted and shall be replaced. Stakes that split during installation shall not be accepted and shall be replaced. A dead-blow hammer may be used for inserting the stakes. The quantity and type and location of plants are presented in the Project Construction Plans. Care shall be taken not to damage the live stakes during installation. Those damaged at the top during installation shall be trimmed back to undamaged condition.

H. Planting Times:

1. Balled and Burlap Trees: Ball and burlap trees shall only be installed between September 1 through November 30 and February 1 through May 31.
2. Container Grown Material: Container grown material shall only be installed between September 1 through November 30 and February 1 through May 31.
3. Live Stake Material: Live stakes shall only be installed between December 1 through March 31.

4. Plug and Rhizome Material: Plug and rhizomes shall only be installed between February 15 through May 31.

3.6 PLANT RELOCATION AND RE-PLANTING

A. Relocate plants as indicated by the Owners Representative.

B. Ball or pot removed plants when temporary relocation is required. Plants with broken balls will be replaced.

C. Replant plants in pits or beds, partly filled with prepared topsoil mixture, at minimum depth as indicated on Drawings under each plant. Scarify the burlap halfway down the ball.

D. Saturate soil with water when pit or bed is half full of topsoil and again when full.

3.7 INSTALLATION OF ACCESSORIES

A. Wrap deciduous shade and flowering tree trunks and place guying system. Maintain guys throughout planting process.

3.8 PLANT SUPPORT

A. Brace plants vertically with plant protector wrapped guy wires and stakes to the following:

Tree Caliper	Tree Support Method
Less than 2 inches	2 stakes with two ties minimum
Less than 2 inches (multi-stem)	3 stakes with two ties minimum
2 - 6 inches	3 guy wires

3.9 TREE PRUNING

A. When pruning of newly installed trees is required, lightly prune trees in accordance with ANSI A300 Maintenance Pruning Type: Crown Cleaning. Refer to Section 01450 for pruning of existing trees.

3.10 FIELD QUALITY CONTROL

A. Plants will be rejected when ball of earth surrounding roots has been disturbed or damaged prior to or during planting.

PART 4 METHOD OF MEASUREMENT

4.1 Plants and all related incidental items will be installed and upon installation and acceptance, the contractor will be paid 90 percent of the lump sum amount for this work within 30 days of receipt of invoice for this work. The contractor will receive the final 10 percent payment following the first successful leafing out of the plants within 60 days of

the first following growing season when leafing out occurs. The replacement (material and installation) of the successful planting material shall be the responsibility of the contractor at no cost to the owner. Replacement shall be made at the direction of the owner.

PART 5 BASIS OF PAYMENT

5.1 The accepted quantities of plants, complete in place, will be paid for at the lump sum price required by the contract. No direct payment will be made for any incidental items such as supporting posts, mulch, edging, erosion control, topsoil placement, and establishment watering necessary for this work. Costs for insurance shall be considered incidental and be included in the contract lump sum price.

END OF SECTION 329300

SECTION 329400B - INVASIVE SPECIES MANAGEMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Invasive Species Vegetation Removal

1.2 REFERENCES

A. Drawings and general provisions of the Contract, including general and supplementary conditions and Division 1 Specification Sections, apply to this section.

B. Missouri Department of Conservation Invasive Plant Website.

1.3 WORK INCLUDED

A. The Contractor shall furnish all labor, equipment, and materials necessary for and to properly complete Invasive Species Management to the satisfaction of Owner and according to the Contract Drawings.

1.4 DEFINITIONS

A. Clearing: Section 311000 Site Clearing

B. Invasive Species: A plant that causes ecological or economic harm in a new environment where it is not native. Invasive species are capable of causing extinctions of native plants and animals, reducing biodiversity, competing with native organisms for limited resources, and altering habitats.

C. Mulch: Mulch is a wood chip covering placed on the ground surface around plants (or covering the ground in lieu of plants) to prevent the growth of unwanted species and to provide erosion control.

1.5 SUBMITTALS

A. Contractor will prepare an invasive species management plan that includes a description of the species to be managed, the procedures proposed to remove the invasive species, herbicide use, and spill prevention procedures, and safe handling and disposal of herbicides. Contractor shall refer to the Missouri Department of Conservation Invasive Plant Section of its website at https://mdc.mo.gov/trees-plants/problem-plant-control/invasive-plants.

B. Contractor and/or its sub-contractor shall have current permits for any chemical treatment activities and submit a copy to Owner.

1.6 QUALITY ASSURANCE

A. Contractor will learn to identify the priority target invasive plant species (see Missouri Department of Conservation Invasive Plant Section of its website at https://mdc.mo.gov/trees-plants/problem-plant-control/invasive-plants).

B. Priority Target Species:
   1. The priority target species are Autumn Olive (Elaeagnus umbellate), Bush Honeysuckle (Lonicera maackii and Lonicera x bella) Callery Pear (Pyrus calleryana), and Wintercreeper (Euonymus fortunei). Additional invasive species that may be of priority concern in the area will be identified by the Owner.

1.7 MINIMIZE SOIL DISTURBANCE

A. Due to the nature of invasive plants to rapidly colonize areas of disturbed soil, out-compete native species and become firmly established very quickly, it is essential to minimize areas of soil disturbance during clearing.

B. Some of the methods described herein require actual digging or pulling of plants from the soil. Each removal technique must be evaluated to determine if the proposed management method will destabilize soils to the point where erosion is threatened.

1.8 MULCH

A. Invasive plants rapidly colonize any area of disturbed soil, it is essential that all disturbed areas be mulched and seeded as soon as possible. If outside the growing season for seed germination, disturbed sites should still be mulched. Outside sources of mulch should be free of invasive plant parts or seeds. Use of wood fiber mulch is preferred.

1.9 DISPOSITION OF COLLECTED MATERIAL

A. Collected plant material will be hauled off-site. Invasive plants shall NOT be left on-site, nor burned nor ground on-site. Transport the material to an appropriate disposal location as at the time of removal.

1.10 HERBICIDES

A. All herbicide use shall be applied by hand applicator and in accordance with label instructions, state and federal laws and will be conducted by, or under the supervision of experience applicators. Herbicide application techniques will generally fall under two types; foliar application and steam cut and treat. Foliar herbicides will be applied to actively growing plants prior to flowering.

PART 2 PRODUCTS

2.1 MATERIAL AND EQUIPMENT

A. Contractor shall furnish all material, tools, equipment, facilities and services as required for performing clearing and removal of invasive target species.

2.2 NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. Accepted methods of exotic and invasive management include:
   1. Hand pulling.
   2. Foliar herbicide application.
   3. Cut stump method.
   4. Clear, mulch, and spray with herbicide.

3.2 INVASIVE VEGETATION REMOVAL

A. This work shall consist of managing invasive plants in accordance with the Contract Documents.

B. Hand Pulling:
   1. All target species;
   2. Plants with stems one inch or smaller can be removed by hand pulling. Since the root system of most of these plants is extensive, pulling larger plants is seldom possible.
   3. Stems up to 2 in diameter can be removed using a weed wrench or similar uprooting tools. The entire root must be removed since broken fragments may re-sprout.

C. Foliar Herbicide Application:
   1. Autumn Olive (Elaeagnus umbellata)
      a. Foliar application of a solution of 1 to 2% glyphosate or triclopyr with a 0.5% nonionic surfactant may be adequate for small patches of autumn olive. Ambient air temperature should be above 65 degrees F.
      b. If Garlon is used, apply according to manufactures specifications.
      c. Application of herbicide should be done in late August or September when the plant is actively translocating materials to the roots.
   2. Bush honeysuckle (Lonicera maackii or Lonicera x bella);
      a. Apply a solution of 2% glyphosate or triclopyr and 0.5% nonionic surfactant to thoroughly wet all foliage. For vines climbing into surrounding trees use a 25% solution of glyphosate or triclopyr on

cut vine surfaces. Ambient air temperature should be above 65 degrees F.

D. Cut Stump Method:
   1. All target species;
      a. This management method should be considered when treating individual bushes or where the presence of other desirable species precludes foliar applications over a given area.
      b. The plant will be cut off at the main stem 1 to 2 inches above ground and immediately painted with a 50% solution of glyphosate or triclopyr. Cover the outer 20% of all cut stumps.
      c. In addition, the basal section of the plant (ground to 12 inches) can be treated with a solution of 25% triclopyr and 75% horticultural oil. After treatment, wet the area thoroughly. Ambient air temperature should be above 65 degrees F.
      d. If Garlon is used, apply according to manufactures specifications.

E. Clear, Mulch, and Spray with Herbicide:
   1. All target species:
      a. This management method should be considered when treating nonspecific stand of invasive species or where the presence of desirable plant species is not abundant and do not provide a significant cover.
      b. This method must be used before fruit is produced, generally in the summer and before August.
      c. Clearing limits of monospecific stand of exotic and invasive species will be identified and marked with flagging by the Contractor and shown in the invasive species management plan specified in SUBMITTALS section of this specification.
      d. Desirable shrub and tree species will be marked by the Owner. Contractor will install protection barrier fencing on marked shrub and trees. Protection fencing will consist of 3 feet high orange barrier fence. Radius of the barrier will extend 3 feet from trunk of each individual plant. No vegetation shall be removed until all protection zones are established and approved by the Owner.
      e. Undesirable vegetation will be ground to 1 to 2 inches above ground using a mechanical grinder specified in Part 2 of this section. Cut vegetation will be sprayed with herbicide within 30 minutes after cutting.
      f. Cleared and mulched areas will be painted with a 50% solution of glyphosate or triclopyr.
      g. If Garlon is used, apply according to manufactures specifications.
      h. Mulching on or near stream channel banks shall be done in manner so as not to disturb the soil.
      i. Maximum dimension of chipped material used for on-site mulch shall be 1/2 inch by 6 inches.

3.3 DISPOSAL OF MATERIAL NOT USED AS A MULCH

A. Proper disposal of harvested invasive plant parts and soil containing invasive plant seeds or rootstock (rhizomes) is essential to managing the spread of invasive plants and should not be used as mulch. Full consideration should be given, as appropriate, as follows:
   1. Transportation: Cut living plant material will be transported to processing areas in covered vehicles with tarp, topper, cap or other method to securely fasten the load in order to prevent spread of the plant material from the project work site.

PART 4 METHOD OF MEASUREMENT

4.1 Measurement will be confirmation that invasive species management has been performed. This confirmation will be made by the submission of reports summarizing the visits to the site to accomplish invasive species management, and the procedures completed during the visits.

PART 5 BASIS OF PAYMENT

5.1 The accepted quantity of invasive species management will be paid for at the lump sum price required by the contract. Invasive species management performed during the Establishment Maintenance Period will be paid for as part of the Establishment Period Maintenance. See section 329700.

END OF SECTION 329400B

SECTION 329700 - ESTABLISHMENT MAINTENANCE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Work Period and Schedule
   2. Woody and Herbaceous Plant Care and Maintenance
   3. Seeded, Sodded and Turf Area Plant Care and Maintenance
   4. Invasive Species Vegetation Removal
   5. Insurance.

1.2 REFERENCES

A. American National Standards Institute:
   1. ANSI A300 - Tree Care Operations - Tree, Shrub and Other Woody Plant Maintenance - Standard Practices. (Most current versions)
   2. Section 32 9400B Invasive Species Management

1.3 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, Brome Grass and any plant life not specified.

B. Invasive Species: As defined in Section 329400B.

C. Woody and Herbaceous Plants: Installed and living trees, plants, and ground cover installed as part of the construction of project improvements.

D. Seeded, Sodded and Turf Area Plants: Seeded and living plants installed as part of the construction of project improvements.

E. Establishment Maintenance Period of Service: Time period during which maintenance services shall be provided for both 1) Woody and Herbaceous Plants and 2) Seeded, Sodded and Turf Area Plants installed as part of the construction of project improvements. The Establishment Maintenance Period of Service shall be 12 months (1 year) starting with Final Acceptance by the Owner.

F. Initial Maintenance Period: Time period from when plant material is installed until Final Acceptance by the Owner.

1.4 SUBMITTALS

A. Maintenance Schedule:

1. Submit maintenance schedule, outlined by week for entire Establishment Maintenance period showing the following:
    a. Proposed mowing activities
    b. Proposed watering activities
    c. Proposed spot seeding
    d. Proposed weed control plan and invasive species management plan for the Establishment Maintenance Period as described in Section 329400B.
    e. Proposed litter removal prior to mowing

B. Photographs or videos of project area to receive establishment maintenance at the time of final project acceptance which is understood to be the start of establishment maintenance.
    1. Photographs or videos shall capture the extents of the project and installed plant material. In lieu of photographs or videos, a walk through with the Owners representative to document the condition of the installed plant material will be completed. The results of this walk through will be documented on a digital copy of the as-built drawings of the project.
    2. Images shall include a scale figure or measuring device to indicate true size.
    3. Photographs and/or videos may be transmitted electronically but the title of electronic files must bear the plant name, nursery, and date.

C. Maintenance Contractor Qualifications: In addition to requirements of Section 013300 “Submittal Procedures,” provide qualifications for the Project Manager and Foreman/Site Supervisor showing years of experience, and a minimum of three project references. For each reference list client, design or engineering professional hired by the client, type, cost and duration of project and role of personnel.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: Include a maintenance report describing recommended annual maintenance procedures for landscape maintenance of the project.

1.6 QUALITY ASSURANCE

A. Tree Pruning: ANSI A300 Pruning Standards for Woody Plants.

1.7 QUALIFICATIONS

A. Maintenance Services Contractor:
    1. Contractor shall specialize in maintenance services of the type specified with a minimum of five years’ experience in the field. Contractor must have the following personnel performing maintenances services on site:

2. A horticulturist who shall demonstrate knowledge of best horticultural practices and best maintenance practices for all aspects of grounds maintenance.
3. A state certified arborist who shall demonstrate knowledge of best horticultural practices and best maintenance practices for all trees. Only certified arborists shall perform pruning work on all on trees.
4. A state licensed applicator of fertilizers and pesticides shall perform all pesticide, herbicide, fertilization and micronutrient services based on State requirements and shall not apply chemicals that will harm the owner, neighbors or general public.
5. Contractor shall be responsible for appearance and conduct of his/her employees at all times. Contractor's employees shall wear uniform shirts or other acceptable identification while performing maintenance duties for the Owner. Pants shall not be cut-offs, nor have rips or tears. Contractor employees shall wear orange, or other bright colored, safety vests at all times.
6. All work being performed under this contract shall be done in accordance with Federal and State labor laws and will adhere to O.S.H.A. regulations.

1.8 QUARTERLY MAINTENANCE REVIEW MEETINGS

A. Attend an on-site meeting, four times as appropriate with the Owner to review the project site conditions and on-going maintenance activities and discuss any adjustments or changes to the establishment maintenance procedures.

1.9 SCHEDULE OF WORK AND PAYMENT

A. Prior to commencement of work, the Contractor shall submit a proposed monthly payment schedule breakdown covering the entire annual contract period to the Owner for approval. Include items of work to be accomplished for each month clearly associated with the payment schedule. Adjustment to actual payments will be made as needed and mutually agreed to by the Contractor and Owner. Maintenance activities are scheduled to occur between March and November of the maintenance contract year.

B. The Contractor shall submit a work ticket to the Owner each month of planned work listing specific tasks and work that will be accomplished. Monthly work tickets shall be available to the Owner at the end of each month and included as backup with the monthly invoices. Contractor shall sign the ticket attesting that the work was completed. The Owner shall sign the ticket indicating that it was received and picked-up.

C. Contractor shall provide Owner a copy of the approved monthly payment schedule before authorization to proceed is issued by the Owner.

D. Payment for work completed shall be conditional upon the approval of the Owner. The contractor shall submit, to the Owner an invoice itemizing services provided. Invoice shall be submitted monthly and be itemized on a per

occurrence basis. ADJUST PAYMENT METHOD BASED OF TYPE OF BID (Lump Sum or Unit Price)

E. Payment for any and all additional services shall pre-approved by Owner and be based on a time and materials basis or other mutually agreed to amount by the Owner and Contractor prior to proceeding with additional work.

PART 2 PRODUCTS

2.1 MATERIAL AND EQUIPMENT

A. Contractor shall furnish all material, tools, equipment, facilities and services as required for performing the Establishment Period Maintenance specified here within, including Invasive Species Management to be accomplished during this period as described in Section 329400B.

B. Water for use during Establishment Maintenance
   1. Water will be available at hose bib locations shown on the Civil Site Plans.

2.2 ESTABLISHMENT PERIOD INSURANCE

A. The contractor shall provide insurance to cover “Acts of God” for flood events, to cover the replacement and installation of plant material (trees, live stakes, shrubs and seeding) lost as a result of a flood in the project area. The period of coverage shall be for each year of Establishment Maintenance.

B. The contractor shall provide an insurance certificate for the above-mentioned insurance and the City of Brentwood shall be listed on the certificate as additional insured. HOSE BIBS AND A WATER LINE WILL NEED TO BE PROVIDED FOR NEXT SUBMITTAL FOR ESTABLISHMENT MAINTENANCE.

PART 3 EXECUTION

3.1 ESTABLISHMENT MAINTENANCE – ZONE 3: TURF SEEDED AREAS, AND SODDED AREAS

A. Maintain plant life immediately after final acceptance through end of Establishment Maintenance Period.

B. Maintenance activities include:
   1. Invasive Species Management per Section 329400B
   2. Watering sufficient to saturate root system. Installed plants shall be watered sufficient to saturate root system at least once each week during construction unless otherwise instructed by the Owner’s Representative. Plants that are installed during the spring planting period shall be watered once a week during the following summer months of May, June, July and

August. Plants that are installed during the fall planting period shall be watered once a week during the following spring months of March, April and May only if there is less than 1" of rain during each week, and once a week during the following summer months of June, July and August regardless of rainfall. Weeks shall be measured 12:00 a.m. Monday to 12:00 a.m. Monday.

3. Mowing
   a. Contractor shall mow the lawn areas at a frequency indicated below to maintain the grass at the following heights. The mowing schedule may vary depending on the actual growth rate of the grass at the different times throughout the growing season and the various mowing heights specified in this specification. Additional mowings beyond those listed below will require Owner's prior approval.
      1) Cool Weather (March to June and September to November) – Maintain grass height at 2 ½" min. to 3 ½" max.
      2) Warm/Hot Weather (June to August) – Maintain grass height at 3 ½" min. to 4" max.
      3) Last Mowing of the Season – Mow grass at 2" min. and 2 ½" max. height.
         a) Note: Taller mowing heights are mandatory to assist in weed suppression and soil moisture retention.
   b. Mowing Frequencies
      1) March: 2 mowings
      2) April: 4 mowings
      3) May: 4 mowings
      4) June: 3 mowings
      5) July: 2 mowings
      6) August: 2 mowings
      7) September: 3 mowings
      8) October: 3 mowings
      9) November: 1 mowing
   c. Monitor lawn growth as necessary and notify Owner if additional mowings are required to not cut more than 1/3 of the blade length of the overall height of the grass at any cutting. Additional mowings require prior approval by the Owner.
   d. Grass clippings can be left if item B above is satisfied. If adverse weather conditions result in cutting more than 1/3 of the blade length at any cutting, the grass clippings shall be bagged and disposed of legally off-site by the Contractor.

3.2 ESTABLISHMENT MAINTENANCE – ZONES 1,2, 4 RIPARIAN MIX SEEDED AREAS, AND STORAGE POND SEEDING

A. Maintain plant life immediately after final acceptance through end of Establishment Maintenance Period.

B. Maintenance activities include:
   1. Invasive Species Management per Section 329400B
   2. Watering sufficient to saturate root system. Installed plants shall be watered sufficient to saturate root system at least once each week during construction unless otherwise instructed by the Owner's Representative. Plants that are installed during the spring planting period shall be watered once a week during the following summer months of May, June, July and August. Plants that are installed during the fall planting period shall be watered once a week during the following spring months of March, April and May only if there is less than 1" of rain during each week, and once a week during the following summer months of June, July and August regardless of rainfall. Weeks shall be measured 12:00 a.m. Monday to 12:00 a.m. Monday.
   3. Maintain riparian seed areas for a period of one growing season including mowing, spotseeding/plugging and weed control, including spot herbicide application to establish a stand of native plants complying with coverage requirements specified in the Maintenance section of Specification 329219 and final acceptance by the Owner.
   4. Mow native grasses at 12 inches high a maximum of three (3) time during the growing season covered by the maintenance period as recommended by seed manufacturer to reduce weed competition.
   5. Recommended timing: April, June & August.
   6. Selective weeding shall be done manually as recommended by seed manufacturer and/or industry standards for establishing native grasses.

3.3 ESTABLISHMENT MAINTENANCE – LIVE STAKE PLANT MATERIAL

A. Maintain plant life immediately after final acceptance through end of Establishment Maintenance Period.

B. Maintenance activities include:
   1. Invasive Species Management per Section 329400B.
   2. Cultivation and weeding plant beds and tree pits.
   3. Watering sufficient to saturate root system. Installed plants shall be watered sufficient to saturate root system at least once each week during construction unless otherwise instructed by the Owner's Representative. Plants that are installed during the spring planting period shall be watered once a week during the following summer months of May, June, July and August. Plants that are installed during the fall planting period shall be watered once a week during the following spring months of March, April and May only if there is less than 1" of rain during each week, and once a week during the following summer months of June, July and August

regardless of rainfall. Weeks shall be measured 12:00 a.m. Monday to 12:00 a.m. Monday.

4. Contractor shall monitor plantings on a regular basis for damage due to waterfowl. Any damage shall be reported to the Owners Representative along with a recommendation for reducing future damage.
5. Due to the susceptibility of live stake plant materials to be damaged from a variety of conditions until establishment, the live stake installations shall be inspected more frequently. Plant materials missing or damaged should be replaced as soon as possible at no additional cost to the Owner.

3.4 ESTABLISHMENT MAINTENANCE – SHRUBS

A. Maintain plant life immediately after final acceptance through end of Establishment Maintenance Period.

B. Maintenance activities include:
1. Invasive Species Management per Section 329400B.
2. Weeding of shrubs.
3. Watering sufficient to saturate root system. Contractor shall thoroughly water installed plants within 24 hours of installation. Installed plants shall be watered sufficient to saturate root system at least once each week during construction unless otherwise instructed by the Owner's Representative. Plants that are installed during the spring planting period shall be watered once a week during the following summer months of May, June, July and August. Plants that are installed during the fall planting period shall be watered once a week during the following spring months of March, April and May only if there is less than 1" of rain during each week, and once a week during the following summer months of June, July and August regardless of rainfall. Weeks shall be measured 12:00 a.m. Monday to 12:00 a.m. Monday.
4. Pruning, including removal of dead or broken branches.
5. Disease control.
6. Replacement of mulch, except in events as a result of an act of God or vandalism.
7. Contractor shall monitor plantings on a regular basis for damage due to waterfowl and animals. Any damage shall be reported to the Owners Representative along with a recommendation for reducing future damage.

3.5 ESTABLISHMENT MAINTENANCE – TREES (Both Balled and Burlaped and RPM)

A. Maintain plant life immediately after final acceptance through end of Establishment Maintenance Period.

B. Maintenance activities include:
1. Invasive Species Management per Section 329400B.
2. Weeding of trees.
3. Watering sufficient to saturate root system. Contractor shall thoroughly water installed plants within 24 hours of installation. Installed plants shall be watered sufficient to saturate root system at least once each week

during construction unless otherwise instructed by the Owner's Representative. Plants that are installed during the spring planting period shall be watered once a week during the following summer months of May, June, July and August. Plants that are installed during the fall planting period shall be watered once a week during the following spring months of March, April and May only if there is less than 1" of rain during each week, and once a week during the following summer months of June, July and August regardless of rainfall. Weeks shall be measured 12:00 a.m. Monday to 12:00 a.m. Monday.

4. Pruning, including removal of dead or broken branches.
5. Disease control.
6. Maintaining wrapping, guys, turnbuckles, and stakes. Adjust turnbuckles to permit sway and movement of trunk and limbs. Repair or replace accessories when required.
7. Replacement of mulch, except in events as a result of an act of God or vandalism.
8. Contractor shall monitor plantings on a regular basis for damage due to waterfowl and animals. Any damage shall be reported to the Owners Representative along with a recommendation for reducing future damage.

3.6 ESTABLISHMENT MAINTENANCE CLOSEOUT

A. Final Project Acceptance
   1. The Contractor shall notify the Owner's Representative for final inspection. The request shall be in written form and received at least ten (10) calendar days before the anticipated date of inspection.
   2. Based on the sole judgment of the Owner's Representative, he shall certify in writing as to the satisfaction and substantial completion of the project, which shall be deemed final acceptance. Final acceptance is defined as when all punch list items have been determined to be complete by either the Owner or the Owner's Representative and the Contractor is authorized to submit the final pay application.

B. End of Maintenance Final Acceptance
   1. The Contractor shall notify the Owner's Representative for final inspection and turnover of maintenance activities. The request shall be in written form and received at least ten (10) calendar days before the anticipated date of inspection.
   2. Based on the sole judgment of the Owner's Representative, he shall certify in writing as to the satisfaction and substantial completion of the Establishment Maintenance, which shall be deemed final acceptance. Final acceptance is defined as when all punch list items have been determined to be complete by either the Owner or the Owner's Representative and the Contractor is authorized to submit the final pay application.

PART 4 METHOD OF MEASUREMENT

4.1 Monthly work tickets as described above, and field identification that maintenance work has been completed.

PART 5 BASIS OF PAYMENT

5.1 Submission of monthly work ticket as described above. The accepted quantity of establishment maintenance will be paid for on a monthly basis at the lump sum price required by the contract.

5.2 The base bid should include Establishment Maintenance for a Period of Service of one (1) year starting after the Initial Maintenance Period.

5.3 Pricing for additional years (Years 2 and 3) of Establishment Maintenance shall be provided as described on the Bid Form.

5.4 Costs for insurance shall be considered incidental and be included in the contract lump sum price.

END OF SECTION 329700

SECTION 331000 – WATER IRRIGATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

B. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling requirements.

1.2 SUMMARY

A. Section Includes:

1. Pipe materials.

2. Backflow preventers.

3. Yard hydrants.

B. Related Requirements:

1. ASTM – American Society for Testing and Materials

a. A536: Standard Specification for Ductile Iron Castings.

b. D2241: Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

c. D2855: Standard Practice for Making Solvent Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

2. AWWA – American Water Works Association

a. Standard C605: Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water

b. Standard C900: Polyvinyl Chloride (PVC) Pressure Pipe, and Fabricated Fittings, 4 In. Through 48 In. (100 mm Through 1200 mm), for Water Transmission and Distribution.

c. M23: PVC Pipe - Design and Installation

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality control reports.

PART 2– PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable water piping and components shall comply with NSF 61.

2.2 PIPE MATERIALS

A. PVC Pipe 2 inch shall be Schedule 80 PVC conforming to ASTM D1785 with solvent weld joint design meeting requirements of ASTM D2672.

B. Fittings: Schedule 80 PVC with solvent weld joint. All fittings shall be restrained.

2.3 BACKFLOW PREVENTERS

A. Contractor shall provide MDNR approved backflow preventer with double check valve assembly.

2.4 YARD HYDRANTS

A. As indicated on Drawings.

2.5 RECEIVING, HANDLING, AND STORAGE

A. Inspect pipe and appurtenances for defects prior to installation in the trench. Set aside and clearly mark defective, damaged or unsound material and hold material for inspection by the Owner or Engineer.

B. Load and unload all materials in accordance with the manufacturer's recommendations and in such a manner as to prevent damage. Do not drop pipe and accessories or handle then in a rough manner.

C. Provide safe storage for all materials. Cover stored pipe that will be exposed to sunlight for periods longer than 6 months. Cover with canvas or other opaque material with provision for adequate air circulation. PVC pipe shall not be stored close to heat sources, such as heaters, boilers, steam lines, or engine exhaust

PART 3 - EXECUTION

3.1 PIPING SYSTEM – COMMON REQUIREMENTS

A. The Uni-Bell Plastic Pipe Association guide should be used only as a guide in the installation of polyvinyl chloride plastic pressure pipe for municipal water main distribution system.

B. Pipe line alignment and gradient shall be straight. Curvature in pipelines is not allowed unless approved by Owner within allowable tolerances.

C. Excavation, cleaning, laying, jointing and backfilling shall follow as closely as is possible so as to progress the work. In no case shall pipe be left in the trench overnight without completing the jointing. The completed pipeline shall not be left

exposed in the trench unnecessarily, and the Contractor shall backfill and compact (if required by the engineer) the trench as soon as is possible after lying and jointing is completed. Each day at the close of work, and at all times when laying is not in progress, the exposed end of the pipe line in the trench shall be covered and protected. If at any time it becomes necessary to cover the end of any uncompleted pipeline with backfill, the end of that pipe shall be closed with a mechanical joint plug.

D. The Contractor shall keep exposed ends of pipe properly plugged during laying to prevent dirt and other materials from entering the line, and shall also, before the system is accepted, thoroughly clean all lines.

E. Restrained joints shall be provided at all bends, tees, and valves.

3.2 FIELD TESTS

A. All newly laid water lines shall be tested before being placed in service. Trenches may be backfilled as the pipe is laid, or where practicable and at the option of the Contractor, trenches or bell holes may be left open for visual inspection during tests. Prior to making tests, all air shall be expelled from the pipe. Contractor shall install taps at high points of the line for purpose of expelling air.

B. Prior to testing, Contractor shall submit testing plan to Owner and Engineer for review and approval. Testing lengths shall be limited to a maximum of 1,000 feet unless otherwise approved by Owner.

C. Pressure Test: A two-hour test shall be made in accordance with AWWA C600 on the pipe line between valves or temporary plugs at a test pressure of at least 1.5 times normal operating pressure, except that the pressure rating of the pipe shall not be exceeded. Any open trench or bell holes over dry joints may be backfilled following this test. Where trenches have been backfilled prior to making the tests, any leaks evident at the surface shall be uncovered. All leaking joints disclosed by this test shall be remade and retested. All pipe, fittings, valves, and other materials found defective under this test shall be removed and replaced at the Contractor's expense.

D. Leakage Test: A leakage test shall be made on the water line concurrently with the pressure test between valves or temporary plugs at a constant test pressure of 1.5 times normal operating pressure. The test shall be run in accordance with AWWA C600. Leakage in the test system shall be measured through a meter or approved measuring device. The allowable leakage shall be not greater than that specified per AWWA C600. Should tests disclose leakage greater than the allowable amounts, the Contractor, at his expense, shall locate and repair defective joints until the leakage is within the specified allowance.

E. All testing, filling, flushing, and disinfections of new water main are to be conducted under direct supervision of the Owner.

3.3 DISINFECTING WATER LINES

A. Sterilizing of the completed lines shall be done in accordance with AWWA C651 and in a manner approved by the Missouri Department of Natural Resources.

B. Prior to chlorination, the main shall be flushed as thoroughly as possible with the water pressure and outlets available. Flushing shall be done after the pressure

tests are made. After flushing, all valves shall be carefully inspected to see that the entire operating mechanism is in good condition.

C. Following sterilization, all treated water shall be thoroughly flushed from the newly laid pipeline at its extremities until the replacement water throughout its length shall, upon test, be proved comparable to the quality of water served the public from the existing water supply system and approved by the Owner. This quality of water delivered by the new main should continue for a period of at least two full days as demonstrated by laboratory examination of samples taken from a tap located and installed in such a way as to prevent outside contamination. Samples shall not be taken from an unsterilized hose or from a fire hydrant. Contractor is responsible for obtaining all sample test results.

D. Should the initial treatment fail to result in the condition specified in the preceding paragraph, the sterilizing procedure shall be repeated until such results are obtained. The Contractor is responsible and shall obtain the approval of the Owner for the work performed under this contract.

END OF SECTION 331000

SECTION 332000 - SEWER FACILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Metropolitan St. Louis Sewer District Standard Construction Specifications for Sewers and Drainage Facilities, dated 2009.

C. Refer to Section 312000 "Earth Moving" for excavating, trenching, and backfilling requirements.

D. Section 033100 “Antimicrobial Additive for Precast and Cast-In-Place Concrete” for special concrete requirements for sanitary precast and cast-in-place concrete structures.

1.2 SUMMARY

A. Sewer materials and construction shall be in accordance with the Metropolitan St. Louis Sewer District Standard Construction Specifications for Sewers and Drainage Facilities, unless as otherwise noted in this section.

B. Section Includes:
1. PVC pipe and fittings.
2. Fiberglass pipe and fittings.
3. Concrete pipe and fittings.
4. Pipe couplings.
5. In-line check valves.
6. Encasement for piping.
7. Manholes & Junction Structures.
8. Pipe Outlets.
9. Concrete.

1.3 DEFINITIONS

A. FRP: Fiberglass-reinforced plastic.

1.4 ACTION SUBMITTALS

A. Shop Drawings: For pipe, fittings, couplings, structures, frames and covers, and other miscellaneous sewer appurtenances to be incorporated into the work.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle manholes according to manufacturer's written rigging instructions.

1.6 FIELD CONDITIONS

A. Interruption of Existing Sewerage Service: Do not interrupt service to any sewer facilities.

1.7 BYPASS PUMPING FOR SANITARY SEWER

A. A bypass pumping plan shall be submitted for approval to Owner’s Representative and Engineer before construction may begin.

B. Provide all labor, materials, and equipment necessary to provide bypass pumping as required by construction operations and schedule.

C. The bypassing or discharging of sewage into existing storm sewers or natural channels will not be allowed.

D. Bypass plan shall be capable of maintaining daily flow and have a means to handle wet weather flow. Sewers are designed to convey sanitary sewage, however infiltration and inflow related to wet weather events are expected to cause significant flow increases. Contractor is responsible for wet weather events at no additional cost.

PART 2 - PRODUCTS

2.1 SANITARY SEWER PIPE (72” DIAMETER)

A. Pipe: Fiberglass pipe shall conform to requirements of ASTM D3262, minimum pipe stiffness SN 72.

B. Fittings for gravity sewer installations shall conform to ASTM D3840. Pipe for gravity sewer installations shall be installed in accordance with ASTM D3839.

C. Gaskets shall be manufactured in accordance with the requirements of ASTM F477.

2.2 SANITARY SEWER PIPE (12” DIAMETER)

A. Pipe: PVC Gravity Pipe, ASTM F679

2.3 STORMWATER SEWER PIPE (12” DIAMETER AND LARGER)

A. Pipe and Fittings: Reinforced Concrete Pipe, ASTM C76, Wall B, Class III

2.4 PIPE COUPLINGS

A. Connections of sanitary sewer pipe of dissimilar materials or of different sizes shall be made by means of an MSD approved connector or adapter of the compression or mechanical seal type.

2.5 IN-LINE CHECKVALVES

A. In-line check valves shall be CheckMate Ultraflex Elastomeric Check Valve by Red Valve or approved equal.

B. Check Valves are to be all rubber and the flow operated check type with slip-in cuff connection. The entire Valve shall be ply reinforced throughout the body, saddle and bill, which is cured and vulcanized into a one-piece unibody construction. A separate valve body or pipe used as the housing is not acceptable. The valve shall be manufactured with no metal, mechanical hinges or fasteners, which would be used to secure any component of the valve to a valve housing. The port area of the saddle shall contour into a circumferential sealing area (the bill) that is concentric with the pipe which shall allow passage of flow in one direction while preventing reverse flow. The entire valve shall fit within the pipe inside diameter. The saddle area of the valve must be flat, not conical, and integral with the rubber body above center line in order to not produce any areas or voids that can collect or trap debris. The valve must be easily installed in pipes with poor end condition without the need to modify or utilize the headwall or structure to seal and anchor the valve. Once installed, the Valve shall not protrude beyond the face of the structure or end of the pipe.

C. The Valve shall incorporate multiple concave grooves molded integrally into the flat saddle wall thickness extending longitudinally a minimum of 80% of the length of the saddle to reduce opening resistance and reduce head loss.

D. The Valve shall incorporate a custom shaped notch in the end of the bill to reduce cracking pressure. The notch shall be at the invert/bottom of the bill and symmetrical about the valve centerline. The longitudinal length of the notch shall be no greater than half the length of the bill.

E. The outside diameter of the upstream and downstream sections of the valve must be circumferentially in contact with the inside diameter of the pipe.

F. Slip-in style Valves will be furnished with a set of stainless steel expansion clamps. The clamps, which will secure the valve in place, shall be installed in the upstream or downstream cuff of the valve, depending on installation orientation, and shall expand outwards by means of a turnbuckle. Each band shall be pre-drilled allowing for the valve to be pinned and secured into position in accordance with the manufacturer’s installation instructions.

G. Manufacturer must have flow test data from an accredited hydraulics laboratory to confirm pressure drop and hydraulic data.

H. Company name, plant location, valve sized patent number, and serial number shall be bonded to the check valves.

2.6 ENCASEMENT FOR PIPING

A. Low slump Class “A” concrete, constructed in accordance with MSD Standard Specifications and Details for Sewer Construction.

2.7 MANHOLES

A. Sanitary and stormwater manholes shall be precast. Sizes and shapes shall conform to MSD Standard Specifications and Details of Sewer Construction.

B. Manhole Frames and Covers:

1. Stormwater Inlets: MSD Standard Cast Iron
2. Stormwater Manholes: MSD Type “A”
3. Sanitary Manholes: MSD Type “N”

C. Manhole Cover Seals:

1. All sanitary manholes shall be provided with an approved MSD cover seal such as manhole cover gasket as manufactured by Cretex Specialty Products or approved equal.

2. Installation - The cover bearing surface area of both the frame and the cover shall be wire brushed and cleaned of all loose rust, scale, or debris. A small bead of butyl caulk, conforming to AASHTO M-198 Type B, shall be applied to the clean and dry bearing surface of the frame prior to the installation of the cover gasket. Care must be taken to insure that any butyl that gets on the top of the gasket or on the side of the cover recess is removed. Detailed installation procedures shall be in accordance with the manufacturer's instructions.

2.8 JUNCTION STRUCTURES

A. Junction structures shall be in accordance with Drawing Details.

B. Structures shall be constructed of Class “A” concrete.

2.9 PIPE OUTLETS (FLARED END SECTIONS)

A. Flared end sections shall be precast. Construction shall conform to MSD Standard Details of Sewer Construction.

B. Rock Blanket Type: MSD Type 5

2.10 CONCRETE

A. All sanitary precast and cast-in-place concrete structures shall include antimicrobial additive as specified in Section 033100.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details to indicate general location and arrangement of underground sewer piping. Follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

C. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Place plug in end of incomplete piping at end of day and when work stops.

3.3 MANHOLE INSTALLATION

A. General: Install manholes complete with all appurtenances.

B. Set tops of frames and covers as indicated on Drawings.

3.4 CONCRETE PLACEMENT

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

3.5 ABANDONMENT OF SANITARY SEWER SYSTEMS

A. Refer to section 024119 Selective Demolition.

3.6 PIPE FIELD TESTS

A. Tests all sewer facilities in accordance with MSD Standard Construction Specifications for Sewers. Coordinate testing with Owner’s Representative and Engineer a minimum of 48 hours prior to testing. Tests include:

1. Air tests for plastic gravity sanitary sewers.

2. Joint tests for fiberglass gravity sanitary sewers.

3. Mandrel tests for all sanitary and storm pipes.

4. Vacuum tests for all sanitary sewer manholes. The vacuum test must be performed prior to backfilling around the manhole unless the Contractor provides documentation from the precast manhole manufacturer stating that the manhole may be vacuum tested after backfilling has taken place. The Contractor must submit this documentation prior to backfilling around any manhole.

3.7 CLEANING

A. Clean dirt and superfluous material from interior of piping.

END OF SECTION 332000