PROJECT MANUAL FOR

MCFEE PARK
PHASE 4

Farragut, Tennessee

CONSTRUCTION DOCUMENTS PACKAGE

April 14, 2023

SET NO. _____

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PROJECT MANUAL For:
McFee Park Phase 4
Construction Documents Package

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PROJECT MANUAL FOR
MCFEE PARK PHASE 4
FARRAGUT, TENNESSEE

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SECTION 01 11 00 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 DESCRIPTION OF SCOPE

A. The work of this Contract shall include the furnishing of all labor, materials, equipment, tools, construction equipment, water, telephone, electric, utilities, transportation, safety measures, insurance, permits, taxes, supervision, coordination and other services required for the construction and completion of the work. All work shall be performed and completed in strict conformance to the Contract documents including but not limited to the following: Trailhead Pavilion, site grading, concrete curbs, permeable paver parking lots, concrete walks and plazas, new storm drainage, new pole lighting, tree, shrub, groundcover and turf planting, irrigation system, and other site improvements as called for in the contract documents.

B. Pedestrian Safety and traffic Plan:

1. The Contractor shall prepare and submit for approval in accordance with Section 01 a project phasing plan which will allow construction of the project while allowing safe pedestrian and traffic movement around the perimeter of the site

C. Related Requirements Specified Elsewhere include drawings and general provisions of the contract, General and Supplementary Conditions as well as the following:

1. Section 012973: Schedule of Values
2. Section 013200: Construction Progress
3. Section 015000: Temporary Facilities and Controls

1.2 CONTRACTOR'S DUTIES

A. Contractor shall limit his use of the construction area for work and for storage to allow for:

1. Limited traffic around the site for access to the buildings.
2. Access for emergency/security/service vehicles

B. On-site working rules for the Contractor, subcontractors, material suppliers, and all employees shall be as follows:

1. Sexual harassment will not be tolerated. This shall include but not be limited to, catcalls, whistling, hooting, physical gestures and suggestive working or graphics on clothing.
2. Proper attire must be worn at all times.
3. Workers shall wear shirts at all times.
4. Unacceptable or foul language is not allowed.

C. Parking, storage and loading/unloading at the site is restricted and shall be coordinated with the Owner.

D. Assume full responsibility for site safety and security and the protection and safe

keeping of products under this Contract, stored on and off the site.

E. Move any stored products, under the Contractor's control which interfere with operations of the Owner or separate Contractor.

F. Obtain and pay for the use of additional storage or work areas needed for operations.

G. Except as specifically noted, provide and pay for:

1. Labor, materials and equipment.
2. Tools, construction equipment, and machinery.
3. Water, heat, electricity and all utilities required for construction.
4. Other facilities and services necessary for proper execution and completion of work.
5. Aids to construction required for proper completion of the work.

H. Pay legally required sales, consumer, and use taxes.

I. Contractor shall secure, coordinate and pay for, as necessary for proper execution and completion of work and as applicable at time of receipt of bids:

1. All Permits, including but not limited to grading, building, right of way, traffic, and NPDES Storm Water Protection permits.
2. All fees and licenses.

J. Give all required notices.

K. Comply with codes, ordinances, rules, regulations, orders, and other legal requirements of public authorities which bear performance of work.

L. Promptly submit written notice to Architect of observed variances of Contract Documents from legal requirements. It is not Contractor's responsibility to make certain that drawing and specifications comply with codes and regulations.

1. Appropriate modifications to Contract Documents will adjust necessary changes.
2. Assume responsibility for work known to be contrary to such requirements without notice.

M. Enforce strict discipline and good working order among employees. Employ persons whom are fit and skilled in the assigned tasks.

N. Install and maintain functioning erosion control measures throughout the life of the project.

1.3 CONTRACTS

A. Project will be constructed under a single contract under the direction of the General Contractor. It is anticipated that the site furniture will be furnished and installed by the Town.

B. There shall be complete cooperation between Contractor and Subcontractors to ensure satisfactory progress and performance of the work.

C. The Owner reserves the right to award other contacts for additional work in connection with this project as required to furnish or equip the project.

1.4 COORDINATION WITH THE LANDSCAPE ARCHITECT

A. Representatives of the design team will be available for assistance in construction document coordination during construction.

1.5 WORK SCHEDULE

Contractor shall submit in accordance with Section 01 32 00, a schedule of work sequence for the major portions of the work to be done. This schedule shall indicate the time the work will commence and be completed on each separate portion.

1.6 CONTRACTOR USE OF PREMISES

A. The Contractor shall have full use of premises for construction operations, including use of the Project site, during the construction period. Each Contractor's use of premises is limited only by Owner's right to perform work or to retain other contractors on portions of Project. The Contractor shall confine the construction operations at the project site to the areas defined by the Contract documents and as permitted by:

1. Law.
2. Ordinances.
3. Permits.

B. Do not encumber site with materials or equipment.

C. Assume full responsibility for protection and safekeeping of products stored on premises.

1.7 PARTIAL OWNER OCCUPANCY

A. The Contractor shall allow the Owner to take possession of and use any completed or partially completed portion of the work, or to place and install as much of his own equipment during the progress of the work as is possible without interference before its entire completion; such possession and use of structure or work or such placing and installation of equipment, or both, shall not in any way evidence completion of the work or any part of it.

B. After the specified time of completion, it shall be understood that the Owner will not be liable for any inconvenience caused the Contractor by the Owner’s occupancy.

1.8 OWNER-FURNISHED PRODUCTS

A. Products furnished and paid for by the Owner shall be incorporated into the project by the Contractor as required.

B. Owner’s Responsibilities:

1. Inspect deliveries jointly with Contractor.

2. Arrange for replacement of damaged or defective items.

C. Contractor's Responsibilities:

1. Promptly inspect products jointly with the Owner, record damaged and defective items.
2. Handle products at the site, including un-crating and storage.
3. Protect products from exposure to the elements and from damage.
4. Assemble, install, connect, adjust and finish products as stipulated in the respective section of the specifications.
5. Repair or replace items damaged by the Contractor.

1.9 PROTECTION OF EXISTING STRUCTURES AND UNDERGROUND SYSTEMS

A. The Contractor shall protect the existing structures in the project limits from damage caused by his workmen, and be responsible for any damage thus caused.

B. The Contractor shall locate and protect from damage the existing underground splash pad piping system in the project limits.

C. The Contractor shall be responsible to repair or replace to its original condition all areas disturbed by construction, including but not limited to utilities, drives, paving, walls, walks, lawns, landscaping, etc.

1.10 SITE INVESTIGATION

A. The Contractor acknowledges that he has satisfied himself as to the nature and location of the work, the general and local conditions, particularly those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, power, roads and the uncertainties of weather, or other physical conditions of the site, the location and probable depth of underground utilities, the quality and character of surface materials to be encountered and all other matters which can affect the work or the cost thereof under this contract. Any failure by the Contractor to acquaint himself with all the available information concerning these conditions will not relieve him from the responsibility for estimating properly the difficulty or cost of successfully performing the work.

1.11 PROTECTION REQUIREMENTS

A. The Contractor shall protect all finished surfaces against damage.

B. All finished surfaces including factory-finished and job-finished items, shall be clean and not marred upon delivery to the Owner. The Contractor shall, without extra compensation, refinish all such spaces where surfaces prove to have been inadequately protected and are damaged.

C. The Contractor shall be responsible for the prevention of water or dust leakage into adjacent buildings that may result from the activities involved in the construction and completion of the project. He shall pay for and provide the necessary devices or materials that he may deem necessary to provide such protection, all of which are subject to the approval of the Owner and the designer.

D. Plywood sheathing shall be laid under any materials that are stored on finished concrete surfaces. Reinforced non-staining Kraft paper and plywood shall be laid over all types of finished surfaces in traffic areas and before moving any material over these finished areas. Wheelbarrows, if used over such areas, shall have rubber tires.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 11 00

SECTION 01 26 20 - WEATHER DELAYS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes extensions of time based on weather conditions.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this section.

1.3 EXTENSIONS OF CONTRACT TIME

A. If the basis exists for an extension of Contract time in accordance with the General Conditions, an extension of time on the basis of weather may be granted only for the number of Weather delay days in excess of the number of days listed in the standard baseline for that month as shown in Article 1.4, Paragraph C of this Section.

1.4 STANDARD BASELINE FOR AVERAGE CLIMATIC RANGE

A. The Owner has reviewed weather data available from the National Oceanic and Atmospheric Administration and determined a Standard Baseline of average climatic range for the project area.

B. Standard Baseline shall be regarded as the normal and anticipated number of days each month as listed in the Standard Baseline is included in the Work and is not eligible for extension of Contract Time.

C. Standard Baseline for each month of the year is as follows (the anticipated delay days follow the month):

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
12	11	8	7	7	6	7	5	4	5	6	11

1.5 ADVERSE WEATHER AND WEATHER DELAYS

A. Adverse Weather is defined as the occurrence of one or more of the following conditions, substantiated by NOAA data, which prevents exterior construction activity or access to the site within a twenty-four (24) hours:

B.

1. Precipitation threshold (rain, snow or ice) in excess of one-tenth inch (0.10") liquid measure. Snow to liquid measure ratio is 10:1.

2. Standing snow is excess of one inch (1.00")

C. Additional extension of Time may be granted for drying days following periods of two or more consecutive days of precipitation of the following conditions:

1. At a rate of one day extension of Contract Time for each period of one or

more consecutive days of precipitation of 1.0 inch or more (liquid measure).

2. Only if there is a hindrance to the site access or site work, such as excavation, backfill and footings and the like and then only when no such work is permitted.

D. A Weather Delay Day may be counted only if adverse weather prevents work on the Project for fifty percent (50%) or more of the contractor's scheduled work day, including a weekend day or holiday if Contractor has scheduled construction activity that day.

1.6 DOCUMENTATION AND SUBMITTALS

A. Contractor shall submit on a monthly basis daily job site work logs (daily reports) showing which, and to what extent, construction activities have been adversely affected by weather.

B. Submit actual weather data collected at the project site. If requested by Landscape Architect to support claim for time extension, submit weather data as obtained from NOAA weather reporting station at Knoxville, Tennessee.

C. Use Standard Baseline data provided in this Section when documenting actual delays due to weather in excess of the average climatic range.

D. Organize claim and documentation to facilitate evaluation on a basis of calendar month periods, and submit in accordance with the procedures for Claims established in the General Conditions.

E. Extension of Contract Time requested by the Contractor and approved by the Landscape Architect on the basis of conditions stated above shall be acknowledged and communicated in writing to the Contractor periodically.

F. For extensions of Contract Time granted, a modification shall be issued in accordance with the provisions of the General Conditions, and the applicable General requirements. Modifications for extensions of Time may be issued quarterly or held to the end of the Project as appropriate based on Landscape Architect's approval of such extensions as noted in Paragraph 1.6 E above.

G. Extensions of Time not requested in a timely manner by the Contractor will not be granted at a later date.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION 01 26 20

SECTION 01 29 73 - SCHEDULE OF VALUES

1.1 GENERAL

A. Related Requirements Specified Elsewhere:
   1. Section 013200: Construction Progress.

B. Submit Schedule of Values to the Architect at least twenty-one days prior to submitting first Application for Payment.

C. Upon request by Architect, support values given with data that will substantiate their correctness.

D. Submit quantities of materials stored on site.
   1. Payment for materials stored on site will be limited to those materials listed in Schedule of Unit Material Values.

E. Use only Schedule of Values as basis for Contractor's Application for Payment.

1.2 FORM OF SUBMITTAL

A. Submit typewritten Schedule of Values on 8 1/2" x 11" white paper.

B. Use Table of Contents of this Specification as basis for format for listing costs of work for sections under Divisions 2-33.

C. Identify each line item with number and title as listed in Table of Contents of this Specification.

1.3 PREPARING SCHEDULE OF VALUES

A. Itemize separate line item cost for each of following general cost items:
   1. Performance and Payment Bonds.
   2. Field Supervision and Layout.
   3. Temporary Facilities and Controls.

B. Itemize separate line item cost for work required by each section of this Specification.

C. Break installed costs into:
   1. Delivered cost of product, with taxes paid.
   2. Total installed cost, with overhead and profit.

D. For each line item which has installed value of more than $20,000, break down costs to list major products or operations under each item.

E. Round off figures to nearest dollar.

F. Make sum of total costs of all items listed in schedule equal to total Contract Sum.

1.4 PREPARING SCHEDULE OF UNIT MATERIAL VALUES

A. Submit separate schedule of unit prices for materials to be stored on which progress

payments will be made.

B. Make form of submittal parallel to Schedule of Values, with each line item identified same as line item in Schedule of Values.

C. Include in unit prices only:
   1. Cost of material.
   2. Delivery and unloading at site.
   3. Sales taxes.

D. Make sure that unit prices multiplied by quantities given equal material cost of that item in Schedule of Values.

1.5 REVIEW AND RESUBMITTAL

A. After review by Architect, revise and resubmit schedule as required.

B. Resubmit revised schedule in same manner.

END OF SECTION 01 29 73

SECTION 01 31 00 - PROJECT MANAGEMENT

PART 1 - GENERAL

1.1 PROJECT MEETINGS

A. Contractor's Duties:
The Contractor shall schedule and administer pre-construction meetings, pre-installation job meetings, periodic progress meetings, and specially called meetings throughout the progress of the Work.
1. Prepare agenda for meetings.
2. Distribute written notice of each meeting four days in advance of meeting date.
3. Make physical arrangements for meetings.
4. Preside at meetings.

B. Landscape Architect's Duties:
1. Record the minutes; include all significant proceedings and decisions.
2. Reproduce and distribute copies of minutes within seven days after each meeting to participants in the meeting and to parties affected by decisions made at the meeting.

C. Authorized Representatives: Representatives of contractors, subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of entity each represents.

D. Landscape Architect and Consulting Architects and Engineers Attendance: Landscape Architect, and/or Consulting Architects and Engineers will attend meetings as required to provide interpretations of the Contract Documents, to discuss problems the Contractor may have encountered, and the ascertain that Work is expedited consistent with Contract Documents and the Construction Schedules.

1.2 PRE-CONSTRUCTION MEETING

A. Scheduling: Schedule within 15 days after date of Notice to Proceed.

B. Locations: Contractor's Field Office or other mutually acceptable location.

C. Attendance:
1. Owner's Representative.
2. Landscape Architect and his professional consultants.
3. Contractor and Superintendent.
4. Major Subcontractors.
5. Major Suppliers.
6. Others as Appropriate.

D. Suggested Agenda:
1. Distribution and discussion of:
    a. List of major subcontractors and suppliers.
    b. Projected Construction Schedules.
2. Critical work sequencing.
3. Major equipment deliveries and priorities.
4. Project Coordination.
    a. Designation of responsible personnel.

5. Procedures and processing of:
    a. Field decisions.
    b. Proposal requests.
    c. Submittals.
    d. Change Orders.
    e. Applications for Payment.
6. Adequacy of distribution of Contract Documents.
7. Procedures for maintaining Record Documents.
8. Use of premises:
    a. Office, work and storage areas.
    b. Owner's requirements.
9. Construction facilities, controls and construction aids.
10. Temporary utilities.
11. Safe and first-aid procedures.
12. Security procedures.
13. Housekeeping procedures.
14. Coordination with Owner's Separate Contractors.

1.3 PRE-INSTALLATION JOB MEETINGS

A. Scheduling: Schedule pre-installation job meeting for installation of work when required, but prior to actual start of work.

B. Pre-installation Job Meeting: Prior to installation of work, conduct job meeting at project site with Contractor's superintendent and foreman, primary materials installer, installer of each component of associate work, representative(s) of materials manufacturer, inspection and testing agency representative (if any), installers of other work requiring coordination, and Owner's representative for purpose of reviewing job mock-up (if any), job conditions, project requirements and procedures to be followed in performing work.
    1. Examination: At pre-installation job meeting, examine areas and conditions under which work is to be performed. Report in writing any conditions detrimental to proper and timely completion of the work. Do not proceed with work until satisfactory conditions have been corrected. Commencement of work shall constitute acceptance of substrate conditions.

    2. Manufacturer's Recommendations: At pre-installation job meeting, review manufacturer's product data publication and other published instructions for material installation compliance.
        a. Where manufacturer's representative offers recommendations (either oral or written) on material use, such recommendations shall be in writing and substantiated by dated, printed, published product data or material use statement which is complete, definite, and clear, and signed by authorized company official.
    3. Statement of Non-Compliance:
        a. Where it is necessary to proceed with installation under conditions which do not fully comply with requirement (because of time schedule or other reasons which Contractor determined to be crucial to project), prepare a written statement for Owner's record (with copies to Contractor and Architect) indicating nature of non-compliance, reasons for proceeding, precautionary measures taken to ensure best possible work, and names of individuals concurring with decision to proceed with installation.

4. Meeting Report:
    a. Include copy of manufacturer's inspection report, manufacturer's recommendations, and any statement of non-compliance as applicable.

C. Agenda:
1. Prepare agenda.
2. Distribute written notice and agenda of meeting in advance of meeting date.
3. Make physical arrangements for meetings.
4. Preside at meetings.
5. Record minutes; include significant proceedings and decisions.
6. Distribute copies of minutes to participants within 4 days after meeting.

1.4 PROGRESS MEETINGS

A. Scheduling:
1. Schedule regular bi-monthly meetings.
2. Hold other called meetings as required by progress of the work.

B. Location of the Meetings: The project field office of the Contractor.

C. Attendance:
1. Owner.
2. Architect and his professional consultants as needed.
3. Subcontractor as appropriate to the agenda.
4. Suppliers as appropriate to the agenda.
5. Superintendent and Project Manager.

D. Suggested Agenda:
1. Review, approval of minutes of previous meeting.
2. Review of work progress since previous meeting.
3. Field observations, problems, and conflicts.
4. Problems which impede Construction Schedule.
5. Review of off-site fabrication, delivery schedules.
6. Corrective measures and procedures to regain project schedule.
7. Revisions to Construction Schedule.
8. Plan progress schedule, during succeeding work period.
9. Coordination of schedules.
10. Review submittal schedules; expedite as required.
11. Maintenance of quality standards.
12. Review proposed changes for:
    a. Effect on Construction Schedule and on completion date.
    b. Effect on other contracts of the Project.
13. Other business.
14. Review proposed percent complete to be reflected on upcoming Request for Payment.

END OF SECTION 01 31 00

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SECTION 01 32 00 - CONSTRUCTION PROGRESS

1.1 DESCRIPTION

A. Related Requirements Specified Elsewhere:
   1. Section 011100: Summary of Work.
   2. Section 012973: Schedule of Values.
   3. Section 013300: Submittal Procedures

B. Provide projected construction schedules for entire Work; revise periodically.

1.2 FORM OF SCHEDULES

A. Prepare in form of horizontal bar chart.
   1. Provide separate horizontal bar column for each trade or operation.
   2. Order: Table of Contents from Project Manual.

1.3 CONTENT OF SCHEDULES

A. Provide complete sequence of construction by activity.
   1. Shop Drawings, Product Data and Samples:
      a. Submittal dates.
      b. Dates reviewed copies will be required.
   2. Decision dates for selection of finishes.
   3. Product procurement and delivery dates.
   4. Dates for beginning, and completion of, each element of construction, specifically:
      a. Concrete placement.
      b. Subcontractor work.

B. Identify Work of separate phases, or other logically grouped activities.

C. Show projected percentage of completion for each item of Work as of first day of each month.

D. Provide separate sub-schedule, showing submittals, review times, procurement schedules, and delivery dates.

E. Provide sub-schedules to define critical portions of entire schedule.

1.4 UPDATING

A. Show all changes occurring since previous submission of updated schedule.

B. Indicate progress of each activity; show completion dates.

C. Include:
   1. Major changes in scope.
   2. Activities modified since previous updating.
   3. Revised projections due to changes.
   4. Other identifiable changes.

D. Provide narrative report, including:
   1. Discussion of problem areas, including current and anticipated delay factors, and their impact.

2. Corrective action taken, or proposed, and its effect.
3. Description of revisions:
    a. Effect on schedule due to change of scope.
    b. Revisions in duration of activities.
    c. Other changes that may affect schedule.

1.5 SUBMITTALS

A. Submit initial schedules within 15 days after date of Notice to Proceed.
    1. Architect will review schedules and return review copy within ten days after receipt.
    2. If required, resubmit within seven days after return of review copy.

B. Submit monthly with application for payment updated schedules accurately depicting progress to first day of each month or to progress meeting date as agreed to at Pre-Construction Conference.

C. Submit the number of copies required by Contractor, plus four copies to be retained by Architect.

1.6 DISTRIBUTION

A. Distribute copies of reviewed schedules to:
    1. Job-site file.
    2. Subcontractors.
    3. Other concerned parties.

B. Instruct recipients to report any inability to comply, and provide detailed explanation, with suggested remedies.

END OF SECTION 01 32 00

SECTION 01 33 00 – SUBMITTAL PROCEDURES

1.1 DESCRIPTION

A. Submit, to the Architect, shop drawings, product data and samples required by specification sections.

B. Related Requirements Specified Elsewhere:
   1. Construction Progress: Section 013200.
   2. Project Record Documents: Section 017839.

C. Designate the Construction Schedule dates for submission and dates reviewed shop drawings, product data and samples will be needed for each product.

1.2 SHOP DRAWINGS

A. Original drawings, prepared by Contractor, subcontractor, supplier or distributor, which illustrate some portion of the work, showing fabrication, layout, setting or erection details.

B. Prepared by a qualified detailer.

C. Identify details by reference to sheet and detail numbers shown on Contract Drawings.

D. Reproduction for Submittals. Furnish four (4) blue or black-line prints and one digital version in PDF format.

1.3 PRODUCT DATA

A. Manufacturer's standard schematic drawings:
   1. Modify drawings to delete information which is not applicable to project.
   2. Supplement standard information to provide additional information applicable to project.

B. Manufacturer's catalog sheets, brochures, diagrams, schedules, performance charts, illustrations and other standard descriptive data.
   1. Clearly mark each copy to identify pertinent materials, products or models.
   2. Show dimensions and clearances required.
   3. Show performance characteristics and capacities.
   4. Show wiring diagrams and controls.

1.4 SAMPLES

A. Physical examples to illustrate materials, equipment or workmanship, and to establish standards by which completed work is judged.

B. Office Samples: Of sufficient size and quantity to clearly illustrate:
   1. Functional characteristics of product or material, with integrally related parts and attachment devices.
   2. Full range of color samples.

C. Field Samples and Mock-ups:
   1. Erect at Project site at location acceptable to Architect.

2. Construct each sample or mock-up complete, including Work of all trades required in finished Work.

1.5 CONTRACTOR RESPONSIBILITIES

A. Review shop drawings, product data and samples prior to submission.

B. Verify:
   1. Field measurements.
   2. Field construction criteria.
   3. Catalog numbers and similar data.

C. Coordinate each submittal with requirements of Work and of Contract Documents.

D. Contractor's responsibility for errors and omissions in submittals is not relieved by Architect's review of submittals.

E. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved by Architect's review of submittals, unless Architect gives written acceptance of specific deviations.

F. Notify Architect, in writing at time of submission, of deviations in submittals from requirements of Contract Documents.

G. Begin no work which requires submittals until return of submittals with Architect's stamp and initials or signature indicating review.

H. After Architect's review, distribute copies.

1.6 SUBMISSION REQUIREMENTS

A. Schedule submissions at least 14 days before dates reviewed submittals will be needed.

B. Submit number of copies of shop drawings and product data which Contractor requires for distribution plus four (4) copies which will be retained by Architect.

C. Submit number of samples specified in each of specification sections.

D. Accompany submittals with transmittal letter, in duplicate, containing:
   1. Date.
   2. Project title and number.
   3. Contractor's name and address.
   4. The number of each shop drawing, product data and sample submitted.
   5. Notification of deviations from Contract Documents.
   6. Other pertinent data.

E. Submittals shall include:
   1. Date and revision dates.
   2. Project title and number.
   3. The names of:
      a. Architect.
      b. Contractor.

c. Subcontractor.
d. Supplier.
e. Manufacturer.

4. Identification of product or material.
5. Relation to adjacent structure or materials.
6. Field dimensions, clearly identified as such.
7. Specification section number.
8. Applicable standards, such as ASTM number or Federal Specification.
9. A blank space, 3" x 5", for the Architect's stamp.
10. Identification of deviations from Contract Documents.
11. Contractor's stamp, initialed or signed, certifying to review of submittals, verification of field measurements and compliance with Contract Documents.

1.7 RESUBMISSION REQUIREMENTS

A. Shop Drawings:
1. Revise initial drawings as required and resubmit as specified for initial submittal.
2. Indicate on drawings any changes which have been made other than those requested by Architect.
3. Product Data and Samples: Submit new data and samples as required for initial submittal.

B. Distribute samples as directed.

1.8 DISTRIBUTION OF SUBMITTALS AFTER REVIEW

A. Distribute copies of shop drawings and product data which carry Architect's stamp to:
1. Contractor's file.
2. Job site file.
3. Record Documents file.
4. Subcontractor's.
5. Suppliers.
6. Fabricator.

1.9 ARCHITECT'S DUTIES

A. Review submittals with reasonable promptness. The Architect will make all correction marks directly on the reproducible.

B. Review for:
1. Design concept of project.
2. Information given in Contract Documents.

C. Review of separate item does not constitute review of an assembly in which item functions.

D. The copy will be returned to the Contractor. The Architect will not furnish additional copies to the Contractor.

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SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

1.1 DESCRIPTION OF WORK

A. Arrange for and provide temporary facilities and controls as required for the proper and expeditious prosecution of the work. Pay all costs, except as otherwise specified, until final acceptance of the work unless the Owner makes arrangement for the use of completed portions of the work after substantial completion in accordance with the provisions of the General Conditions.

1.2 TEMPORARY OFFICE

A. Provide a temporary field office sized as required to carry on the work. Adequate space and facilities shall be provided in the field office for convenient use and storage of contract drawings and specifications, approved shop drawings and field records. All temporary structures shall be structurally sound, neat, and workmanlike in appearance.

1.3 TEMPORARY SHEDS

A. Provide watertight and secure storage sheds as necessary to hold materials to be protected while stored on the site.

1.4 TEMPORARY TOILET FACILITIES

A. Provide adequate temporary toilet and hand washing facilities for the use of all workmen, conforming to all applicable codes, ordinances, and regulations. Maintain these facilities in sanitary condition and remove upon completion of the work.

1.5 TEMPORARY ENCLOSURES

A. Provide temporary weathertight enclosures or coverings for exterior openings in the building when required to permit the use of temporary heat or to protect the finished work from damage by the elements, and when necessary for security of safety protection.

1.6 PROTECTION

A. Provide and maintain all fences, planking, bridges, bracing, shoring, sheet-piling, lights, barricades, warning signs, and guards as necessary for the protection of streets, sidewalks, landscaping, bridges, piers, buildings, and property, both on and off the site, from construction related damage.

B. Should any damage occur, restore such to its original condition in a manner acceptable to the Owner.

C. Take adequate precautions against fire; keep flammable material at an absolute minimum; and ensure that such material is properly handled and stored. Except as otherwise provided herein, do not permit fires to be built or open salamander heaters to be used in any part of the work.

1.7 WATER AND SNOW CONTROL

A. Keep the site and the project free from accumulation of water, and supply, maintain, and operate all necessary pumping and bailing equipment.

B. Remove snow and ice as necessary for the protection and prosecution of the work. Protect the work against weather damage.

1.8 EXISTING AND TEMPORARY UTILITIES

A. Provide water and electric power required for construction purposes which shall be at the expense of the Contractor.

B. Furnish and install all temporary piping and wiring required for the use of water and electric power for construction and other purposes; and upon completion of work, remove all temporary piping and wiring. Temporary utility lines are not specifically shown on the drawings, but shall be routed as required by conditions at the site.

C. Existing utility lines which are to remain permanently or temporarily in service shall be carefully protected from damage or dislocation, and any damage to these lines shall be made good at no additional cost to the Owner. Existing utility lines that are so shown or noted shall be abandoned and removed, removed and relocated, or abandoned and replaced with new lines, as specifically shown on the drawings or noted in the specifications.

1.9 TEMPORARY TELEPHONES

A. Furnish one single party telephone in the field office for the use of the Contractor, Architect, and Owner. Maintain telephone service from start to completion of work.

1.10 TEMPORARY HEATING

A. Provide heat, fuel, and services as necessary to protect all work and materials against injury from dampness and cold until final acceptance of all work and material in the contract. The Contractor shall provide heat as follows:
   1. At all times during the placing, setting, and curing of concrete, provide sufficient heat to ensure the heating of the space involved to not less than 50 degrees F.

B. Provide temporary heat by approved heating apparatus which will not endanger or damage work in place. Do not use unvented open-flame heaters to heat or dry out freshly placed concrete.

1.11 MAINTENANCE OF TRAFFIC AND CIRCULATION

A. Maintain circulation of traffic both pedestrian and vehicular, and access to all parts of the site by firefighting apparatus during construction.

B. For vehicular and pedestrian traffic, the Contractor shall furnish, erect, and maintain barricades, warning signs, lights and other traffic control devices in reasonable conformity with the Manual of Uniform Traffic Control Devices for Streets and Highways (published by the United States Government Printing Office).

1.12 VERMIN CONTROL

A. During construction, keep the building and the area of the construction free from food scraps and similar organic matter that would attract vermin; and take other preventive measures necessary to prevent infestation of the building. If, at the time of final occupancy, the building is found to be infected by rodents or vermin, the Contractor

shall bear the expense of the extermination.

1.13 PROJECT IDENTIFICATION

A. Erect and maintain until completion of the project one painted project name sign on the site where directed by the Architect. Sign shall be approximately 4' x 8' of 3/4" exterior plywood, edge trim, and wood supports. The sign shall contain the name of the project, the Owner, and the firm names of the Landscape Architect and his consultants and the Contractor. Detailed construction, color, and lettering of the sign shall be in accordance with instructions to be issued subsequent to contract award.

1.14 DUST CONTROL

A. The Contractor shall control dust on the construction site from affecting adjacent properties.

B. In the event of an extended time in which there is not sufficient rainfall to control dust, the Contractor shall water daily the construction site that has been disturbed or cover the area to control dust.

1.15 ON-SITE STORAGE AND SECURITY

A. Arrangements for on-site storage of construction materials shall be the responsibility of the Contractor in cooperation with the Owner. Security, temporary utilities and repair and cleaning of disturbed areas shall be the sole responsibility of the Contractor.

1.16 REMOVAL

A. Temporary facilities shall be removed promptly as each is no longer required.

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SECTION 01 55 26 - CONSTRUCTION AREA TRAFFIC CONTROL

PART 1 - GENERAL

1.1 CONTRACTOR RESPONSIBILITY AND GENERAL PROVISIONS

A. The Contractor shall provide, erect, and maintain all traffic control devices necessary to preserve the safe and orderly movement of traffic. All operations shall be scheduled and conducted in such a manner and sequences as to cause the least practicable interference with the traveling public, fire protection, and public utility service.

B. Payment for materials and labor associated with the required construction area traffic control shall be included in the Base Bid Lump Sum Price.

C. All necessary protective devices and operations shall be in accordance with Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), published by the Federal Highway Administration. The Contractor shall submit a Traffic Control Plan to define general traffic control needs or show why no plan is required. The Contractor's Traffic Control Plan shall be submitted for the approval of the Landscape Architect.

D. A project safety officer or other similarly responsible individual shall be made known to the Department of Engineering, Traffic Engineering Division prior to the commencement of construction. This notification shall include a telephone number or numbers where the individual(s) may be reached on a 7 day, 24 hour basis.

E. Written request for road closure shall be made at least 72 hours in advance to the Town of Farragut.

F. If any additional lane closures are requested, the Contractor shall provide one adequate traffic lane, minimum of 10' in width, in each direction (if appropriate) during the hours of 7:00 a.m. - 9:00 a.m. and 3:00 p.m. - 6:00 p.m. During hours when work is not in progress, the Contractor shall also maintain one similarly adequate traffic lane in each direction. Exceptions to the above must be approved by the Department of Engineering.

1.2 INSTALLATION AND MAINTENANCE OF TRAFFIC CONTROL DEVICES

A. The Contractor shall be fully responsible for the supplying, erection, and maintenance of all traffic control devices. These functions shall occur in a workmanlike manner such that all supports are vertical, sign panels generally perpendicular to the travel way and legends horizontal so that they effectively convey the intended message. Signs shall be mounted on stationary or portable support dependent on the type work being performed. In general, work being performed at spot locations and of short duration will necessitate the use of portable supports properly weighted for stability.

B. All existing traffic signs within the limits of this project shall also be the maintenance responsibility of the contractor for the duration of construction. This includes STOP and street name signs on side streets which intersect within the project limits. This responsibility shall include temporary sign relocations caused by construction activities.

The Contractor shall provide continuous and expeditious maintenance of all required traffic control devices. This shall include replacement of a sign panel, barricades, and other devices which in the opinion of the Department of Engineering are damaged or deteriorated beyond continued use, replacement of broken supports, plumbing of leaning signs, cleaning of dirty signs, barricades and other devices, pair of defaced sheeting and legends, replacement of stolen items, etc. All items used for traffic control shall be generally maintained in their original placement condition and such maintenance will be considered a part of the original installation cost. Failure to provide continuous safety to the public will be cause for suspension of construction operations until proper traffic control is re-established.

C. In the event that the Contractor, in the opinion of the Landscape Architect, has failed to provide or maintain adequate traffic control devices, the Owner shall have the right to provide the necessary items and deduct the expense of same from payments due the Contractor.

D. Existing and proposed regulatory signs shall be installed, relocated, or modified in any manner only in the presence of or under the direct orders of a Town of Farragut police officer or an identified employee of the Department of Engineering, Traffic Engineering Division, or an individual appropriately designated by such division acting at the direction of the Landscape Architect.

1.03 APPLICATION AND USE OF TRAFFIC CONTROL DEVICES

A. Cones are not permissible as channelizing devices during hours of darkness. Standard barricades, drums or vertical panels are permissible.

B. Short term operations will be permissible which conflict with existing pavement markings, but proper vehicle path must be ensured through the appropriate use of warning signs, flagmen and/or channelizing devices.

Where a newly paved section of roadway is to be open to traffic overnight, temporary centerline and lane line stripes shall be provided by the Contractor at the conclusion of each work day. These stripes shall be a temporary reflective tape. The segments shall be two feet long with thirty-eight foot gaps. Skip lines shall not be used for lane lines separating a turn lane from a through lane or for edge lines. Painted lines in lieu of tape will be allowed on non-final surface pavements.

C. Mesh or other fabric type signs are not considered acceptable for use during hours of darkness.

D. When flaggers are required, "Flagger Ahead" signs shall be installed. Flaggers shall utilize STOP/SLOW paddles and proper attire, including a reflectorized orange vest. Flagmen will be considered a general requirement of traffic control and no direct payment will be made for such.

E. During periods of non-use, warning signs and other devices shall be promptly removed from the work area, covered or otherwise positioned so they do not covey their message to the traveling public. If covered, the covering material shall be maintained in a neat and workmanlike manner.

F. The official maximum speed limit is to be used for determining taper lengths, device spacing, sign placement and other pertinent details unless otherwise notified.

PART 2 - PRODUCTS

2.1 MATERIALS

Materials for all traffic control and marking devices shall be in accordance with the provisions of the current edition of the MUTCD. Exceptions are listed below with reference to the appropriate subsections of the "Standard Specifications for Road and Bridge Construction" of the Alabama Department of Transportation, dated March 1, 1981.

Material	
Signs:	
Aluminum	
Reflective Sheeting	
Paint	
Cold Rolled Carbon Steel-16 gal.	ASTM A366
Drums and Barricades:	
Reflective Sheeting	

Temporary Pavement Marking Material:
The material for temporary traffic centerline and lane line marking shall be a pressure-sensitive, adhesive backed and reflective pavement marking tape.

Cones:
Cones shall be a minimum of 28" high and weighted at the base.

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01 56 39 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

RELATED DOCUMENTS

1.1 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. This Section includes the protection, pruning and trimming of existing trees that interfere with, or are affected by, execution of the Work, whether temporary or permanent construction. This Section also includes the thinning and raising of existing tree canopies as well as the root pruning and relocation of existing trees.

B. Related Sections include the following:

1. Division 01 Section "Summary" for limits placed on Contractor's use of the site.
2. Division 01 Section "Temporary Facilities and Controls" for temporary tree protection.
3. Division 31 Section "Site Clearing" for removal limits of trees, shrubs, and other plantings affected by new construction.
4. Division 31 Section "Earthwork" for building and utility trench excavation, backfilling, compacting and grading requirements, and soil materials.
5. Division 32 Section "Trees, shrubs and groundcovers" for tree and shrub planting, tree support systems, and soil materials

1.3 DEFINITIONS

A. Critical Root Zone: The soil area below ground and the space above ground defined by measuring one (1) foot radius away from the trunk of the tree for every inch diameter at breast height (DBH).

B. Diameter At Breast Height (DBH): This is a diameter measurement for existing or established trees. This standard of measure is made at four and one-half (4.5) feet above the ground.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Tree Pruning Schedule: Written schedule from arborist detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

C. Qualification Data: For tree service firm and arborist.

D. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to City of Knoxville tree protection standards and that trees were promptly and properly treated and repaired when damaged.

E. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

1.5 QUALITY ASSURANCE

A. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed tree protection and trimming work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of tree protection and trimming.

1. Approved Tree Service Firms are Wolfe Tree Service and Cortese Tree Specialists.

B. Arborist Qualifications: An arborist certified by ISA or licensed in the jurisdiction where Project is located.

C. Tree Pruning Standard: Comply with ANSI A300 (Part 1), "Tree, Shrub, and Other Woody Plant Maintenance--Standard Practices (Pruning)."

D. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Before tree protection and trimming operations begin, meet with representatives of authorities having jurisdiction, Owner, Architect, consultants, and other concerned entities to review tree protection and trimming procedures and responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch sieve and not more than 10 percent passing a 3/4-inch sieve.

B. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of weeds, roots, and toxic and other non-soil materials.

1. Obtain topsoil only from well-drained sites where topsoil is 4 inches deep or more; do not obtain from bogs or marshes.

C. Filter Fabric: Manufacturer's standard, nonwoven, pervious, geo-textile fabric of polypropylene, nylon, or polyester fibers.

D. Tree Protection Fence: Plastic fencing of 48-inch high orange polyethylene webbing, secured to metal “T” or “U” posts driven to a depth of at least 18 inches on 8 feet maximum centers, placed at the limits of the Critical Root Zone.

E. Organic Mulch: Shredded hardwood, free of deleterious materials.

PART 3 - EXECUTION

3.1 PREPARATION

A. Temporary Fencing: Install temporary fencing around critical root zones to protect remaining trees and vegetation from construction damage. Maintain temporary fence and remove when construction is complete.

1. Install fence as indicated on drawings and manufacturer's written instructions.

B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

C. Mulch areas inside tree protection zones and within drip line of trees to remain and other areas indicated.

1. Apply 2-inch average thickness of organic mulch. Do not place mulch within 6 inches of tree trunks.

D. Do not store construction materials, debris, or excavated material inside tree protection zones. Do not permit vehicles or foot traffic within tree protection zones; prevent soil compaction over root systems.

E. Maintain tree protection zones free of weeds and trash.

F Do not allow fires within tree protection zones.

3.2 EXCAVATION

A. Install shoring or other protective support systems to minimize sloping or benching of excavations.

B. Do not excavate within tree critical root zones, unless otherwise indicated.

C. Where excavation for new construction is required within tree critical root zones, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks and comb soil to expose roots.

1. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction.

2. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

D. Where utility trenches are required within tree protection zones, tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.

1. Root Pruning:
   a. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with sharp pruning instruments; do not break or chop.

b. Vertical cuts shall be made within 2 feet (61cm) of the limit of the grading or excavation.
c. Contractor shall, upon completion of the cut, immediately backfill the cut with soil, avoiding any voids. Construction fencing shall be installed no closer to the trunk of the tree than the location where the root pruning took place.

3.3 RE-GRADING

A. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist, unless otherwise indicated.

1. Root Pruning:
   a. Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots with sharp pruning instruments; do not break or chop.
   b. Vertical cuts shall be made within 2 feet (61cm) of the limit of the grading or excavation.
   c. Contractor shall, upon completion of the cut, immediately backfill the cut with soil, avoiding any voids. Construction fencing shall be installed no closer to the trunk of the tree than the location where the root pruning took place.

B. Minor Fill: Where existing grade is 6 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single un-compacted layer and hand grade to required finish elevations. Upon completion of minor fill, ensure that the tree root flare is exposed and that no fill dirt is placed against trunk or on tree root flare.

3.4 TREE PRUNING

A. Prune trees to remain as directed by the Landscape Architect that are affected by temporary and permanent construction.

B. Prune trees to remain as directed by the Landscape Architect to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.

C. Pruning Standards: Prune trees according to ANSI A300.

1. Type of Pruning: Cleaning, Thinning, Raising and Reduction.

D. Cut branches with sharp pruning instruments; do not break or chop.

E. Chip removed tree branches and properly dispose of excess material off-site.

3.5 TREE REPAIR AND REPLACEMENT

A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to arborist's written instructions.

B. Remove and replace trees indicated to remain that die or are damaged during construction operations that the arborist and the Landscape Architect determine are incapable of restoring to normal growth pattern.

1. Provide new trees of same size and species as those being replaced when damaged trees are less than 6-inches in size; plant and maintain as specified in Division 32 Section "Trees, Shrubs and Ground covers."

2. Provide new trees of 6-inch caliper size and of a species selected by Architect when damaged trees more than 6 inches in caliper size, measured 12 inches above grade, are required to be replaced. Plant and maintain new trees as specified in Division 32 Section “Trees, Shrubs and Ground covers."

C. Aerate surface soil, compacted during construction, 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch-diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augured soil and sand.

3.6 DISPOSAL OF WASTE MATERIALS

A. Burning is not permitted.

B. Disposal: Remove excess excavated material and displaced trees from Owner's property.

3.7 SPECIMEN TREE RELOCATION

A. Trees to be relocated shall be root pruned as soon as possible after the commencement of construction operations to maximize the amount of time available for the development of a new root system.

B. Buttress roots shall be broken to encourage the growth of a fibrous root system.

C. The root pruned area shall be irrigated with an automatic irrigation system for the life of the project.

D. After relocation of the trees, provide nutrient injections for the continued health of the trees.

E. Tree relocation shall be performed by a professional with at least 5 years’ experience in the transplantation of large specimen trees.

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SECTION 01 60 00 – PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings, general provisions of the Contract, including General and Supplementary Conditions, and other Division 1 specification sections, apply to work of this section.

1.2 DESCRIPTION OF WORK

This section specifies administrative and procedural requirements governing the Contractor's selection of products for use in the Project. This section also specifies administrative and procedural requirements for handling requests for substitutions.

1.3 DEFINITIONS

A. Definitions used in this Article are not intended to change the meaning of other terms used in the Contract Documents, such as "specialties", "systems", "structure", "finishes", "accessories", and similar terms. Such terms are self-explanatory and have well recognized meanings in the construction industry.

B. "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "material", "equipment", "systems", and terms of similar intent.

C. "Named Products" are items identified by manufacturer's product name, including make or model designation, indicated in the manufacturer's published product literature, that is current as of the date of the Contract Documents.

D. "Materials" are products that are substantially shaped, cut, worked, mixed, finished, refined, or otherwise fabricated, processed, or installed to form a part of the Work.

E. "Equipment" is a product with operational parts, whether motorized or manually operated, that requires service connections such as wiring or piping.

1.4 QUALITY ASSURANCE

A. Source Limitations: To fullest extent possible, provide products of same kind, from single source.

B. Nameplates: Except for required labels and operating data, do not attach or imprint manufacturers or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view in occupied spaces or on the exterior.

C. Required Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface that is not conspicuous.

D. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface which is inconspicuous in occupied spaces. The nameplate

shall contain name of product, manufacturer, model number, serial number, capacity, speed, ratings, and other essential operating data.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products in accordance with manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.

B. Schedule delivery to minimize long-term storage at site and to prevent overcrowding of construction spaces. Available storage space at the job site is limited to the site. Any additional off-site space required is the responsibility of the Contractor. Allocate the available storage areas and coordinate their use by the trades on the job. Maintain a current list showing all items and where they are stored.

C. 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.

D. Deliver products to site in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.

E. Inspect products upon delivery to ensure compliance with Contract Documents and to ensure that products are undamaged and properly protected. Do not use damaged material in the work.

F. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.

G. Store heavy materials away from the Project structure in a manner that will not endanger the supporting construction.

H. Store products subject to damage by the elements above ground, under cover in a weather tight enclosure, with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated or approved, unused at time of installation. Provide products complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation as specified.

B. Standard Products: Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

C. Product Selection Procedures: Product selection is governed by the Contract Documents and governing regulations, not by previous Project experience.

Procedures governing product selection include the following:

1. Semi-Proprietary Specification Requirements: Where two or more products or manufacturers are named, provide one of the products indicated. No substitutions will be permitted as base bid. Where products or manufacturers are specified by name, accompanied by the term "or equal" or "or approved equal" or "or approved substitution", the written approval of the Architect is required and the Contractor shall comply with the Contract Document provisions concerning "substitutions" to obtain approval for use of an unnamed product.

2. Non-Proprietary Specifications: When the Specifications list products or manufacturers that are available and may be incorporated in the Work, but do not restrict the Contractor to use of these products only, the Contractor may propose any available product that complies with Contract requirements. Comply with Contract Document provisions concerning "substitution" to obtain approval for use of an unnamed product.

3. Descriptive Specification Requirements: Where Specifications describe a product or assembly, listing exact characteristics required, with or without use of a brand or trade name, provide a product or assembly that provides the characteristics and otherwise complies with Contract requirements.

4. Performance Specification Requirements: Where Specifications require compliance with performance requirements, provide products that comply with these requirements and are recommended by the manufacturer for the application indicated. General overall performance of a product is implied where the product is specified for a specific application. Manufacturer's recommendations may be contained in published product literature, or by the manufacturer's certification of performance.

5. Compliance with Standards, Codes, and Regulations: Where the specifications require compliance with an imposed code, standard, or regulations, select a product that complies with the standards, codes, or regulations specified. Whenever the Contract Documents require that a product be in accordance with Federal Specification, ASTM designation, ANSI specification, or other association standard, the Contractor shall submit an affidavit from the manufacturer certifying that the product complies therewith. Where requested or specified, submit supporting test data to substantiate compliance.

6. Visual Matching: Where specifications require matching an established sample, the Architect's decision will be rendered on whether a proposed product matches satisfactorily and the Owner's decision will be final.

7. Visual Selection: Where specified product requirements include the phrase "... as selected from manufacturer's standard colors, patterns, textures ..." or a similar phrase, select a product and manufacturer that complies with other specified requirements. The Architect will select the

color, pattern, and texture from the product line selected. The Architect reserves the right to reject any manufacturer whose standard selections are too limited or unacceptable, when a specified manufacturer offers a sufficiently broad range of selection.

8. Allowances: Refer to individual specification sections and Section 01020 "Allowances" for allowances that control product selection and for procedures required for processing such selections.

2.2 PRODUCT SUBSTITUTIONS

A. Policy

1. Wherever in the specifications or on the drawings a material or article required is specified or shown by using the name of a product of a manufacturer or vendor, the item named is intended to set standard of design, dimension, substance, performance, and quality for such material or article.
2. Contractor may propose equal substitutions for all products called for in any section of this specification and is encouraged to do so when a substitution would result in a savings to the Owner with no sacrifice of quality or design intent.

B. Procedure Respecting Substitutions

1. Should the Contractor wish to substitute some product other than one specified, permission shall be requested in writing from the Architect. Request for substitution shall be made on the "Substitution Request Form" attached to this section. Contractor shall give the following information in the letter of request:
   a. The name and manufacturer of the product specified.
   b. The name and manufacturer of the product proposed for substitution.
   c. Complete descriptive and specification data, illustrations, etc., of the product proposed for substitution.
   d. Samples, where applicable or requested.
   e. A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as size, weight, durability, performance, and visual effect.
   f. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate Contractors, which will become necessary to accommodate the proposed substitution.
   g. Statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on overall Contract Time.
   h. Cost information, including a proposal of the net change, if any, in the Contract Sum.
   i. Certification by Contractor that the substitution proposed is equal-to or better to that required by the Contract Documents, and

that it will perform adequately in the application indicated. Include the Contractor's waiver of rights to additional payment or time, that may subsequently become necessary because of the failure of the substitution to perform adequately.

j. The reason(s) for substitution.

k. Substitution request forms shall be signed by a representative of the Contractor. Forms submitted with signatures of subcontractors, suppliers, or other parties will not be considered.

2. In the consideration of proposed substitutions, the Contractor shall supply the Architect with all information which may be requested.

3. The Architect will approve or disapprove the proposed substitution in writing.

4. The burden of proof shall rest with the Contractor to prove that the proposed substitute is equal to the material or article specified unless the substitution is required because the specified material or article is no longer available or obsolete.

C. Substitutions during Bidding

Substitutions will only be considered during the bidding period if proposed as a voluntary alternate. All base bids shall be based on the materials and products specified. Substitution requests will be evaluated and decided upon after receipt of base bids.

D. Substitutions After Award of Contract

1. Substitution of products after award of contract will be considered only under one of the following conditions:

a. When the proposed substitution would result in a savings to the Owner without sacrifice of quality or design intent.

b. When the specified product is not available. The request will not be considered if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly. Contractor must submit proof that firm orders for the product or method were placed in a timely manner. A proposed substitution will not be considered unless proof is submitted that firm orders were placed within thirty days after final submittal review by the Architect of the item listed in the Specifications. A request for substitution will be considered when unavailability is due to a strike, lockout, bankruptcy, discontinuance by the manufacturer of a product, or natural disasters.

c. When the specified product or method of construction cannot provide a warranty required by the Contract Documents and where the Contractor certifies that the proposed substitution provides the required warranty.

d. When the specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

e. When the specified product or method of construction cannot be provided in a manner that is compatible with other materials, and where the Contractor certifies that the substitution will overcome the incompatibility.

f. When the specified product or method of construction cannot be coordinated with other materials, and where the Contractor certifies that the proposed substitution can be coordinated.

2. Request for such substitutions shall be made in writing to the Architect within 10 days of the date that the Contractor ascertains he cannot obtain the material or equipment specified, or that the performance cannot be guaranteed.

E. Submittal Review: The Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data, or Samples that relate to construction activities not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval.

PART THREE - EXECUTION

3.1 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned, and conditioned as directed by the respective manufacturers, unless otherwise specified. Anchor each product securely in place, accurately located and aligned with other Work.

B. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

SUPPLEMENT TO SECTION 01 60 00 - SUBSTITUTION REQUEST FORM

PROJECT DATA

PROJECT: McFee Park Phase 3

OWNER: Town of Farragut

LANDSCAPE ARCHITECT/ARCHITECT:

Ross/Fowler, P.C.
5103 Kingston Pike, Suite 105
Knoxville, TN 37919

GENERAL CONTRACTOR:

_____

CONTRACTOR'S REQUEST, WITH SUPPORTING DATA

1. Section of the Specifications to which this request applies:_____

_____ Product data for specified item and proposed substitution is attached, including product description, specification data, illustrations, reference standards, and performance and test data.

_____ Sample is attached

_____ Sample will be sent if requested by Architect

2. Itemized comparison of proposed substitution with specified item

   a. Data Relative to Specified Item:

      1) Name, Brand: _____

      2) Catalog No.: _____

      3) Manufacturer: _____

   b. Data Relative to Proposed Substitution

      1) Name, Brand: _____

      2) Catalog No.: _____

      3) Manufacturer: _____

   c. Significant variations, including elements such as size, weight, durability,

performance, and visual effect: _____

_____

_____

_____

_____

_____

3. Proposed change in Contract Sum:

   Credit to Owner $_____

   Additional Cost to Owner $_____

4. Effect of the proposed substitution of the Work:

   Contract Time _____

   Changes or Modifications required to Other Parts of the Work: _____

   _____

   _____

   _____

   _____

   _____

   Changes or Modifications required to Other Contracts: _____

   _____

   _____

   _____

-

-

5. Reason for Substitution Request:

-

-

-

CONTRACTOR'S STATEMENT OF CONFORMANCE

I/we have investigated the proposed substitution. I/we:

A. believe and certify that it is equal or superior in all respects to the originally specified product, except as stated in 2 above;

B. certify that it will perform adequately in the application indicated;

C. will provide the same warranty or guaranty as required in the Contract Documents;

D. have included all cost data and cost implications of the proposed substitution, including, if required, costs to other contractors, and redesign and special inspection costs caused by the use of this product;

E. will coordinate the incorporation of the proposed substitution in the Work;

F. will modify other parts of the Work as may be needed to make all parts of the Work complete and functioning;

G. have verified that use of this substitution conforms to all applicable codes;

H. waive future claims for added cost to Owner caused by the proposed substitution.

Contractor: _____ Date _____

ARCHITECT'S REVIEW AND ACTION

_____ Provide more information in the following categories and resubmit:

_____

_____

_____ Sign Contractor's Statement of Conformance and resubmit.

_____ The proposed substitution is approved.

_____ The proposed substitution is approved, with the following conditions:

_____

_____

_____ The proposed substitution is rejected for the following reasons:

_____

_____

The following changes will be made by Change Order:

Addition to/Deduction from the Contract Sum: $ _____

Addition to/Deduction from the Contract Time _____ days

_____ _____

Ross/Fowler Date

END OF SECTION 01 60 00

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SECTION 01 70 00 - CONSTRUCTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Laying out the work.
2. General construction and installation procedures.
3. Cleaning during construction.
4. Instruction of the owner's personnel.
5. Project completion procedures.
6. Final cleaning.

1.2 DEFINITIONS

A. Concealed Spaces: Spaces which are not accessible after completion of construction.

B. Cutting: Removal of material by cutting, sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation.

C. Damage: Any sort of deterioration whether due to weather, normal wear and tear, accident, or abuse, resulting in soiling, marring, breakage, corrosion, rotting, or impairment of function.

D. Debris: Rubbish, waste materials, litter, volatile wastes, and similar materials, with the exception of surplus materials which are to become the property of the owner.

E. Patching: Restoration to completed condition by patching, repairing, refinishing, finishing, filling, closing up, and similar operations.

F. Spaces Not Normally Occupied: Accessible spaces such as roofs, accessible plenums and shafts, accessible spaces above ceilings, trenches, equipment vaults, manholes, accessible attics, and similar spaces, but not including the interior of duct or concealed spaces.

1.3 SUBMITTALS

A. Project Record Documents: Mark existing property survey to show changes and new information.
1. Include actual survey data.
2. Include locations and elevations of new benchmarks.
3. Include locations of underground utilities and other underground construction.

B. Certificate from surveyor stating that the construction has been placed in the locations and at the elevations required by the contract documents.

1.4 QUALITY ASSURANCE

A. Qualifications of Surveyor: Registered land surveyor licensed in the state in which the project is located.

B. Cleaning: Perform cleaning in accordance with the recommendations of the manufacturer or fabricator of the product or system. Use only cleaning materials and tools which are specifically recommended, which are not hazardous to health or property, and which will not damage finishes.

1.5 PROJECT CONDITIONS

A. Take precautions to prevent fires and to facilitate fire-fighting operations.
   1. Keep flammable materials in non-combustible containers; store away from potential fire sources; remove flammable waste regularly.
   2. Keep temporary and permanent firefighting facilities readily accessible; keep firefighting routes open.
   3. Do not allow smoking in areas where highly combustible or explosive materials are present.
   4. Carefully supervise the operation of potential fire sources, including heating units.
   5. Conduct welding operations in manner to prevent fire; comply with local regulations.

B. Take precautions to prevent accidents due to physical hazards:
   1. Provide barricades, warning lights, or signs as required to inform personnel and the public of the hazard being protected against.
   2. Safety barricades: Comply with regulations.
   3. Provide temporary walkways where walking surfaces are hazardous.
   4. Notify the owner before beginning work that involves hazardous operations, including use of explosives and the like.

C. Take care to prevent pollution of air, water, and soil.
   1. Comply with environmental protection regulations.
   2. Limit effluent and rainwater runoff into waterways as required by regulations.
   3. Do not dump contaminants in areas that will result in contamination of waterways.

D. Minimize discharge of effluent and rainwater runoff into sewers.
   1. Control sediment discharge into sewers; filter out construction debris, soil, and contaminants.
   2. Comply with regulations and orders of public utilities regarding use of sewers.
   3. Where disposal of effluent or rainwater by means of sewers is not lawful or is not possible, provide alternative methods of disposal.

E. Prevent erosion due to rainwater runoff.

F. Control windblown dust; prevent erosion to site and nuisance to neighbors.

G. Prevent flooding of excavations, below-grade construction, and adjacent properties due to rainwater runoff.

H. Do not use tools or equipment which produce harmful levels of noise.

I. Keep the site and adjacent public ways free of hazardous and unsanitary conditions and public nuisances.

J. Control rodents and other pests; prevent infestation of adjacent sites and buildings due to pests on this site.

K. Keep public streets free of debris due to this work.

L. Provide adequate traffic control by means of signs, signals, and flagmen, as necessary.

M. Conduct construction operations so that waste of power, water, and fuel is avoided.

N. Provide temporary supports as required to prevent movement and structural failure.

O. Install products only during environmental conditions which will ensure the best possible results.

1.6 SEQUENCING AND SCHEDULING

A. Install products only at the time and in the sequence which will ensure the best possible results.

B. Coordinate required administrative activities with related construction activities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Patching Materials: Identical to the materials of the work to be cut, unless indicated as specific materials specified in other sections.

PART 3 - EXECUTION

3.1 LAYING OUT THE WORK

A. Locate the construction on the site where indicated.

B. The Owner will furnish an existing property survey identifying control points and bench marks.

C. Verify locations of layout control points and bench marks.

D. Check layout data provided in the contract documents against existing control points and benchmarks before proceeding.
   1. Promptly notify the architect of discrepancies found.
   2. Protect existing benchmarks and control points during construction; replace if lost or destroyed using original survey control points.
   3. Do not change new control points without prior written approval.

E. Perform layout using recognized surveying practices.
   1. Locate and lay out using instrumentation or other appropriate methods.
   2. Establish required dimensions within the indicated tolerances.
      a. Where no tolerances are indicated, use recognized limits.
      b. Do not scale drawings to obtain required dimensions.

3. As the work proceeds, check the location, level, and plumb-ness of every major element.

F. Furnish location data required for work related to the project which is to be performed by other entities, including public utilities.

G. Reference Points: Where actual location or elevation of layout points or lines cannot be marked, provide temporary reference points or marks sufficient to locate the construction.
1. Preserve reference points during construction.
2. Promptly report and replace lost or destroyed reference points.
3. Promptly report the necessity to relocate reference points due to required changes in grades or locations.
4. Remove temporary reference points and marks when no longer needed; restore marked construction to original condition.

H. Provide at least 2 new permanent benchmarks on the site, referenced to data established by survey control points.

I. Maintain a log of layout control work; make log available for reference by the architect.
1. Keep records of all deviations from required lines and levels.

J. Inform installers of marked lines and levels to which they must conform.

K. Notify the architect when deviations from required lines and levels exceed allowable tolerances.

3.2 GENERAL EXAMINATION REQUIREMENTS

A. Prior to performing work, examine the applicable substrates and the conditions under which the work is to be performed.

B. If unsafe or otherwise unsatisfactory conditions are encountered, take corrective action before proceeding.

C. Conditions which could have been discovered by examination will not be allowed as cause for claims for extra work.
1. In particular, verify the following:
a. Underground utilities.
b. Other underground construction.
c. Location and invert elevation of points of connection to piped utilities.
d. Field routed utilities and systems.
e. Work inconsistent with Contract Documents.
f. Building in easements or setbacks.

D. Verify that utility requirements of operating equipment are compatible with building utilities.

E. Verify space requirements of items which are shown diagrammatically on the drawings.

3.3 GENERAL PREPARATION REQUIREMENTS

A. Take field measurements as required to fit the work properly.

B. Recheck measurements prior to installing each product.

3.4 GENERAL INSTALLATION PROCEDURES

A. Accurately locate the work and components of the work; make vertical work plumb; make horizontal work level.

B. See sections describing specific parts of the work for additional requirements.

C. Where space is limited, install components to maximize space available for maintenance and to maximize ease of removal for replacement.

D. Install work in such manner and sequence as to preclude, if possible, or at least to minimize, cutting and patching.

3.5 CLEANING AND PROTECTION

A. Remove debris from concealed spaces prior to enclosing the space.

B. Keep the site and the work free of waste materials and debris.
   1. Remove waste from site at least once a week.
   2. When temperature exceeds or is expected to exceed 80 degrees F, remove waste at frequency necessary to prevent development of health hazards and nuisance odors.
   3. Keep hazardous and unsanitary materials in containers separate from other waste.

C. Keep installed work clean, and clean again when soiled by other operations.
   1. Provide periodic cleaning as required to prevent damage due to soiling.
   2. Remove liquid spills promptly.

D. Protect installed work from soiling and damage.
   1. Provide protective coverings as required.
   2. Provide protective coverings for work which may be damaged by subsequent operations.
   3. Where heavy abuse is expected, use minimum of plywood for protection.
   4. Maintain protective coverings until substantial completion.

F. Any cost due to failure to keep work area clean will be back charged to the contractor(s) responsible.

3.6 INSTALLATION OF COMPONENTS

A. Install all products in accordance with manufacturer's instructions and recommendations, whether conveyed in writing or not.

B. Mounting Heights: Where mounting heights are not indicated, mount at heights directed by the architect.

C. Separate incompatible materials with suitable materials or spacing to prevent

cathodic corrosion.

D. Provide all anchors and fasteners required and use methods necessary to securely fasten work.
   1. Allow for thermal expansion and contraction, and for building movement.

E. Joints in Exposed Work:
   1. Make joints of uniform widths.
   2. Where joint locations are not indicated, arrange joints for the best visual effect.
      a. When in doubt, obtain the architect's instructions.

F. After installation, adjust operating components to proper operation.

3.7 INSTRUCTION OF THE OWNER'S PERSONNEL

A. Instruct personnel designated by the owner in the operation and maintenance of equipment and systems, prior to substantial completion.
   1. Explain all modes of operation and types of maintenance required.
   2. Demonstrate all functions, including startup, operation, control, adjustment, troubleshooting, servicing, maintenance, and shutdown.
   3. Review terms of warranties and procedures for obtaining warranty service.
   4. Review maintenance agreements and other similar commitments which extend past final completion.
   5. Have operating and maintenance data available for use during instruction.
      a. Review contents in detail.
      b. Prepare and insert additional data when need for such becomes apparent during instruction.

B. Arrange times and places of instruction with the owner.

C. Provide instruction by qualified personnel of the contractor, unless otherwise specified.

D. For equipment and systems which have different operation at different seasons, provide instruction during subsequent seasons until all modes of operation have been covered.

3.8 FINAL CLEANING

A. Remove materials and equipment which are not part of the work and all debris from the site prior to substantial completion.
   1. Remove all surplus materials which are to remain property of the contractor; obtain the owner's instructions as to disposition of surplus material remaining on site and deliver, store, or dispose of as directed.
   2. Remove protective coverings.
   3. Remove temporary facilities.

B. Dispose of debris in a lawful manner.
   1. Do not burn or bury debris on the site.
   2. Do not dispose of volatile wastes in storm or sanitary drains.

C. Perform final cleaning prior to requesting inspection for substantial completion.

1. Clean up landscaped areas.
2. Pressure wash and clean paved areas.
3. Rake smooth all exposed earth surfaces.

D. Remove paint and other coatings from permanent labels and from mechanical and electrical equipment nameplates.

E. Leave the project clean and ready for use.

3.9 PROJECT COMPLETION PROCEDURES

A. Complete the work, prior to substantial completion, as required to obtain consent to occupancy from the governing authorities.

B. Arrange for final inspections to be accomplished prior to substantial completion.

C. Provide close out documentation as required

END OF SECTION 01 70 00

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SECTION 01 73 29 - CUTTING AND PATCHING

PART 1- GENERAL

1.1 SUMMARY

A. This Section includes procedural requirements for cutting and patching.

1.2 DEFINITIONS

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

B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.3 QUALITY ASSURANCE

A. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety.

B. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

PART 2 - PRODUCTS

2.1 MATERIALS

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

B. In-Place Materials: Use materials 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 match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.

1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Temporary Support: Provide temporary support of Work to be cut.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to minimize interruption to occupied areas.

3.3 PERFORMANCE

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Division 2 Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.

D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 01 73 29

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SECTION 01 74 00 - CLEANING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Related Requirements Specified Elsewhere:
   1. Section 01010: Summary of Work.
   2. Cleaning for Specific Products or Work: Specification Section for that Work.

B. Maintain construction areas and public properties free from accumulations of waste, debris, and rubbish caused by operations.

C. At completion of Work, remove waste materials, rubbish, tools, equipment, machinery, and surplus materials, and clean all sight-exposed surfaces; leave project clean and ready for use.

1.2 SAFETY REQUIREMENTS

A. Standards: Maintain Project in accord with applicable safety and insurance standards.

B. Hazards Control:
   1. Store volatile wastes in covered metal containers, and remove from premises daily.
   2. Prevent accumulation of wastes which create hazardous conditions.
   3. Provide adequate ventilation during use of volatile or noxious substances.

C. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
   1. Do not burn or bury rubbish or waste materials on project site.
   2. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.
   3. Do not dispose of wastes into streams or waterways.

PART 2-PRODUCTS

2.1 MATERIALS

A. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3-EXECUTION

3.1 DURING CONSTRUCTION

A. Execute cleaning to ensure that construction site and public properties are maintained free from accumulations of waste materials and rubbish.

B. Wet down dry materials and rubbish to lay dust and prevent blowing dust.

C. At reasonable intervals during progress of work, clean construction site and public properties, and dispose of waste materials, debris, and rubbish.

D. Provide on-site containers for collection of waste materials, debris, and rubbish.

E. Remove waste materials, debris, and rubbish from site and legally dispose of at public or private dumping areas off Owner's property.

F. Handle materials in a controlled manner with as few handlings as possible.

G. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not damage completed work.

3.2 FINAL CLEANING

A. Employ experienced workmen, or professional cleaner, for final cleaning.

B. In preparation for substantial completion, conduct final inspection of sight-exposed exterior surfaces, and of concealed spaces to assure entire project is adequately cleaned.

C. Remove grease, dust, dirt, stains, labels, and other foreign materials from sight-exposed exterior finished surfaces.

D. Remove tire marks, mud stains and other blemishes from paved exterior surfaces.

E. Repair, patch, and touch up damaged or marred surfaces to specified finish, to match adjacent surfaces.

F. Owner will assume responsibility for cleaning as of time designated on Certificate of Substantial Completion for Owner's acceptance of Project or portion thereof.

END OF SECTION 01 74 00

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

A. Section 013300: Submittal Procedures

1.2 MAINTENANCE OF DOCUMENTS

A. Maintain at job site one copy of:
1. Contract Drawings.
2. Specifications.
3. Addenda.
4. Reviewed Shop Drawings.
5. Change Orders.
6. Other Modifications to Contract.
7. Field Test Records.

B. Store documents in field office, apart from documents used for construction.

C. Provide files and racks for storage of documents.

D. File documents in accordance with Project Filing Format of Uniform Construction Index.

E. Maintain documents in clean, dry, legible condition.

F. Do not use record documents for construction purposes.

G. Make documents available at all times for inspection by Engineer and Owner.

1.3 MARKING DEVICES

A. Provide colored pencils for marking, using different colors for:
1. Landscape architectural work.
2. Structural work.
3. Storm drainage work.
4. Electrical work.
5. Site Utilities work.
6. Irrigation work.
Trees, shrubs and groundcovers work.

1.4 RECORDING

A. Label each document "PROJECT RECORD".

B. Keep record documents current.

C. Do not permanently conceal any work until required information has been recorded.

D. Contract Drawings: Legibly mark to record actual construction.
1. Depths of various elements of foundation in relation to finished elevations.

2. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
3. Location of items concealed in construction referenced to visible and accessible features.
4. Field changes of dimension and detail.
5. Changes made by Change Order or Field Order.
6. Details not on original Contract Drawings.

E. Specifications and Addenda: Legibly mark up each section to record:
1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
2. Changes made by Change Order or Field Order.
3. Other matters not originally specified.

F. Shop Drawings: Maintain as record documents; legibly annotate drawings to record changes made after review.

1.5 SUBMITTAL

A. Record Documents:
1. Records shall be arranged in order, in accordance with the various sections of the specifications, and properly indexed. At the completion of the work, certify by endorsement thereof that each of the revised prints of the Drawings, Specifications, Shop Drawings, and Product Data is complete and accurate. Prior to application for final payment, and as a condition to its approval by the Architect and Owner, deliver the record documents, arranged in proper order, indexed, and endorsed as hereinbefore specified. Provide suitable transfer cases and deliver the records therein, indexed and marked for each division of the work.

2. Contractor's Responsibility: No review or receipt of such records by the Architect or Owner shall be waiver of any deviation from the Contract Documents or the shop drawings or in any way relieve the Contractor from responsibility to perform the work in accordance with the Contract Documents and the shop drawings to the extent they are in accordance with the Contract Documents.

B. Operation and Maintenance Manuals:

1. Furnish three complete sets of manuals containing the manufacturer's instructions for maintenance and operation of each item of equipment and apparatus furnished under the Contract and any additional data specifically required under the various sections of the Specifications.

2. Arrange the manuals in proper order, indexed, and suitably bound. Certify by endorsement thereon that each of the manuals is complete and accurate. Assemble these manuals for all divisions of the work, review them for completeness, and submit them to the Architect. Provide suitable transfer cases and deliver the manuals therein, indexed and marked for each division of the work.

3. Include the following types of information in the manuals:

    a. Emergency instructions.
    b. Spare parts list.
    c. Copies of warranties.
    d. Wiring diagrams.
    e. Inspection procedures.
    f. Shop Drawings and Product Data.
    g. Fixture lamping schedule.

C. Accompany submittal with transmittal letter, in duplicate, containing:

1. Date.
2. Project title and number.
3. Contractor's name and address.
4. Title and number of each record document.
5. Certification that each document as submitted is complete and accurate.
6. Signature of Contractor, or his authorized representative.

D. Written certification that all required training and instruction of Owner's maintenance personnel has been completed.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.1 OPERATING AND MAINTENANCE INSTRUCTIONS

A. Arrange for each installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. If installers are not experienced in procedures, provide instruction by manufacturer's representatives. Include a detailed review of the following items:

1. Maintenance manuals.
2. Record documents.
3. Spare parts and materials.
4. Tools.
5. Lubricants.
6. Fuels.
7. Identification systems.
8. Control sequences.
9. Hazards.
10. Cleaning.
11. Warranties and bonds.
12. Maintenance agreements and similar continuing commitments.
13. Other appropriate information relative to specific equipment.

B. As part of instruction for operating equipment, demonstrate the following procedures:

1. Start-up.
2. Shutdown.
3. Emergency operations.

4. Noise and vibration adjustments.
5. Safety procedures.
6. Economy and efficiency adjustments.
7. Effective energy utilization.
8. Other appropriate information relative to specific equipment.

C. Certify in writing that all required training and instruction of Owner's personnel is completed. This written certification must be submitted prior to application for final payment.

END OF SECTION 01 78 39

SECTION 02 41 00 - SITE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Demolition and removal of major site elements both above and below grade.
2. Patching and repairs.
3. Disconnecting, capping or sealing, and removing site utilities associated with the work of this Section.
4. Salvaging items for reuse by Owner.
5. Pre-cautionary measures to prevent damage to existing features to remain is part of the work.

B. Related Sections include the following:

1. Division 1 Section "Summary of Work" for use of the premises and phasing requirements.
2. Division 1 Section “Cutting and Patching” for cutting and patching procedures for selective demolition operations.
3. Division 2 Section "Selective Demolition" for partial demolition of buildings, structures, and site improvements.
4. Division 1 Section “Project Closeout” for record document requirements.
5. Division 31 Section "Site Clearing" for site clearing and removal of above- and below-grade site improvements not part of site demolition.
6. Division 26 Sections for demolishing or relocating site electrical items.

1.2 DEFINITIONS

A. Demolish: Completely remove and legally dispose of off-site unless indicated to be reinstalled, salvaged, or to remain the Owner’s property.

1. All demolished or removed items and materials shall be considered scrap except for those indicated to remain, those indicated to be reinstalled, and those indicated to be salvaged.

2. Items of value to the Contractor:
   a. The Contractor may provide for temporary storage on site, if approved by the Architect.
   b. Remove all items from site when requested by the Architect or the Owner.
   c. Sale of removed items on site will not be permitted.

B. Recycle: Recovery of demolition waste for subsequent processing in preparation for reuse.

C. Salvage: Carefully detach from existing construction, in a manner to prevent damage, wrap in protective waterproof covering and deliver to Owner ready for reuse. Include fasteners or brackets needed for re-attachment elsewhere.

D. Existing to remain and be protected: Protect all existing site elements indicated to remain against damage and soiling during demolition and for the life of the project. When permitted by the Architect, items may be removed to a suitable, protected

storage location during demolition and then cleaned and reinstalled in their original locations.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor and shall be removed from the site with further disposition at the Contractor's option.

B. Historic items and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 SUBMITTALS

A. Schedule of Demolition Activities: Indicate the following:

1. Detailed sequence of demolition work, with starting and ending dates for each activity.
2. Temporary interruption of utility services.
3. Coordination for shutoff, capping or re-routing, and continuation of utility services.

B. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

C. Pre-demolition photographs or videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, which might be misconstrued as damage caused by demolition operations. Comply with Division 1 Section "Photographic Documentation." Submit to the Architect before the Work begins.

D. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

E. Proposed dust-control measures.

F. Proposed noise-control measures.

G. Record drawings at Project closeout according to Division 1 Section "Contract Closeout."
1. Identify and accurately locate capped utilities and other subsurface structural, electrical, or mechanical conditions.

1.5 QUALITY ASSURANCE

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

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

C. Demolition Firm Qualifications: Engage an experienced firm that has successfully completed selective demolition Work similar to that indicated for this Project.

D. Pre-demolition Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings." Review methods and procedures related to demolition including, but not limited to, the following:

1. Inspect and discuss condition of construction to be demolished.
2. Review and finalize demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review and finalize protection requirements.
4. Review procedures for noise control and dust control.
5. Review items to be salvaged and returned to Owner.

1.6 PROJECT CONDITIONS

A. Owner assumes no responsibility for structures to be demolished.

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

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

1. Hazardous materials will be removed by Owner before start of the Work.
If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

C. On-site storage or sale of removed items or materials is not permitted.

D. Unforeseen Conditions: Should unforeseen conditions be encountered that affect design or function of project, investigate fully and submit an accurate, detailed, written report to the Architect. While awaiting the Architect's response, reschedule operations if necessary to avoid delay of overall project.

1.7 COORDINATION

A. Arrange demolition schedule so as minimize interference with Owner's on-site operations.

PART 2 - PRODUCTS (Not Used)

PART 3 – EXECUTION

3.1 EXAMINATION

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

B. Survey existing conditions and correlate with requirements indicated to determine extent of demolition required.

C. Inventory and record the condition of items to be removed and salvaged. Provide photographs or video of conditions that might be misconstrued as damage caused by salvage operations.

D. When unanticipated mechanical, electrical, or structural elements that conflict with the intended function or design are encountered, investigate and measure the nature and extent of the conflict. Promptly submit a written report to the Architect.

E. Perform surveys as the Work progresses to detect hazards resulting from demolition activities.

3.2 PREPARATION

A. Existing Utilities: Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.

1. Arrange to shut off indicated utilities with utility companies.
2. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
3. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.

B. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

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

C. Salvaged Items: Comply with the following:

1. Clean salvaged items of dirt and demolition debris.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to storage area designated by Owner.
5. Protect items from damage during transport and storage.

3.3 PROTECTION

A. Existing Facilities: Protect adjacent buildings, pavements, walkways, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.

B. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.
1. Refer to Division 26 for shutting off, disconnection, removing, and sealing or capping utility services. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.
2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.
    a. Provide at least 72 hours' notice to occupants of affected buildings if shutdown of service is required during changeover.

C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction

and as indicated. Comply with requirements in Division 1 Section "Temporary Facilities and Controls."

1. Protect existing site improvements, appurtenances, and landscaping to remain.
2. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
3. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
4. Provide protection to ensure safe passage of people around demolition area and to and from occupied portions of adjacent buildings and structures.

D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.4 DEMOLITION, GENERAL

A. General: Demolish indicated existing site improvements completely. Use methods required to complete the Work within limitations of governing regulations.

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

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

C. Explosives: Use of explosives is not permitted.

D. Conduct demolition operations so as to prevent injury to people and damage to adjacent buildings and facilities to remain. Ensure safe passage of people around demolition areas.

1. Protect existing site improvements, appurtenances, and landscaping to remain.
2. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of individual or groups of trees to remain.
3. Provide temporary weather protection, during interval between demolition and removal of existing construction, on exterior surfaces and new construction to ensure that no water leakage or damage occurs to structure or interior areas.

3.5 DEMOLITION BY MECHANICAL MEANS

A. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures.

1. Piping: Disconnect piping at unions, flanges, valves, or fittings.
2. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

3.6 SITE RESTORATION

A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.

B. Below-Grade Areas: Completely fill below-grade areas and voids resulting from demolition operations with satisfactory soil materials according to backfill requirements in Division 31 Section "Earthwork."

C. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface.

D. Provide a smooth transition between adjacent existing grades and new grades.

3.7 REPAIRS

A. Promptly repair damage to adjacent buildings caused by demolition operations.

B. Patching is addressed in Division 1 Section “Cutting and Patching”.

3.8 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site. See Division 1 Section "Construction Waste Management" for recycling and disposal of demolition waste.

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. Do not burn demolished materials.

C. Disposal: Transport demolished materials off Owner’s property and legally dispose of them.

3.9 CLEANING

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

B. Remove tools and equipment. Dispose of scrap.

C. Leave site free of debris

END OF SECTION 02 41 00

SECTION 03 06 00 - CONCRETE TESTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Testing of concrete materials, proposed mix designs and resulting concrete. An Independent Testing Agency will be approved by the Designer and paid for by the Contractor. Additional testing required because of deficiencies, or to verify the adequacy of a condition allegedly not built in accordance with Contract Documents shall be performed at the expense of the Contractor under the direction of the Designer.

1.2 STANDARD

A. Test in accordance with ASTM C31 and Chapters 16, 17, and 18 of ACI 301-72, entitled "Specifications for Structural Concrete for Buildings", except as otherwise indicated.

1.3 QUALIFICATIONS OF TESTING AGENCY

A. The Testing Agency shall meet the requirements of ASTM E329, entitled "Tentative Recommended Practice for Inspection and Testing Agencies for Concrete Steel as Used in Construction". The Testing Agency shall perform the following:

B.

1. Check concrete materials for compliance with specifications and report results along with recommendations to Designer.

2. Sample concrete at job site and prepare compression test specimens, tests for slump, air content, and unit weight as required by specifications.

3. Place concrete test specimens in designated location after casting.

4. Transport test specimens to laboratory and perform compression tests according to specifications. Report results on field test data sheet to Designer. Notify Designer immediately of any test specimens that do not meet design strength at 28 days or 70% of design strength at 7 days.

5. Complete field test data sheet for each set of concrete test specimens. The completed data sheet shall show all information required by ACI specifications. Include: laboratory number, date, plant, truck number, time batched, time sampled, air temperature, concrete temperature, inspector, mix design number, required strength, unit weight, air content, slump, location of placement, 7 day and 28 day strength.

1.4 RECORD DOCUMENTS

A. Testing Agency shall distribute copies of test report to:
   1. One (1) copy to Designer.
   2. One (1) copy to Contractor.
   3. One (1) copy to Owner.
   4. One (1) copy to Concrete Supplier.

PART 2 – PRODUCTS

2.1 ITEMS PROVIDED BY TESTING AGENCY

A. Maintain supplies, apparatus, tools and devices at job site to obtain specimens and perform on-site tests as indicated. Provide not less than the following:
   1. Molds for compression test specimens.
   2. Slump cones with rod for slump test.
   3. Scale and unit weight measure.
   4. Appropriate air meters.
   5. Concrete thermometer.

2.2 ITEMS PROVIDED BY CONTRACTOR

A. Provide stable, lockable storage box thermostatically controlled to maintain temperature between 60 and 80 degrees Fahrenheit for storage of cylinders for first 24 hours after molding. Box shall be a minimum of 40 cu. ft. Locate box in a permanent lockable area of approximately 100 sq. ft. Limit access to laboratory personnel and Contractor's superintendent.

PART 3 - EXECUTION

3.1 NOTIFICATION

A. Notify Testing Agency not less than 24 hours in advance of placing concrete to enable agency to have technician available for conducting tests and obtaining specimens.

3.2 DESIGN MIXES

A. Verify proposed design mixes and report recommendations to Designer in accordance with ACI 318-71, Chapter 4.

3.3 CYLINDERS

A. The following quantity of cylinders will be required for each 150 cubic yards (or fraction thereof) of each class of concrete placed each day:

   2 at 7 days for information
   2 at 28 days for acceptance
   2 additional, for testing if cylinders tested at 28 days do not indicate acceptable strength.

3.4 COMPRESSION TEST

A. Test specimens in accordance with ASTM C39 standards. At the job site, prepare cylinders for testing and perform required tests on concrete. Six cylinders shall be made for each sample of concrete to be tested; two to be broken at 7 days for information and two at 28 days for strength compliance. Hold two cylinders for 56 days. For frequency, see 3.10.

3.5 CORE TESTS

A. Core tests, at Contractor's expense, shall be required whenever concrete fails to meet the "Acceptance of Concrete" criteria as described in Concrete Section.

Cores shall be taken under the direction of the Designer. Criteria for acceptance of cores shall be as described in ACI 318-71, Section 4.3.5.1. Additional core tests at Contractor's expense may be required by the Designer whenever other requirements of these specifications are not complied with fully.

3.6 LOAD TESTS

A. Perform, at Contractor's expense, when core testing is inconclusive or impracticable. Evaluate load tests in accordance with ACI-318,301.

3.7 TESTS FOR AIR CONTENT

A. Perform each time a set of cylinders prepared for compression testing. Test in accordance with ASTM C138 (Gravimetric Method), ASTM C173 (Volumetric Method) or ASTM C231 (Pressure Method).

3.8 SLUMP TEST

A. Perform each time a set of cylinders prepared for compression testing. Test in accordance with ASTM C143.

3.9 SHRINKAGE TEST

A. Perform only if directed by the Designer.

3.10 FREQUENCY OF TESTING

A. Take samples for strength tests of concrete not less than once each placement, each 5000 sq. ft. of surface area, or each 100 cu. yard placed.

3.11 ADDITIONAL TESTING

A. Perform testing of materials, other than concrete, to determine compliance with Contract Documents when directed by the Architect. Contractor shall furnish samples and deliver them to Testing Agency's laboratory.

END OF SECTION 03 06 00

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SECTION 03 20 00 - CONCRETE REINFORCEMENT (Expansion Bars)

PART 1 - GENERAL

1.1 RELATED SECTIONS

A. Section 03 10 00 - Concrete Formwork.

B. Section 03 30 00 - Cast-in-Place Concrete.

1.2 Submittals

A. Submit warranty from mill or supplier stating that materials meet requirements of referenced ASTM and ACI Standards.

B. Detail reinforcing steel in accord with ACI SP-66-94, "Details and Detailing of Concrete Reinforcement." Submit shop drawings indicating placement of expansion dowels. Shop drawings shall include the following note completed and signed by the contractor: The data submitted does not contain material deviation from requirements of contract documents except as follows:

1.3 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in bundles marked with metal tags for easy identification.

B. Handle and store materials to prevent contamination.

C. Deliver and store welding electrodes in accordance with American Welding Society D1.4-92.

PART 2 - PRODUCTS

2.1 BAR SUPPORTS

A. Bar supports and spacing of same shall be as per recommendations set forth by Chapter 3 of the CRSI Manual of Standard Practice, 24th Edition, 1986.

2.2 OTHER SUPPORTS

A. Concrete brick may be used to support reinforcement to obtain proper clearance from earth and rigidity of reinforcement under concreting operations.

2.3 FABRICATING

A. In accordance with CRSI Manual of Standard Practice, 24th Edition, 1986.

PART 3 - EXECUTION

3.1 CONDITION OF SURFACES

A. Maintain reinforcement surfaces free of mud, oil or other coatings which might impair bond as described in Section 7.4 of ACI 318-95. Rust or mill scale is

acceptable provided the minimum dimensions are not less than applicable ASTM Standards. Loose rust scale is to be removed with wire brush.

3.2 INSTALLING REINFORCING STEEL

A. Handle, place and tie reinforcement steel in accordance with "Building Code Requirements for Reinforced Concrete," ACI 318-95 and CRSI publication "Placing Reinforcing Bars," 4th Edition, 1981.

B. All reinforcement bars shall be supported and secured as directed in ACI 315-94 (Revised 1986) and CRSI Manual of Standard Practice, 24th Edition, 1986.

3.3 CONCRETE PROTECTION FOR REINFORCEMENT

A. Protect reinforcing by thickness of concrete indicated on Contract Drawings.

B. Variation from clear cover shall conform to section 7.5 of ACI 318-95.

END OF SECTION 03 20 00

SECTION 03 30 00 - CAST IN PLACE CONCRETE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Related Work Specified Elsewhere:

1. Section: Concrete Formwork.
2. Section: Concrete Reinforcement.

B. Definition: Standard Specifications refers to ACI 301.

1.02 QUALITY ASSURANCE

A. Testing Agency: Possessing ability to perform testing in accordance with ASTM E 329.

B. Allowable Tolerances: Conform to requirements of Article 11.9 of Standard Specifications.

C. Reference Standards: Comply with the requirements of ACI 301 "Specifications for Structural Concrete for Buildings" by American Concrete Institute.

D. Design, construct and erect formwork per ACI 347R-88, Guide to Formwork to Concrete.

1.03 SUBMITTALS

A. Test Reports: Submit laboratory test or evaluation reports for concrete materials and mix designs.

B. Concrete mix design for each class of concrete.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Comply with Standard Specifications for concrete materials.

B. Deliver proprietary materials in original unopened containers, store and handle in accordance with manufacturer's recommendations.

1.05 JOB CONDITIONS

A. Cold Weather:
1.Comply with Standard Specifications and ACI 306.
2.Do not use frozen materials.
3.Do not use calcium chloride or other antifreeze agents unless accepted by Architect in writing.

B. Hot Weather:
1.Comply with Standard Specifications and ACI 305
2.Do not use retarding admixtures unless accepted in mix design.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concrete Materials:
1. Portland Cement: ASTM C 150, type as required.
2. Aggregates: ASTM C 33.
3. Water: Clean, drinkable.
4. Admixtures: Use only admixtures which have been tested and accepted in mix design.
   a. Air Entraining Admixture: ASTM C 260.
   b. Water Reducing Admixture: ASTM C 494, Type A.

B. Ready-Mixed Concrete: ASTM C 94.

C. Moisture Barrier: Paper consisting of heavy Kraft papers laminated together with glass fiber reinforcement and over coated with black polyethylene on each side.

D. Expansion Joint Fillers: Bituminous impregnated fiberboard, ASTM D 1751.

E. Curing Compound: ASTM C 309, Type 1, membrane forming.

F. High - Range Water Reducer: ASTM C 494 (super plasticizer).

2.02 MIX DESIGN

A. Proportion mixes by laboratory test or field experience methods, using materials to be employed on the project, complying with Standard Specifications.

B. Design mix to provide 4000 psi 28-day compressive strength.

C. Use air entraining admixture in exterior exposed concrete.

D. Slump shall be 4" maximum for vibrated concrete.

E. Minimum cement content per cubic yard for stone aggregate concrete: 5.5 bags.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine formwork and items to be embedded or cast-in-place.

B. Do not begin placement until work of other trades affecting concrete is completed.

3.02 PLACING OF CONCRETE

A. Preparation:

Clean and remove water from all spaces to receive concrete before pouring. Remove form oil and spattered concrete from reinforcement. All conveyances, buggies, and barrows shall be cleaned before and during placing of concrete. Protect mechanical and electrical equipment from contact with concrete placement and spatter.

B. Time of Placing:

Concrete shall not be placed except under the following conditions:

1. All reinforcement shall be securely and properly fastened in correct position and protected against displacement during pouring operations.
2. Engineer shall have inspected formwork and reinforcing.
3. All bucks, sleeves, thimbles, hangers, pipes, conduits, bolts, wires and other items to be embedded in concrete shall have been placed and securely anchored in position.
4. Forms shall have been thoroughly wetted or oiled.
5. Form ties at construction joints have been retightened.
6. Concrete shall be placed under direct observation of the Engineer who shall be notified 24 hours in advance of the proposed placing and again on the day of actual placing of the concrete.

C. Transportation of Concrete:
Concrete shall be handled from the mixer to the place of final deposit by means of carts, buggies, or conveyors. If the concrete is to be transported more than fifty feet in carts or buggies, they shall be equipped with pneumatic tires. Concrete delivered to the carts, buggies, or conveyors from spouts, troughs, or mixer trucks, shall not have a free fall of more than three feet. Prevent separation or loss of ingredients while transporting the concrete. Delivery carts, buggies, conveyor trucks or barrows shall be kept on temporary runways built over the floor system; runway supports shall not bear upon reinforcing steel or fresh concrete. Pumping is an acceptable method for placing concrete.

D. Before depositing new concrete on or against concrete that has hardened, the forms shall be retightened and the surface of the hardened concrete shall be roughened, thoroughly cleaned of foreign matter and laitance, and moistened with water. The new concrete placed in contact with hardened concrete shall contain an excess of cement paste to ensure bond. Hardened concrete, including vertical and inclined surfaces shall be slushed with a coating of neat cement grout; new concrete shall be placed before the grout has attained its initial set. Before placing concrete wall or column forms, a uniform layer of grout 2 inches thick shall be placed at the bottom of forms (or on the top of hardened cement below). The grout shall consist of one part cement and two parts sand with enough water added to make a thick consistency.

E. Method of Placing:
1. No water shall be added to the mix without the Architect's approval.
2. No partially-hardened concrete shall be deposited. No concrete shall be used when the elapsed time after the addition of water and cement to batch exceeds one (1) hour.
3. Unless otherwise specified, all concrete shall be placed upon clean, damp surfaces, free from water, and never upon soft mud, dry absorbent earth or rock, or upon fills that have not been subjected to approved tamping to provide ultimate settlement. No concrete pour shall be started until the condition of the form or place of pouring has been approved by the Engineer.
4. Concrete shall be distributed so that when consolidated and finished, the thickness and surface grade required by the drawings are obtained at all joints.
5. After the concrete has been deposited, it shall be distributed over the entire area within the forms in horizontal layers not more than 18 inches thick. It shall be compacted and worked into all corners and angles and around reinforcement and embedded fixtures in a manner to fill all voids, prevent honeycombing against the forms and avoid segregation of course aggregate. This operation shall be performed using spaders and internal vibrators. The operation shall be continuous and all concrete

shall be in final position before initial set has started. Concrete shall not be placed when the sun, wind, heat, or humidity prevents proper placement and consolidation.

6. Vibration shall be transmitted directly to the concrete and in no case shall be transmitted through the forms. Vibrator driving mechanism shall revolve at no less than 7,000 rpm. The intensity of vibration shall be sufficient to cause settlement of the concrete into place. The vibration shall be of sufficient duration to accomplish thorough compaction. Vibration shall be supplemented by spading by hand adjacent to the forms along exposed faces in order to secure smooth, dense, even surfaces. Vibrators shall not be used to transport concrete within the forms. Vibrators shall be kept in motion at all times to prevent excessive vibration in one area.
7. Freshly placed concrete shall be protected from wash by rain, flowing water, mud deposits and other injurious conditions. Concrete shall not be allowed to dry out from the time it is placed until the expiration of curing periods.
8. Workmen shall not walk on concrete during placing or finishing with earth or foreign matter or footgear. Hand spreading shall be done with shovels, not rakes.
9. Concrete must not be poured within 25 feet of workmen placing or securing reinforcement in areas outside of the pour being made.
10. Special care shall be observed to avoid concrete slopping over forms when pouring.
11. The work shall be laid out and carried on so that there is a minimum of construction joints. Obtain Engineer's approval for joint locations. Footings, except wall footings, shall be poured in one operation with no joints.
12. Imperfect or damaged work, or any materials damaged before final acceptance, shall be replaced by the Contractor in a manner than will not impair the adequacy, stability or appearance of the structure.

3.03 SEVERE WEATHER CONCRETING

Special measures shall be taken in both severe cold and hot weather and shall be in accordance with ACI Recommended Practice (ACI 305 and ACI 306).

A. Winter Concreting

Equipment shall be provided during freezing or near freezing weather to prevent freezing of newly placed concrete. When air temperature of surrounding air is below 40 degrees F, concrete placed in forms shall have a temperature between 70 degrees F and 80 degrees F. Adequate means shall be provided for maintaining the air temperature at 70 degrees F for three days or 50 degrees F for five days or for as much more time as is necessary to ensure proper curing of the concrete. Housing or covering or other protection used in connection with heating shall remain in place and intact at least 24 hours after the artificial heat is discontinued. The use of calcium chloride or other chemicals to prevent freezing will not be permitted.

B. Hot Weather Concreting:

Hot weather precautions shall be taken whenever the maximum air temperature during the day exceeds 85 degrees F. When rapid mixing water evaporation in transit causes the concrete to be delivered in an unworkable condition, initial correction may be made at the job site provided that water added is in the form of cement paste containing the same w/c ratio as the batch in the truck and provided that the drum or mixer blades be operated at mixing speed for at least 70 revolutions after the paste addition. Once the need for water has been observed, subsequent additions shall be at the batching plant until the need has passed. Correction shall consist of simultaneous and proportionate increase of water and cement up to 10% of the stated quantity of each material in the batch. Such increase in cement shall not constitute an extra or increase in contract price. During hot weather, extra caution shall be taken to prevent too quick evapora-

tion of water. Forms shall be kept cool by frequent wettings. Flat work shall be protected from drying winds, direct sun and high temperatures whenever conditions of temperature and humidity are such as to cause plastic shrinkage cracking

3.04 TOLERANCES

A. Tolerances for cast-in-place concrete shall not exceed the limitations as set forth in ACI 347, latest addition.

B. Variation in plumb shall also comply with ACI 347 - latest edition.

3.05 CLEANING

At the completion of this work, remove from the site all excess materials and debris. Leave entire work in a neat condition ready for the Architect's inspection.

3.06 CURING

A. Apply curing compound to damp concrete surfaces as soon as water film has disappeared. Apply uniformly in accord with manufacturer's recommendations.

B. Do not use compound on surfaces to receive a coating material when manufacturer's recommendations prohibit the use of curing compound.

3.07 PATCHING OF CONCRETE

A. Immediately after removing forms, all concrete surfaces shall be thoroughly inspected for damaged or imperfect work. Any concrete which is poorly formed, out of alignment or level, or shows a defective surface, shall at the election of the Engineer, be removed from the job by the Contractor at the Contractor's expense. The Engineer may grant permission to patch or repair defective work; but such permission shall not be considered a waiver of the Engineer's right to require complete removal of the defective work, if in the Engineer's opinion, the patching or repairs do not satisfactorily restore the quality and appearance of the items in questions.

B. Where permitted by the Architect, all honeycombs, voids, stone pockets, tie holes and other defective areas shall be patched as soon as practicable. Patching shall be done in accordance with the following procedure.

1. Defective areas shall be chipped away to a depth of not less than 1 inch with the edges cut perpendicular to the surface.
2. The area to be patched and a space at least 6 inches wide entirely surrounding it shall be wetted to prevent absorption of water from the patching mortar.
3. A grout of equal parts of Portland Cement and sand, with sufficient water to produce a brushing consistency, shall be well brushed into the surface followed immediately by the patching mortar.
4. The patch shall be made of the same materials and of approximately the same proportions as used for the concrete except that the coarse aggregate shall be omitted. The mortar shall not be richer than 1 part cement to 3 parts sand. White Portland Cement shall be substituted for concrete. The proportions of white and gray cements shall be determined by making a trial patch. The amount of mixing water used shall be the minimum consistent with the requirements of handling and placing. The mortar shall be re-tempered without the addition of water by allowing it to stand for one hour, during which time it shall be mixed with a trowel to prevent setting.

5. The mortar shall be thoroughly compacted into place and screeded off so as to leave the patch slightly higher than the surroundings surface. The patch shall then be left undisturbed for one to two hours to permit initial shrinkage before being finally finished.
6. The patched area shall be finished to match the adjoining surface. On exposed surfaces, where unlined forms have been used, the final finish shall be obtained by striking off the surface with a straight edge spanning the patch and held parallel to the form marks.
7. Curing of the patched areas shall be in accordance with these specifications.
8. Contractor's Option:
   In lieu of mixing grout for patching, the Contractor may provide a PVC bonding agent recommended by the manufacturer for the use intended. Approved products and manufacturers:
   a."Dara Weld C" by W. R. Grace
   b."Weldcrete" by E. A. Larson
   c."Vinyl Hesive" by Nox-Crete

3.08 FINISHES ON FORMED CONCRETE SURFACES

A. Common finish shall be confined to concrete surfaces which will be covered by other construction, and which will not be visible. This finish shall be produced by filling smoothly at tie holes, honeycomb and other depressions, knocking off and evening-up burrs and form marks.

3.09 FIELD QUALITY CONTROL

A. An independent Testing laboratory will be approved by the Landscape Architect and paid for by the Contractor. The Contractor's testing laboratory will perform testing for slump and compressive strength during concrete placement see Section Concrete Testing.

END OF SECTION 03 30 00

SECTION 10 73 00 - PROTECTIVE COVERS

PART 1 – GENERAL

1.1 DESCRIPTION OF PRODUCT

A. SQR 20 (Square) with Multi-Rib Metal Roof "R" Panel.

B. ROOF SLOPE: **6/12**.

C. Minimum Clearance Height (MCH): **8.0 in ft.** Minimum clearance height under the structure indicates the lowest height of a member from finish grade for clearance under the structure. This is generally the clearance under roof eave or frame, whichever is lower.

1.2 REFERENCES

A. REFERENCE STANDARDS:
1. AISC - American Institute of Steel Construction Manual of Steel Construction.
2. ASTM - American Society for Testing and Materials.
3. AWS - American Welding Society.
4. LEED - Leadership in Energy and Environmental Design.
5. OSHA - Occupational Safety and Health Administration Steel Erection Standard 29 CFR 1926 Subpart R-Steel Erection.
6. PCI - Powder Coating Institute.
7. SSPC - The Society for Protective Coatings.

1.3 SUBMITTALS

A. Submit 4 sets of submittal drawings and 2 sets of calc books, both signed and sealed by a Professional Engineer licensed in the State of TN.

B. PRODUCT DESIGN REQUIREMENTS:
The building shall meet the following design requirements as shown on the drawings:
1. Building Code: **2012 IBC**.
2. Ground Snow Load (Pg): **10**.
3. Basic Wind Speed (V): **115**.
4. Seismic Design: See drawings.

C. SUBMITTAL REQUIREMENTS:
Calculations and Submittal drawings shall include, at a minimum:
1. Calculations:
   a. References to building codes and design manuals used for calculations.

b. Identification of lateral force resisting system.
c. Formulas used for determining snow, wind, and seismic loads to specific project location.
d. Three-dimensional modeling input, model geometry, and analysis results.
e. Member design results and controlling load combinations.
f. Connection design for structural bolts, welds, plate thicknesses, and anchorage to the foundation.
g. Foundation designs shall include the required combinations of gravity and lateral loads.

2. Submittal Drawings:
   a. Anchor bolt layout.
   b. Foundation design.
   c. Three dimensional views of frame.
   d. Member sizes and locations.
   e. Structural connection details, including bolt sizes and plate thicknesses.
   f. Roof trim and connection details for installation clarity.

D. FOUNDATION DESIGN:
1. The shelter shall be set on foundations designed by manufacturer.
2. Foundation materials shall be provided by contractor.
3. Owner shall provide manufacturer with complete information about the site including soil bearing capacity and lateral load capacity.
4. If soil data are not provided, foundations will be designed to the minimum values identified in the governing building code.

E. ANCHOR BOLTS:
Anchor bolts shall be provided by manufacturer.

F. LEED SUBMITTALS:
LEED MR Credit 4.0: Material and Resources, Recycled Content.

1.4 QUALITY ASSURANCE

A. MANUFACTURER QUALIFICATIONS:
1. Minimum of (10) years in the shelter construction industry.
2. Full time on-staff Licensed Engineer.
3. Full time on-staff AWS Certified Associate Welding Inspector.
4. Full time on-staff Quality Assurance Manager.
5. Full time on-staff LEED AP.
6. All welders AWS Certified.
7. Manufacturer owned and controlled finishing system to include shot blast, pretreatment, primer, and topcoat.
8. Published Quality Management System.
9. Annual audit of Quality System and Plant Processes by Third Party Agency.

10. Annual audit of powder coat finish system by Third Party Agency (PCI).

B. MANUFACTURER'S CERTIFICATONS:
   1. PCI 4000 S Certified, Certification thru Powder Coating Institute for original equipment manufacturers (OEMs) to evaluate process on entire finish system to add powder coat over steel.
   2. City of Los Angeles, CA Approved Fabricator Type I Steel.
   3. Clark County, NV Approved Fabricator steel.
   4. City of Houston, TX Approved Fabricator Structural Steel and Structural Insulated Panels.
   5. Miami Dade County Certificate of Competency for Structural Steel and Miscellaneous Metal Products and Assemblies.
   6. State of Utah Approved Fabricator for Medium and High Strength Steel.
   7. City of Riverside, CA Approved Fabricator Type I Steel.
   8. City of Phoenix, AZ Approved Steel Fabricator.

1.5 FIELD OR SITE CONDITIONS

A. Foundations shall be at the same elevation unless specifically noted otherwise on the drawings.

1.6 MANUFACTURER WARRANTY

A. Shelter must have a (10) year limited warranty on steel frame members.

B. Shelter must have a (10) year limited warranty on paint system.

C. Pass through warranty of Metal Roof manufacturer shall be provided upon request.

PART 2 - PRODUCTS

2.1 SHELTER SYSTEM AND MATERIALS

A. MANUFACTURERS:
   1. Acceptable Manufacturer: Poligon, a Product of Porter Corp, 4240 N 136th Ave., Holland, MI, 49424; 616.888.3500; E-mail: info@poligon.com; www.poligon.com. Receive pricing from Mid-South Recreation at Mid-South Recreation, 7341 Crowther Cove, MEMPHIS, TN 38119, Phone 800-576-5846, Fax 901-753-8906, Email recboys3@aol.com.
   2. The product shall be designed, produced, and finished at a facility operated and directly supervised by the supplier who has a minimum of (10) years in the business of making pre-manufactured shelters.

B. SUBSTITUTION LIMITATIONS:
   1. Substitutions must be approved a minimum of (10) days before bid. All approved manufacturers shall be notified in writing before the bid date and shall not be allowed to bid without written notification.
   2. Alternate suppliers must meet the qualifications and provide proof of certifications listed under Section 1.4 QUALITY ASSURANCE.
   3. Alternate suppliers must provide an equivalent paint system to Poligon's Poli-5000 listed under Section 2.1 C. 8. FINISHES.
   4. Staff members' cumulative experience in fabrication will not be an acceptable alternative for manufacturer's experience in the shelter construction industry.

C. PRODUCT REQUIREMENTS AND MATERIALS:
   1. GENERAL:
      The pre-engineered package shall be pre-cut unless otherwise noted and prefabricated which will include all parts necessary to field construct the shelter. The shelter shall be shipped knocked down to minimize shipping expenses. Field labor will be kept to a minimum by pre-manufactured parts. Onsite welding is not necessary.
   2. REINFORCED CONCRETE:
      a. Concrete shall have minimum 28-day compressive strength of 3,000 psi and slump of 4" (+/- 1"), unless otherwise noted on the drawings.
      b. Reinforcing shall be ASTM A615, grade 60.
   3. STEEL COLUMNS:
      a. Hollow structural steel tube minimum ASTM A500 grade B with a minimum wall thickness of 3/16".
      b. Unless columns are direct buried, columns shall be anchored directly to concrete foundation with a minimum of four anchor rods to meet OSHA requirement 1926.755(a)(1).
   4. STRUCTURAL FRAMING:
      Hollow Structural Steel tube minimum ASTM A500 grade B, “I” beams, tapered columns or open channels shall not be accepted for primary beams. Frame will have a **STANDARD POLI-5000** finish. Color chosen from manufacturer's standard color chart: **TBD.**
   5. COMPRESSION MEMBERS:
      Compression Rings of structural channel or welded plate minimum ASTM A36 or compression tubes of structural steel tube minimum ASTM A500 grade B shall only be used.
   6. CONNECTION REQUIREMENTS:
      a. Anchor bolts shall be ASTM F1554 (Grade 36) unless otherwise noted.
      b. Structural fasteners shall be zinc plated ASTM A325 high strength bolts and A563 high strength nuts.
      c. Structural fasteners shall be hidden within framing members wherever possible.

d. No field welding shall be required to construct the shelter.
e. All welds shall be free of burrs and inconsistencies.
f. Exposed fasteners shall be powder coated by manufacturer prior to shipment to match frame or roof colors as applicable.
g. Manufacturer shall provide extra structural and roofing fasteners.

7. ROOFING MATERIALS:
   a. PRIMARY ROOF DECK OF “R” PANEL METAL ROOFING (MR):
      1) Roofing shall be 24-gauge ribbed galvalume steel sheets, with ribs 1 3/16” high and 12” on center.
      2) Roof surface shall be painted with Kynar 500 to the manufacturer’s standard color: **TBD.**
         Ceiling surface shall be a "wash coat" primer.
      3) Roof panels shall be factory precut to size and angled to provide ease of one-step installation.
      4) Metal roofing trim shall match the color of the roof and shall be factory made of 26-gauge Kynar 500 painted steel.
      5) Trim shall include panel ridge caps, hip caps, eave trim, splice channels, rake trim, roof peak cap, and corner trim as applicable for model selected. Trim may need to be cut to length and notched. Installation drawings shall have detailed information on how to cut and affix roof trim.
      6) Ridge, hip, and valley caps shall be pre-formed with a single central bend to match the roof pitch and shall be hemmed on the sides. Roof peak cap shall be pre-manufactured.
      7) Manufacturer shall supply painted screws and butyl tape.

8. FINISHES:
   a. STANDARD POLI-5000 FINISH:
      1) Steel shall be cleaned, pretreated and finished at a facility owned and directly supervised by the manufacturer.
      2) Steel shall be shot blasted to SSPC-SP10 near-white blast cleaning. SSPC-SP2 hand tool cleaning will not be an acceptable alternative.
      3) Parts shall be pretreated in a 3-stage iron phosphate or equal washer.
      4) Epoxy primer powder coat shall be applied to parts for superior corrosion protection.
      5) Topcoat of Super Durable TGIC powder coat shall be applied over the epoxy primer.
      6) Finish shall not have any VOC emissions.
      7) Sample production parts shall have been tested and meet the following criteria:
         a) Salt spray resistance per ASTM B 117/ ASTM D 1654 to 10,000 hours with no creep from scribe line and rating of 10.
         b) Humidity resistance per ASTM D2247-02 to 5,000 hours with no loss of adhesion or blistering.

c) Color/UV resistance per ASTM G154-04 to 2,000 hours exposure, alternate cycles with results of no chalking, 75% color retention, color variation maximum 3.0 E variation CIE formula (before and after 2,000 hours exposure).

8) The manufacturer shall be PCI 4000 S Certified.

9) Exposed fasteners for frame and ornamentation shall be powder coated to match structure.

9. ACCESSORIES:

a. ELECTRICAL ACCESS & CUTOUTS:

1) Electrical access to be provided through a 1 1/8” diameter hole in the column base plate and ¾” diameter holes are provided through connection plates for wire access through columns, trusses, and into the compression ring/tube.

2) Electrical cutouts shall be provided in 5 places for fixtures or wires.

PART 3 - EXECUTION

3.1 INSTALLERS STORAGE AND HANDLING

A. Protect building products after arrival at destination from weather, sunlight, and damage.

B. Installer shall store product elevated to allow air circulation and to not introduce mold, fungi decay or insects to the product.

C. Product must be handled with protective straps or padded forks if lifting with mechanical equipment. Use of chain or cable to lift product into place will not be accepted and may void manufacturer’s warranty.

3.2 ERECTION

A. INSTALLATION:
Install all components according to manufacturer's installation instructions and these specifications.

B. GENERAL CONTRACTOR:
Interface with other work is to be coordinated by the customer or the customer's agent. Certain designs have electrical or other plumbing requirements that are not supplied by Poligon.

C. TOLERANCES:
Tolerances on steel structural members are set according to AISC construction practices, abided in the factory, and cannot be increased. No field slotting or opening

of holes will be allowed. It is therefore essential that contractors conform to the tolerances specified on the installation drawings for anchor bolt or column layout details.

D. OSHA COMPLIANCE:
OSHA Compliance to Steel Erection Standard 29CRF 1926 Subpart R-Steel Erection.

3.3 REPAIR

A. Do not attempt any field changes without first contacting Poligon.

3.4 FIELD OR SITE QUALITY CONTROL

A. Field or Site Tests and Inspections are not required by Poligon but may be required by the customer or by the local building inspector.

END OF SECTION 10 73 00

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SECTION 26 00 00 - GENERAL ELECTRICAL

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall furnish all plant, labor, materials, equipment, and services necessary for and reasonably incidental to the complete installation of all electrical work as shown on the drawings and as specified herein.

1.2 RELATED WORK

A. General Provisions of the Contract, General and Supplementary Conditions, and Division 1 Specification Sections, General Requirements, apply to this section.

1.3 GENERAL

A. The drawings indicate the extent and general arrangement of the electrical system. Details of proposed departures due to unforeseen conditions or other causes shall be submitted to the Architect for approval before proceeding.

B. Equipment and materials to be furnished under this specification shall be the standard products of manufacturer's latest standard, shall be new and unused, and bear the Underwriter's Seal of Approval.

C. All work of the installation to be done by skilled workmen in a workmanlike manner, following the best modern practices. The work shall present a neat and workmanlike appearance when completed.

D. Manufacturers, catalog numbers, etc., used in these specifications or shown on the drawings are to denote design, workmanship and quality desired.

1.4 APPLICABLE STANDARDS AND CODES

A. Be governed by these specifications and by the current rules and regulations as listed in Division 1 General Conditions, Section 1A, Item No. 4, Applicable Codes.

B. Secure and pay for all permits, licenses, and inspection fees as are necessary to perform the work under this section.

C. The codes and ordinances of the following shall govern this Section and shall be considered minimum requirements:
   1. National Electrical Code.
   2. Rules and Regulations of the National Fire Protection Association (NFPA).
   3. Local and state electric building codes and ordinances.
   4. Occupational Safety and Health Act.
   5. Rules and regulations of local utilities.

D. The labor and materials for the installation of equipment and wiring shall be in accordance with the latest issues of the following standards and regulations:
   1. National Electrical Manufacturers Association (NEMA) applicable standards.
   2. IEEE applicable standards.
   3. American National Standards Institute (ANSI).

E. All electrical equipment shall be UL listed.

1.5 PRINCIPAL FEATURES

A. A complete system of conduit and conductors to supply electrical energy to and throughout the construction area.

B. Wiring devices.

C. Lighting fixtures and lamps.

1.6 SHOP DRAWINGS

A. Furnish eight (8) copies of shop drawings for approval of the following:
   1. Panelboards/safety switches/switchboards/transformer.
   2. Lighting fixtures.

1.7 MATERIAL AND EQUIPMENT SUBMITTAL

A. Furnish catalog data including cuts, properly assembled in a binder and labeled for the following items including all of the items for which catalog data exists from the manufacturer; submit eight (8) sets.
   1. Lighting fixtures and exit signs.
   2. Panelboards/safety switches.

1.8 SERVICE TO EQUIPMENT

A. Check service required by equipment prior to making final connection. Call differences to attention of Architect. Check equipment for proper protective devices and safety devices to allow proper operation of equipment and prevent burnout. Assist Owners in initial operation of equipment and make necessary adjustment for proper operation.

1.9 ARCHITECTURAL DRAWINGS

A. Refer to architectural drawings for details such as finishes, dimensions, materials, etc. Refer to drawings for door locations, door swings, partitions location, cabinet and counters, making proper allowances therefore. Refer to equipment plans for exact location of electrical connections, which may be dimensioned.

1.10 INITIAL OPERATION OF EQUIPMENT

A. Give all equipment furnished in the contract an operational test prior to final acceptance. Assist the Owner in the initial operation when the Owner operates the building and

equipment. Instruct the Owner's personnel in the proper operation and maintenance of all the equipment furnished under this section of the specifications.

1.11 GUARANTEE

A. Guarantee all work to be free from defects of material and workmanship for a period of one year after date of final acceptance of the work. Repair and/or replace all defective material or equipment and any work damaged thereby or make any other adjustments necessary without additional cost to the Owner.

1.12 CONNECTIONS TO EQUIPMENT

A. Wiring to and connection to all equipment shall be included in the electrical contract work. Equipment shall be properly prepared to receive a single connection with all wiring internal to the equipment installed by the equipment supplier. Verify all connections and rough-in location with the equipment supplier prior to start of work.

1.13 LABELS, NAMEPLATES, SIGNS, TAGS, ETC.

A. Install a plastic engraved nameplate on the inside of door of each communication and electric cabinet to indicate the following as illustrated by this example:

"Panel A-5"
208/120-Volts

Install a plastic nameplate to identify nature and use of each electric conduit 2" in size and larger in each room in which it occurs. Plate shall be suitably strapped to the conduit line. Plate shall show the following information:

Use: "Telephone", "communications", "fire alarm", "208-volt", or "480-volts", etc.

From: Panel A-3.

To: Panel X.

Conductors: 3 No. 4/0, 1 No. 2 (this required for electric lines only).

B. Paint junction boxes with 1" high letters its basic system such as telephone, fire alarm, sound, 480-volts, or 208-volts.

1.14 RECORD DRAWINGS

A. Furnish record drawings showing the changes and modifications that occurred during the construction period.

B. The job supervisor shall maintain a set of prints of the job office to be used to illustrate the note the job changes as they occur. This set of prints shall then be used as a reference to prepare the record drawings tracing. At the contractor's option, a "sepia" or translucent print may be made from the contract drawings at the contractor's expense and the

modifications made thereon. Secure approval of the type of translucent print used prior to having them made.

1.15 WORK IN CONNECTION WITH OTHER TRADES

A. Coordinate and review all ceiling systems, grid systems by other sections so that lighting fixtures and other ceiling mounted equipment and their trims are compatible with the ceiling system used prior to submittal of shop drawings and brochures.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION 26 00 00

SECTION 26 05 19 - 600 VOLT CONDUCTORS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install conductors throughout the raceway system and distribution of electrical energy for the lighting and power needs.

1.2 RELATED WORK

A. General Provisions of the Contract, General and Supplementary Conditions, and Division 1 Specification Sections, General Requirements, apply to this section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use stranded conductors for sizes No. 8 and larger and solid conductors for No. 10 and 12. Minimum size shall be No. 12 AWG. Insulate conductors with Type "THWN" insulation unless specifically indicated otherwise on drawings. Rating shall be 600 volts, AC.

B. Connectors for conductors size No. 10 and 12 shall be approved type insulated twist-on wire nuts. Use hydraulic compression type connectors for conductors No. 8 and larger. For all connections in pole lighting fixtures, use split bolt connectors with rubber tape and vinyl tape insulation.

C. All conductors are to be copper, color coded.

D. Conductors should be color coded.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Conform to manufacturer's recommendations and latest standard practice of industry. Color code all conductors for phase, neutral, and ground reference.

B. All conductors terminating at wired outlets shall extend a minimum of 8" beyond the outlet box conduit fitting.

END OF SECTION 26 05 19

SECTION 26 05 26 - ELECTRICAL POWER SERVICE AND GROUNDING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Install new underground infrastructure on site as illustrated on plans, consisting of multiple 2” conduit 48” below grade to allow for relocation of a primary vault.

B. Pay all costs associated with power service primary relocation.

C. Power service for new lighting and receptacles shall be taken from existing panelboards.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Other products for the Power Service shall be covered under other sections of the Specification.

B. Products for grounding shall be as follows:
   1. Grounding conductors No. 4 AWG and smaller shall have green colored Type "T" insulation. Larger grounding conductors shall be bare.
   2. Conductors shall be Code size for the application unless specifically noted larger on the drawings or in the specifications. The grounding conductor in conduit containing 20-ampere circuit wiring shall be No. 12 AWG. The grounding conductor in 100 ampere circuits in conduit shall be No. 8 AWG. Conform to Table No. 250-95 in the National Electrical Code.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Furnish and install separate insulated grounding conductors in all conduit runs. Grounding conductor is generally not illustrated on drawings but is required.

END OF SECTION 26 05 26

SECTION 26 05 33 - CONDUIT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install a system of raceways and boxes for installation of conductors for distribution of power and controls throughout building. All wiring shall be in conduit. Conduit shall be concealed.

1.2 RELATED WORK

A. General Provisions of the Contract, General and Supplementary Conditions, and Division 1 Specification Sections, General Requirements, apply to this section.

PART 2 - PRODUCTS

2.1 POWER RACEWAYS

A. Underground lines shall be Schedule 40 PVC. All other wiring shall be in metallic raceway. Exposed conduit on the exterior shall be rigid steel.

2.2 MINIMUM SIZE

A. Minimum size conduit shall be 3/4".

2.3 BUSHING

A. Bushings for conduit 2" in size and smaller shall be plastic. Conduit size 2-1/2" and larger shall be OZ Company Type "B" Appleton Company Efcor Series No. 55 or approved equal with metal ring and insulator as an integral part of bushing.

2.4 COUPLINGS, CONNECTORS, AND FITTINGS

A. All are to be galvanized for metallic raceway.

2.5 MANUFACTURER

A. Conduit shall be as manufactured by Pittsburgh, National, Republic Steel Companies, General Electric Company, or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Protect threads on rigid conduit during storage. To prevent entry of moisture and foreign matter in conduit during construction, install factory made conduit caps on conduit stubs. Swab conduit runs clean and dry prior to pulling wire.

B. Cut conduit square, ream smooth, and thread properly and fully. Paint job cut male threads with conductive lead prior to making up a threaded conduit joint.

C. Conduits shall be continuous from outlet to outlet and from outlet to panel or pull box. No continuous conduit run shall exceed 100' without a pull or junction box. Connect conduit in building construction except as indicated. Secure conduit to all boxes and bushings with double locknuts so that system will be electrically continuous.

D. In concrete slabs, block up conduit from forms and securely fasten in place. All conduits in slabs shall have a minimum of 2" concrete coverage above and below.

E. Where conduit is installed in poured concrete slabs and cross an expansion joint, an expansion fitting equal to OZ type "AX" with a bonding jumper type "AL" shall be installed. Use Crouse-Hinds, Appleton, or approved equal.

F. Install all conduit in a workmanlike manner with bends made using tools specifically designed for purpose to prevent kinks and flattened areas. Where electric metallic tubing is connected to an outlet box or panel, terminate tubing in an approved type connector and couple together with approved type connectors in order to insure adequate bonding.

G. Where conduit is installed above ceilings, secure it in place by attachment to building structural framing system with appropriate clamps or approved wire ties, manufactured for purpose of making conduit attachment.

H. The use of "explosion" type or "shot" type attachment to the building structure is prohibited. Attachment shall be by bolted connection, use of drilled and set expansion bolts, or other approved means.

I. Maintain minimum 6" clearance from hot water pipes, floors, or high temperature piping or ductwork.

J. All conduit that exit to exterior shall be sealed off to prevent condensation. Use a suitable compound at outlet boxes at both ends of conduit. Use Johns-Manville "Dux-Seal" or equal.

K. All conduit shall be run concealed. Exceptions to this shall be in mechanical and electrical rooms. Exposed wiring shall be run in a neat and orderly manner. All exposed conduit runs shall be run parallel/perpendicular to building structure.

END OF SECTION 26 05 33

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SECTION 26 05 43 - EXCAVATION AND BACKFILLING FOR UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Perform necessary trenching and backfilling as detailed on the drawings to accommodate the underground electrical lines as located on the drawings and specified hereafter.

B. Coordinate conduit runs with other underground improvements including, but not limited to, site water lines, telephone lines, and irrigation lines. Provide 5'0" diameter clear zone for root ball where trees are shown on planting plans.

1.2 RELATED WORK

A. General Provisions of the Contract, General and Supplementary Conditions, and Division 1 Specification Sections, General Requirements, apply to this section.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Asphalt Concrete Paving: See Section 02520 for patching and repair of asphalt concrete paving. All pavements which are cut, trenched, or damaged as a result of work on this project at no additional cost to the owner.

B. Concrete Curbs, Walks, and Paving: See Section 02510 for patching and repair of all concrete curbs, walks, and paving.

C. Lawns and Grounds: See Section 02930 for patching and repair of lawns.

PART 3 - EXECUTION

3.1 INSTALLATION

A. See Section 02200, Earthwork for excavation and backfilling. Minimum cover for all conduit lines shall be 24" under paved areas. Otherwise, in earth, minimum cover shall be 18".

END OF SECTION 26 05 43

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SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install plug receptacles as specified hereafter and shown on the drawings. Devices offered as a substitute to those specified will be carefully checked to see that quality such as grounding continuity, retention force for insertion devices, are equal to those specified.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The plug receptacles shall have a minimum rating of 20 amperes for the voltage service applied. All receptacles shall have built-in GFCI protection. All receptacles shall be specification grade.

B. Coverplates: Coverplates shall be waterproof in-use type.

C. The manufacturer shall be Hubbell, General Electric, Bryant, P & S, Leviton, or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation of devices shall be in accord with the manufacturer's recommendations. Grounding devices such as jumper straps between the device grounding pole and the junction box, or the connection of a grounding conductor will be required at each plug receptacle. Where metal conduit serves the outlet box, a device using a "UL" approved grounding arrangement making use of the contact between the yoke and the device box is approved for use.

END OF SECTION 26 27 26

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SECTION 26 27 29 - BOXES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish outlet boxes for lighting fixtures, wall receptacles, switches, and other boxes as required. Also, pull boxes and junction boxes shall be furnished as required.

1.2 RELATED WORK

A. General Provisions of the Contract, General and Supplementary Conditions, and Division 1 Specification Sections, General Requirements, apply to this section.

PART 2 - PRODUCTS

2.1 WALL BOXES

A. Plug receptacle boxes and telephone boxes shall be cast 4" square by 2-1/8" deep with a weatherproof device cover, either one or two-gang as required.

2.2 EXPOSED WIRING

A. Where conduits are run exposed, galvanized malleable fittings (FS condulets) with proper type covers and hubs threaded for screw connections shall be used at each switch or receptacle location. Pressed steel boxes will not be permitted on exposed work except for ceiling fixture outlets.

2.3 MANUFACTURER

A. Boxes and fittings shall be Appleton, Steel City, Raco, Efcor, Crouse-Hinds, or equal.

2.4 FABRICATION

A. Pull and junction boxes shall be galvanized or sherardized sheet metal of code thickness with lapped and welded joints and with 3/4" flange. They shall be rigidly supported on ceiling or wall. Conduit runs entering a box shall not be considered as adequate support.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install pull and/or junction boxes in conduit lines wherever necessary to avoid excessive length of runs or number of bends in a run. No run shall exceed 100 feet without a pull box.

B. Pull and junction boxes shall be accessible and sized in accordance with provisions of Article No. 370-18 of latest edition of National Electrical Code.

C. Pull and junction boxes shall be installed so that cover shall be accessible at all times.

D. No pull or junction box shall be installed for joint use of line voltage and signal or low-voltage controls unless wires are all insulated for highest voltage being used in same pull box.

E. The use of powder actuated devices for attachment to the building structure is prohibited. Attachment shall be by bolted connection, use of drilled and set expansion bolts, or other approved means.

END OF SECTION 26 27 29

SECTION 26 51 00 - LIGHTING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish and install the lighting fixtures as called for on the drawings and specified hereinafter. Equipment shall be complete including lamps and accessories with the mounting arrangement suitable for the mounting condition encountered.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The lighting fixtures shall be as listed in the lighting fixture schedule shown on the drawings.

B. LED lamps shall be 4000-degree K. color temperature.

2.2 SUBMITTALS

A. Submit samples of each lighting fixture in the approved finish and color.

B. Submit manufacturer's product data for each fixture and accessory item, with finish indicated, for approval prior to manufacture.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Each lighting fixture shall be secured to the structural system.

B. Provide concrete bases for fixtures as shown on drawings. Install anchor bolts in concrete for mounting of bollards and area lights. Use template provided from manufacturer for rough-in of anchor bolts. Concrete base shall be constructed of 4,000 psi concrete in concrete form. Furnish and install steel reinforcement as detailed on plans. Any exposed surfaces of concrete base shall be rubbed for quality finish. Grout bases with non-shrink grout after plumbing of poles.

END OF SECTION 26 51 00

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SECTION 31 00 00 - EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Preparing and grading sub-grades for slabs-on-grade, walks, pavements, and landscaping.
2. Excavating and backfilling for structures.
3. Drainage and moisture-control fill course for slabs-on-grade.
4. Base course for walks.
5. Excavating and backfilling trenches.
6. Excavating and backfilling for underground electrical utilities and appurtenances.
7. Topsoil stripping and placement

B. Related Sections: The following Sections contain requirements that relate to this Section.

1. Division 32 Section “Permeable Unit Pavering”
2. Division 32 Section “Concrete Pavement”.
3. Division 32 Section "Trees, Shrubs and Ground Covers"

1.2 UNIT PRICES

A. Not required.

1.3 DEFINITIONS

A. Excavation consists of the removal of material encountered to sub-grade elevations and the reuse or disposal of materials removed. (The excavation under this Section is unclassified.)

B. Sub-grade: The uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

C. Borrow: Soil material obtained off-site when sufficient approved soil material is not available from excavations.

D. Subbase Course: The layer placed between the sub-grade and base course in a paving system or the layer placed between the sub-grade and the bottom surface of a pavement system.

E. Base Course: The layer placed between the subbase and surface pavement in a paving system.

F. Drainage Fill: Course of washed granular material supporting slab-on-grade placed to cut off upward capillary flow of pore water.

G. Unauthorized excavation consists of removing materials beyond indicated sub-grade elevations or dimensions without direction by the Architect. Unauthorized excavation, as well as remedial work directed by the Architect, shall be at the Contractor's expense.

H. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below ground surface.

I. Utilities include on-site underground pipes, conduits, ducts, and cables, as well as underground services within building lines.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Perform earthwork complying with requirements of authorities having jurisdiction.

B. Comply with applicable erosion control regulations.

C. Testing and Inspection Service: Contractor will employ a qualified independent geo-technical engineering testing agency approved by the Architect to classify proposed on-site and borrow soils to verify that soils comply with specified requirements and to perform required field and laboratory testing. Advise this agency of earthwork schedule and all changes thereto in ample time to schedule inspections.

1.5 PROJECT CONDITIONS

A. Site Information: Not provided.

B. Existing Utilities: Locate existing underground utilities in areas of excavation work. If utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.

1. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
2. Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Architect and then only after acceptable temporary utility services have been provided.

    a. Provide minimum of 48-hour notice to Owner and Architect, and receive written notice to proceed before interrupting any utility.

3. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shutoff of services if lines are active.

C. Use of Explosives: Use of explosives is not permitted.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide approved borrow soil materials from off-site when sufficient approved soil materials are not available from excavations.

B. Satisfactory Soil Materials: Satisfactory soil materials are defined as those with a plasticity index (PI) of less than 30 and which are free of organic or debris material and have a dry unit weight of at least 90 PCF when compacted to 100 percent of the soil's standard Proctor density (ASTM D 698-78).

C. Unsatisfactory Soil Materials: Unsatisfactory soil materials do not meet the definition for satisfactory soil materials.

D. Backfill and Fill: Satisfactory soil materials.

E. Subbase: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (38-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

F. Base: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch (38-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

G. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch (38-mm) sieve and not more than 12 percent passing a No. 200 (0.075-mm) sieve.

H. Bedding: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch (25-mm) sieve and not more than 8 percent passing a No. 200 (0.075-mm) sieve.

I. Drainage Fill: Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (38-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.

J. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch (25-mm) sieve and 0 to 5 percent passing a No. 4 (4.75-mm) sieve.

K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

L. Topsoil:

1. Natural friable, fertile, fine loamy soil possessing the characteristics of representative topsoils in the vicinity which produce a heavy growth; free from subsoil, objectionable weeds, litter, sods, stiff clay, stones larger than one (1") inch in diameter, stumps, roots, trash, toxic substances, or any other material which may be harmful to plant growth or hinder planting operations.
2. The furnishing of all topsoil not already existing on site for grassed, sodded or areas shown to be backfilled with topsoil shall be included in Earthwork. Topsoil furnished from offsite shall have a minimum PH of 6.5 and be obtained from naturally well drained areas which have never been stripped before. Topsoil shall not be delivered in a frozen or muddy condition.
3. Topsoil for planting and soil mix shall be under the Division 32 Section for Trees, Shrubs, and Ground Covers.

2.2 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility.

1. Tape Colors: Provide tape colors to utilities as follows:

a. Red: Electric.
b. Yellow: Gas, oil, steam, and dangerous materials.
c. Orange: Telephone and other communications.
d. Blue: Water systems.
e. Green: Sewer systems.

B. Drainage Fabric: Non-woven geotextile, specifically manufactured as a drainage geotextile; made from polyolefins, polyesters, or polyamides; and with the following minimum properties determined according to ASTM D 4759 and referenced standard test methods:

1. Grab Tensile Strength: 110 lbf (490 N); ASTM D 4632.
2. Tear Strength: 40 lbf (178 N); ASTM D 4533.
3. Resistance: 50 lbf (222 N); ASTM D 4833.
4. Water Flow Rate: 150 gpm per sq. ft. (100 L/s per sq. m); ASTM D 4491.
5. Apparent Opening Size: No. 50 (0.3 mm); ASTM D 4751.

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 earthwork operations.

B. Protect sub-grades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

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

D. Tree protection is specified in the Division 1.

3.2 DEWATERING

A. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared sub-grades, and from flooding Project site and surrounding area.

B. Protect sub-grades and foundation soils from softening and damage by rain or water accumulation.

3.3 EXCAVATION

A. Explosives: Do not use explosives.

B. Unclassified Excavation: Excavation is unclassified and includes excavation to required sub-grade elevations regardless of the character of materials and obstructions encountered.

3.4 STABILITY OF EXCAVATIONS

A. Comply with local codes, ordinances, and requirements of authorities having jurisdiction to maintain stable excavations.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 0.10 foot. Extend excavations a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated slopes, lines, depths, and invert elevations.

1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

1. Clearance: 12 inches each side of pipe or conduit.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape sub-grade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove stones and sharp objects to avoid point loading.

1. For pipes or conduit less than 6 inches in nominal diameter and flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support pipe and conduit on an undisturbed sub-grade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe circumference. Fill depressions with tamped sand backfill.
3. Where encountering rock or another unyielding bearing surface, carry trench excavation 6 inches below invert elevation to receive bedding course.

3.8 APPROVAL OF SUB-GRADE

A. Notify Architect when excavations have reached required sub-grade.

B. Certain unsatisfactory soil conditions were identified in the subsurface investigation. These conditions shall be excavated and replaced with compacted backfill or fill material as directed. This work is considered unclassified in accordance with Section 3.3 of this specification.

C. Reconstruct sub-grades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by the Architect.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending indicated bottom elevation of concrete foundation or footing to excavation bottom, without altering required top elevation. Lean concrete (f'c = 2500 p.s.i.) fill may be used to bring elevations to proper position when acceptable to the Architect.

1. Fill unauthorized excavations under other construction as directed by the Architect.

B. Where indicated widths of utility trenches are exceeded, provide stronger pipe, or special installation procedures, as required by the Architect.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill soil materials, including acceptable borrow materials. Stockpile soil materials without intermixing. Place grade, and shape stockpiles to drain surface water. Cover to prevent wind-blown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Backfill excavations promptly, but not before completing the following:

1. Acceptance of construction below finish grade including, where applicable, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for record documents.
3. Testing, inspecting, and approval of underground utilities.
4. Concrete formwork removal.
5. Removal of trash and debris from excavation.
6. Removal of temporary shoring and bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

3.12 UTILITY TRENCH BACKFILL

A. Place and compact bedding course on rock and other unyielding bearing surfaces and to fill unauthorized excavations. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

B. Concrete backfill trenches that carry below or pass under footings and that are excavated within 18 inches of footings. Place concrete to level of bottom of footings.

C. Provide 4-inch-thick concrete base slab support for piping or conduit less than 2'-6" below surface of roadways. After installation and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway sub-base.

D. Place and compact initial backfill of approved soil material or sub-base material as shown on the drawings and in accordance with the recommendations of the report of subsurface investigation, free of particles larger than 1 inch, to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.

E. Coordinate backfilling with utilities testing.

F. Fill voids with approved backfill materials as shoring and bracing, and sheeting is removed.

G. Place and compact final backfill of satisfactory soil material to final sub-grade.

H. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below sub-grade under pavements and slabs.

3.13 SUBSURFACE DRAINAGE BACKFILL

A. Drainage Backfill: Place and compact drainage backfill of filtering material over subsurface drain, in width indicated, to within 12" of final sub-grade. Overlay drainage backfill with one layer of filter fabric, overlapping edges at least 6".

B. Impervious Fill: Place and compact impervious fill material over drainage backfill to final sub-grade.

3.14 FILL

A. Preparation: Remove vegetation, topsoil, debris, wet and unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placing fills.

1. Plow strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing surface.

B. When sub-grade or existing ground surface to receive fill has a density less than that required for fill, break up ground surface to depth required, pulverize, moisture-condition or aerate soil and re-compact to required density.

C. Place fill material in layers to required elevations for each location listed below.

1. Under grass, use satisfactory excavated or borrow soil material.
2. Under walks and pavements, use subbase or base material, or satisfactory excavated or borrow soil material.
3. Under steps and ramps, use subbase material.
4. Under building slabs, use drainage fill material.
5. Under footings and foundations, use engineered fill.

3.15 MOISTURE CONTROL

A. Uniformly moisten or aerate sub-grade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air-dry satisfactory soil material that is too wet to compact to specified density.

    a. Stockpile or spread and dry removed wet satisfactory soil material.

3.16 COMPACTION

A. Place backfill and fill 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. Place backfill and fill materials evenly on all sides of structures to required elevations. Place backfill and fill uniformly along the full length of each structure.

C. Percentage of Maximum Dry Density Requirements: Compact soil to not less than the following percentages of maximum dry density according to ASTM D 698:

1. Structures - 95% Standard Proctor except upper one foot to be 100%
2. Paved Areas - 95% Standard Proctor except upper two feet to be 100%
3. Retention Basins & Structural Fills - 95% Standard Proctor.
4. Planting Areas & Lawns - 90% Standard Proctor.

3.17 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between existing adjacent grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to conform to required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish sub-grades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 0.10 foot.
2. Walks: Plus or minus 0.10 foot.
3. Pavements: Plus or minus 1/2 inch.

C. Grading Inside Building Lines: Finish sub-grade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.18 SUBSURFACE DRAINAGE

A. Drainage Piping: Drainage pipe is specified in Division 2 Section "Sub-drainage."

B. Subsurface Drain: Place a layer of drainage fabric around perimeter of drainage trench as indicated. Place a 6-inch course of filter material on drainage fabric to support drainage pipe. Encase drainage pipe in a minimum of 12 inches of filter material and wrap in drainage fabric, overlapping sides and ends at least 6 inches.

1. Compact each course of filter material to 95 percent of maximum dry unit weight according to ASTM D 698.

C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final sub-grade. Overlay drainage backfill with one layer of drainage fabric, overlapping sides and ends at least 6 inches.
   1. Compact each course of filter material to 95 percent of maximum dry density according to ASTM D 698.
   2. Place and compact impervious fill material over drainage backfill to final sub-grade.

3.19 SUBBASE AND BASE COURSES

A. Under pavements and walks, place sub-base course material on prepared sub-grades. Place base course material over sub-bases to pavements.

   1. Compact sub-base and base courses at optimum moisture content to required grades, lines, cross sections and thickness to not less than 95 percent of ASTM D 4254 relative density.
   2. Shape sub-base and base to required crown elevations and cross-slope grades.
   3. When thickness of compacted sub-base or base course is 6 inches or less, place materials in a single layer.
   4. When thickness of compacted sub-base or base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

B. Pavement Shoulders: Place shoulders along edges of sub-base and base course to prevent lateral movement. Construct shoulders at least 12 inches wide of acceptable soil materials and compact simultaneously with each sub-base and base layer.

3.20 DRAINAGE FILL

A. Under slabs-on-grade, place drainage fill course on prepared sub-grade.

   1. Compact drainage fill to required cross sections and thickness.
   2. When compacted thickness of drainage fill is 6 inches or less, place materials in a single layer.
   3. When compacted thickness of drainage fill exceeds 6 inches thick place materials in equal layers, with no layer more than 6 inches thick nor less than 3 inches thick when compacted.

3.21 TOPSOIL

A. Topsoil shall be stripped to whatever depths encountered and in such manner so as to prevent intermingling with underlying subsoil or other objectionable material. Stockpile topsoil in storage piles constructed to freely drain surface water for later use. Cover and protect topsoil from weather.

B. Contractor shall place topsoil in a uniform 6" layer. Use approved topsoil stockpiled or secure additional as required.

C. Topsoil all areas shown on the drawing to receive grass or sod. Backfill mass planting areas with 8” of topsoil.

D. Dispose of any excess topsoil not required as directed by the Landscape Architect and the Owner.

3.22 FIELD QUALITY CONTROL

A. Testing Agency Services: Testing agency shall inspect and test each sub-grade and each fill or backfill layer and provide results to the Owner and the Design Team. Do not proceed until test results for previously completed work verify compliance with requirements.

B. When testing agency reports that sub-grades, fills, or backfills are below specified density, scarify and moisten or aerate, or remove and replace soil to the depth required, re-compact and retest until required density is obtained.

C. If in the opinion of the Architect, based on reports of testing service and inspections at the site, sub-grades or fills which have been placed are below specified density, additional compaction and re-testing shall be provided at no additional cost to the Owner.

3.23 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and re-establish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace material to depth directed by the Architect; reshape and re-compact at optimum moisture content to the required density.

C. Settling: Where settling occurs during the Project correction period, remove finished surfacing, backfill with additional approved material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.24 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.

END OF SECTION 31 00 00

SECTION 31 10 00 - 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. Stripping and stockpiling topsoil.
5. Stripping and stockpiling rock.
6. Removing above- and below-grade site improvements.
7. Disconnecting, capping or sealing, and removing site utilities and abandoning site utilities in place.
8. Temporary erosion and sedimentation control.

B. Related Requirements:

1. Section 015000 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.

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. Its appearance is generally friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects larger than 2 inches in diameter; and free of weeds, roots, toxic materials, or other non-soil materials.

D. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

E. Tree-Critical Root Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings and indicated according to requirements in Section 015639 "Temporary Tree and Plant Protection."

F. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.5 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.

1.6 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. Topsoil stripping and stockpiling program.

C. Rock stockpiling program.

D. Record Drawings: Identifying and accurately showing locations of capped utilities and other subsurface structural, electrical, and mechanical conditions.

1.7 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 and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by Owner or authorities having jurisdiction.

B. Improvements on Adjoining Property: Authority for performing site clearing indicated on property adjoining Owner's property will be obtained by Owner before award of Contract.

1. Do not proceed with work on adjoining property until directed by Architect.

C. Salvageable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where directed.

D. Utility Locator Service: Notify utility locator service and One Call for area where Project is located before site clearing.

E. Do not commence site clearing operations until temporary erosion- and sedimentation-control, Critical Root Zone fencing and plant-protection measures are in place.

F. Tree-Critical Root and Plant-Protection Zones: Protect according to requirements in Section 015639 "Temporary Tree and Plant Protection."

G. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. 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.

B. Antirust Coating: Fast-curing, lead- and chromate-free, self-curing, universal modified-alkyd primer complying with MPI #23 (surface-tolerant, anticorrosive metal primer) or SSPC-Paint 20 or SSPC-Paint 29 zinc-rich coating.

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 015639 "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 erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity 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 015639 "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 015639 "Temporary Tree and Plant Protection."

3.4 EXISTING UTILITIES

A. Owner will arrange for disconnecting and sealing indicated utilities that serve existing structures before site clearing, when requested by Contractor.

1. Verify that utilities have been disconnected and capped before proceeding with site clearing.

B. 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.
2. Owner will arrange to shut off indicated utilities when requested by Contractor.

C. Locate, identify, and disconnect utilities indicated to be abandoned in place.

D. 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 Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

E. Excavate for and remove underground utilities indicated to be removed.

F. Removal of underground utilities is included in earthwork sections; in applicable fire suppression, plumbing, HVAC, electrical, communications, electronic safety and security, and utilities sections; and in Section 024116 "Structure Demolition" and Section 024119 "Selective Demolition."

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 Tree Critical Root protection zones.
4. Chip removed tree branches and dispose of off-site.
5. Selectively prune undergrowth along the river as detailed on the drawings.

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 TOPSOIL STRIPPING

A. Remove sod, grass and organic material (leaf litter, etc.) before stripping topsoil.

B. Strip topsoil to whatever depth required in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and non-soil materials from topsoil, including clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

C. Stockpile topsoil away from edge of excavations without intermixing with subsoil or other materials. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust and erosion by water.

1. Limit height of topsoil stockpiles to 12’
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil only as directed by the Landscape Architect. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for re-spreading deeper topsoil.

3.7 STOCKPILING ROCK

A. Remove from area indicated on Drawings or the construction area naturally formed rocks that measure more than 1 foot across in least dimension. Do not include excavated or crushed rock.

1. Separate or wash off non-rock materials from rocks, including soil, clay lumps, gravel, and other objects larger than 2 inches in diameter; trash, debris, weeds, roots, and other waste materials.

B. Stockpile rock away from edge of excavations without intermixing with other materials. Cover to prevent windblown debris from accumulating among rocks.

1. Limit height of rock stockpiles to 36 inches.
2. Do not stockpile rock within protection zones.
3. Dispose of surplus rock. Surplus rock is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus rock to allow later use by the Owner.

3.8 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.
2. Paint cut ends of steel reinforcement in concrete to remain with two coats of antirust coating, following coating manufacturer's written instructions. Keep paint off surfaces that will remain exposed.

3.9 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.

B. Burning tree, shrub, and other vegetation waste is permitted according to burning requirements and permitting of authorities having jurisdiction. Control such burning to produce the least smoke or air pollutants and minimum annoyance to surrounding properties. Burning of other waste and debris is prohibited.

C. Separate recyclable materials produced during site clearing from other non-recyclable materials. Store or stockpile without intermixing with other materials, and transport them to recycling facilities. Do not interfere with other Project work.

END OF SECTION 31 10 00

SECTION 31 23 33 - EXCAVATION SUPPORT AND PROTECTION

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.

1.2 SUMMARY

A. This Section includes temporary excavation support and protection systems.

B. Related Sections include the following:

1. Section "Temporary Facilities and Controls" for temporary utilities and support facilities.
2. Section "Earthwork" for excavating and backfilling and for existing utilities.
3. Division 3 Section "Cast in Place" for use in excavation support and protection.

1.3 PERFORMANCE REQUIREMENTS

A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.

1. Provide professional engineering services needed to assume engineering responsibility, including preparation of Shop Drawings and a comprehensive engineering analysis by a qualified professional engineer.
2. Prevent surface water from entering excavations by grading, dikes, or other means.
3. Install excavation support and protection systems without damaging existing buildings, pavements, and other improvements adjacent to excavation.

1.4 SUBMITTALS

A. Shop Drawings for Information: Prepared by or under the supervision of a qualified professional engineer for excavation support and protection systems.

1. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.

B. Qualification Data: For Installer and professional engineer.

C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by the absence of, the installation of, or the performance of excavation support and protection systems.

1.5 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

B. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data.

1. Make additional test borings and conduct other exploratory operations necessary for excavation support and protection.
2. The geotechnical report is referenced elsewhere in the Project Manual.

C. Survey adjacent structures and improvements, employing a qualified professional engineer or land surveyor; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Architect if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that are either new or in serviceable condition.

B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.

C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.

D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of 4 inches.

E. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.

F. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.

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 that could develop during excavation support and protection system operations.

1. Shore, support, and protect utilities encountered.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Locate excavation support and protection systems clear of permanent construction so that forming and finishing of concrete surfaces is not impeded.

D. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.

E. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

3.2 SOLDIER BEAMS AND LAGGING

A. Install steel soldier beams before starting excavation. Space soldier beams at regular intervals not to exceed allowable flexural strength of wood lagging. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

B. Install wood lagging within flanges of soldier beams as excavation proceeds. Trim excavation as required to install lagging. Fill voids behind lagging with soil, and compact.

C. Install wales horizontally at centers indicated and secure to soldier beams.

3.3 SHEET PILING

A. Before starting excavation, install one-piece sheet piling lengths and tightly interlock to form a continuous barrier. Limit vertical offset of adjacent sheet piling to 60 inches. Accurately align exposed faces of sheet piling to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment. Cut tops of sheet piling to uniform elevation at top of excavation.

3.4 TIEBACKS

A. Tiebacks: Drill for, install, grout, and tension tiebacks into position. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.

1. Test loading shall be observed by a qualified professional engineer responsible for design of excavation support and protection system.
2. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.5 BRACING

A. Bracing: Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move brace, install new bracing before removing original brace.

1. Do not place bracing where it will be cast into or included in permanent concrete work, unless otherwise approved by Architect.
2. Install internal bracing, if required, to prevent spreading or distortion of braced frames.
3. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.

1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlying construction and abandon remainder.
2. Repair or replace, as approved by Architect, adjacent work damaged or displaced by removing excavation support and protection systems.

B. Leave excavation support and protection systems permanently in place.

END OF SECTION 31 23 33

SECTION 32 13 16 - CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes exterior cement concrete pavement for the following:

1. Curbs
2. Walkways.

B. Related Sections include the following:

1. Division 31 Section "Earthwork" for sub-grade preparation, grading, and subbase course.
2. Division 32 Section "Pavement Joint Sealants" for joint sealants of joints in concrete pavement and at isolation joints of concrete pavement with adjacent construction.
3. Division 3 Section "Cast-in-Place Concrete" for general building applications of concrete.

1.2 DEFINITIONS

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

1.3 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. Qualification Data: For manufacturer.

D. 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:

1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

E. 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. Admixtures.
4. Curing compounds.
5. Applied finish materials.
6. Bonding agent or epoxy adhesive.

7. Joint fillers.

G. Minutes of pre-installation conference.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.

C. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

D. Installer/Finisher Qualifications: **IT IS THE EXPECTATION OF THIS SECTION THAT THE WORK ASSOCIATED WITH THE CONCRETE WALKWAY PAVING OF THE PROJECT WILL PRODUCE THE HIGHEST QUALITY ARCHITECTURE CONCRETE FLAT WORK AVAILABLE. IN SUBMITTING THIS BID, THE GENERAL CONTRACTOR AND THE CONCRETE FLAT WORK SUB-CONTRACTOR ASSURE THE DESIGNER AND OWNER THAT ALL ASPECTS OF THE CONCRETE WORK WILL RECEIVE THEIR BEST PROFESSIONAL CONSIDERATION.**

E. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

F. Mockups: Cast mockups of full-size sections of each concrete pavement to demonstrate typical joints, surface finish, texture, color, and standard of workmanship.

1. Build mockups 10' x 10' minimum size of each type of concrete paving in the location indicated or, if not indicated, as directed by Architect.
2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
3. Obtain Architect's approval of mockups before starting construction.
4. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed pavement.
5. Demolish and remove approved mockups from the site when directed by Architect.
6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
7. In the event samples are rejected, the Contractor shall prepare samples until accepted by the Landscape Architect.

G. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."

1. Before submitting design mixtures, review concrete pavement mixture design and examine procedures for ensuring quality of concrete materials and concrete pavement construction practices. Require representatives, including the following, of each entity directly concerned with concrete pavement, to attend conference:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete producer.
   d. Concrete pavement subcontractor.

1.5 PROJECT CONDITIONS

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

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.2 FORMS

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

1. Use flexible or curved forms for curves with a radius 100 feet (30.5 m) or less.

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

2.3 STEEL REINFORCEMENT

A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420); deformed.

C. Plain Steel Wire: ASTM A 82, as drawn.

D. Deformed-Steel Wire: ASTM A 496.

E. Joint Dowel Bars: Plain steel bars, ASTM A 615/A 615M, Grade 60 (Grade 420). Cut bars true to length with ends square and free of burrs.

F. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from

steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:

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

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use one of the following cementitious materials, of the same type, brand, and source throughout the Project:

1. Portland Cement: ASTM C 150, Type I, gray.

B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate, uniformly graded. Provide aggregates from a single source.

1. Maximum Coarse-Aggregate Size: 3/4 inch (19 mm)] nominal.

C. Fine Aggregate: Clean manufactured sand, free of materials with deleterious reactivity to alkali in cement.

D. Water: ASTM C 94/C 94M.

E. Air-Entraining Admixture: ASTM C 260.

F Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and to contain no more than 0.1 percent water-soluble chloride ions by mass of cementitious material.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

1. Available Products:
   a. Anti-Hydro International, Inc.; AH Curing Compound #2 DR WB.
   b. Burke by Edoko; Aqua Resin Cure.
   c. ChemMasters; Safe-Cure Clear.

d. Conspec Marketing & Manufacturing Co., Inc.; W.B. Resin Cure.
e. Dayton Superior Corporation; Day Chem Rez Cure (J-11-W).
f. Euclid Chemical Company (The); Kurez DR VOX.
g. Kaufman Products, Inc.; Thinfilm 420.
h. Lambert Corporation; Aqua Kure-Clear.
i. L&M Construction Chemicals, Inc.; L&M Cure R.
j. Meadows, W. R., Inc.; 1100 Clear.
k. Nox-Crete Products Group, Kinsman Corporation; Resin Cure E.
l. Symons Corporation; Resi-Chem Clear.
m. Tamms Industries Inc.; Horncure WB 30.
n. Unitex; Hydro Cure 309.
o. Vexcon Chemicals, Inc.; Certi-Vex Enviocure 100.

2.6 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, ASTM D-545 “Ceramar” Flexible foam Expansion Joint Filler (W.R. Meadows Company) or ASTM D 1752, cork or self-expanding cork.

B. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to requirements, and as follows:

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

2.7 CONCRETE MIXTURES

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

B.

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

C. Proportion mixtures to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 4000 psi (27.6 MPa).
2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.45.
3. Slump Limit: 4 inches (100 mm), plus or minus 1 inch (25 mm).

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

1. Air Content: 4-1/2 percent plus or minus 1.5 percent for 1-1/2-inch (38-mm) nominal maximum aggregate size.
2. Air Content: 4-1/2 percent plus or minus 1.5 percent for 1-inch (25-mm) nominal maximum aggregate size.
3. Air Content: 5 percent plus or minus 1.5 percent for 3/4-inch (19-mm) nominal maximum aggregate size

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

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

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

G. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement according to ACI 301 requirements as follows:

1. Fly Ash or Pozzolan: 25 percent.
2. Ground Granulated Blast-Furnace Slag: 50 percent.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Furnish batch certificates for each batch discharged and used in the Work.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine exposed sub-grades and sub-base surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared sub-base surface below concrete pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding.

1. Completely proof-roll sub-base in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.

C. Proof-roll with a loaded 10-wheel tandem-axle dump truck weighing not less than 15 tons.

1. Sub-base with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch require correction according to requirements in Division 31 Section "Earthwork."

D. Proceed with concrete pavement operations only after nonconforming conditions have been corrected and sub-grade is ready to receive pavement.

3.2 PREPARATION

A. Remove loose material from compacted sub-base surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.

B. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edgings true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to centerline, unless otherwise indicated.

1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of pavement and at locations where pavement operations are stopped for more than one-half hour unless pavement terminates at isolation joints.

1. Continue steel reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of pavement strips, unless otherwise indicated.

C. Butt Joints: Use epoxy bonding adhesive at joint locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

D. Keyed Joints: Provide preformed key way-section forms or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

E. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate one-half of dowel length to prevent concrete bonding to one side of joint.

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

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

G. Contraction Joints: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of the concrete thickness, as follows to match jointing of existing adjacent concrete pavement:

H. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a radius noted on the drawings. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover marks on concrete surfaces.

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

J. Edging: Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete form work installation, steel reinforcement, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from sub-base surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

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

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

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

F. Do not add water to fresh concrete after testing.

G. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.

H. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.
   1. consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocating reinforcement, dowels, and joint devices.

I. Place concrete in two operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay welded wire fabric or fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.

   1. Remove and replace concrete that has been placed for more than 15 minutes without being covered by top layer, or use bonding agent if approved by Architect.

J. Screed pavement surfaces with a straightedge and strike off.

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

L. Curbs and Gutters: When automatic machine placement is used for curb and gutter placement, submit revised mix design and laboratory test results that meet or exceed requirements. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing as specified on the plans for machine formed concrete. If results are not approved, remove and replace with formed concrete.

M. When adjoining pavement lanes are placed in separate pours, do not operate equipment on concrete until pavement has attained 85 percent of its 28-day compressive strength.

N. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

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

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

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

3.7 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:
1. Moist Curing: Keep surfaces continuously moist for not less than seven days with the following materials: Water.
   a. Continuous water-fog spray.
   b. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.8 PAVEMENT TOLERANCES

A. Comply with tolerances of ACI 117 and as follows:
1. Elevation: 1/4 inch.
2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-foot long, unleveled straightedge not to exceed 1/4 inch.
4. Lateral Alignment and Spacing of Tie Bars and Dowels: 1 inch.
5. Vertical Alignment of Tie Bars and Dowels: 1/4 inch.
6. Alignment of Dowel-Bar End Relative to Line Perpendicular to Pavement Edge: Length of dowel 1/4 inch per 12 inches.
7. Joint Spacing: 3 inches.
8. Contraction Joint Depth: Plus 1/4 inch, no minus.
9. Joint Width: Plus 1/8 inch, no minus.

3.9 FINISHES ON FORMED CONCRETE SURFACES

A. Common finish shall be confined to concrete surfaces which will be covered by other construction and which will not be visible. This finish shall be produced by filling smoothly at tie holes, honeycomb and other depressions, knocking off and evening-up burrs and form marks.

B. A medium broom finish will be applied to all exposed flatwork concrete surfaces. The contractor will produce a sample of the medium broom finish on an area of in-place concrete for approval by the designer prior to proceeding with the rest of the work.

3.10 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:

C. Testing Frequency: Obtain at least 1 composite sample for each 100 cu. yd. or fraction thereof of each concrete mix placed each day.
   1. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
   2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mix. Perform additional tests when concrete consistency appears to change.
   3. Air Content: ASTM C 231, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mix.

D. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F and below and when 80 deg F and above, and one test for each composite sample.

E. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.

F. Compressive-Strength Tests: ASTM C 39/C 39M; test 1 specimen at 7 days and 2 specimens at 28 days.
   1. A compressive-strength test shall be the average compressive strength from 2 specimens obtained from same composite sample and tested at 28 days.

G. Strength of each concrete mix will be satisfactory if average of any 3 consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.

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

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

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

K. Remove and replace concrete pavement where test results indicate that it does not comply with specified requirements.

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

3.11 REPAIRS AND PROTECTION

A. Remove and replace immediately, concrete pavement that is broken, damaged, or defective, does not comply with requirements in this Section and in the opinion of the designer does not reasonably match the approved mock up in color, texture, jointing or appearance.

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

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur and protecting concrete pavement with plywood or other covering material.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 16

SECTION 32 13 17 - TACTILE/ DETECTABLE WARNING SURFACE TILES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and Division 1 Specifications Section, apply to this Section.

1.2 DESCRIPTION

A. This Section specifies furnishing and installing Surface Applied Detectable/Tactile Warning Surface Tiles where indicated. Not recommended for asphalt applications.

1.3 SUBMITTALS

A. Product Data: Submit manufacturer's literature describing products, installation procedures and routine maintenance.

B. Samples for Verification Purposes: Submit two (2) tile samples minimum 6"x6" of the kind proposed for use.

C. Shop drawings are required for products specified showing fabrication details, composite structural system, tile surface profile, fastener locations, sound on cane contact amplification feature, plans of tile placement including joints, and material to be used as well as outlining installation materials and procedure.

D. Material Test Reports: Submit complete test reports from qualified accredited independent testing laboratory's to qualify that materials proposed for use are in compliance with requirements and meet or exceed the properties indicated on the specifications. All tests shall be conducted on a Surface Applied Detectable/Tactile Warning Surface Tile system as certified by a qualified independent testing laboratory and be current within a 24 month period.

E. Maintenance Instructions: Submit copies of manufacturer's specified installation and maintenance practices for each type of Detectable Warning Surface Tile and accessory as required.

1.4 QUALITY ASSURANCE

A. Provide Surface Applied Detectable/Tactile Warning Surface Mats and accessories as produced by a single manufacturer with a minimum of three (3) years experience in the manufacturing of Surface Applied Detectable/Tactile Warning Surface Surfaces.

B. Installer's Qualifications: Engage an experienced Installer certified in writing by Surface Applied Detectable/Tactile Warning Surface Tile manufacturer as qualified for installation, who has successfully completed installations similar in material, design, and extent to that indicated for project.

C. Americans with Disabilities Act (ADA): Provide tactile warning surfaces which comply with the detectable warnings on walking surfaces section of the Americans with Disabilities Act (Title 49 CFR TRANSPORTATION, Part 37.9 STANDARDS FOR ACCESSIBLE TRANSPORTATION FACILITIES, Appendix A, Section 4.29.2 DETECTABLE WARNINGS ON WALKING SURFACES.

D. Vitrified Polymer Composite (VPC) Surface Applied Detectable/Tactile Warning Surface Mats shall be an polymer composition with an ultra violet stabilized coating employing aluminum oxide particles in the truncated domes. The tile shall incorporate an in-line pattern of truncated domes measuring nominal 0.2" height, 0.9" base diameter, and 0.45" top diameter, spaced center-to-center 2.35" as measured on a diagonal and 1.67" as measured side by side. For wheelchair safety the field area shall consist of a non-slip surface with a minimum of 40 - 90° raised points 0.045" high, per square inch; "Armor-Tile" as manufactured by Engineered Plastics Inc., Tel: 800-682-2525, or approved equal.

1. Dimensions: Surface Applied Detectable/Tactile Warning Surface Tiles shall be held within the following dimensions and tolerances:
   Length and Width: 24x48 nominal
   Depth: (3/16"), (+/-) 5% max.
   Face Thickness: 0.1875 (3/16), (+/-) 5% max. Warpage of Edge: 0.5% max.
2. Water Absorption of Tile when tested by ASTM D 570-98 not to exceed 0.05%.
3. Slip Resistance of Tile when tested by ASTM C 1028-96 the combined Wet and Dry Static Co-Efficients of Friction not to be less than 0.80 on top of domes and field area.
4. Compressive Strength of Tile when tested by ASTM D 695-02a not to be less than 28,000 psi.
5. Tensile Strength of Tile when tested by ASTM D 638-03 not to be less than 19,000 psi.
6. Flexural Strength of Tile when tested by ASTM D 790-03 not to be less than 25,000 psi.
7. Chemical Stain Resistance of Tile when tested by ASTM D 543-95 (re approved 2001) to withstand without discoloration or staining - 10% hydrochloric acid, urine, saturated calcium chloride, black stamp pad ink, chewing gum, red aerosol paint, 10% ammonium hydroxide, 1% soap solution, turpentine, Urea 5%, diesel fuel and motor oil.
8. Abrasive Wear of Tile when tested by BYK - Gardner Tester ASTM D 2486-00 with reciprocating linear motion of 37± cycles per minute over a 10" travel. The abrasive medium, a 40 grit Norton Metallite sand paper, to be fixed and leveled to a holder. The combined mass of the sled, weight and wood block is to be 3.2 lb. Average wear depth shall not exceed 0.060 after 1000 abrasion cycles when measured on the top surface of the dome representing the average of three measurement locations per sample.
9. Resistance to Wear of Unglazed Ceramic Tile by Taber Abrasion per ASTM C501-84 (re approved shall not be less than 500.
10. Fire Resistance of Tile when tested to ASTM E 84-05 flame spread shall be less than 15.
11. Gardner Impact to Geometry "GE" of the standard when tested by ASTM D 5420-04 to have a mean failure energy expressed as a function of specimen thickness of not less than 550 in. lbf/in. A failure is noted when a crack is visible on either surface or when any brittle splitting is observed on the bottom plaque in the specimen.

12. Accelerated Weathering of Tile when tested by ASTM G 155-05a for 3000 hours shall exhibit the following result – ΔE <4.5, as well as no deterioration, fading or chalking of surface of tile color No 33538
13. Accelerated Aging and Freeze Thaw Test of Tile and Adhesive System when tested to ASTM D 1037-99 shall show no evidence of cracking, delamination, warpage, checking, blistering, color change, loosening of tiles or other detrimental defects.
14. Salt and Spray Performance of Tile and Adhesive System when tested to ASTM B 117-03 not to show any deterioration or other defects after 200 hours of exposure.

1.5 DELIVERY, STORAGE AND HANDLING

A. Surface Applied Detectable/Tactile Warning Surface Tiles shall be suitably packaged or crated to prevent in shipment or handling. Finished surfaces shall be protected by sturdy wrappings and tile type shall be identified by part number.

B. Surface Applied Detectable/Tactile Warning Surface Tiles shall be delivered to location at building site for storage prior to installation.

1.6 SITE CONDITIONS

A. Environmental Conditions and Protection: Maintain minimum temperature of 40 degrees F in spaces to receive tactile tiles for at least 48 hours prior to installations, during installation, and for not less than 48 hours after installation. Store tactile tile material in spaces where they will be installed for at least 48 hours before beginning installation. Subsequently, maintain minimum temperature of 40 degrees F in areas where work is completed.

B. The use of water for work, cleaning or dust control, etc. shall be contained and controlled and shall not be allowed to come into contact with the passengers or public. Provide barricades or screens to protect passengers or public.

1.7 GUARANTEE

A. Surface Applied Detectable/Tactile Warning Surface Tiles shall be guaranteed in writing for a period of five (5) years from date of final completion. The guarantee includes defective work, breakage, deformation, fading and loosening of tiles.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Engineered Plastics, Inc., 300 International Drive, Suite 100, Williamsville, NY Telephone 1-800-682-2525; www.armor-tile.com.
2. ADA Solutions, Inc., P.O. Box 3, N. Billerica, MA 01862, Telephone 1-800-372-0519, www.adatile.com.
3. Advantage Tactile Systems, 241 Main Street, Suite 100, Buffalo, NY 14203, Telephone 1-800-679-4022; www.advantagetactile.com

B. The Vitrified Polymer Composite (VPC) Surface Applied Detectable/Tactile Warning Surface Tile specified based on existing engineered and field tested products, which have been in successful service for a period of three (3) years are subject to compliance with requirements, may be incorporated in the work and shall meet or exceed the specified test criteria and characteristics.

D. Color: TBD from Manufacturer's full availability of colors.

2.2 MATERIALS

A. Fasteners: Color matched, corrosion resistant, flat head drive anchor: 1/4" diameter x 1 1/2" long.
B. Adhesive
C. Sealant

PART 3 – EXECUTION

3.1 INSTALLATION

A. During all surface preparation and Surface Applied Detectable/Tactile Warning Surface Tile installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the industry and government standards.

B. The application of all tiles, adhesives, mechanical fasteners, and caulking shall be in strict accordance with guidelines set by their respective manufacturers. Not recommended for asphalt applications.

C. Coordinate with the Contractor or Engineer to ensure that the surfaces being prepared and fabricated to the tiles are constructed correctly and adequately for tile installation. Review manufacturer and contract drawings with the Contractor prior to the construction and refer any and all discrepancies to the Engineer.

D. Set the tile true and square to the curb ramp area as detailed in the design drawings, so that its location can be marked on the concrete surface. Remove tile when done marking its location.

E. The surface to receive the Surface Applied Detectable/Tactile Warning Surface Tile is to be mechanically with a diamond cup grinder or shot blaster to remove any dirt or foreign material. This cleaning and roughening of the concrete surface should include at least 4 inches around the perimeter of the area to receive the tile, and also along the cross pattern established by the corresponding areas on the backside of the tile. Those same areas should then be cleaned with a clean rag soaked in Acetone.

F. Immediately prior to installing the Surface Applied Detectable/Tactile Warning Surface Tile, the concrete must be inspected to ensure that they are clean, dry, free of voids, curing compounds, projections, loose material, dust, oil, grease, sealers and determined to be structurally sound and cured from a minimum of 30 days.

G. Using Acetone, wipe the backside of the tile around the perimeter and along the internal cross pattern, to remove any dirt or dust particles from the area to receive the adhesive.

H. Apply Armor-Bond adhesive to the backside of the tile, following the perimeter and internal cross established by the tile manufacturer. Sufficient adhesive must be placed on the prescribed areas to have full coverage across the 2” width of the adhesive locator and shall be applied to within 1/4” continuously around the perimeter edge of the tile. The entire tube of adhesive shall be applied to the back of each tile, sizes 24” x 36” and greater.

I. Set the tile true and square to the curb ramp area as detailed in the design drawings.

J. Working from the center of the tile outwards, proceed to drill and install all fasteners in the tile’s molded recesses.

K. Standing with both feet applying pressure around the molded recess provided in the tile, drill a hole true and straight to a depth of 31/2” using a 1/4” masonry drill bit. Drill through the tile without hammer option (on the drill) until the tile has been successfully penetrated, then with hammer option (on the drill) to drill into the concrete. Maintaining foot pressure on both sides of the hole while drilling prevents concrete dust from accumulating between the tile and concrete which can affect the tile being installed flush and may compromise installation integrity.

L. Immediately after drilling each hole, before moving on to the next, and while still applying foot pressure, mechanically fasten tiles to the concrete substrate using a leather bound or hard plastic mallet to set the fasteners. Ensure the fastener has been placed to full depth in the dome, straight, and flush to the top of dome. Drive the pin of the fastener with the mallet, taking care to avoid any inadvertent blows to the truncated dome or tile surface.

M. Following the installation of the fasteners, the concrete dust should be vacuumed, brushed or blown away from the tile’s surface and adjacent concrete. Using Acetone on a rag, wipe the concrete around the tile’s perimeter to ensure a clean, dry surface to receive perimeter sealant.

N. Seal perimeter caulking sealant should be applied following the sealant manufacturer’s recommendations. Tape all perimeter edges of the tile back 1/16” from the tile’s perimeter edge and tape the adjacent concrete back 1/2” from the tile’s perimeter edge to maintain a straight and even caulking line. Apply sealant around tile perimeter using care to work sealant into any void between the tile and concrete interface. Tool the perimeter caulking with a rounded plastic applicator or spatula to create a cove profile between the tile and adjacent concrete. Remove tape immediately after tooling perimeter caulking sealant.

O. Do not allow foot traffic on installed tiles until the perimeter caulking sealant has cured sufficiently to tracking. Curing time is weather dependant (average cure time at 75° F is 30 minutes). Adhesive or caulking on the surface of the Tile can be removed with Acetone.

P. If installing adjacent tiles, note the orientation of each tile. Careful attention will reveal that one of the long edges of the tile is different than the other in regard to the tiny dotted texture. You may also note a larger perimeter margin before the tiny dotted texture pattern begins. Consistent orientation of each Tile is required in order that the truncated domes on adjacent tiles line up with each other.

Q. In order to maintain proper spacing between truncated domes on adjacent tiles, the tapered edge should be trimmed off using a continuous rim diamond blade in a circular saw or mini-grinder. The use of a straightedge to guide the cut is required. All cuts should be made prior to installation of the tiles. If installing adjacent tiles, care should be taken to leave a 1/8 inch gap between each tile to allow for expansion and contraction.

R. If tiles are custom cut to size, if pre-molded recesses (to receive fasteners) are removed by the cut, or to a tight installation to the substrate then any truncated dome can be center-drilled with a 1/4 inch masonry drill bit to create a through hole, and the through hole must be countersunk with a suitable carbide countersink bit to receive mechanical fasteners. Care should be taken to not countersink too widely or deeply. Fasteners should be flush with the top of the truncated dome when countersunk properly.

3.2 CLEANING AND PROTECTING

A. Protect tiles against damage during construction period to comply with tactile tile manufacturer's specification.

B. Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.

C. Clean tactile tiles not more than four days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean tactile tile by method specified by tactile tile manufacturer.

D. Comply with manufacturers maintenance manual for cleaning and maintaining tile surface and it is recommended to perform annual inspections for safety and tile integrity

END OF SECTION 32 13 17

SECTION 32 13 73 - PAVEMENT JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Expansion and contraction joints within cement concrete pavement.
2. Joints between cement concrete and asphalt pavement.

B. Related Sections include the following:

1. Division 32 Section "Concrete Pavement" for constructing joints in concrete pavement.

1.2 SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

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

C. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.

D. Qualification Data: For Installer.

E. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for sealants.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Submit not fewer than six pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing of current sealant products within a 36-month period preceding the commencement of the Work.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 for testing indicated, as documented according to ASTM E 548.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.5 PROJECT CONDITIONS

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

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer.
2. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
3. When joint substrates are wet or covered with frost.
4. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
5. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

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

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 COLD-APPLIED JOINT SEALANTS

A. Multi-component Jet-Fuel-Resistant Sealant for Concrete: Pourable, chemically curing elastomeric formulation complying with the following requirements for formulation and with ASTM C 920 for type, grade, class, and uses indicated:

1. Urethane Formulation: Type M; Grade P; Class 12-1/2; Uses T, M, and, as applicable to joint substrates indicated, O.
    a. Available Products:
        1) Pecora Corporation; Urexpan NR-300.
        2) Architect approved equivalent
2. Coal-Tar-Modified Polymer Formulation: Type M; Grade P; Class 25; Uses T and, as applicable to joint substrates indicated, O.
    a. Available Products:
        1) Meadows, W. R., Inc.; Sealtight Gardox.
        2) Architect approved equivalent
3. Bitumen-Modified Urethane Formulation: Type M; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.
    a. Available Products:
        1) Tremco Sealant/Waterproofing Division; Vulkem 202.
        2) Architect approved equivalent

B. Single-Component Jet-Fuel-Resistant Urethane Sealant for Concrete: Single-component, pourable, coal-tar-modified, urethane formulation complying with ASTM C 920 for Type S; Grade P; Class 25; Uses T, M, and, as applicable to joint substrates indicated, O.

1. Available Products:
    a. Sonneborn, Div. of ChemRex, Inc.; Sonomeric 1.
    b. Architect approved equivalent

C. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.

1. Available Products:
    a. Crafco Inc.; RoadSaver Silicone.
    b. Dow Corning Corporation; 888.
    c. Architect approved equivalent

D. Type SL Silicone Sealant for Concrete and Asphalt: Single-component, low-modulus, neutral-curing, self-leveling silicone sealant complying with ASTM D 5893 for Type SL.

1. Available Products:
    a. Crafco Inc.; RoadSaver Silicone SL.

b. Dow Corning Corporation; 890-SL.
c. Architect approved equivalent

E. Multicomponent Low-Modulus Sealant for Concrete and Asphalt: Proprietary formulation consisting of reactive petropolymer and activator components producing a pourable, self-leveling sealant.

1. Available Products:
a. Meadows, W. R., Inc.; Sof-Seal.
b. Architect approved equivalent

2.4 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

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

2.5 PRIMERS

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

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

3.2 PREPARATION

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

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

3.3 INSTALLATION OF JOINT SEALANTS

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

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

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

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

D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

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

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

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

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

G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

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

3.5 PROTECTION

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

END OF SECTION 32 13 73

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SECTION 32 14 43 - PERMEABLE UNIT PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Solid concrete pavers with openings between pavers filled with aggregate.
   2. Aggregate setting bed for pavers.
   3. Edge restraints.

1.2 ACTION SUBMITTALS

A. Product Data: For materials other than aggregates.

B. Sieve Analyses: For aggregate materials, according to ASTM C 136.

C. Samples:
   1. Full-size units of each type of unit paver indicated including the ADA symbol paver.
   2. Exposed edge restraints.
   3. Aggregate fill.
   4. Aggregate setting bed materials.

1.3 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
   1. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCRETE UNIT PAVERS

A. Solid Concrete Pavers for Porous Paving: Solid interlocking paving units of shapes that provide openings between units, complying with ASTM C 936/C 936M, resistant to freezing and thawing when tested according to ASTM C 67, and made from normal-weight aggregates.
   1. Belgard Aqua Brick paver.
   2. Thickness: 3-1/8” (80mm)
   3. Face Size and Shape: 5”x9”
   4. Color: TBD for the paver field; and TBD for the darker contrasting banding, ADA Symbols and parking lot striping. Colors will be selected by Owner from the manufacturer’s full range of colors.

2.2 ACCESSORIES

A. Steel Edge Restraints: Painted steel edging, 3/16 inch thick by 4 inches, with loops pressed from or welded to face to receive stakes at 36 inches o.c., and with steel stakes 15 inches long for each loop.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
   a. Collier Metal Specialties, Inc.
   b. Sure-loc Edging Corporation.

2. Color: Black.

2.3 AGGREGATE SETTING-BED MATERIALS

A. Graded Aggregate for Base Course: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 57, ASTM D 2940, base-course material requirements in Section 310000 "Earthwork" for base-course material.

B. Graded Aggregate for Leveling Course: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 9.

C. Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured according to test methods referenced:
   1. Survivability: Class 2; AASHTO M 288.
   2. Apparent Opening Size: No. 40 sieve, maximum; ASTM D 4751.
   3. Permittivity: 0.5 per second, minimum; ASTM D 4491.
   4. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.4 FILL MATERIALS

A. Aggregate Fill for Porous Paving: Graded, sound, crushed stone or gravel complying with ASTM D 448 for Size No. 9.
   1. Color: Match Architect's sample.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be structurally unsound or visible in finished work.

B. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.

C. Tolerances:
   1. Variation in Plane between Adjacent Units (Lipping): Do not exceed 1/16-inch unit-to-unit offset from flush.
   2. Variation from Level or Indicated Slope: Do not exceed 1/8 inch in 24 inches and 1/4 inch in 10 feet or a maximum of 1/2 inch.

D. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.

3.2 SETTING-BED INSTALLATION

A. Compact subgrade uniformly to at least 95 percent of ASTM D 698 laboratory density.

B. Place drainage geotextile over prepared subgrade, overlapping ends and edges at least 12 inches.

C. Place aggregate sub base and base, compact by tamping with plate vibrator, and screed to depth indicated.

D. Place aggregate sub base and base, compact to 100 percent of ASTM D 1557 maximum laboratory density, and screed to depth indicated.

E. Place drainage geotextile over compacted sub base, overlapping ends and edges at least 12 inches.

F. Place drainage geotextile over compacted base course, overlapping ends and edges at least 12 inches.

G. Place leveling course, and screed to a thickness 2 inches, taking care that moisture content remains constant and density is loose and constant until pavers are set and compacted.

3.3 PAVER INSTALLATION

A. Set unit pavers on leveling course, being careful not to disturb leveling base. If pavers have lugs or spacer bars to control spacing, place pavers hand tight against lugs or spacer bars. If pavers do not have lugs or spacer bars, place pavers with a 1/16-inch-minimum and 1/8-inch maximum joint width

B. Compact pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf compaction force at 80 to 90 Hz.

C. Place graded aggregate fill immediately after vibrating pavers into leveling course. Spread and screed aggregate fill level with tops of pavers.

D. As work progresses, remove and replace pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

END OF SECTION 32 14 43

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SECTION 32 84 23 - IRRIGATION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings, general provisions of the Contract, including General and Supplementary Conditions, and other Division 1 specifications sections, apply to work of this section.

1.2 DESCRIPTIONS

A. Provide complete underground irrigation system as shown on the drawings and specified herein. The work includes:
   1. Automatic 2-wire irrigation system including piping, fittings, sprinkler heads, quick coupler valves and accessories.
   2. Valves, decoders and fittings.
   3. Existing Controller in East Pavilion
   4. Control wire for two-wire system
   5. Soil moisture sensors with sensor decoders
   6. Testing
   7. Excavating and backfilling irrigation system work.
   8. Associated exterior plumbing, wiring and accessories to complete the system.
   9. Pipe and wire sleeves.

B. Related Requirements specified elsewhere:

   1. General requirements: Division 1 sections
   2. Sodding: Section 32 92 23
   3. Trees, Shrubs and Ground Covers: Section 32 93 00

1.3 QUALITY ASSURANCE

A. Acceptable Manufacturers:

   1. Rainbird Sales, Inc., or approved equivalent.

B. Provide underground sprinkler irrigation systems as a complete unit with brand name goods produced by a single acceptable manufacturer, including heads, valves, controls and accessories.

C. Installer's qualifications: The firm shall have a minimum of 3 years experience with a satisfactory record of performance for installing irrigation systems of comparable size and quality. This Contractor shall be licensed in the State in which the project is located and have a monetary limit that is not exceeded by the value of the work. Workmanship shall be of the highest quality.

D. Materials, equipment, and methods of installation shall comply with all applicable codes and standards including:

   1. National Fire Protection Association (NFPA), National Electrical Code.

2. American Society for Testing and Materials, (ASTM).
3. National Sanitation Foundation, (NSF).
4. The Irrigation Association, (IA).

E. Excavating, backfilling, and compacting operations: Comply with requirements as specified herein.

F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management."

1. After irrigation shop drawings and submittals are reviewed and at least ten (10) days before installation begins, examine shop drawing and physical samples of all irrigation products for ensuring compliance of irrigation materials and irrigation construction practices. Require representatives, including the following, of each entity directly concerned with irrigation system installation, to attend conference:
   a. Contractor's project manager
   b. Contractor’s superintendent
   c. Irrigation subcontractor owner, superintendent and labor force

G. Obtain in writing Landscape Architect's acceptance of installed and tested irrigation system.

1.4 SUBMITTALS

A. Submit the following in accordance with Division 1 requirements.

1. Manufacturer's Literature: Materials and installation instructions for each of the system components.
2. Shop Drawings: Shop drawings for the complete exterior irrigation system. Include piping layout and details illustrating location and types of factory sprinkler heads and control valves, control systems and wiring, pipe and wire sleeves, pipe sizes, quick coupler valves and list of fittings and pressure at last head in each zone.
3. Material Samples: Furnish upon request.
4. Prior to final inspection and before irrigation system acceptance, submit written operating and maintenance instructions signed by Irrigation Subcontractor, Landscape Subcontractor, General Contractor and Owner. Obtain Landscape Architect's approval for the same in writing.
5. Provide to Owner's appointed maintenance personnel instruction in proper use and monitoring of irrigation system. Submit with Close-Out Documents statement signed by General Contractor, Irrigation Subcontractor and Owner's representative that Contractor has provided the specified training to the Owner’s maintenance personnel.
6. Subscription information for link to weather data for use in weather data module controller add-on.

B. Provide irrigation system record drawings.

1. Legibly mark drawings to record actual construction.
2. Indicate horizontal and vertical locations, referenced to permanent surface

improvements using planting plans or other appropriate drawings as base sheets. Submittals shall include one paper copy of each sheet and three (3) compact discs (CDs) or flash drives of as-built drawings in pdf format and as required by the Owner.

3. Identify field changes of dimension and detail and changes made by Change Order.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver irrigation system components in manufacturer's original undamaged and unopened containers with labels intact and legible.

B. Deliver plastic piping in bundles, packaged to provide adequate protection of pipe ends, both threaded or plain.

C. Store and handle materials to prevent damage, theft, and deterioration.

D. Provide secure, locked storage for valves, sprinkler heads, and similar components that can not be immediately replaced, to prevent installation delays.

1.6 PROJECT CONDITIONS

A. The water supply for the site irrigation system is an existing 2” irrigation water meter located adjacent to the East Pavilion. The existing backflow preventer is located in the mechanical room of the East Pavilion.

B. The Contractor shall, at his own expense, locate, excavate and verify the alignment and depth of all known underground utilities including splash pad systems as shown or inferred on the drawings. Protect existing utilities, paving, and other facilities from damage caused by irrigation installation operations.

C. Promptly repair damage to adjacent facilities caused by irrigation system work operations. All damage to adjacent facilities resulting from work covered in these specifications will be repaired at the Contractor's expense.

D. Protect new and existing trees, plants, lawns, and other features designated to remain as part of the final landscape work.

E. Promptly repair damage to finish grades, lawn areas and planting caused by irrigation system work operations. All damage to grades, lawns and planting resulting from work covered in these specifications will be repaired at the Contractor's expense.

F. Promptly notify the Landscape Architect in writing of unexpected sub-surface conditions.

G. Coordinate irrigation work with other trades to avoid conflicts and permit all trades to perform their work in a timely manner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. Provide only new materials, without flaws or defects and of the highest quality of their specified class or kind.
2. Provide pipe sizes required. No substitution of smaller pipes will be permitted. Larger sizes may be used subject to acceptance of the Landscape Architect. Remove damaged and defective pipe.

3. Provide pipe continuously and permanently marked with manufacturer's name or trademark, size schedule and type of pipe, working pressure at 73 degrees F. and National Sanitation Foundation (NSF) approval.

B. Plastic pipe, fittings, and connections:

1. Polyvinyl chloride pipe: ASTM D2241, rigid, unplasticized PVC, extruded from virgin parent material. Provide pipe homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, wrinkles, and dents. Provide one insulated No. 12 solid copper "locator" wire with all water line installations as required.
   a. 2" diameter and under: SDR 21.
   b. 2-1/2" diameter and larger: SDR 21 with integral bell and rubber ring gasket.
2. PVC pipe fittings: ASTM D2466 molded fittings suitable for solvent weld, slip joint ring tight seal, or screwed connections. Fittings made of other materials are not permitted.
   a. Size slip fitting socket taper to permit a dry unsoftened pipe end to be inserted no more than halfway into the socket. Saddle and cross fittings are not permitted.
   b. Schedule 80 PVC pipe may be threaded.
   c. Use male adapters for plastic to metal connections. Hand tighten male adapters plus one turn with a strap wrench.

C. Sprinkler heads, valves and associated equipment:

1. In order to afford the Owner their best possible warranty support as stated by the manufacturer and herein, all irrigation brand name goods (i.e. valves, heads, controllers, etc.) shall be purchased from an authorized distributor recognized by the manufacturer to provide warranty support for the geographic location of the project.
2. Sprinkler Head: Manufacturer’s standard pop up unit with built-in check valve designed to provide uniform coverage over entire area of spray shown on the drawings as follows:
   a. Flush Surface: Fixed pattern, with screw-type flow adjustment and precipitation rates matched across patterns and sets.
   b. Bubbler: Fixed pattern, with screw-type flow adjustment.
   c. Shrubbery: Fixed pattern, with screw-type flow adjustment and precipitation rates matched across patterns and sets.
   d. Pop-up Spray: Fixed pattern, with screw-type flow adjustment and nozzles

with precipitation rates matched across patterns and sets, stainless steel retraction spring and ratcheting stem adjustment. Check valves shall be serviceable through top of sprinkler body while body is still properly installed in the ground.

e. Pop-up Rotary Spray: Gear or turbine drive, full circle and adjustable part circle type.

3. Existing master valves are located east of the East Pavilion. Master valves are 200 PSI-rated globe style valve, low power solenoid, normally closed fiberglass filled nylon body and bonnet with low flow, low pressure operating capabilities having brass flow control stem, manual open/close control, nylon reinforced rubber diaphragm and manual internal and external bleed.
4. Manual circuit valves of 3" or less shall be globe valves of PVC and rated for 200 psi and come complete with handle. One valve shall be installed on supply side of each automatic circuit valve.
5. Existing flow sensors are located in the vicinity of the master valves east of the East Pavilion along with the associated sensor decoder.
6. Automatic circuit valves shall be 200 PSI-rated globe style valve, low power solenoid, normally closed fiberglass filled nylon body and bonnet with low flow, low pressure operating capabilities having brass flow control stem, manual open/close control, nylon reinforced rubber diaphragm and manual internal and external bleed.
7. Quick coupling values marked shall be heavy-duty two piece brass construction with locking rubber cover.

D. Automatic Control System

1. Existing two-wire modular controller is located in the storage room of the East Pavilion. Confirm the controller has the number of circuits available to add the zones required as part of this contract.
3. Exterior Control Enclosure: Manufacturer's standard metal wall mount with weatherproof locking cover.
4. Timing Device: Adjustable 0 minute to 12 hours with four independent programs A, B, C and D.
   a) Start Times: 8 start times per program per day
   b) Programming Schedule: A, B and C programs have independent day cycles which include custom days of the week, odd, odd no 31st, even and cyclical dates.
   c) Station Control: 50-station standard expandable up to 200 with optional modules
   d) Station Valves: Up to 8 valves in simultaneous operation per program and total for the controller including master valves
   e) Master Valves: Up to 5 normally open or normally closed valves programmable by station
   f) Cycle/Soak: by station
   g) Manual Operation: allow manual control without disturbing present automatic operation
   h) Test Program and built-in diagnostics
   i) Rain Delay: Set number of days system is off before resuming automatic operation
   j) Seasonal Adjust: adjust station run time 0% to 300% in 1% increments; adjust monthly seasonal run time 0% to 300% in 1% increments

k) Program Backup and Decoder Address Reader Cartridge: provides 8 full backups of all programming and decoder addresses; provide complete with Unitech pen model MS100-2 with 9-pin female serial connector
l) Sensor Inputs: One wired and up to three decoder-managed

5. Provide soil moisture sensors and software required to interface with controller as available from Rainbird or approved equivalent. Provide companion sensor decoder to connect soil moisture sensors to controller.
6. Decoders: Capable of controlling one solenoid valves per unit. Decoders shall be sealed in such a manner that they are not susceptible to moisture intrusion.
7. Provide maximum manufacturer's recommended lightning protection for the Southeastern U.S.

E. Remote Control System:

1. Remote control system: Minimum system includes transmitter, permanent controller, permanent connector, two antennas, carrying case with keys, battery operated and user manual.

F. Electrical control wires:

1. Electrical control and ground wire: Type UF #14 two-way irrigation control cable or larger containing the copper wires to connect each decoder to the controller.
2. Wire color code: Provide control or "hot" wires either black or red in color. Provide common or "ground" wires in different colors, one for each moisture sensor, or as shown on the drawings.
3. Provide ground rod(s) in accordance with applicable codes.
4. Provide line surge protection equipment at intervals along the two-wire path in accordance with manufacturer's recommendations.

2.2 MISCELLANEOUS MATERIALS

A. Drainage fill: Clean 3/4" crushed stone.

B. Fill: Clean soil free of stones larger than 2" diameter foreign matter, organic material, and debris.

1. Provide imported fill material as required to complete the work. Obtain rights and pay all costs for imported materials.
2. Suitable excavated materials removed to accommodate the irrigation system work may be used as fill material subject to the Landscape Architect's review and acceptance.

C. Low voltage wires connectors: Socket seal type wire connectors and waterproof sealer, direct burial splice (DBY) by 3M or other approved equal.

D. Valve access box, cover and frame: Tapered enclosure of rigid plastic material with frame and bolt locking cover comprised of fibrous components chemically inert and unaffected by moisture, corrosion and temperature changes as manufactured by Carson, or approved equal.

E. Teflon tape of virgin material and free of deleterious substances.

F. Locator wire: No. 12 solid copper wire with THWN insulation.

G. Concrete: 3000 psi.

H. Soil Separator: Rot resistant polypropylene filter fabric, water permeable, and unaffected by freeze-thaw.

I. Sleeves: Schedule 80 PVC at walkways; extra-strength steel at roadways.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine final grades and installation conditions. Do not start irrigation system work until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Install SCH 80 PVC or extra-strength steel sleeve(s) at each location where pipe crosses pavement as shown on the drawings. Extend sleeves 2'-0" minimum beyond edge of pavement then turn up to finish grade and cap the sleeve at both ends for future use. Coordinate with other trades to achieve timely installation of sleeves. No pavement patching shall be permitted.

B. Layout and stake the location of each water main, pipe run and all controllers, sprinkler heads and sprinkler valves, quick coupler valves and of pressure regulators, etc. where required. Coordinate layout with planting drawings and other trades to avoid conflicts. Obtain Landscape Architect's acceptance of layout in writing prior to excavating.

C. Notify Landscape Architect in writing of adverse sub-surface conditions. State conditions and submit a proposal for correction including costs. Obtain approval for method of correction prior to continuing work in the affected area. In the event that alternate locations are selected, the Contractor will prepare such areas at no additional expense to the Owner. Irrigation installation shall be performed only by experienced workmen familiar with installation procedures under the supervision of a qualified supervisor.

3.3 INSTALLATION

A. Excavating and backfilling:

1. All excavation shall be considered unclassified excavation and include all materials encountered.
2. Excavate trenches of sufficient depth and width to permit proper handling and installation of pipe and fittings. Bottoms shall slope uniformly to low points.
3. Excavate to depths required to provide 3" depth of earth fill or sand bedding for piping unless otherwise indicated.
4. Fill to match adjacent grade elevations with approved earth fill material. Place and compact fill in layers not greater than 8" depth.

a. Provide approved earth fill or sand to a point 4" above the top of pipe.
b. Fill to within 6" of final grade with approved excavated or borrow fill materials free of lumps or rocks larger than 1/2" in any dimension.
c. Provide clean topsoil fill free of rocks and debris for top 6" of fill.
d. Provide mineral aggregate base under all paving compacted to 100% Standard Proctor.

5. Install main supply lines with a minimum cover of 24" based on finished grades.
6. Install irrigation lines with a minimum cover of 12" based on finished grades.
7. Excavate trenches and install piping during the same working day. Protect open trenches or partially filled trenches open overnight.

B. Plastic pipe:

1. Install plastic pipe in accordance with manufacturer's installation instructions. Provide for thermal expansion and contraction**. Install one insulated No. 12 solid copper "locator" wire continuous in trench with all pipe installations.** Terminate locator wire in each valve box for ease of access as required.
2. Saw cut plastic pipe. Use a square-in-sawing vice, to ensure a square cut. Remove burrs and shavings at cut ends prior to installation.
3. Make plastic to plastic joints with solvent weld joints or slip seal joints. Use only solvent recommended by the pipe manufacturer. Install plastic pipe fittings in accordance with pipe manufacturer's instructions. Contractor shall make arrangements with pipe manufacturer for all necessary field assistance.
4. Make plastic to metal joints with plastic male adapters.
5. Make solvent weld joints in accordance with manufacturer's recommendations.
6. Allow joints to set at least 24 hours before pressure is applied to the system.
7. Slope circuit piping to drain valve at ½" in 10'-0" minimum.

C. Sprinklers, fittings, valves, and accessories:

1. Install fittings, valves, sprinkler heads, pressure regulators and accessories in accordance with manufacturer's instructions.
   a. Install a manual valve on the supply side of each remote control valve.
   b. Make minor adjustments in location of sprinkler heads to avoid plantings and other obstructions. Obtain approval in writing from Landscape Architect if locations shown on plan require alteration.
   c. Provide concrete thrust blocks on 2-1/2" pipe and larger at all 90's, 45's, and tees.
2. System pressures shall be indicated on the approved shop drawings at source and last sprinkler head in each circuit.
3. Install sprinkler heads perpendicular to finished grade or on risers where shown.
4. Install pop-up spray, pop-up impact, stream rotor, turbine or gear drive sprinklers with an adjustable double swing joint riser of at least 3 standard 90 degree elbows. Fabricate double swing joint risers of schedule 80 PVC nipples and schedule 40 PVC elbows. The horizontal nipple connected directly into side of the lateral line shall be a minimum of 3” long. All other nipples of the swing joint riser shall be of length as required for proper installation of the sprinkler head. Polyethylene pipe and proper barbed fittings may also be used to make up swing joints provided maximum flow does not exceed 8 gpm.
5. Obtain Landscape Architect’s review and acceptance of height for proposed sprinkler heads, and valves prior to installation.

6. Locate sprinkler heads to assure proper coverage of indicated areas. Minimum water coverage shall be 95% in turf areas and 85% in other planting areas. Do not exceed spacing distances indicated on the approved shop drawings.
7. Install in-ground control valves, manual gate valves, quick coupling valves, and pressure regulators in a valve access box. Electric valves shall have a minimum of 6” clearance between wires and top of box when wiring is complete.
8. Install valve access boxes on a suitable base of gravel completely enclosed with soil separator fabric to provide a level foundation at proper grade and to provide drainage of the access box as shown on the drawings.
9. Seal threaded connections on pressure side of control valves with Teflon tape or approved plastic joint type compound.
10. Install manual gate valve, minimum 1" size, at the end or low point of all dead end laterals to provide for flushing and system drain-down in the fall.
11. Install manual gate valve on the main line, same size as main line, in a valve box on the source side of any roadway crossing.

D. Control wiring:

1. Install electric two-wire control cable in the piping trenches wherever possible. Place cable in trench a minimum of 4” vertically above pipe. Install cable with sufficient slack to allow for thermal expansion and contraction. Where necessary to run wire in a separate trench, provide minimum cover of 12”.
2. Provide sufficient slack at site connections at decoders in valve boxes, and at all wire splices to allow rising the decoder or splice to the surface without disconnecting the wires when repair is required.
3. Make wire connections to decoders, remote control electric valves, sensor decoders and splices of wire in the field, using wire connectors and sealing cement in accordance with manufacturer’s recommendations. Install wire splices in valve box.
4. Provide tight joints to prevent leakage of water and corrosion build-up on the joint.
5. Install manufacturer’s recommended surge protection device between field valves and control unit.
6. Provide manufacturer’s maximum recommended lightning protection throughout the entire system.

E. Sleeves:

1. Install sleeves for installation of irrigation system prior to paving installation. No cutting and patching of finished surfaces shall be permitted.

F. Controller:

1. Existing controller is already installed in the storage room of the East Pavilion.

G. Remote Control System:

1. Confirm proper operation of existing remote control system.

H. Flushing, testing, and adjustment:

1. After piping is installed and before sprinkler heads are installed, open control valves and flush out the system with full head of water.
2. Perform system testing upon completion of each section. Make necessary repairs and retest repaired sections as required.
3. Adjust sprinklers after installation for proper and adequate distribution of the water over the coverage pattern. Adjust for the proper arc of coverage.
4. Tighten nozzles on spray type sprinklers after installation. Adjust sprinkler adjusting screw on lateral line or circuit as required for proper radius. Interchange nozzles patterns if so directed by the Landscape Architect, to give best arc of coverage.
5. Adjust all electric remote control valves, pressure regulators and flow control stems for system balance and optimum performance.
6. Test and demonstrate the controller by operating appropriate day, hour, and station selection features as required to automatically start and shut down irrigation cycles. Demonstrate that system meets coverage requirements which are based on operation of one circuit at a time.
7. Upon completion of seeding/sodding operations and repair to seeded/sodded areas, carefully adjust lawn sprinkler heads so they will be flush with or not more than ½" above finish grade.

I. Service:

1. When requested, or as required, return to the site during the subsequent fall season and winterize the system. Drain all water from the system or blow out the system with compressed air.
2. When requested, or as required, return to the site during the subsequent spring season and demonstrate to the Owner the proper procedures for the system start-up, operation, and maintenance. Repair damage to irrigation system that occurred during the winter due to improper installation.

3.4 DISPOSAL OF WASTE MATERIAL

A. Stockpile, haul from site, and legally dispose of waste materials, including unsuitable excavated materials, rock, trash, and debris.

B. Maintain disposal route clear, clean, and free of debris.

3.5 TEST REPORT RECORD

A. Tests of all water lines shall be recorded on a form with the data and format as listed below. When the form(s) is (are) completed, it (they) shall be turned over to the Owner.
   1. Job Name:
   2. Test Location:
   3. Type System: Irrigation
   4. Test Pressure:
   5. Length of Time for Test:
   6. I certify that the above test was performed in my presence and that all leaks observed were fixed prior to backfilling.

SIGNED: _____
General Contractor's Superintendent

SIGNED: _____
Irrigation Contractor's Superintendent

3.6 INSPECTION AND ACCEPTANCE

A. Upon completion of work, notify Landscape Architect in writing at least ten (10) days prior to requested date of inspection for acceptance. Submit written operating and maintenance instructions with request for inspection. Where inspected irrigation work does not comply with requirements, replace rejected work as specified until re-inspected by Landscape Architect and found to be acceptable. Remove rejected materials promptly from project site.

B. Test and demonstrate to the Landscape Architect and Owner the satisfactory operation of the system free of leaks.

C. Instruct the Owner's designated personnel in the operation of the system.

D. Upon acceptance the Owner will assume operation of the system.

3.7 WARRANTY

A. Warrant all components of underground and interior irrigation systems for a period of one year after the date of Substantial Completion. Replace in accordance with the drawings and specifications, any defective material or damage to the system which is the result of improper installation procedures, at no additional cost to the owner.

3.8 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment. Repair damage resulting from irrigation system installation.

END OF SECTION 32 84 23

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SECTION 32 92 19 - SEEDING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide seeded areas as shown and specified. The work includes:

1. Soil preparation.
2. Seeding lawns and areas disturbed by construction.
3. Mulching existing shrub areas disturbed by construction.
4. Maintenance.

1.2 QUALITY ASSURANCE

A. From a testing agency acceptable to the Landscape Architect, Provide the following data:

1. Test each representative material sample proposed for use.
2. Topsoil analysis:
   a. pH factor.
   b. Mechanical analysis.
   c. Percentage of organic content.
   d. Recommendations on type and quantity of additives required to establish satisfactory pH factor and supply of nutrients to bring nutrients to satisfactory level for planting.

1.3 SUBMITTALS

A. Submit seed vendor's certification for required grass seed mixture, indicating percentage by weight, and percentages of purity, germination, and weed seed for each grass species.

B. Submit the following material samples:

1. Seed.
2. Hydromulch
3. Erosion Control Blanket

C. Submit the following material certification:

1. Fertilizer analysis.
2. Tackifier

D. Submit materials test report.

E. Upon seeding, submit written maintenance instruction recommending procedures for maintenance of seeded areas.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver seed and fertilizer materials in original unopened containers, showing weight, analysis, and name of manufacturer. Store in a manner to prevent wetting and deterioration.

1.5 PROJECT CONDITIONS

A. Work notification:
Notify Landscape Architect at least 7 working days prior to start of seeding operations.

B. Protect existing utilities, paving and other facilities from damage caused by seeding operations.

C. Perform seeding work only after planting and other work affecting ground surface has been completed.

D. Restrict traffic from seeded areas until seed is established. Erect signs and barriers as required.

E. Provide hose and watering equipment as required.

F. Locate, protect and maintain any existing irrigation systems during seeding operations. Repair irrigation system components damaged during seeding operations.

1.6 WARRANTY

A. Warrant all seeding for a period of one year after the date of acceptance against defects including death and unsatisfactory growth in the opinion of the Landscape Architect.

B. Replace in accordance with the drawings and specifications, all seeding that is dead or, as determined by the Landscape Architect, in an unhealthy or unsightly condition. The cost of such replacement (s) is at Contractor's expense. Warrant all replacement seeding for 1 year after installation.

C. Warranty shall not include damage or loss of seeding by fires, floods, freezing rains, lightning storms, or winds over 75 miles per hour, winter kill caused by extreme cold and severe winter conditions not typical of planting area; acts of vandalism or negligence on the part of the Owner.

D. Replacements:
Replacements are subject to all requirements stated in this specification and subject to inspection by the Landscape Architect.

E. Repair grades, lawn areas, paving and any other damage resulting from replacement seeding operations, at no additional cost to the Owner.

F. Inspect job site monthly during warranty period to determined what changes, if any, should be made in the maintenance program. Submit all recommended changes in writing to the Landscape Architect and the Owner.

G. At the close of the warranty period, one year after acceptance of the work, notify the Owner and Landscape Architect in writing of the date for warranty inspection. Make any repairs or replacements identified by the Landscape Architect in the Warranty Inspection.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Seeds shall meet the requirements of applicable seed laws and shall be tested in accordance with the most current edition of the U.S. Department of Agriculture Handbook No. 30, Testing Agricultural and Vegetable Seed. Seeds shall be from the last preceding crop and comply with the requirements outlined below for purity and germination. Each variety of seed shall be furnished in separate, strong bags with each bag being fully tagged or labeled to show the variety, weight, purity, germination, and test data prescribed by law. All test results shall be fully certified by the vendor or by a recognized seed testing agency. Seeds found not to comply with specification requirements shall be subject to rejection.

When mixing or forming seed mixture, the seeds shall be carefully and uniformly mixed. Seeds shall not be mixed until each variety of seed to be used in the mix has been inspected and/or tested separately and approved. Use only seed of improved turf-type fescue similar to the types listed below.

Lawn Seed Mix:

Seed Varieties	Purity, Minimum %	Germination, Minimum %	Seeding Rate
Turf Type Fescue Blend (Festuca arundinacea)	95	85	10 lbs/1000 S.F.

B. Seeding materials shall be free from seeds or bulbets of Wild Onion (Allium vineal), Canada Thistle (Cirsium arvense), and Johnson Grass (Sorghum halepense).

C. Seed species shall not contain more than six seeds per ounce of the seed of any of the following noxious weeds or the seeds of any other weed specifically listed as noxious:

Bindweed (Convolvulvus arvensis)	Oxyedaisy (Chrysanthemum leucantheumum)
Buckhorn (Plantago lanceolata)	
Corncockle (Agrostemmo githago)	Quackgrass (Agropyron repens)
Dodder (Cuscuta species)	Sorrel (Rumex acetosella)

D. Seed species shall not contain an excess of 2 percent by weight of weed seeds, noxious or otherwise.

E. Seed Mixtures, Rates and Seasons:
Seeding mixtures, rates, and seasons shall be those specified herein. The types to be used for each area are specified by the drawings. Seeding shall be planted during the season and between the dates specified.

1. Spring or fall seeding.
Plant between March 15 and May 1 or between August 15 and October 15.

2. Winter seeding (Temporary Cover)
Plant between October 15 and March 15.
Mixture:
Annual Ryegrass 2 lbs. per 1000 sq.ft.
White Clover .50lbs. per 100 sq.ft.

3. Summer seeding (Temporary Cover)
   Plant between May 1 and August 15.
   Mixture:
   Red Clover 1lb. Per 1000 sq.ft.
   Weeping Lovegrass .50 lb. per 1000 sq.ft.

F. Fertilizers - Fertilizers shall be those readily available commercially. The application of fertilizer shall be at a rate of 200 pounds Ureaform (38-0-0) per acre with either 400 pounds of 15-15-15 per acre of 600 pounds of 6-12-12. Fertilizer rates shall be modified by the recommendations of the soil test and shall be approved by the Landscape Architect in writing.

G. Limestone - Limestone shall contain no less than 85 percent calcium carbonate by weight. It shall be crushed so that at least 85 percent will pass a no. 10 sieve. The application of limestone shall be at the rate of 2 tons per acre. Hydrated lime may be substituted at a rate of 1 ton per acre. Limestone rates shall be modified by the recommendations of the soil test and shall be approved by the Landscape Architect in writing.

H. Straw Mulch - Clean oat or wheat straw well seasoned before bailing, free from mature seed bearing stalks or roots of prohibited or noxious weeds. Use straw on slopes no steeper than 4:1. Omit straw if hydromulching procedure is used.

I. Wood cellulose fiber mulch:
   Degradable green dyed wood cellulose fiber of 100% recycled long fiber pulp, free from weeds or other foreign matter toxic to seed germination and suitable for hydromulching. Use for hydromulching in lieu of straw on erosion prone slopes greater than 4:1 or drainage swales.
   Available manufacturers and types:
   Conwed Hydromulch: Conwed Corp., St. Paul, MN
   Cellin Hydromulch: Cellin Mfg. Inc., Lorton, VA
   Superior Turf Fiber: Cellin Mfg. Inc., Lorton, VA

J. Tackifier:
   Liquid concentrate diluted with water forming a transparent 3--dimensional film like crust permeable to water and air and containing no agents toxic to seed germination. Use tackifier on erosion prone slopes to hold either wood cellulose fiber mulch or straw.
   Available Manufacturers and types:
   Polybind DLR: Celtite, Inc., Cleveland, OH
   Curasol AK: American Hoechst Corp., Elk Grove, IL

K. Water:
   Free of substance harmful to seed growth. Hoses or other methods of transportation furnished by Contractor.

L. Erosion Control Blanket:
   Erosion control blanket shall consist of a clean weed free straw, knitted into a strong mat with a biodegradable plastic mesh secured to the mat with by biodegradable thread.
   Available Manufacturers:
   Colbond Geosynthetics, Enka, N.C. 28728
   Superior Drainage, Knoxville, TN 865-637-0069

Or approved equivalent supplier.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine finish surfaces, grades, topsoil quality, and depth. Do not start seeding work until unsatisfactory conditions are corrected and acceptable for seeding.

3.2 PREPARATION

A. Limit preparation to areas which will be immediately seeded.

B. Loosen topsoil of seeded areas to minimum depth of 4". Remove stones over 1" in any dimension and sticks, roots, rubbish and extraneous matter. It is strongly recommended that scarifying and preparation of seed beds on cut and fill slopes be accomplished with tools or equipment specially designed for this purpose. Small furrows or grooves formed in the slopes shall be horizontal or as nearly horizontal as practical. The work shall be performed only when the ground is in a workable and tillable condition as determined by good farming practices.

C. Grade seeded areas to a smooth, free drainage even surface with a loose, moderately coarse texture. Roll and rake, remove ridges, and fill depressions as required to drain.

D. Apply limestone, at rate determined by the soil test, to adjust pH of topsoil. Distribute evenly by machine and incorporate thoroughly into topsoil.

E. Apply fertilizer to all seeded areas at the approved rates as determined by the soil test.

F. Apply fertilizers by mechanical rotary to drop type distributor, thoroughly and evenly incorporated with soil to a depth of 3" by discing or other approved method. Fertilize areas inaccessible to power equipment with hand tools and incorporate into soil.

G. Restore prepared areas to specified condition if eroded, settled, or otherwise disturbed after fine grading and prior to seeding.

3.3 INSTALLATION

A. Seeding:

1. Seed immediately after preparation of bed. See 2.01 E Seed Mixtures, Rates and Seasons.
2. Contractor shall re-seed temporary cover with permanent spring/fall seeding at no additional cost during the appropriate season.
3. Seed all areas within and adjoining project limits disturbed as a result of construction operations.
4. Perform seeding operations when the soil is dry and when winds do not exceed 5 miles per hour velocity.
5. Apply seed with a rotary or drop type distributor. Install seed evenly by sowing equal quantities in 2 directions, at right angles to each other. When broadcasting wildflower seeds, mix seeds with sand at a 1 to 1 ratio to aid in the uniform distribution of the seed.
6. Once seeds are broadcast rake in seeds lightly or drag surface with a piece of chain-link fence to mix seed into the soil surface.

B. Hydro mulching and Erosion Control Blanket:
   1. Hydro mulching and erosion control blanket shall be required on slopes greater than 4:1.
   2. Use a hydromulcher (sprayer) and apply mixtures at the following rates. Mix in accordance with manufacturer's recommendations.
   3. Apply hydro mulch slurry to indicated areas.
      a. Tackifier: 60 gals/acre.
      b. Wood cellulose fiber mulch: 2,000 lbs./acre on slopes greater than 4:1.
         1,500 lbs./acre on slopes less than 4:1.
   4 Erosion Control Blanket:
      a. Seeding and erosion control blanket shall be used on slopes greater than 4:1.
      b. Apply seed as directed above and cover with erosion control blanket according to manufacturers recommendations.

C. Mulching:

   Seeded areas:
   1. Place straw mulch on seeded areas within 24 hours after seeding. Omit straw mulch if hydroseeding procedure is used.
   2. Place straw mulch uniformly in a continuous blanket at the rate of 2-1/2 tons per acre, or two 50 lb. bales per 1,000 sq. ft. of area. A mechanical blower may be used for straw mulch application when acceptable to the Landscape Architect.
   3. Anchor straw mulch with liquid tackifier applied uniformly at a rate of 60 gal. per acre on slopes greater than 4:1.
   4. Protect buildings, paving, plantings, and all non-seeded areas from liquid tackifier over-spray.

D. Existing shrub areas:
   1. Place a 3" thick layer of hardwood bark mulch in all existing shrub areas disturbed by construction.

E. Provide straw bale checking in ditches or problem swales at intervals required to adequately slow water velocity and impede soil loss.

3.4 MAINTENANCE

A. Maintain seeded areas until completion and acceptance of the entire project or not less than 30 days after completion and acceptance of seeding operations.

B. Maintain seeded areas, including watering, spot weeding, mowing, applications of herbicides, fungicides, insecticides, and re-seeding until a full, uniform stand of grass free of weeds, undesirable grass species, disease, and insects is achieved and accepted by the Landscape Architect.

   1. Water periodically to maintain adequate surface soil moisture for proper seed germination. Continue watering for not less than 30 days. Thereafter apply water as required until provisional acceptance.
   2. Repair, rework, and re-seed all areas that have washed out, are eroded, or do not catch.
   3. Mow lawn (LAWN) areas as soon as lawn top growth reaches a 4" height. Cut back to 3" in height. Repeat mowing as required to maintain specified height. Following mowing limit as directed by Landscape Architect.

3.5 CLEAN UP AND PROTECTION:

A. During seeding work, keep pavements clean and work area in an orderly condition.

B. Upon completion of work, clear grounds of debris, superfluous materials and all equipment. Remove from site to satisfaction of Landscape Architect.

C. Protect seeding work and materials from damage due to landscape operations, operations by other contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged seeding as directed, at no additional cost to the Owner.

3.6 INSPECTION AND ACCEPTANCE

A. Upon completion of work, notify Landscape Architect at least ten (10) days prior to requested date of inspection for acceptance. Where inspected work does not comply with requirements, replace rejected work and continue specified maintenance until re-inspected by Landscape Architect and found to be acceptable.

1. Seeded areas will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, uniform, close stand of the specified mixture is established free of weeds, undesirable species, disease, and insects.

2. No individual seeded areas shall have bare spots or unacceptable cover totaling more than 2% of the individual areas, in areas requested to be inspected.

B. Upon satisfactory completion of repairs and, or replacements, the Landscape Architect certifies, in writing, the acceptance of the work in total.

C. The one-year warranty period begins on the date of the acceptance of the work in total.

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SECTION 32 92 23 - SODDING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide sodded lawns as shown and specified. The work includes:

1. Soil preparation.
2. Sodding lawns and other indicated areas.
3. Maintenance.

B. Related Work:

1. Earthwork: Division 31
2. Irrigation: Division 32.
3. Trees, Shrubs and Ground Covers: Division 32

1.2 QUALITY ASSURANCE

A. Sod: Comply with American Sod Producers Association (ASPA) classes of sod materials.

B. Provide and pay for materials testing. Testing agency shall be acceptable to the Landscape Architect. Provide the following data:

1. Test representative materials samples proposed for use.
2. Topsoil:
   a. Water pH factor.
   b. Mechanical analysis.
   c. Percentage of organic content.
   d. Soil test ratings for Phosphorus, Potassium, Calcium, Magnesium, Zinc, Iron, and Manganese.
   e. Soluble salt concentration.
   f. Recommendations on type and quantity of additives required to establish satisfactory pH factor and supply of nutrients to bring nutrients to satisfactory level for planting.

1.3 SUBMITTALS

A. Submit sod growers certification of grass species. Identify source location.

B. Submit the following materials certification:

1. Fertilizer analysis.

C. Submit materials test report.

D. Upon sodded lawn acceptance, submit written maintenance instructions recommending procedures for maintenance of sodded lawns.

1.4 DELIVERY, STORAGE AND HANDLING

A. Cut, deliver, and install sod within 24-hour period.

1. Do not harvest or transport sod when moisture content may adversely affect sod survival.
2. Protect sod from sun, wind and dehydration prior to installation.
3. Do not tear, stretch or drop sod during handling and installation.

1.5 PROJECT CONDITIONS

A. Work notification: Notify Landscape Architect at least 7 working days prior to start of sodding operations.

B. Protect existing utilities, paving, and other facilities from damage caused by sodding operations.

C. Perform sodding work only after planting and other work affecting ground surface has been completed.

D. Restrict traffic from lawn areas until grass is established. Erect signs and barriers as required.

E. Provide hose and lawn watering equipment as required. Water transportation shall be the sole responsibility of the Contractor.

F. The irrigation system will be installed prior to sodding. Coordinate all work with irrigation contractor as required. Locate, protect and maintain the irrigation system during sodding operations. Repair irrigation system components damaged during sodding operations.

1.6 WARRANTY

A. Warrant all sodding for a period of one year after the date of acceptance against defects including death and unsatisfactory growth in the opinion of the Landscape Architect.

B. Replace in accordance with the drawings and specifications, all sod that is dead or, as determined by the Landscape Architect, is in an unhealthy or unsightly condition. The cost of such replacement (s) is at Contractor's expense. Warrant all replacement sod for 1 year after installation.

C. Warranty shall not include damage or loss of sodding caused by fires, floods, freezing rains, lightning storms, or winds over 75 miles per hour, winter kill caused by extreme, cold and sever winter conditions not typical of planting area; acts of vandalism or negligence on the part of the Owner.

D. Replacements:
Replacements are subject to all requirements stated in this specification and subject to inspection by the Landscape Architect.

E. Repair grades, lawn areas, paving and any other damage resulting from replacement sodding operations, at no additional cost to the Owner.

F. Inspect job site monthly during warranty period to determine what changes, if any, should be made in the maintenance program. Submit all recommended changes in writing to the Landscape Architect and the Owner. In the absence of monthly written reports from the Contractor it shall be assumed that the Contractor is satisfied with the Owner's maintenance operations and procedures and waives any and all claims for damages against the Owner with respect to the warranty requirements of this specification.

G. At the close of warranty period, one year after acceptance of the work, notify the Owner and Landscape Architect in writing of the date for warranty inspection. Make any repairs or replacements identified by the Landscape Architect in the Warranty Inspection.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lawn Sod: An "approved" nursery grown sod composed of a blend of turf-type heat and drought tolerant fescues known as "Fescue/Bluegrass blend", as available from Mid-Tenn Turf, Inc., Manchester, Tennessee, or approved equal. Unless otherwise noted, Sod containing Common Bermuda grass, Quackgrass, Johnson grass, Poison Ivy, Nutsedge, Nimble will, Canada Thistle, Timothy, Bentgrass, Wild Garlic, Ground Ivy, perennial Sorrel, or Bromegrass weeds will not be acceptable. Provide sod free of grassy or broadleaf weeds.

B. Provide well-rooted, healthy sod, free of diseases, nematodes and soil borne insects. Provide sod uniform in color, leaf texture, density, and free of weeds, undesirable grasses, stones, roots, thatch, and extraneous material; viable and capable of growth and development when planted.

1. Furnish sod, machine stripped in square pads or strips not more than 3'-0" long; uniformly 1" to 1-1/2" thick with clean cut edges. Mow sod before stripping.

C. Fertilizer - Fertilizers shall be those readily available commercially. The application of fertilizer shall be at a rate of 200 pounds Ureaform (38-0-0) per acre with either 400 pounds of 15-15-15 per acre or 600 pounds of 6-12-12. Fertilizer rates shall be modified by the recommendation of the soil test and shall be approved by the Landscape Architect in writing.

D. Limestone - Limestone shall contain no less than 85 percent calcium carbonate by weight. It shall be crushed so that at least 85 percent will pass an no. 10 sieve. The application of limestone shall be at the rate of 2 tons per acre. Hydrated lime may be substituted at a rate of 1 ton per acre. Limestone rates shall be modified by the recommendations of the soil test and shall be approved by the Landscape Architect in writing.

E. Stakes - Use where sod slopes greater than 3:1 or in drainage swales.

1. Softwood, 3/4" dia. x 8" long or,
2. Steel, tee shaped pins, 4" head x 8" leg.

F. Water:
Free of substance harmful to sod growth. Hoses or other methods of transportation furnished by Contractor.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine finish surfaces, grades, topsoil quality and depth. Do not start sodding work until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Limit preparation to areas which will be immediately sodded.

B. Loosen topsoil of lawn areas to minimum depth of 4". Remove stones over 1" in any dimension and sticks, roots, rubbish and extraneous matter.

C. Grade lawn areas to smooth, free draining and even surface with a loose, uniformly fine texture. Roll and rake; remove ridges and fill depressions as required to drain.

D. Apply limestone at rate determined by the soil test, to adjust pH of topsoil. Distribute evenly by machine and incorporate thoroughly into topsoil.

E. Apply fertilizer at the approved rates. Apply fertilizer by mechanical rotary or drop type distributor, thoroughly and evenly incorporated with the soil to a depth of 3" by discing or other approved methods. Fertilize areas inaccessible to power equipment with hand tools and incorporate it into soil.

F. Dampen dry soil prior to sodding.

G. Restore prepared areas to specified condition if eroded, settled, or otherwise disturbed after fine grading and prior to sodding.

3.3 INSTALLATION

A. Sodding:

1. Lay sod to form a solid mass with tightly-fitted joints. Butt ends and sides of sod strips. Do not overlay edges. Stagger strips to offset joints in adjacent courses. Remove excess sod to avoid smothering of adjacent grass. Provide sod pad top flush with adjacent curbs, sidewalks, drains, and seeded areas.
2. Do not lay dormant sod or install sod on saturated or frozen soil.
3. Install initial row off sod in a straight line, beginning at bottom of slopes, perpendicular to direction of the sloped area. Place subsequent rows parallel to and lightly against previously installed row.
4. Peg sod on slopes greater than 3 to 1 to prevent slippage at a minimum rate of 2 stakes per yd. of sod but no less than 2 stakes per individual piece of sod.
5. Water sod thoroughly with a fine spray immediately after laying.
6. Roll with light lawn roller to ensure contact with sub-grade.

3.4 MAINTENANCE

A. Maintain sodded lawns until completion and acceptance of the entire project or not less than 30 days after completion and acceptance of sodding operations.

B. Maintain sodded lawn areas, including water, spot weeding, mowing, application of herbicides, fungicides, insecticides and re-sodding until a full, uniform stand of grass free of weed, undesirable grass species, disease, and insects is achieved and accepted by the Landscape Architect.
   1. Water sod thoroughly every 2 to 3 days, as required to establish proper rooting.
   2. Repair, rework and re-sod all areas that have washed out or are eroded. Replace undesirable or dead areas with new sod.
   3. Mow lawn areas as soon as lawn top growth reaches a 4" height. Cut back to 3" height. Repeat mowing as required to maintain specified height. Not more than 40% of grass leaf shall be removed at any single mowing.
   4. Apply herbicides to control weed growth or undesirable grass species.
   5. Apply fungicides and insecticides as required to control diseases and insects.
   6. Remove sod pegs.

3.5 CLEAN UP AND PROTECTION:

A. During sodding work, keep pavements clean and work area in an orderly condition.

B. Upon completion of work, clear grounds of debris, superfluous materials and all equipment. Remove from site to satisfaction of Landscape Architect.

C. Protect sodding work and materials from damage due to landscape operations, operations by other contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged sodding work as directed, at no additional cost to the Owner.

3.6 INSPECTION AND ACCEPTANCE

A. Upon completion of work, notify Landscape Architect at least ten (10) days prior to requested date of inspection for acceptance. Where inspected work does not comply with requirements, replace rejected work and continue specified maintenance until re-inspected by Landscape Architect and found to be acceptable. Sodded areas will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, even colored viable lawn is established, free of weeds, undesirable grass species, disease, and insects.

B. Upon satisfactory completion of repairs and/or replacements, the Landscape Architect certifies, in writing, the acceptance of the work in total.

C. The 1 year warranty period begins on the date of the acceptance of the work in total.

END OF SECTION 32 92 23

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SECTION 32 93 00 - TREES, SHRUBS, AND GROUND COVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide and furnish all trees, shrubs and ground covers, labor, miscellaneous materials and equipment required or inferred from drawings and specifications to complete the work of this section.

1.2 SUBMITTALS

A. Certification:
   1. Submit certificates of inspection for all plant materials with project close-out documents and as required by governmental authorities.
   2. Submit manufacturer's or vendor's certified analysis for soil amendments and fertilizer materials. Submit other data substantiating that materials comply with specified requirements.

B. Notice of Sources:
Within 15 days following the award of Contract, the Landscape Architect shall be notified in writing of the sources of all plant materials for this project. This notification shall include an itemized list of all plant materials and the complete address and telephone number of the supplier of each plant. Any requests for plant material substitution shall be included with this notification. Requests for substitution will not be considered before or after this notification.

C. Specimen Plant Material Photography
Contractor must locate, photograph or videotape from both sides with a scale figure, and tag at the source each individual plant material labeled "Specimen" in the Plant Legend. The Contractor must furnish photographs of each individual plant and inform Landscape Architect in writing of the source/location at least ten (10) days prior to digging. Subsequently the Landscape Architect may, at his discretion, inspect and seal specimen plant materials before digging. In the event plant material is found to be unacceptable the Contractor will pursue other sources until acceptable plant material is found, at no additional cost to the owner. The contractor will reimburse the owner for time and travel costs incurred by the Landscape Architect ($650.00 per day plus travel costs) because of requested inspections of unacceptable specimen plant materials. Approval at the plant source does not impair the right of inspection and rejection during the progress of the work.

D. Planting Schedule:
Submit planting schedule showing scheduled dates for each type of planting work in each area of site. Submit planting schedule prior to beginning of the work. Planting schedule shall demonstrate a thorough understanding of the overall project schedule in accordance with the requirements of this specification section and good horticultural practices of the area in which the project is located.

E. Maintenance Instructions:
Upon completion of the installation, submit typewritten recommendations for maintenance of any portion of the landscape which, in the opinion of the Contractor, requires special attention.

F. Topsoil Sample:
Submit one cubic foot of topsoil proposed for use if required, two (2) weeks prior to beginning work. If the topsoil source changes submit sample from new source.

G. Soil Test Report:
Submit results of laboratory soil tests two (2) weeks prior to beginning of the work. If the topsoil source changes submit soil test report from new source.

H. Approval:
Obtain approval from Landscape Architect in writing for all submittals including miscellaneous materials prior to beginning of work.

I. Miscellaneous Materials:
Submit product literature and samples of all miscellaneous materials required to complete the work of this section.

J. Provide plant material record drawings:
1. Legibly mark drawings to record actual construction.
2. Identify field changes of dimension and detail and changes made by Change Order referenced to permanent surface improvements.

1.3 QUALITY ASSURANCE

A. Applicable Standards:
1. Plant names indicated, comply with "Standardized Plant Names" as adopted by the latest edition of the American Joint Committee of Horticultural Nomenclature. Names of varieties not listed conform generally with names accepted by the nursery trade. Provide stock true to botanical name and legibly tagged.
2. Provide stock true to botanical name and legibly tagged. Characteristics of individual plant species shall be as described in "Hortus Third". The character of individual plant varieties not listed shall be as defined in current horticultural literature and practice.
3. Comply with sizing and grading standards of the latest edition of "American Standard for Nursery Stock." A plant shall be dimensioned as it stands in its natural position.

B. General:
All plants shall be grown in a recognized nursery in accordance with good horticultural practice. Provide healthy stock free of disease, insects, eggs, larvae and defects such as knots, sun scald injuries abrasions or disfigurement.

C. Tree Sources:
All trees shall be obtained from the following nursery sources:
1. Moon’s Tree Farm
2. Select Trees Inc.
3. Bold Spring Nursery
4. Landscape Architect approved equivalent nursery prior to bidding only.

D. Substitutions:
Do not make substitutions. If specified plant material is not obtainable, submit to Landscape Architect proof of non-availability and proposal for use of equivalent material. For proof of non-availability submit a written statement from a minimum of 6 reliable nursery sources (American Nurserymen's Association Members) that the

plant in question is not obtainable in the Eastern United States.

E. Analysis and Standards:
Package standard products with manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.

F. Topsoil:
Before delivery of topsoil, furnish Landscape Architect with written statement giving location of properties from which topsoil is to be obtained, depth to be stripped, and, if applicable, crops grown during past 2 years.

G. Soil Test Report:
Contractor shall engage a reputable laboratory to include testing and analysis of soils representative of planting areas on site and new topsoil with reference to specified plant materials. The soil test report should provide the following data: Water pH; soil test ratings for Phosphorus, Potassium, Calcium, Magnesium, Zinc, Iron and Manganese; percentage of organic matter; soluble salts; recommendations on type and quantity of additives required to establish satisfactory pH factor and supply nutrients to bring nutrients to satisfactory level for planting specified plant materials.

H. Approval and Selection of Materials and Work:
The selection of all materials and the execution of all operations required under the specifications and drawings is subject to the approval of the Landscape Architect. The Landscape Architect has the right to reject any and all materials and any and all work which, in the opinion of the Landscape Architect does not meet the requirements of the Contract Documents at any stage of the operations. The Contractor shall promptly remove rejected work and or materials from job site. The Contractor shall replace rejected work and or materials promptly.

1.4 DELIVERY, STORAGE AND HANDLING:

A. Deliver fertilizer materials in original, unopened, and undamaged containers showing weight, analysis, and name of manufacturer. Store in a manner to prevent wetting and deterioration.

B. Shipment and Delivery:
Promptly notify the Landscape Architect in advance, when the plant material is to be delivered and the manner of shipment; (2) furnish therewith an itemized list of the actual quantity and sizes; (3) deliver the necessary inspection certificates to accompany each plant or shipment prior to acceptance and planting; (4) when shipment is made by truck, pack all plant material to provide adequate protection against climate and breakage during transit and tie to prevent whipping; (5) cover the tops with tarpaulin to minimize wind whipping and drying, or spray adequately with anti-transparent; (6) exercise care at all times during the handling operations to prevent damage to bark, branches, and root system; (7) employ a suitable method of handling to insure the careful workmanlike delivery of heavy balled plants to preclude cracked plant balls. No balled plant shall be planted if the ball is cracked or broken either before or during the planting operation.

C. Protection After Delivery:
The balls of "B & B" plants which cannot be planted immediately on delivery shall be covered with moist soil or mulch, or other protection from drying winds, sun, and freezing temperatures. Rooted plants shall be planted or heeled in immediately upon

delivery. All plants shall be watered as necessary until planted.

D. Do not remove container grown stock from containers until planting time.

E. Label at least one tree and one shrub of each variety with a securely attached waterproof tag bearing legible designation of botanical and common name.

F. Do not remove labels attached to plant material until directed by the Landscape Architect to do so.

1.5 PROJECT CONDITIONS

A. Work notification:
Notify Landscape Architect at least 7 working days prior to installation of plant material.

B. Protect existing utilities, paving, and other facilities from damage caused by landscaping operations.

C. Proceed with and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required. Schedule delivery of the plant materials to closely coincide with installation and to minimize stored plant materials. **All stored plant materials shall be protected, maintained and subject to all provisions of this specification.**

D. Existing Utilities:
The Contractor shall--at his own expense--locate, excavate and verify the alignment and depth of all underground utilities as shown on the drawings. Perform work in a manner which will avoid possible damage. Maintain grade stakes set by others unless removal is mutually agreed upon by parties concerned. All damage to utilities resulting from work covered in these specifications will be repaired at the Contractor's expense.

E. Excavation:
When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, adverse soil conditions or obstructions, notify Landscape Architect in writing before planting.

F. Planting Time:
1. Plant or install materials during suitable weather conditions.
2. A dormant season planting is required. (November 1 to March 1)

G. Planting Schedule:
Submit proposed planting schedule to Landscape Architect. Schedule dates for each type of landscape work during contract period.

H. Out-of-Season Planting:
Out-of Season planting shall not be permitted unless approved in writing by Landscape Architect. If an out-of-season planting is anticipated Contractor shall submit in writing the program for out-of season planting including digging schedules, temporary nursery location, maintenance methods and procedures for stored plant material and proposed planting dates. Out-of-season planting program shall be submitted to Landscape Architect no later than November 1 in advance of the dormant digging season.

I. The irrigation system will be installed and operational prior to planting. Coordinate all work with irrigation trade contractor as required. Locate, protect and maintain the irrigation system during planting operations. Repair irrigation system components damaged during planting operations.

1.6 WARRANTY

A. Warrant all trees, shrubs and ground covers against defects including death and unsatisfactory growth in the opinion of the Landscape Architect. Warrant trees shrubs and ground covers for one (1) year from the date of Substantial Completion of the entire project.

B. Replace in accordance with the drawings and specifications, all plants that are dead or, as determined by the Landscape Architect, are in an unhealthy or unsightly condition, and have lost their natural shape due to dead branches, or other causes. The cost of such replacement(s) is at Contractor's expense. Warrant all replacement plants for one (1) year after installation.

C. Warranty shall not include damage or loss of trees, plants, or ground covers caused by fires, floods, freezing rains, lightning storms, or winds over 75 miles per hour, winter kill caused by extreme cold and severe winter conditions not typical of planting area; acts of vandalism or negligence on the part of the Owner.

D. Remove and immediately replace all plants, as determined by the Landscape Architect, to be unsatisfactory during the initial planting installation and one year warranty period.

E. Replacements:
Match adjacent specimens of same species. Replacements are subject to all requirements stated in this specification and subject to inspection by the Landscape Architect.

F. Repair grades, paving and any other damage resulting from replacement planting operations, at no additional cost to the Owner.

G. Inspect job site monthly during warranty period to determine what changes, if any, should be made in the maintenance program. Submit all recommended changes in writing to the Landscape Architect and the Owner. In the absence of monthly written reports from the Contractor it shall be assumed that the Contractor is satisfied with the Owner's maintenance operations and procedures and waives any and all claims for damages against the Owner with respect to the warranty requirements of this specification.

H. Immediately prior to the one year warranty Inspection remove all stakes and guy wires from the plant material unless the plant material has settled out of plumb. If out of plumb, re-plumb material and re-stake/guy the plant material. All new warranty replacement plant material shall be staked and guyed per the contract documents.

I. At the close of the warranty period, one (1) year after Substantial Completion of Trees, Shrubs, and Groundcovers work, notify the Owner and Landscape Architect in writing of the date for warranty inspection. Make any repairs or replacements identified by the Landscape Architect in the Warranty Inspection.

I. Upon satisfactory completion of repairs and/or replacements the Landscape Architect certifies, in writing, the final acceptance of the work.

PART 2 - PRODUCTS

2.1 TOPSOIL

Topsoil: (If required)

New topsoil shall be fertile, friable, natural surface soil of fine to medium textured loamy character. Topsoil should be representative of the dark brown surface soils in the vicinity which produce heavy growth. The topsoil shall be reasonably free from subsoil, objectionable weeds, litter, sod, stiff clay, stones larger than one inch in any dimension, stumps, roots, weeds, toxic substances, or any other material which may be harmful to plant growth or hinder planting operations. Topsoil shall exhibit the following characteristics as evidenced by the soil test report: Water pH 6.5 minimum, phosphorus 9-30 pounds per acre, potassium 45-160 pounds per acre, organic matter 2.5% minimum, soluble salts 0-1060 parts per million. Obtain topsoil only from naturally, well drained sites where topsoil occurs in a depth of not less than four inches. Topsoil shall not be delivered in a frozen or muddy condition. The furnishing of all topsoil needed for planting and soil mix will be considered a subsidiary portion of this specification and covered in the cost of trees, shrubs, and ground covers.

2.2 SOIL AMENDMENTS

A. Fertilizer shall be a mixed commercial fertilizer, of Grade 10-10-10 or as recommended by the Soil Report with guaranteed chemical analysis of contents marked on containers or sacks.

B. Lime:
Ground or pulverized of horticultural grade capable of neutralizing soil acidity and containing not less than 85% of total carbonates. Containers or sacks shall be labeled to show chemical and mechanical analysis.

2.3 PLANTING SOIL MIX

A. Planting soil mix shall be provided amended as per soils test report recommendations. Basic soil mix is as follows:

70% Excavated soil from the planting hole
20% Peat with organic compost
10% Sand
Fertilizer as recommended by the test report
Lime as recommended by the test report

2.4 PLANT MATERIALS

A. General:
1. A complete list of plants including a schedule of sizes, quantities, and other requirements is shown on the drawings. In the event that quantity discrepancies or material omissions occur in the plant materials list, the planting plans shall govern.
2. Specific requirements concerning plant material and the manner in which it is to be supplied are shown on the drawings and plant list.
3. Acclimatization: Plants must have grown under climatic conditions and temperature extremes similar to those of the locality of the project site for a

minimum of two years immediately prior to being planted on the job.

B. Quality and Size:
   1. Plants shall have a habit of growth that is normal for a well maintained sample of the species and shall be sound, healthy, vigorous and free from insect pests, plant diseases, and injuries. Plants to be selected for specific branching habit where a range of habit occurs within a species shall be furnished thickly branched as noted on the plant list. All plants shall equal or exceed the measurements specified in the plant list, which are minimum acceptable sizes. They shall be measured before pruning with branches in normal position. Pruning shall be done at the discretion of or as directed by the Landscape Architect, but in no case shall the plants supplied under this contract be pruned back to such an extent that they no longer meet specifications. Requirements of plants in the plant list generally follow the code of standards currently recommended by the American Association of Nurserymen, Inc., in the American Standard of Nursery Stock.
   2. Collected Plant Material. (Plants which are not nursery grown). **Plant material shall be collected only if specifically authorized in writing by the Landscape Architect**. Any collected plant material which is authorized shall be dug with a ball of earth which has a diameter at least 1/3 greater than that specified for nursery-grown stock and burlapped.
   3. Plants furnished shall be at least the minimum size indicated. Larger stock is acceptable, at no additional cost, and providing that the larger plants will not be cut back to size indicated. Provide plants indicated by two measurements so that only a maximum of 25% are of the minimum size indicated and 75% are of the maximum size indicated.
   4. Specimen Plant Material: Plants labeled "Specimen" in the plant list shall be outstanding plants of the species and shall be of the highest quality possessing all the characteristics shown in the plant materials list.
   5. Furnish plants to match as closely as possible whenever symmetry is called for.
   6. Balled and Burlapped Plants: All plants designated "B &B" on the plant list shall have firm natural balls of soil in sizes as set forth in the "American Standard for Nursery Stock" and shall be: (1) wrapped firmly with burlap or approved material; (2) bound carefully with twine, cord or wire mesh, in a manner so as not to damage the bark, break branches, or destroy natural shape; (3) covered with moist soil, mulch, or other protection from drying if not planted immediately. Cracked or mushroomed balls are not acceptable.
   7. Bare Root Plants: Plants designated "BR" in the list of plants to be furnished shall be dug with substantially all of the root system intact, and with the earth carefully removed from the roots. Cover all roots with a thick coating of mud by puddling, or otherwise protect from drying after they are dug.
   8. Container grown plants in cans or plastic containers will be acceptable in lieu of balled and burlapped plants provided that they are of specified quality. The container must be removed prior to planting, care being exercised as to not injure the plant. <u>All four sides and the bottom of the football shall be cut with a hand or electric saw in order to cut circling roots. Cuts should be made approximately 1 to 2 inches from the sides of the root ball.</u>

C. Trees
   1. Provide trees of height and caliper listed or shown and with branching configuration recommended by ANSI Z60.1 for type and species required. Provide single stem trees except where special forms are shown or listed.
   2. Determining dimensions for trees are caliper, height and spread. Caliper taken 6" above ground for trees up to and including 4" caliper. For Trees over 4"

caliper measure shall be taken 12" above ground. Height and spread dimensions specified refer to the main body of the plant and not from branch tip to tip. Take measurements with branches in normal position.

3. Evergreen trees shall be branched to the ground unless otherwise noted.
4. No pruning wounds shall be present with a diameter of more than 1" and such wounds must show vigorous bark on all edges.

D. Shrubs
1. The measurements for height shall be taken from the ground level to the average height of the top of the plant and not the longest branch. Single stemmed or thin plants will not be accepted.
2. Side branches shall be generous, well-twigged, and the plant as a whole well-bushed to the ground.
3. Plants shall be in a moist, vigorous condition, free from dead wood, bruises, or other root or branch injuries.

E. Ground Cover
Provide good ground cover plants established and well-rooted in removable containers or integral peat pots and with not less than minimum number and length of runners by ANSI Z60.1 for the pot size shown and as listed in plant list.

F. Perennials
1. Provide perennial bulbs, corms and tubers which are fleshy and free of rot and not less than the grade and size recommended by ANSI Z60.1 for the size shown or listed.
2. Provide good perennials in either a dormant condition or actively growing. Actively growing perennials shall be furnished rooted in removable containers or field dug. Field dug perennials shall be in a moist, vigorous condition with no sign of desiccation.

2.5 MISCELLANEOUS LANDSCAPE MATERIALS

A. Burlap for wrapping earth ball to be biodegradable jute mesh not less than 7.2 oz. per square yard.

B. Stakes: screw-in steel anchors in various lengths from 15" to 48" capable of holding from 200 to 6000 pounds as distributed by A.M. Leonard Co. (1-800-543-8955) and Ben Meadows Co. (1-800-241-6401), 2 x 2 or better uniform grade pressure treated pine, or sound new hardwood or redwood free of knot holes and other defects.

C. Guy and Wire Ties: 2-strand, twisted, pliable galvanized steel wire not lighter than # 8 gauge with zinc-coated turnbuckles.

D. Hose: 1/2" diameter black reinforced rubber or plastic garden hose, cut to required lengths to protect tree trunks from damage by wires. Used hose is acceptable.

E. Soil Separator: Rot resistant polypropylene filter fabric, water permeable, and unaffected by freeze-thaw.

F. Drainage Gravel: Clean 3/4" crushed stone.

G. Water transportation is the sole responsibility of the Contractor.

H. Mulch:
   1. Temperature stabilized 6 month old well-rotted shredded native hardwood bark mulch not larger than 4" in length and 1/2" in width, free of woodchips, sawdust recycled wood waste, fine composted or dyed mulches.
   2. Finely shredded pine bark no larger than 1/2" diameter.

I. Anti-Desiccant: Protective film emulsion providing a protective film over plant surfaces; permeable to permit transpiration. Mixed and applied in accordance with manufacturer's instructions.

J. Pre-Emergence Herbicide for general use shall be "Ronstar", "Casaron", or approved equal. Apply at the rates, times and manner recommended by the manufacturer.

K. Guy Cable and Turnbuckles: Stranded steel cable not less than 1/4" diameter with galvanized steel turnbuckles of size and gauge required to provide tensile strength equal to that of cable. Turnbuckle openings shall be 3" minimum. Provide cable clips and accessories as required to complete the guying operations.

PART 3 - EXECUTION

3.1 PREPARATION

A. General
   1. Contractor must examine conditions under which planting is to be installed. Review applicable architectural and engineering drawings, and be familiar with alignment of underground utilities before digging.
   2. Planting Time: Planting operations are to be performed at such times of the year as the job may require, with the stipulation that the Contractor guarantees the plant material as specified herein. Plant only during periods of suitable weather conditions.
   3. Layout individual tree and shrub locations and areas for multiple plantings. Stake locations and outline areas and secure Landscape Architect's acceptance before start of excavation for planting work. Make adjustments as may be requested.
   4. Notify Landscape Architect before planting in writing of adverse sub-surface drainage or soil conditions. State conditions and submit a proposal for correction including costs. Obtain approval for method of correction prior to continuing work in the affected area. In the event that alternate locations are selected, the Contractor will prepare such areas at no additional expense to the Owner.
   5. Planting shall be performed only by experienced workmen familiar with planting procedures under the supervision of a qualified supervisor.

3.2 EXCAVATION

A. Preparation of Tree and Shrub Pits:
   1. Excavate pits with sloped sides 2 -3 times the diameter of the container or root ball and equal to the ball depth, as specified and as shown on the drawings. Mechanical augers and diggers may be used but the sloped sides of the planting hole shall be excavated and scarified with a hand tool to remove glazed surfaces. Before placing the root ball in the hole the Contractor shall ensure that the depth of the hole is the same as or slightly less than the distance between the upper most structural root and the bottom of the root ball. In no case shall the topmost structural root be lower than the adjacent grade. The top

of the root ball does not denote the topmost structural root; in some instances the top of the root ball shall be removed to expose the root flare or top most structural root.

2. Loosen hardpan and moisture barrier to a depth of 2' minimum below the bottom of the tree pit or until hardpan has been broken and moisture is allowed to drain freely. For shrub pits, loosen hardpan 8" minimum below bottom of excavation or until hardpan has been broken and moisture is allowed to drain freely.
3. For container grown stock, excavate as specified for balled and burlapped stock, adjusted to size of container width and depth.
4. Conduct drainage tests.
5. During planting process fill planting pit excavation to final grade using planting soil mix.

B. Test Drainage:

1. Acceptable Drainage Rate
   Minimum acceptable percolation rate for tree pits, shrub pits and shrub/ground cover beds shall be 0.10 inch per hour.
2. Tree and Shrub Pits:
   Fill each pit with water. If percolation is less than 0.10 inch per hour in a 24 hour period, drill a 12" auger to a depth of four feet below the bottom of the pit. Fill auger hole with 3/4" stone and cover with soil separator. Re-test pit. In case drainage is still unsatisfactory, notify Landscape Architect, in writing, of the unsatisfactory condition before planting in such questionable areas. If not, Contractor is fully responsible for warranty of trees.

C. Dispose of excess subsoil removed from landscape excavations.

3.3 PREPARATION OF PLANTING SOIL MIX

A. Before mixing, clean excavated soil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.

B. Mix specified soil amendments and fertilizers with excavated soil at rates specified by the test report. Delay mixing of fertilizer if planting will not follow placing of planting soil within a few days.

C. For pit and bed type backfill, mix planting soil prior to backfilling.

3.4 PLANTING TREES AND SHRUBS

A. Pit Planting: All trees/shrubs shall be set upright and oriented to give the best relationship to adjacent traffic, structures and trees. After putting ¼ of the backfill in the hole, all burlap, twine, rope and wire baskets shall be cut off and removed at least 8-10 inches below the topmost structural root. No burlap shall be pulled out from under balls. If roots are circling or girdling, they shall be cut and removed. Roots shall be spread in their normal position. All broken or frayed roots shall be cut off cleanly. The hole shall be backfilled with the same soil removed from the hole. Soil shall be placed and tamped carefully to avoid injury to roots and to fill voids. When the hole is 2/3 filled, add water as necessary to eliminate air pockets and allow the water to soak in completely. Tamping of the soil shall not occur once the soil has been watered. Fill the hole to finish grade with the remaining excavated soil. No soil shall be placed above the topmost structural root. After the ground settles, additional

soil shall be added into the hole to the level of the structural root as required. Excess soil form the planting operations shall be removed from the site by the Contractor.

B. Bed Planting: Install 8" approved topsoil in all areas to be planted with shrubs, groundcovers, perennials, mass plantings, etc. Set plants in backfill soil mix to such depth that the finished grade level at the plant after settlement will be the same as that at which the plant has grown. They shall be planted upright and faced to give the best appearance or relationship to adjacent structures. No burlap shall be pulled out from under balls. Platforms, wire and surplus binding from top and sides of the balls shall be removed. Plants shall be removed from containers. Roots shall be spread in their normal position. All broken or frayed roots shall be cut off cleanly. Soil shall be placed and compacted carefully to avoid injury to roots and to fill voids. When planting is finished, add water as necessary and allow it to soak away. After the ground settles, additional soil shall be filled into the level of the finished grade.

C. If deciduous trees or shrubs are moved in full leaf, spray with anti-desiccant at nursery before moving and again after planting as per manufacturer's recommendations.

D. Mulching:
Immediately after planting work has been completed, mulch pits, trenches and planting beds. Provide a 2" thickness of hardwood bark mulch at all locations where mulch is required except color beds. Provide not less than 1" of shredded pine bark at all annual and perennial beds. Apply/incorporate pre-emergence herbicide per manufacturer's instructions. Finish edges according to details.
Mulch shall be installed on top of the root system and planting hole and shall not touch the tree/shrub trunk.

E. Water:
Soak all plants immediately after planting; continue watering thereafter as necessary until acceptance of the work in total.

F. Smooth planting areas to conform to specified grades after full settlement has occurred and mulch has been applied.

3.5 STAKING, GUYING AND PRUNING:

A. Stake and guy trees immediately after planting as indicated on the plans or as directed by the Landscape Architect. Plants shall be plumb after staking or guying. Maintain stakes, wires and guys until acceptance of the work in total. Stakes and guys are considered temporary support during the tree settling and establishment period and shall be removed immediately prior to the one year warranty inspection.

B. Staking trees of 1" to 3" caliper.
Drive stakes securely into ground and fasten to tree with wire and tie. Use hose around wire so wire is not in contact with plant. Adhere to staking details unless alternate detail has been approved by Landscape Architect prior to beginning of planting operation.

C. Staking trees of 1" and under or 4' height:
Use single stake with rubber hose and wire loop around trunk.

D. Guy deciduous trees over 3" to 5" caliper and evergreen trees 4'-8' all as described and detailed. Position guys around trunk at approximately two-fifths the height of the

tree. Anchor guys in ground either to steel rods driven securely into ground with top end 3" below finish grade or steel anchors securely screwed into ground with top end at or below finished grade. Use hose around wire to prevent wire from coming in contact with tree. Flag all guy wires as required.

E. Guy deciduous trees over 5" caliper and evergreen trees over 8' tall as described and detailed. Install 3 screw anchors minimum equally spaced around the tree at approximately two-fifths the height of the tree. Securely anchor cable to screw anchors. Use hose around cable so cable is not in contact with plant. Secure cable around tree trunk. Securely attach ends of cable to turnbuckle so that cable is taut before adjusting turnbuckle. Flag all guy cables as required.

F. Pruning:
Unless otherwise directed by the Landscape Architect do not cut tree leaders, and remove only injured or dead branches from trees, if any. Prune shrubs at the direction of the Landscape Architect.

G. Remove and replace promptly any plants pruned or malformed resulting from improper pruning.

H. Paint wounds and cuts over 3/4" in diameter with approved tree paint designed for this purpose.

3.6 MAINTENANCE:

A. Begin maintenance immediately after planting.

B. Maintain trees, shrubs and other plants until Substantial Completion of the entire project and for not less than 60 days after Substantial Completion of the entire project.

C. Maintain trees, shrubs and other plants by watering, pruning, cultivating, weeding, and re-mulching as required for healthy growth. Tighten and repair stake and guy supports and reset trees and shrubs to proper grades or vertical position as required. Spray as required to keep trees and shrubs free of insects and disease.

3.7 CLEAN UP AND PROTECTION:

A. During landscape work, keep pavements clean and work area in an orderly condition.

B. Upon completion of work, clear grounds of debris, superfluous materials and all equipment. Remove from site to satisfaction of Landscape Architect.

C. Protect landscape work and materials from damage due to landscape operations, operations by other contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged landscape work as directed, at no additional cost to Owner.

3.8 SUBSTANTIAL COMPLETION AND FINAL COMPLETION

A. Upon completion of work, notify Landscape Architect at least ten (10) days prior to requested date of inspection for Substantial Completion. Contractor shall prepare a list of incomplete work and submit the list with the request for inspection. Remove rejected plants and materials from project site prior to inspection.

B. Landscape Architect will review the work and document incomplete or incorrect work in an inspection report or list. If Trees, Shrubs, and Groundcovers work is found to be substantially complete a Certificate of Substantial Completion will be issued that establishes a date of substantial completion. The list of incomplete or incorrect work will be attached to the Certificate.

C. Complete or correct Trees Shrubs and Groundcovers work identified on the list within the number of days established in the Certificate of Substantial Completion.

D. Upon satisfactory completion of repairs and/or replacements, the Landscape Architect certifies, in writing, the Final Completion of the work.

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SECTION 33 72 00/TS-20 – STORM SEWERS AND PIPE CULVERTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work shall consist of the placing of precast concrete pipe, structural plate pipe and pipe arches, and all fittings as called for in the Plans and in accordance with the Specification including trench excavation, bedding, and backfill.

PART 2 - MATERIALS

2.1 PIPE MATERIALS

A. Reinforced concrete pipe shall conform to AASHTO M 170 for the specified diameters and strength classes. Horizontal and vertical elliptical pipe shall conform to AASHTO M207. Precast end sections shall conform to the above specifications to the extent to which they apply. The pipe shall have tongue and groove joints for mortar joints, or bell and spigot joints suitable for the use of a rubber gasket to be provided as a part of this item.

B. Corrugated metal pipe, pipe arches, and their coupling bands shall conform to AASHTO M 36 for the specified sectional dimensions and gauges. Special sections such as elbows and end sections shall be the same gauge as the pipe and conform to the applicable requirements of AASHTO M 36. All pipes and pipe arches shall be bituminous coated as specified on the Plans and conforming to AASHTO M 190 Specifications.

C. Structural Plate for pipe, pipe arches, arches and their accessories shall conform to the requirements of AASHTO M 167.

D. Each pipe shall be clearly marked to show its class or gauge, date of manufacture, name of manufacturer, and mark of approval by an approved commercial testing laboratory prior to delivery. All costs of inspection are to be included in the cost of furnishing and installing the pipe.

E. All pipe and special fittings shall be new materials which have not been previously used and free of any defects or damage.

F. Pipe sizes, class or gauge, and type of bituminous coating will be shown on the Plans. Size of the pipe is nominal inside diameter.

2.2 JOINT MATERIAL

A. Pipe joint mortar shall consist of one-part Portland Cement and 1 parts sand with water necessary to obtain the required consistency. The materials used shall meet the requirements for these items as specified in the Standards Specifications for Concrete Structures.

B. Rubber Gaskets for concrete pipe shall be O-ring rubber gaskets joints conforming to the requirements of AASHTO M 198 or an approved equal.

C. Joints for corrugated metal pipe, pipe arches and fittings shall be coupling bands that have galvanized steel angles riveted near the end and bolts through the angles to draw the bands tight.

2.3 BEDDING MATERIAL

A. Bedding Material shall consist of well-graded crushed stone or crushed gravel meeting the requirements of TDOTSS, January 1, 2015, Section 903, Grading Size No. 57 or No. 67.

2.4 BACKFILL MATERIALS

A. Backfill Material for pipe in the roadway or less than 5 feet from the outside edge of the roadway shall be of quality and gradation as specified in Section 5, Subsection 2-a of these Specifications. Also, this backfill shall be compacted to 100% of the standard Proctor Density at 2% less than the optimum moisture content as determined by AASHTO T99, Method D. In addition, all backfill material for pipe more than 5 feet from the outside edge of the roadway shall be fine compactable soil free of sod, brush, roots, and other perishable material and stones having a maximum dimension of more than six (6) inches. Also, this material shall be compacted in layers of not more than six inches to 95% of the Standard Proctor Density at the optimum moisture content as determined by AASHTO T99, Method D.

PART 3 - EQUIPMENT

3.1 SUMMARY

A. The Contractor shall provide all equipment necessary and required for the construction of storm sewers and culverts, and have all equipment on the project in proper working condition before construction will be permitted to begin.

B. The Contractor shall provide hoisting equipment to handle the pipe in unloading and placing in its final position, without damage to the pipe.

C. The Contractor shall provide mechanical tampers of a design or designs approved by the Engineer.

3.2 CONSTRUCTION REQUIREMENTS

A. Excavation (unclassified) shall consist of the removal of all materials necessary for the construction of storm sewers, culvert pipes, other pipe lines and all drainage structures such as manholes, catch basins, junction boxes, head walls, wing walls and concrete collars.

B. Excavation shall be made in open cuts unless shown otherwise on the Plans. Excavation shall be made to the lines and grades shown on the Plans or established by the Engineer.
   1. The width of trenches shall be sufficient to permit satisfactory jointing of the pipe, but shall not exceed the width where specified for Class “A” Bedding and permit thorough tamping around the pipe. The bottom of the trenches shall be carefully cut to the required grade of the pipe except where bedding material or cradles are shown; in which case the excavation shall extend to the bottom of the bedding or cradles as shown on the plans. Excavation around manholes, catch

basins, junction boxes, and end walls shall be such as to allow proper compaction around the structure.

2. Any unsatisfactory material shall be excavated below the grades shown on the Plans as directed by the Engineer and backfilled with bedding material or other approved material and compacted.
3. Any excavation below the elevations shown on the Plans other than unsuitable material as designated by the Engineer shall be filled at the Contractor's expense with properly compacted bedding material or concrete.
4. Pipe trenches shall not be excavated more than 400 feet in advance of pipe laying and all work shall be performed to cause the lease possible inconvenience to the public. Adequate temporary bridges or crossing shall be constructed and maintained where required to permit uninterrupted vehicular and pedestrian traffic.
5. In all cases where materials are deposited along open trenches, they shall be placed so that no damage will result to the work and/or adjacent property in case of rain or other surface wash.
6. Rock and/or boulders not classified as rock excavation shall be removed to the limits of excavation and grades shown on the plans. The spaces created outside the excavation limits by such removal shall be backfilled with suitable material and compacted to the proper lines and grades.

C. Rock Excavation

1. Rock excavation when specifically provided for in the Contract Documents and Plans shall be performed and paid for as set forth in Section 4 of the Standard Specifications for Sewer and Pipe Excavation.

D. Laying and Bedding Pipe

1. Pipe shall be laid true to line and grade on a bed which is uniformly firm throughout its entire length. If material in the bottom of the excavation is of such character as to cause unequal settlement along the length of the storm sewer or culvert, the material shall be removed below the grade given, to such depth as ordered and shall be backfilled with bedding material and thoroughly tamped or otherwise compacted to insure an unyielding foundation.
2. Pipes shall be laid only on a foundation which is practically free of water.
3. Pipes shall be laid beginning at the downstream end of the pipe line. The lower segment of the pipe shall be in contact with the shaped bedding throughout its full length.
4. Concrete pipe shall be laid with the hubs or receiving ends upgrade. The spigot or tongue end shall be inserted into the receiving end as far as the pipe will permit. Circumferential laps of corrugated metal pipe shall be placed facing upstream and any longitudinal seams at the sides.
5. Concrete pipe joints shall be made with Portland cement mortar, rubber gaskets, or other joints recommended by the pipe manufacturer and approved by the Engineer.
6. When mortar joints are used the pipe ends shall be thoroughly cleaned and wetted before the joint is made. Stiff mortar shall then be placed so as to completely fill and seal the joint. The inner surface shall be finished smooth and any surplus material removed. The completed joint shall be protected against rapid drying by suitable covering material.
7. Rubber ring gaskets shall be installed so as to form a flexible watertight seal.
8. Other type joints that are permitted shall be installed according to manufacturer's specifications.

9. Each section or joint of corrugated metal pipe shall be securely attached to the adjoining section or joint of pipe with connecting bands or other approved type of joint and drawn or connected as to form a rigid joint.
10. Any breaks in the bitumen or treatment of bituminous coated pipe shall be refilled with the type and kind of bitumen used in coating the pipe originally.
11. The ends of pipe shall be rigidly supported to prevent any movement pending and during the construction of end supports.
12. Any pipe which is not in true alignment or which shows any settlement after laying or is damaged shall be taken up and re-laid at the Contractor's expense.

E. Bedding and Backfilling
1. The bed for the pipe shall be shaped as specified for Class B in the City of Knoxville Standard Drawing for Storm Pipe Bedding and Backfilling. If bell and spigot pipe is used, the area under the bell shall be excavated so that the barrel supports the entire weight of the pipe.
2. Bedding material shall be Mineral Aggregate Base, Section 5, No. 57 or No. 67 stone and the cost of furnishing and placing the bedding material shall be included in the bid price per linear foot.
3. After the pipe has been laid to line and grade and properly bedded, the backfill material shall be placed and where required compacted by means of a vibrator or mechanical tamper. Tamping by hand will not be permitted. The trench shall be filled in 6-inch lifts and each lift shall be compacted with mechanical tampers. Compaction shall be 100% of the Standard Proctor Density at 2% less than the optimum moisture content as determined by AASHTO T99, Method D.
4. Backfill of pipes, sewers and culverts under streets (or less than 5 feet from the outside edge of the roadway), curbs, gutters and sidewalks shall be accomplished with Mineral Aggregate Base Material meeting the requirements of Section 5 of these Specifications and compacted as herein above specified. The cost of the backfill is not a separate pay item and shall be included in the bid price per linear foot.
5. The bedding for pipe must be laid in a dry trench. Removal of water encountered in ditches, springs, etc. shall be considered a necessary part of construction and shall be handled by pumping, ditching or any other method satisfactory to the Engineer.

F. Existing Utilities
1. All existing sewers, water lines, gas lines, underground conduits, telephone lines, electric lines, or other utilities or structures in the vicinity of the work shall be carefully protected by the Contractor from damage at all times.

END OF SECTION 33 72 00/TS-20

SECTION 33 72 10/TS-22 – MANHOLES, CATCHBASINS, INLETS, AND JUNCTION BOXES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This work shall consist of constructing the following drainage structures: manholes, catch basins, inlets, and junction boxes. Construction shall be in conformity to the lines, grades, dimensions, and sizes shown on the Plans or as directed by the Engineer.

B. The height or depth of these drainage structures will vary with location, but unless otherwise shown on the plans, shall be such that the frames will match the grades and lines of the roadway surface and the invert will be at designed elevations.

C. Cast iron frames, grates, and covers shall be provided as specified on the Plans.

D. Connections to pipes and other existing structures as may be necessary as a required part of the construction.

PART 2 - MATERIALS

2.1 MATERIALS

A. Concrete, cement, sand, and water shall conform to the applicable requirements of the Standard Specifications, Section 15.0, Concrete Structures. Concrete shall be Class A.

B. Brick shall conform to AASHTO Designation M 91 Grade SM.

C. Frames, covers, and grates shall be the type specified on the drawings. The castings shall conform to AASHTO Designation M 105, Class 30 (ASTM A 48, Class 30). All castings shall be true to pattern, to form and dimension, free from any faults or cracks, and cleaned of sand in a manner to provide a clean uniform surface. Bearing surfaces between frames and grates shall be machined to provide uniform bearing. Castings shall be treated with two coats of bituminous paint. All castings shall weigh at least 95% of the theoretical weight shown on the drawings. All castings shall have the date of manufacture cast into each unit.

D. Round precast concrete structures shall conform to ASTM C 478. Square and rectangular precast concrete structures shall conform to ASTM C 913 for wall thickness, slab thickness, concrete strength and steel reinforcement requirements.

E. Prior to delivery all basic materials specified herein shall be tested and inspected by an approved independent commercial testing laboratory or, if approved by the Engineer, certified copies of test reports prepared by the manufacturer's testing laboratory will be acceptable. All materials which fail to conform to these Specifications shall be rejected. After delivery to the site, any materials which have been damaged in transit or are otherwise unsuitable for use in the work shall be rejected and removed from the site.

PART 3 - CONSTRUCTION

3.1 CONSTRUCTION REQUIREMENTS

A. General:

1. Manholes, inlets, catch basins, and junction boxes shall conform to the Standard Detail Drawings and Specifications. Deviations from these drawings may be approved by submitting a detailed drawing to the Engineer before construction begins. When poured concrete is to be used instead of brick, a minimum wall thickness of 8 inches for unreinforced concrete and 6 inches for reinforced concrete must be used on the detailed drawing submitted.

2. Structural excavation and backfill shall be done in accordance with the Standard Specifications for Grading.

3. After the foundation has been prepared, the bottom shall be constructed to the required lines and grades. After the bottom has been allowed to set for at least 24 hours, the structure shall be constructed with care being exercised to form the incoming and outgoing sewer pipes into the walls of the structure at the required elevations. Pipe shall be placed in the wall and beyond the outside surface of the walls to allow for connections, the end of the pipe being placed flush with the inside face of the wall. Masonry shall be carefully constructed around the pipe so there will be no leakage around the outer surface. Inverts shall be constructed as shown on the drawings, and be smooth and accurately shaped to the same cross section as the invert of the sewer pipes which they connect.

4. Cast iron frames shall be set in cement mortar beds accurately to line, finished elevation, slope, and crown so that subsequent adjustments will not be necessary.

5. After the masonry and frames have time to set, but in no case less than 24 hours, the space around the drainage structure shall be backfilled and compacted to the required grade. The interior shall be cleaned of debris and excess material, the grating or cover placed, and all unused material, equipment, tools, and debris removed from the area.

B. Precast Reinforced Concrete Manholes

1. Precast sections shall consist of reinforced concrete sections manufactured, tested, and marked in accordance with the provisions of AASHTO Designation M 199(ASTM C 478).
2. Each section of the precast manhole shall have not more than three holes for the purpose of handling and laying. These holes shall be tapered and shall be plugged with stoppers or mortar after installation.

C. Drop Manholes

1. Where the difference in the invert elevation of a sewer 18 inches in diameter or smaller and any other sewer intersecting in one manhole is 3 feet or more, a drop manhole shall be constructed as shown on the plans. They shall be similar in construction to the standard manhole except that a drop connection of pipe and fittings of the proper size and material shall

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