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VOLUME 1 OF 1

TECHNICAL SPECIFICATIONS

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FOR

LYNWOOD PARK

PROJECT MANUAL:

CITY OF BROOKHAVEN, GEORGIA

PROJECT #15088.00
BID #21-115

PREPARED BY:

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SECTION 000110 - TABLE OF CONTENTS

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

DIVISION 01 - GENERAL REQUIREMENTS

DIVISION 02 - EXISTING CONDITIONS

DIVISION 03 – CONCRETE

DIVISION 04 – MASONRY

DIVISION 05 – METALS

DIVISION 10 – SPECIALTIES

DIVISION 11 – EQUIPMENT

DIVISION 12 – FURNISHINGS

DIVISION 13 – SPECIAL CONSTRUCTION

DIVISION 22 – PLUMBING

DIVISION 23 – HEATING VENTILATING AND AIR CONDITIONING

SECTION 26 – ELECTRICAL

END OF SECTION 000110

SECTION 000115 – LIST OF DRAWINGS

GENERAL

C000	COVER SHEET
C001	EXISTING CONDITIONS

CIVIL

C100	CONSTRUCTION ITEMS
C101	POOL CONSTRUCTION ITEMS
C200	DEMOLITION PLAN
C300	LAYOUT KEY PLAN
C301	LAYOUT PLAN – AREA A
C302	LAYOUT PLAN – AREA B
C303	LAYOUT PLAN – AREA C
C304	LAYOUT PLAN – AREA D
C305	LAYOUT PLAN – AREA E
C306	LAYOUT COORDINATE POINTS
C400	SITE DETAILS: PAVING DETAILS
C401	SITE DETAILS: PARKING DETAILS
C402	SITE DETAILS: SITE DETAILS
C403	SITE DETAILS: FENCE DETAILS
C404	SITE DETAILS: DUMPSTER ENCLOSURE DETAILS
C405	SITE DETAILS: SITE FURNISHING DETAILS
C406	SITE DETAILS: PARK SIGNAGE DETAILS
C407	SITE DETAILS: PAVILION DETIALS
C408	SITE DETAILS: PAVILION DETAILS
C409	SITE DETAILS: STAIR AND WALL DETAILS
C500	GRADING AND DRAINAGE PLAN
C501	ARTIFICIAL TURF SUBDRAIN SYSTEM
C502	STORM CHAMBER DETAILS 1
C503	STORM CHAMBER DETAILS 2
C504	STORM SYSTEM DETAILS
C600	UTILITY PLANS
C601	UTILITY DETAILS
C700	EROSION CONTROL NOTES
C701	EROSION CONTROL NOTES
C702	EROSION CONTROL NOTES
C703	EROSION CONTROL PLAN – INITIAL PHASE
C704	EROSION CONTROL PLAN – INTERMEDIATE PHASE
C705	EROSION CONTROL PLAN – FINAL PHASE
C706	EROSION CONTROL DETAILS
C707	EROSION CONTROL DETAILS
C708	EROSION CONTROL DETAILS
C800	STORM SEWER PROFILES
C801	STORM SEWER PROFILES
C802	STORM SEWER PROFILES
C803	SANITARY SEWER PROFILES
C804	SANITARY SEWER PROFILES

LANDSCAPE AND IRRIGATION

L100	LANDSCAPING KEY PLAN
L101	LANDSCAPE PLAN – AREA A
L102	LANDSCAPE PLAN – AREA B
L103	LANDSCAPE PLAN – AREA C
L200	LANDSCAPE PLANT LIST AND DETAILS
L300	TREE INVENTORY AND PROTECTION PLAN
L301	TREE REPLACEMENT PLAN
I100	IRRIGATION KEY PLAN
I101	IRRIGATION PLAN- AREA A
I102	IRRIGATION PLAN- AREA B
I103	IRRIGATION PLAN- AREA C
I200	IRRIGATION SLEEVING PLAN
I300	IRRIGATION DETAILS

SITE ELECTRICAL

SE001	SYMBOL LIST & LIGHTING FIXTURE SCHEDULE
SE002	SITE LIGHTING INSTALLATION DETAILS
SE003	POWER SITE PLAN
SE004	SITE POWER EQUIPMENT MOUNTING DETAILS

AQUATIC FEATURES

SP001	AQUATIC COVER SHEET
SP002	AQUATIC SITE PLAN
SP003	CUT SHEETS
SP004	CUT SHEETS
SP005	CUT SHEETS
SP101	POOL KEYNOTE
SP102	SPLASH PAD KEYNOTE
SP103	SPLASH PAD ELEVATIONS
SP111	POOL PLUMBING
SP112	SPLASH PAD PLUMBING
SP202	DECK DRAINAGE PLAN
SP301	SECTIONS
SP501	POOL DETAILS
SP502	POOL DETAILS
SP503	POOL DETAILS
SP510	SPLASH PAD DETAILS
SP511	SPLASH PAD DETAILS
SP512	SPLASH PAD DETAILS
SP901	EQUIPMENT ROOM KEYNOTE

ARCHITECTURAL

A001	UL DETAILS
A002	UL DETAILS
A003	UL DETAILS
A100	LIFE SAFETY PAN, CODE REVIEW, AND GENERAL NOTES
A200	FLOOR PLAN
A202	ROOF PLAN
A300	BUILDING ELEVATIONS
A301	BUILDING ELEVATIONS
A400	BUILDING SECTIONS

A401	BUILDING SECTIONS
A500	WALL SECTIONS AND DETAILS
A501	WALL SECTIONS AND DETAILS
A502	SECTIONS AND DETAILS
A600	REFLECTED CEILING PLAN
A700	ENLARGED RESTROOM PLAN AND ELEVATIONS
A701	ENLARGED FLOOR PLANS, ELEVATIONS, AND INTEIOR ELEVATIONS
A800	CASEWORK DETAILS
A900	DOOR PANELS, FRAME TYPES, AND SCHEDULES
A901	WINDOW DETAILS

MECHANICAL

M101	HVAC DETAILS AND SCHEDULES
M201	FLOOR PLAN – HVAC

PLUMBING

P101	PLUMBING DETAILS AND SCHEDULE
P102	SANITARY PIPIG RISER DIAGRAM
P201	FLOOR PLAN – SANITARY PIPING
P202	FLOOR PLAN – WATER PIPING

ELECTRICAL

E001	SYMBOL LIST & LIGHTING FIXTURE SCHDULE
E002	ELECTRICAL INSTALLATION DETAILS
E201	LIGHTING FLOOR PLAN POOL HOUSE
E301	POWER FLOOR PLAN POOL HOUSE
E401	HVAC EQUIPMENT CONNECTIONS
E501	ELECTRICAL RISER DIAGRAM & DETAILS
E502	ELECTRICAL PANELBOARD SCHEDULES

STRUCTURAL

S200	FOUNDATION PLAN
S201	ROOF FRAMING PLANS AND WALL ELEVATIONS
S202	ROOF FRAMING PLANS
S400	SECTIONS AND DETAILS
S401	SECTIONS
S402	SECTIONS
S403	WALL ELEVATIONS
S800	STRUCTURAL NOTES
S801	TYPICAL DETAILS

OTHER

G100	GIS SITE PLAN AND ADDRESSING CHART

END OF SECTION 000115

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
1. Project information.
2. Definitions
3. Work covered by Contract Documents.
4. Access to site.
5. Work restrictions.
6. Coordination with occupants.
7. Work by Owner.
8. Owner-furnished products.
9. Specification and drawing conventions.

B. Related Sections:
1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 PROJECT INFORMATION

A. Project Identification: Lynwood Park.

B. Project Location: 3360 Osborne Road NE, Brookhaven, Georgia 30319.

C. Owner: City of Brookhaven.
1. Owner's Representative: Lee Cory, P.E. (Project Manager).

D. Landscape Architect: CPL, 3011 Sutton Gate Drive, Suite 130, Suwanee, Georgia 30024.
1. Contact Person: Bryon G. McCarley, RLA (Landscape Architect).
2. Telephone Number: (800) 274-9000.

E. Landscape Architect's Consultants: The Landscape Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:
1. Irrigation Design: Bob Scott, FASIC/PIC, CLIA, Irrigation Consultant Services, Inc., 2129 Greensboro Road, Madison Georgia 30650, (770) 929-0884.
2. Electrical Engineer: Jeff Lacey, P.E., 4420 Sirrocco Lane SW, Lilburn, Georgia 30047, (770) 265-3006.
3. Aquatic Designer: Brad Morgan, Aqua Design International, 7534 North La Cholla Blvd., Tucson, Arizona 85741, (520) 219-8929.
4. Mechanical & Plumbing: Martin George, P.E., George Engineering Associates, LLC, 405 Millard Farmer Road, Newnan, Georgia 30263, (770) 252-4669.

F. Program / Project Manager: Lee Croy, P.E., (678) 579-9846
1. Program / Project Manager has been engaged for this Project to serve as an advisor to Owner and to provide assistance in administering the Contract for Construction between Owner and each Contractor, according to a separate contract between Owner and Construction Manager.

1.3 DEFINITIONS

A. Work Package: A group of specifications, drawings, and schedules prepared by the design team to describe a portion of the Project Work for pricing, permitting, and construction.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of the Project is defined by the Contract Documents and includes, but is not limited to the following:

1. Coordinate with Coordinate with the City to pick up the LDP and schedule required pre-construction meeting.
2. Install and maintain erosion control measures and tree save fence per the plans.
3. Obtain all permits required for demolition work.
4. Demolish pool, pool house, concrete pool deck, fencing, parking lot, pavilion, retaining wall, concrete stairway, railing, concrete walkways, designated trees, concrete flume, concrete ramps with railing, asphalt park access road, a portion of Mendell Circle, curb and gutter, site furnishings, bollards, signs, irrigation system, concrete driveway, concrete sidewalks, select drainage pipes, and select utilities per the plans.
5. Install underground stormwater detention system.
6. Install storm drainage pipes, catch basin, rip rap and headwalls.
7. Grade the site per the plans.
8. Construct retaining walls per the plans.
9. Design segmented retaining walls with Georgia PE stamp and acquire the required building permit from the City. Build segmented retaining walls once permit is issued.
10. Construct extension of Mendell Circle per the plans.
11. Construct sidewalks and driveway connections along Mendell Circle per the plans.
12. Construct new parking area off of Mendell Circle per the plans.
13. Construct new access road off of Osborne Road per the plans.
14. Construct main parking lot, sidewalks, and dumpster enclosure per the plans.
15. Construct concrete stairways with railing per the plans.
16. Form and pour new sidewalks near tennis courts per the plans.
17. Install new fencing near tennis courts per the plans.
18. Install drinking fountain per the plans.
19. Construct pool house, splash pad, pool, pool decking, and fencing.
20. Erect pavilions with concrete slabs per the plans.
21. Install lighting per the plans.
22. Install artificial turf with surrounding fence and sidewalk per the plans.
23. Install bike rack with concrete pad per the plans.
24. Install site furnishings per the plans.
25. Install utilities per the plans.

B. Type of Contract:

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

1.5 ACCESS TO SITE

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

B. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

C. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Limits: Confine construction operations to the Limits of Disturbance indicated in the Drawings.

2. Driveways, Walkways, and Entrances: Keep roads, driveways, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

   a. Schedule deliveries to minimize use of Osborne Road NE and Mendell Circle NE by construction operations.
   b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

1.6 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.
   1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

B. On-Site Work Hours: Limit work in the existing building to normal business working hours as specified in the City's General Conditions contract.
   1. Weekend Hours: No work may occur on Saturday or Sunday without prior written approval by the City and/or Project Manager.

C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
   1. Notify Landscape Architect and Project Manager not less than two days in advance of proposed utility interruptions.
   2. Obtain Project Manager's written permission before proceeding with utility interruptions.

D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.
   1. Notify Landscape Architect and Project Manager not less than two days in advance of proposed utility interruptions.
   2. Obtain Project Manager's written permission before proceeding with utility interruptions.

1.7 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.
   1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
   2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

1.8 WORK PERFORMED BY THE OWNER

A. General: Cooperate fully with Owner so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Owner. Coordinate the Work of this Contract with work performed by Owner.
   1. Preceding Work: Owner will perform the following construction operations at Project site. Those operations are scheduled to be substantially complete before work under this Contract begins.

a. After the subgrade and drainage system is installed, the Owner may contract with a specialized installer for the artificial turf field.

1.9 OWNER-FURNISHED/CONTRACTOR-INSTALLED (OFCI) PRODUCTS

A. Owner's Responsibilities: Owner will furnish products indicated and perform the following, as applicable:

1. Provide for delivery of Owner-furnished products to Project site.
2. Upon delivery, inspect, with Contractor present, delivered items.

   a. If Owner-furnished products are damaged, defective, or missing, arrange for replacement.

3. Obtain manufacturer's inspections, service, and warranties.
4. Inform Contractor of earliest available delivery date for Owner-furnished products.

B. Contractor's Responsibilities: The Work includes the following, as applicable:

1. Designate delivery dates of Owner-furnished products in Contractor's construction schedule, utilizing Owner-furnished earliest available delivery dates.
2. Review Owner-reviewed Product Data, Shop Drawings, and Samples, noting discrepancies and other issues in providing for Owner-furnished products in the Work.
3. Receive, unload, handle, store, protect, and install Owner-furnished products.
4. Make building services connections for Owner-furnished products.
5. Protect Owner-furnished products from damage during storage, handling, and installation and prior to Substantial Completion.
6. Repair or replace Owner-furnished products damaged following receipt.

C. Owner-Furnished/Contractor-Installed (OFCI) Products:

1. Safe (A701-Ticket Office, Room 102) – Salvaged from demolished pool house.

2. Chairs (A701-Ticket Office, Room 102).

3. Beverage Cases (A701-Concessions, Room 101).

4. Chair (A701-Concessions, Room 101).

5. Table and Chairs (A701-Lifeguard Room, Room 104).

6. Refrigerator (A701-Lifeguard Room, Room 104).

7. Ice Machine (A701-Lifeguard Room, Room 104).

8. Soap Dispensers (A701 & A700-Item I)

All other furniture and equipment not listed above is to be provided by the Contractor as part of the base bid.

1.10 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
3. Drawing Coordination: Requirements for materials and products identified on the Drawings are described in detail in the Specifications. One or more of the following are used on the Drawings to identify materials and products:

B. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
1. Abbreviations: Materials and products are identified by abbreviations and scheduled on Drawings.
2. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION 011000

SECTION 012200 - UNIT PRICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for unit prices.

B. Related Sections:
1. Division 01 Section "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
2. Division 01 Section "Allowances" for procedures in using Unit Prices with Allowances

1.2 DEFINITIONS

A. Unit price is a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.3 PROCEDURES

A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.

B. Measurement and Payment: Refer to individual Specification Sections indicated in the "Schedule of Unit Prices" for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.

D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the schedule contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. SITE WORK

1. Unit Price No.SC-1: Mass Rock excavation and replacement with satisfactory soil material.

a. Description: Classified rock excavation and disposal off site and replacement with satisfactory fill material or engineered fill from off site, as required, in accordance with Division 31 Section "Earth Moving."

b. Unit of Measurement: Cubic yard of rock excavated, based upon survey of volume removed.

~~c.~~ **Quantity Allowance: 100 CY**

2. Unit Price No.SC-2: Trench Rock excavation and replacement with satisfactory soil material.

a. Description: Classified trench rock excavation and disposal off site and replacement with satisfactory fill material or engineered fill from off site, as required, in accordance with Division 31 Section "Earth Moving."
b. Unit of Measurement: Cubic yard of rock excavated, based upon survey of volume removed.
c. **Quantity Allowance: 100 CY**

3. Unit Price No SC-3: Removal of unsatisfactory soil and replacement with satisfactory soil material.
a. Description: Unsatisfactory soil excavation and disposal off site and replacement with satisfactory fill material or engineered fill from off site, as required, in accordance with Division 31 Section "Earth Moving."
b. Unit of Measurement: Cubic yard of soil excavated, based upon survey of volume removed.
c. **Quantity Allowance: 1000 CY**

4. Unit Price No SC-4: Removal of unsatisfactory soil and replacement with 57-stone or surge stone as directed.
a. Description: Unsatisfactory soil excavation and disposal off site and replacement with 57-stone or surge stone as directed, as required, in accordance with Division 31 Section "Earth Moving."
b. Unit of Measurement: Cubic yard of soil excavated, based upon survey of volume removed.
c. **Quantity Allowance: 800 CY**

5. **Unit Price No SC-5: Removal of unsatisfactory soil and replacement with 57-stone aggregate piers.** See recommendations in attached soils reports.
a. Description: Unsatisfactory soil excavation and disposal off site and replacement with 57-stone aggregate piers as directed, in accordance with included soils reports.
b. Unit of Measurement: Cubic yard of soil excavated, based upon survey of volume removed.
c. **Quantity Allowance: 500 CY**

6. Unit Price No SC-6: SOD
a. Description: Supply and install additional SOD beyond that shown on the plans and included in the base bid plan quantity. Sod to meet all required specifications and be installed per project plans and specs.
b. Unit of Measurement: Square yard of sod installed base upon field measurements.
c. **Quantity Allowance: 1,000 Square Feet**

7. Unit Price No SC-7: Silt fence
a. Description: Supply and install additional silt fence beyond that shown on the plans and included in the base bid plan quantity. Silt fence to meet all required specifications and installed and maintained per project plans and specs.
b. Unit of Measurement: Linear feet of fence installed base upon field measurements.
c. **Quantity Allowance: 200 Linear feet**

8. Unit Price No SC-8: Tree save fence
a. Description: Supply and install additional tree save fence beyond that shown on the plans and included in the base bid plan quantity. Tree save fence to meet all required specifications and installed and maintained per project plans and specs.
b. Unit of Measurement: Linear feet of fence installed base upon field measurements.

c. **Quantity Allowance: 200 linear feet**

9. **Alternate Unit Price No SC-9: Unsatisfactory soil: Modification**
   a. Description: Excavation, modification, and placement of unsatisfactory soil as directed, in accordance with included soils reports.
   b. Unit of Measurement: Cubic yard of soil excavated, based upon survey of volume removed.
   c. **Quantity Allowance: 4,000 cubic yards**

10. **Alternate Unit Price No SC-10: Unsatisfactory soil: Modification material**
   a. Description: Material, cement/calciment, as required for Alternate Unit Price 9: Unsatisfactory soil: Modification as directed, in accordance with included soils reports.
   b. Unit of Measurement: Tonnage of material required for cubic yard of soil excavated, based upon survey of volume removed.
   c. **Quantity Allowance: 250 tons**

11. **Alternate Unit Price No SC-11: Sports Field Sod and Topsoil**
   a. Description: Place topsoil at 6” deep with specified sod over area of multiuse sports field. Sod to meet all required specifications and be installed per project plans and specs.
   b. Unit of Measurement: Tonnage of material required for cubic yard of soil excavated, based upon survey of volume removed.
   c. **Quantity Allowance: 56,000 square feet**

12. **Alternate Unit Price No SC-12: Sports Field Irrigation**
   a. Description: Design/build of irrigation system for Alternate Unit Price No SC-11: Sports field Sod and Topsoil. System to meet all required specifications and be installed per project plans and specs.
   b. Unit of Measurement: Lump sum.
   c. **Quantity Allowance: 1**

END OF SECTION 012200

SECTION 012500 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 GENERAL

A. Should the Contractor desire to substitute other articles, materials, apparatus, products or processes than those specified or approved as equal, the Contractor shall apply to the Landscape Architect in writing for approval of such substitution. It should be noted that the bid shall not be based on a substituted article, material, apparatus, product or process. With the application shall be furnished such information as required by the Landscape Architect to demonstrate that the article, material, apparatus, product or process he wishes to use is the equivalent of that specified in quality, finish, design, efficiency, and durability and has been elsewhere demonstrated to be equally serviceable for the purpose for which it is intended. The Contractor shall set forth the reasons for desiring to make the substitution and shall further state what difference, if any, will be made in the construction schedule and the contract price for such substitution should it be accepted; it being the intent hereunder that any savings shall accrue to the benefit of the Owner.

B. The Landscape Architect shall reject any such desired substitution as not being specifically named in the contract, or if he shall determine that the adjustment in price in favor of the Owner is insufficient, the Contractor shall immediately proceed to furnish the designated article, material, apparatus, product, or process.

C. Request for substitutes shall conform to the requirements of this Article.

D. Requests for substitutions shall, include full information concerning differences in cost, and any savings in cost resulting from such substitutions shall be passed on to the Owner.

E. Requests for utilization of substitutes will be reviewed during the course of the project. The impact on the project and the timeliness of submission will be of key consideration.

F. The approval of utilization of a substitute is subject to the sole and final discretion of the Landscape Architect.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Sections:
   1. Division 01 Section "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.
   2. Division 01 Section “Submittal Procedures” for submittal procedures.
   3. Divisions 02 through 49 Sections for specific requirements and limitations for substitutions.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
   1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
   2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

B. Substitute Items (Or Equal): If in Landscape Architect/Architect/Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item it will be considered a proposed substitute item.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A.

2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
   a. Statement indicating why specified product or fabrication, or installation cannot be provided, if applicable.
   b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
   c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
   d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
   e. Samples, where applicable or requested.
   f. Certificates and qualification data, where applicable or requested.
   g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
   h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
   i. Research reports evidencing compliance with building code in effect for Project.
   j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
   k. Cost information, including a proposal of change, if any, in the Contract Sum.
   l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
   m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
   n. See additional requirements in Article 2.3 DETAILED SUBSTITUTION PROCEDURES

3. Landscape Architect's Action: If necessary, Landscape Architect will request additional information or documentation for evaluation within 15 days of receipt of a request for substitution. Landscape Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 15 days of receipt of additional information or documentation, whichever is later.
   a. Forms of Acceptance: Change Order, Construction Change Directive, or Landscape Architect's Supplemental Instructions for minor changes in the Work.

b. Use product specified if Landscape Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

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

PART 2 - PRODUCTS

2.1 SUBSTITUTION PROCEDURES (GENERAL)

A. Conditions: After the 'Notice of Award" and prior to the Contractor entering into a Formal Contract with the Owner, the Landscape Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Landscape Architect will return requests without action, except to record noncompliance with these requirements:

1. Requested substitution is consistent with the Contract Documents and will produce indicated results.
2. Substitution results in substantial cost savings to the Owner or substantial performance improvements.
3. Substitution request is fully documented and properly submitted.
4. Requested substitution will not adversely affect Contractor's construction schedule.
5. Requested substitution has received necessary approvals of authorities having jurisdiction.
6. Requested substitution is compatible with other portions of the Work.
7. Requested substitution has been coordinated with other portions of the Work.
8. Requested substitution provides specified warranty.
9. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
10. The substation is submitted in compliance with Article 2.3 DETAILED SUBSTITUTION PROCEDURES

B. If the Contractor does not present 'Substitutions" in the time frame noted above any future requests to substitute products will not be considered, unless the substitution is for cause.

C. Coordination: Modify or adjust affected work as necessary to integrate work of the approved substitutions.

2.2 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately upon discovery of need for change, but not later than 20 days prior to time required for preparation and review of related submittals.

1. Landscape Architect will consider Contractor's request for substitution when the following conditions are present:
   a. The specified product is not available.
   b. The specified product cannot be delivered in the time frame required under the Project Schedule.

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

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

B. Substitutions for Convenience: Landscape Architect will consider requests for substitution if received 10 days after the Notice of Award and based on the following:
1. The proposed product substitution will result in a significant cost savings to the Owner.
2. The proposed product has substantial performance improvements.
3. The proposed product can be provided much earlier in the schedule enhancing the project completion date.
4. The proposed product warranty is superior to the specified item.

2.3 DETAILED SUBSTITUTION REVIEW PROCEDURES

A. The Landscape Architect in addition to the requirements listed above will require compliance with the following requirements and procedures:

1. Requests for approval of substitutions will be received and considered from Prime Contractors only and not from manufacturers, suppliers, Subcontractors, or other third parties.

2. If the materials and equipment submitted are offered as substitutions to the Contract Documents or approved equal, the Contractor shall advise the Owner and the Landscape Architect of the requested substitutions and comply with the requirements hereinafter specified in this Article.

3. Where the acceptability of substitution is conditioned upon a record of and the proposed substitution does not fulfill this requirement, the Landscape Architect, at the Landscape Architect’s sole discretion, may accept the substitution if the Contractor provides a bond or cash deposit which guarantees replacement at no cost to the Owner for any failure occurring within a specified time. The substitution item must meet all other technical requirements contained in the Specification.

4. The Contractor shall furnish such information as required by the Landscape Architect to demonstrate that the equal article, material, apparatus, product or process is the equivalent of that specified in quality, finish, design, efficiency and durability and has been elsewhere demonstrated to be equally serviceable for the purpose for which it is intended and/or that it offers substantial benefits to the Owner in saving of time and/or cost. The Contractor shall set forth the reasons for desiring to make this substitution.
5. Contractor shall submit:
a. For each proposed request for approved substitute sufficient details, complete descriptive literature and performance data together with samples of the materials, where feasible, to enable the Landscape Architect to determine if the proposed

request for approval should be granted, including manufacturer's brand or trade names, model numbers, description of specification of item, performance data, test reports, samples, history of service, and other data as applicable.

b. Certified tests, where applicable, by an independent laboratory attesting to the performance of the substitute.

c. A list of installations where the proposed substitute equipment or materials is performing under similar conditions as specified.

d. A list of installations where the proposed substitute equipment or materials is performing under similar conditions as specified.

6. Where the approval of a substitute requires revision or redesign of any part of Work, including that of other Contracts, all such revision and redesign, and all new drawings and details required therefore, shall be provided by the Contractor at its own cost and expense, and shall be subject to the approval of the Landscape Architect.

7. In the event that the Landscape Architect is required to provide additional services, then the Landscape Architect's charges for such additional services shall be paid by the Contractor to the Owner.

8. Any modifications in the Work required under other contracts to accommodate the changed design will be incorporated in the appropriate contracts and any resulting increases in contract prices will be charged to the Contractor by the Owner who initiated the changed design.

9. In all cases, the Landscape Architect shall be the judge as to whether a proposed substitute is to be approved. The Contractor shall be bound by the Landscape Architect’s decision. No substitute items shall be used in the Work without written approval of the Landscape Architect.

10. In making request for approval of substitute, Contractor represents that:
    a. Contractor has investigated proposed substitute and determined that it is equal to or superior in all respects to the product, manufacturer or method specified or offers other specified advantages to the Owner.
    b. Contractor will provide the same or better warranties or bonds for proposed substitute as for product, manufacturer or method specified.
    c. Contractor waives all claims for additional costs or extension of time related to proposed substitute that subsequently may become apparent.
    d. Contractor shall have and make no claim for an extension of time or for damages by reason of the time taken by the Landscape Architect in considering a substitute proposed by the Contractor or by reason of failure of the Landscape Architect to approve a substitute proposed by the Contractor. Any delays arising out of consideration, approval, or utilization of a substitute shall be the sole responsibility of the Contractor requesting the substitute and it shall arrange its operations to make up the time lost.

11. Proposed substitute will not be accepted if:
    a. Acceptance will require substantial revision of Contract Documents.
    b. Acceptance will substantially change design concepts or Technical Specifications.
    c. Acceptance will delay completion of the Work, or the Work of other Contractors.
    d. If the Substitute item is not accompanied by formal request for approval of substitute from Contractor.

12. The Landscape Architect reserves the right to disapprove, for aesthetic reasons, any material or equipment on the basis of design or color considerations alone, without prejudice to the quality of the material or equipment, if the manufacturer cannot meet the required colors or design.

13. All requests for approval of substitutes of materials or other changes from the contract requirements shall be accompanied by an itemized list of all other items affected by such substitution or change. The Landscape Architect shall have the right, if such is not done, to rescind any approvals for substitutions and to order such Work removed and replaced with Work conforming to the specified requirements of the contract, all at the Contractor's expense, or to assess all additional costs resulting from the substitution to the Contractor.

14. Approval of a substitute will not relieve Contractor from the requirement to submit Shop Drawings or any of the provisions of the Contract Documents.

15. In the event that the Landscape Architect is required to provide additional services as a result of a request for approval of a substitute results in changes by the Contractor in dimension, weight, power requirements, etc., of the equipment and accessories furnished, or as a result of Contractor's errors, omissions or failure to conform to the requirements of the Contract Documents or if the Landscape Architect is required to examine and evaluate any changes proposed by the Contractor solely for the convenience of the Contractor, or for evaluation of deviations from Contract Documents, then the Landscape Architect's charges in connection with such additional services shall be paid by the Contractor.

16. Structural design shown on the Drawings is based upon the configuration of and maximum loading for major items of equipment as indicated on the Drawings and as specified. If the substituted equipment furnished differs from said features, the Contractor shall pay to the Owner all costs of redesign and for any construction changes required to accommodate the equipment furnished, including the Architect's charges in connection therewith.

B. The Contractor shall respond to required submittals with complete information and with a degree of accuracy to achieve approvals within two (2) submissions. All costs to the Landscape Architect involved with subsequent submissions of Shop Drawings, Samples or other items requiring approval, will be paid by the Contractor to the Owner, by deducting such costs from payments due for Work completed. In the event an approved item is requested by the Contractor to be changed or substituted for, all costs involved in the reviewing and approval process will likewise be back charged to the Contractor unless determined by the Landscape Architect that the need for such substitution and/or deviation from Contract Documents is beyond the control of the Contractor.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 012500

SECTION 012519 - EQUIVALENTS

PART 1 - GENERAL

1.1 SUMMARY:

A. Requirements set forth herein pertain to products specified in divisions included in project manual.

1.2 DEFINITIONS:

A. For the purpose of this contract, the words "similar", "equal to", "or equal", "equivalent" and such other words of similar content and meaning, shall be deemed to mean similar and equal to one of named products.

B. For the purpose of bidding documents, the word "products" shall be deemed to include the words "articles", "materials", "items", "equipment" and "methods". Whenever in contract documents one or more products are specified, words "similar, equivalent, and equal to" shall be deemed inserted.

1.3 EQUIVALENTS:

A. Where, in these specifications or on drawings, certain kinds, types, brands, or manufacturers of materials are named, they shall be regarded as required standard of quality. Where two or more are named these are presumed to be equal, and Contractor may select one of those items.

B. If Contractor desires to use any kind, type, brand, or manufacturer of material other than those named in specification, he may submit the request for approval to the Architect well in advance of the bid date.

C. Requests for approval of proposed equivalents will be received by Architect only from the Contractor.

D. If the Architect approves a proposed equivalent prior to receipt of Bids, such approval will be set forth in an Addendum.

E. After the bid opening the apparent low bidder or bidders will be notified by the Architect or Owner and shall submit to the Architect in writing, within ten (10) calendar days what equivalent kind, type, brand, or manufacture is included in bid in lieu of specified items. No equivalents will be considered after this submission.

F. Contractor shall have burden of proving, at Contractor’s own cost and expense, to satisfaction of Owner/Architect, that proposed product is similar and equal to named product. In making such determination Owner/Architect will be sole judge of objective and appearance criteria that proposed product must meet in order for it to be approved.

1. Supporting data on equivalency is responsibility of bidder. For each equivalent to base specification, included in products list, submit information describing in specific detail -
    a. Wherein it differs from quality and performance required by base specification.
    b. Changes required in other elements of work because of equivalent.
    c. Effect on construction schedule.
    d. Any required license fees or royalties.
    e. Availability of maintenance service, and source of replacement materials.
    f. Such other information as may be required by Owner.

G. Owner, through Architect, shall be judge of acceptability of proposed equivalents. Risk of whether bid equivalents will be accepted is borne by Contractor.

1.4 CONTRACTOR'S REPRESENTATION:

A. Submission of an equivalent product and/or material constitutes a representation that Contractor:
1. Has investigated proposed product and determined it is equal to or superior in all respects to that specified.
2. Will provide same warranties or bonds for equivalent as for product specified.
3. Will coordinate installation of an accepted equivalent into work and make such other changes as may be required to make work complete in all respects.
4. Waives all claims for additional costs, under his responsibility, which may subsequently become apparent.
5. Will provide, at own cost and expense, any different quantity and/or arrangement of ductwork, piping, wiring, conduit or any part of work from that specified, detailed or indicated in Contract Documents if required for proper installation of an approved equivalent.
6. Will provide, at own cost and expense, all such revision and redesign and all new drawings and details required by Architect for approval if proposed equivalent product requires a revision or redesign of any part of work covered by this contract.
7. Provide complete documentation on both the product specified and the proposed substitute, including the following information as appropriate:
    a. Point-by-point comparison of specified and proposed substitute product data, fabrication drawings, and installation procedures.
    b. Copies of current, independent third-party test data of salient product or system characteristics.
    c. Samples where applicable or when requested by Architect.
    d. Detailed comparison of significant qualities of the proposed substitute with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
    e. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
    f. Research reports, where applicable, evidencing compliance with building code in effect for Project.
    g. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, which will become necessary to accommodate the proposed substitute.
8. Provide certification by manufacturer that the substitute proposed is equal to or superior to that required by the Procurement and Contracting Documents, and that its in-place performance will be equal to or superior to the product or equipment specified in the application indicated.
9. Bidder, in submitting the Procurement Substitution Request, waives the right to additional payment or an extension of Contract Time because of the failure of the substitute to perform as represented in the Procurement Substitution Request.

1.5 EQUIVALENT CERTIFICATION:

A. **Contractor must sign the "Equivalent Certification**" following this specification section and deliver it to the Architect along with a complete list of proposed equivalents within ten (10) calendar days after notification from the Architect or Owner. This is mandatory and must be done prior to award of contracts.

END OF SECTION 012519

EQUIVALENT CERTIFICATION

Project Name:

Project Address:

PROJECT NO:

Reviewed Material: AIA A701 – 2007 or 2018 Instructions to Bidders

AIA A201 General Conditions of the Contract

Specification Section: 012519 – Equivalents

Specification Section: 012500 – Substitution Procedures

Specification Section: 016000 – Product Requirements

Check the following box that applies:

☐ No equivalents are proposed.

☐ Proposed equivalents are attached with supporting data as per Section 012519.

All equivalents are hereby presented to Architect and Owner for approval. No future equivalents will be considered.

_____ _____ _____
Signature of Contractor Date Printed Name of Contractor

_____ _____ _____
Approved as Noted Signature of Reviewer Date Printed Name of Reviewer

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SECTION 012600 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Sections:
1. Division 01 Section "Product Requirements" for administrative procedures for handling requests for substitutions made after Contract award.

1.2 NO COST CHANGES IN THE WORK

A. Landscape Architect will issue, through the Project Manager, supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710 form.

1.3 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Landscape Architect, through the Project Manager, will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
1. Proposal Requests issued by Landscape Architect or Project Manager are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request or 10 days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
    a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
    b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
    c. Include costs of labor and supervision directly attributable to the change.
    d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Landscape Architect.
1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times.

6. Comply with requirements in Division 01 Section "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.

1.4 ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, base each Change Order proposal on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
   1. Include installation costs in purchase amount only where indicated as part of the allowance. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.
   2. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
   3. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit. Submit claims within 5 days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than 5 days after such authorization.
   1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
   2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Adjustment from Allowances Refer to Division 01 Section "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

B. Adjustments from Unit Prices: Refer to Division 01 Section "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit price work.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Proposal Request, the Project Manager will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Project Manager may issue a Construction Change Directive on AIA Document G714.
   1. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
      a. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
   2. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
      a. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 012600

SECTION 012900 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

B. Related Sections:
1. Division 01 Section "Unit Prices" for requirements governing the use of unit prices.
2. Division 01 Section "Contract Modification Procedures" for procedures for handling changes to the Contract.
3. Division 01 Section "Construction Progress Documentation" for requirements governing the preparation and submittal of the Contractor's construction schedule.
4. Division 01 Section "Submittal Procedures" for requirements governing the preparation and submittal of the submittal schedule.

1.2 SCHEDULE OF VALUES

A. Schedule of Values: Furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

B. Coordination: Correlate line items in the schedule of values with other required administrative forms and schedules, including the following:
1. Application for Payment forms with continuation sheets. (AIA G702 and G703)
2. Submittal schedule.
3. Submit the schedule of values to Landscape Architect at earliest possible date but no later than seven days before the date scheduled for submittal of initial Applications for Payment.

C. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the schedule of values.
1. Identification: Include the following Project identification on the schedule of values:
   a. Project name and location.
   b. Name of Landscape Architect.
   c. Landscape Architect's project number.
   d. Contractor's name and address.
   e. Date of submittal.
2. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:
   a. Description of the Work.
   b. Change Orders (numbers) that affect value.
3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports.
4. The following line items must be included on the continuation sheet:
   See the Construction Items Bid Schedule
5. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
6. Submit draft of AIA Document G703 Continuation Sheets.
7. Unit Price Allowances: Provide a separate line item in the schedule of values for each unit price allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.3 APPLICATIONS FOR PAYMENT

A. Each Application for Payment shall be consistent with previous applications and payments as certified by Landscape Architect and Project Manager and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

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

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

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. The OWNER shall retain five percent (5%) of the amount due on each Application for both the work completed and materials stored. The OWNER reserves the right to retain a greater percentage in the event the CONTRACTOR fails to make satisfactory progress or in the event there is other specific cause for greater withholding.

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

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

E. Transmittal: Submit, via email, signed and notarized original copies of each Application for Payment to Program Manger by a method ensuring receipt. Include waivers of lien and similar attachments if required.

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

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.

G. Initial Application for Payment: Administrative actions and submittals that must precede submittal of first Application for Payment include the following:
1. Contract or Notice to Proceed.
2. Performance and Payment bonds.
3. Liability, Auto, and Umbrella Insurance
4. Worker Compensation certificates
5. Proposed schedule of values for approval.

H. Initial Application for Payment: Administrative actions and submittals that must coincide submittal of first Application for Payment include the following:
1. Approved Schedule of values.
2. List of subcontractors
3. Contractors Safety Program
4. Contractor's construction schedule (preliminary if not final).
5. Submittal schedule (preliminary if not final).
6. Emergency Contacts List
7. Schedule of unit prices.
8. List of Contractor's staff assignments.
9. List of Contractor's principal consultants.
10. Copies of all required building and demolition permits.
11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.

I. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Administrative actions and submittals that shall precede or coincide with this application include:
   a. Occupancy permits and similar approvals
   b. List of incomplete Work, recognized as exceptions to Landscape Architect’s Certificate of Substantial Completion
   c. Record Drawings and Specifications
   d. Operations and Maintenance Manuals
   e. Maintenance Instructions and Training
   f. Start-up performance reports
   g. Test/adjust/balance records
   h. Warranties (guarantees) and maintenance agreements
   i. Final cleaning
   j. Change-over information related to Owner’s occupancy, use, operation and maintenance
   k. Application for reduction of retainage and consent of surety
   l. Advice on shifting insurance coverages
   m. Final progress photographs

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

J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Ensure that incomplete Work is not accepted and will be completed without undue delay.

2. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
3. Evidence of completion of Project closeout requirements.
4. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
5. Updated final statement, accounting for final changes to the Contract Sum.
6. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
7. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
8. AIA Document G707, "Consent of Surety to Final Payment."
9. Evidence that all claims have been settled.
10. Final liquidated damages settlement statement.
11. Removal of temporary facilities and services
12. Removal of surplus materials, rubbish, and similar elements

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 012900

SECTION 013100 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
   1. General project coordination procedures.
   2. Administrative and supervisory personnel.
   3. Coordination drawings.
   4. Requests for Information (RFIs).
   5. Project meetings.

B. Each contractor shall participate in coordination requirements. Certain areas of responsibility are assigned to a specific contractor.

C. Related Sections:
   1. Division 01 Section " Summary" for Project Information and phasing requirements.
   2. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
   3. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
   4. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.
   5. Division 01 Section "Submittal Procedures.
   6. Division 01 Section "Contract Modification Procedures.

1.2 DEFINITIONS

A. RFI: Request from Owner, Construction Manager, Landscape Architect, or Contractor seeking information from each other during construction.

1.3 INFORMATIONAL SUBMITTALS

A. Use the Landscape Architects Newforma Info Exchange when up loading Submittals or website with substantially the same functions, acceptable to Landscape Architect.

B. Subcontract list is required by AIA Document A201 to be submitted as soon as practical prior to award of the Contract. Coordinate with submittal requirements for subcontract list in Procurement Requirements and Contracting Requirements if any.

C. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:
   1. Name, address, and telephone number of entity performing subcontract or supplying products.
   2. Number and title of related Specification Section(s) covered by subcontract.
   3. Drawing number and detail references, as appropriate, covered by subcontract.

D. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.
   1. Each Contractor to furnish a 24hr. emergency contact person and cellular phone number.

2. Post copies of listing in project meeting room, or field office, on Project Website, and by each field telephone. Keep list current.

1.4 COORDINATION

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

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

B. Coordination: Each contractor shall coordinate its construction operations with those of other contractors and entities to ensure efficient and orderly installation of each part of the Work. Each contractor shall coordinate its operations with operations, included in different Sections that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

C. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

D. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.
9. Project closeout activities.

E. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1.5 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings in accordance with requirements in individual Sections, where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
   a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
   b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
   c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
   d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
   e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
   f. Indicate required installation sequences.
   g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Landscape Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire protection, fire alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work. Provide required information for work sequence to interface with the installation work.
2. Plenum Space: Indicate sub framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire protection, fire alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:
   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
   c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:
   a. Runs of vertical and horizontal conduit 1-1/4 inch diameter and larger.
   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire alarm locations.
   c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
   d. Location of pull boxes and junction boxes, dimensioned from column center lines.
8. Review areas for required access and indicate the need for access doors for access to shutoffs electrical boxes Etc.
9. Review: Landscape Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are the Contractor's responsibility. If the Landscape Architect determines that the coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, the Landscape Architect will so inform the Contractor, who shall make changes as directed and resubmit.
   a. Failure to provide the required coordination drawings as required by this specification section may result in withholding a portion of the Contractor payment requests until such coordination drawings are received.
10. Coordination Drawing Prints: Prepare and submit coordination drawing prints in accordance with requirements of Division 01 Section "Submittal Procedures."

1.6 KEY PERSONNEL

A. Key Personnel Names: Within 5 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and email addresses. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
   1. Post copies of list in project meeting room, or temporary office, and by field telephone.

1.7 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.
   1. Do not submit a RFI if information is readily available in the contract documents. Verify by contacting and questioning the Landscape Architect prior to submitting an RFI.
      a. Landscape Architect will return with no response RFI’s where information is available to the contractor is indicated on the Contract Documents.
   2. Landscape Architect will return RFIs submitted to Landscape Architect by other entities controlled by Contractor with no response.
   3. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:
   1. Project name.
   2. Project number.
   3. Date.
   4. Name of Contractor.
   5. Name of Landscape Architect.
   6. RFI number, numbered sequentially.
   7. RFI subject.
   8. Specification Section number and title and related paragraphs, as appropriate.

9. Drawing number and detail references, as appropriate.
10. Field dimensions and conditions, as appropriate.
11. Contractor's suggested resolution. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
12. Contractor's signature.
13. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI's sent without the required content information will not be considered a formal RFI.

D. RFI Forms: AIA Document G716 or Software-generated form with substantially the same content as indicated above, acceptable to Landscape Architect.

E. Landscape Architect's Action: Landscape Architect will review each RFI, determine action required, and respond. Allow ten working days for Landscape Architect's response for each RFI. RFIs received by Landscape Architect after 1:00 p.m. will be considered as received the following working day.
1. The following RFIs will be refused without action:
    a. Requests for approval of submittals.
    b. Requests for approval of substitutions.
    c. Requests for information already indicated in the Contract Documents.
    d. Requests for adjustments in the Contract Time or the Contract Sum.
    e. Requests for interpretation of Landscape Architect's actions on submittals.
    f. Incomplete RFIs or inaccurately prepared RFIs.
2. Landscape Architect's action may include a request for additional information, in which case Landscape Architect's time for response will date from time of receipt of additional information.
3. Landscape Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
    a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Landscape Architect in writing within ten days of receipt of the RFI response.

F. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use CSI Log Form 13.2B, or software log that is part of Project Website. Include the following:
1. Project name.
2. Name and address of Contractor.
3. Name and address of Landscape Architect.
4. RFI number including RFIs that were dropped and not submitted.
5. RFI description.
6. Date the RFI was submitted.
7. Date response was received.
8. Name and title of responder.
9. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
10. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

G. On receipt of Landscape Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Landscape Architect within seven days if Contractor disagrees with response.

1. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.
2. Identification of related Field Order, Work Change Directive, and Proposal Request, as appropriate.

1.8 PROJECT WEBSITE

A. The contractor will use Newforma Info Exchange for Submittals, Shop Drawings and RFI's; or, online software system with substantially the same functions, acceptable to Landscape Architect.

B. Project Website shall include the following functions:

1. Project directory.
2. Project correspondence.
3. Meeting minutes.
4. Contract modifications forms and logs.
5. RFI forms and logs.
6. Task and issue management.
7. Photo documentation.
8. Schedule and calendar management.
9. Submittals forms and logs.
10. Payment application forms.
11. Drawing and specification document hosting, viewing, and updating.
12. Online document collaboration.
13. Reminder and tracking functions.
14. Archiving functions.

C. Provide up to ten Project Website user licenses for use of the Owner, Construction Manager, Landscape Architect, and Landscape Architect's consultants. Provide eight hours of software training at Landscape Architect's office for Project Website users.

D. On completion of Project, provide two complete archive copies of Project Website files: one to the Owner and one to Landscape Architect in a digital storage format acceptable to Landscape Architect.

E. Contractor, subcontractors, and other parties granted access by Contractor to Project Web site shall execute a data licensing agreement in the form of AIA Document C106 or an Agreement acceptable to Owner and Landscape Architect.

1.9 PROJECT MEETINGS

A. General: The General Contractor shall schedule and conduct meetings and conferences at Project site, unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Landscape Architect of scheduled meeting dates and times. All Prime Contractors are required to attend Project Meetings.
   a. Participants shall be familiar with the Project and authorized to conclude matters relating to the Work.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner, Program Manager, and Landscape Architect, within three days of the meeting.

B. Preconstruction Conference: The Owner will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Landscape Architect, but no later than 15 days after execution of the Agreement.
   1. Conduct the conference to review responsibilities and personnel assignments.
   2. Attendees: Authorized representatives of Owner, Construction Manager, Landscape Architect, and their consultants; Contractors and their superintendents; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to decide matters relating to the Work.
   3. Agenda: Discuss items of significance that could affect progress, including the following:
      a. Tentative construction schedule.
      b. Critical work sequencing and long-lead items.
      c. Special Feature schedules.
      d. Weather conditions and schedule.
      e. Sequencing, Site Access, and Traffic Control.
      f. Designation of key personnel and their duties.
      g. Procedures for project communications.
      h. Procedures for processing field decisions and Change Orders.
      i. Procedures for RFIs.
      j. Testing and inspecting requirements.
      k. Procedures for processing Applications for Payment.
      l. Distribution of the Contract Documents.
      m. Submittal procedures.
      n. Submittal of Shop Drawings, Product Data, and Samples.
      o. Preparation and updating of record documents.
      p. Use of the premises and existing building.
      q. Work restrictions.
      r. Working hours.
      s. Owner's occupancy requirements and restrictions.
      t. Responsibility for temporary facilities and controls.
      u. Procedures for moisture and mold control.
      v. Procedures for disruptions and shutdowns.
      w. Construction waste management and recycling.
      x. Parking availability.
      y. Office, work, and storage areas.
      z. Equipment deliveries and priorities.
      aa. First aid.
      bb. Security.
      cc. Progress cleaning.
   4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: The Contractor will conduct a preinstallation conferences at Project site, unless otherwise indicated, before each construction activity that requires coordination with other construction.
   1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Landscape Architect, Construction Manager, and Owner of scheduled meeting dates.
   2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
      a. Contract Documents.

b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility problems.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written recommendations.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.
x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures, actions, and approved schedules.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information, including the Program Manager and Landscape Architect.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Progress Meetings: The Owner will Conduct progress meetings at regular intervals.
1. Coordinate dates of meetings with preparation of payment requests.
2. Required Attendees: In addition to representatives of Owner, Construction Manager, and Landscape Architect, each Prime contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to decide matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
   a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      1) Review schedule for next period.

   b. Review present and future needs of each entity present, including the following:
      1) Interface requirements.
      2) Schedule and Time.
      3) Sequence of operations.

4) Status of submittals.
5) Deliveries.
6) Off-site fabrication.
7) Access.
8) Site utilization.
9) Temporary facilities and controls.
10) Progress cleaning.
11) Status of correction of deficient items.
12) Field observations.
13) Status of RFIs.
14) Status of proposal requests.
15) Pending changes.
16) Status of Change Orders.
17) Traffic Control Plan.
18) Quality and work standards.
19) Onsite inspections and adjustments.
20) Shop Drawings and submittals.
21) Daily reports and weather conditions.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
   a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

E. Coordination Meetings: The Contractor or Owner will conduct Project coordination meetings at upon request. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
   1. Attendees: In addition to representatives of Owner, Construction Manager, and Landscape Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
   2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
      a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
      b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.
      c. Review present and future needs of each contractor present, including the following:
         1) Interface requirements.
         2) Sequence of operations.
         3) Status of submittals.
         4) Deliveries.
         5) Off-site fabrication.
         6) Access.

7) Site utilization.
8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Change Orders.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

F. Project Closeout Meeting: The Owner will schedule and conduct a Project closeout meeting no later than 30 days prior to the scheduled date of Substantial Completion.
1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Required Attendees: Authorized representatives of Owner, Construction Manager, Landscape Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:
a. Preparation and completion of Contractor's punch list.
b. Responsibility for removing temporary facilities and controls.
c. Owner's partial occupancy requirements.
d. Coordination of separate contracts for owner related work prior to occupancy.
e. Installation of Owner's furniture, fixtures, and equipment.
f. Requirements for preparing operations and maintenance data.
g. Requirements for the Submittal of written warranties.
h. Requirements for demonstration and training.
i. Requirements for submission of record documents, record specifications and record submittals.
j. Responsibility and schedule for final cleaning
k. Procedures for processing Applications for Payment at Substantial Completion and for final payment.

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

1.10 Reports

A. Daily Construction Reports: Contractor shall prepare a daily report recording events on the site. Submit duplicate copies to the Landscape Architect at weekly intervals. Include the following information:
1. Daily record showing work engaged, completed, and started.
2. List of subcontractors at the site.
3. High and low temperatures, general weather conditions.
4. Accidents and unusual events.
5. Stoppages, delays, shortages, and losses.
6. Meter readings and similar recordings.
7. Emergency procedures.
8. Orders and requests of governing authorities.
9. Services connected, disconnected.
10. Equipment or system tests and startups.
11. Substantial Completions authorized.

12. Materials delivered or stored.
13. Inspection or testing completed.
14. Official visitors to the site.

1.11 Construction Records

A. The Contractor shall maintain the following reports and records for review at each Program Meeting:
   1. As Built Field Set: Set of plans kept inside for the purpose of updating and recording all changes and modifications. Update with redlines to record changes as they occur. Update with red lines to record changes as they occur. Said redlines must be issues in Meeting Minutes.
   2. Request for Information (RFI) Book: Sequential record of all request and their subsequent answers.
   3. Shop drawings and approved site field changes.
   4. Documents and Samples of special products.
   5. Change Orders: Sequential record of all accepted or pending change orders with backup data.
   6. Requests for Payment: Sequential record of all requests and correspondence between Landscape Architect and Contractor as well as between Owner and Contractor.

B. All Construction Records shall be available for reference during all on-site project meetings.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 013100

SECTION 013200 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
   1. Start-up construction schedule.
   2. Contractor's construction schedule.
   3. Daily construction reports.
   4. Field condition reports.
   5. Special reports.

B. Related Sections:
   1. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
   2. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.2 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format**[s]:**
   1. PDF electronic file and two paper copies.

B. Start-up construction schedule.

C. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period**.**

D. Daily Construction Reports: Submit at monthly intervals.

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

F. Special Reports: Submit at time of unusual event.

1.3 QUALITY ASSURANCE

A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:
   1. Review software limitations and content and format for reports.
   2. Verify availability of qualified personnel needed to develop and update schedule.
   3. Discuss work stages, area separations, and interim milestones.
   4. Review delivery dates for Owner-furnished products.
   5. Review schedule for work of Owner's separate contracts.
   6. Review time required for review of submittals and resubmittals.
   7. Review requirements for tests and inspections by independent testing and inspecting agencies.
   8. Review time required for completion and startup procedures.
   9. Review and finalize list of construction activities to be included in schedule.
   10. Review submittal requirements and procedures.
   11. Review procedures for updating schedule.

1.4 COORDINATION

A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
   1. Secure time commitments for performing critical elements of the Work from entities involved.
   2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice of Award to date of Substantial Completion.
   1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
   1. Activity Duration: Define activities and days.
   2. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
   3. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
   4. Startup and Testing Time: Include not less than 15 days for startup and testing.
   5. Substantial Completion: Indicate completion in advance of date established for Substantial Completion and allow time for Landscape Architect's and Project Manager's administrative procedures necessary for certification of Substantial Completion.
   6. Punch List and Final Completion: Include not more than 30 days for punch list and final completion.

C. Schedule Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule and show how the sequence of the Work is affected.
   1. Phasing: Arrange list of activities on schedule by phase.
   2. Work under More Than One Contract: Include a separate activity for each contract.
   3. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
   4. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
   5. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
   6. Work Restrictions: Show the effect of the following items on the schedule:
      a. Coordination with existing construction.
      b. Limitations of continued occupancies.
      c. Uninterruptible services.
      d. Partial occupancy before Substantial Completion.
      e. Use of premises restrictions.
      f. Provisions for future construction.

g. Seasonal variations.
h. Environmental control.

7. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
   a. Submittals.
   b. Purchases.
   c. Mockups.
   d. Sample testing.
   e. Deliveries.
   f. Installation.
   g. Tests and inspections.
   h. Adjusting.
   i. Startup and placement into final use and operation.
8. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
   a. Structural completion.
   b. Permanent space enclosure.
   c. Completion of mechanical installation.
   d. Completion of electrical installation.
   e. Substantial Completion.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion, and the following interim milestones:
1. Mendell Circle extension completion.
2. Artificial turf field base completion (everything except artificial turf).
3. Pool house completion.
4. Splash pad completion.
5. Swimming pool completion.

E. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
2. Unanswered RFIs.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.

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

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

2.2 START-UP CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit start-up horizontal bar-chart-type construction schedule within seven days of date established for approval. Schedule to start from the Notice of Award.

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

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (GANTT CHART)

A. Gantt-Chart Schedule: From the approved Bar Chart Schedule submit a comprehensive, fully developed, horizontal, Gantt-chart-type, Contractor's construction schedule within 30 days Base schedule on the approved startup construction schedule and additional information received since the start of Project.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
1. List of Prime contractors at Project site.
2. List of subcontractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (refer to special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.

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

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

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

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

B. Distribution: Distribute copies of approved schedule to Landscape Architect and Project Manager, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies in Project meeting rooms and temporary field offices.
2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013233 - PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

1. Preconstruction photographs.
2. Periodic construction photographs.
3. Final Completion construction photographs.
4. Preconstruction videotapes.
5. Periodic construction videotapes.
6. Time-lapse sequence construction videotapes.

B. Related Sections include the following:

1. Division 01 Section "Unit Prices" for procedures for unit prices for extra photographs.
2. Division 01 Section "Submittal Procedures" for submitting photographic documentation.
3. Division 01 Section "Closeout Procedures" for submitting digital media and construction videotapes as Project Record Documents at Project closeout.
4. Division 01 Section "Demonstration and Training" for submitting videotapes of demonstration of equipment and training of Owner's personnel.
5. Division 02 Section "Structure Demolition" for photographic documentation before building demolition operations commence.

1.3 ALLOWANCE

A. Costs: Photographer's services are included under the cash allowance for construction photographs established in Division 01 Section "Allowances."

1.4 UNIT PRICES

A. Basis for Bids: Base number of construction photographs on four photographs per month over the duration of Project.

1.5 SUBMITTALS

A. Qualification Data: For photographer.

B. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph. Indicate elevation. Include same label information as corresponding set of photographs.

C. Construction Photographs: Submit two photographic views within seven days of taking photographs.

1. Format: Provide images in uncompressed TIFF format, produced by a digital camera with minimum sensor size of 4.0 megapixels, and at an image resolution of not less than 1600 by 1200 pixels.
2. Identification: In an electronic log, provide a list of the following information for each photograph:

a. Name of Project.
b. Name and address of photographer.
c. Name of Landscape Architect.
d. Name of Contractor.
e. Date photograph was taken if not date stamped by camera.
f. Description of vantage point, indicating location, direction (by compass point), and elevation or story of construction.
g. Unique sequential identifier.

3. Digital Images: Submit a complete set of digital image electronic files as a Project Record Document on CD-ROM. Identify electronic media with date photographs were taken. Submit images that have same aspect ratio as the sensor, uncropped.

1.6 QUALITY ASSURANCE

A. Photographer Qualifications: An individual who has been regularly engaged as a professional photographer of construction projects for not less than three years.

1.7 COORDINATION

A. Auxiliary Services: Cooperate with photographer and provide auxiliary services requested, including access to Project site and use of temporary facilities, including temporary lighting required to produce clear, well-lit photographs without obscuring shadows.

1.8 USAGE RIGHTS

A. Obtain and transfer copyright usage rights from photographer to Owner and Landscape Architect for unlimited reproduction of photographic documentation.

1.9 EXTRA PRINTS

A. Negatives: Photographer shall retain all photographic files for three years after date of Substantial Completion. During this period, photographer shall fill orders by Landscape

Architect, Project Manager, or Owner for extra prints. Photographer shall price extra prints at prevailing local commercial prices.

B. Extra Prints: If requested by Landscape Architect or Project Manager, photographer shall prepare extra prints of photographs. Photographer shall distribute these prints directly to designated parties who will pay the costs for extra prints.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

A. Digital Images: Provide images in uncompressed TIFF format, produced by a digital camera with minimum sensor size of 4.0 megapixels, and at an image resolution of not less than 1600 by 1200 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

A. Photographer: Engage a qualified commercial photographer to take construction photographs.

B. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.

1. Maintain key plan with each set of construction photographs that identifies each photographic location.

C. Film Images:

1. Date Stamp: Unless otherwise indicated, date and time stamp each photograph as it is being taken so stamp is integral to photograph.
2. Field Office Prints: Retain one set of prints of progress photographs in the field office at Project site, available at all times for reference. Identify photographs same as for those submitted to Landscape Architect and Project Manager.

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

1. Date and Time: Include date and time in filename for each image.
2. Field Office Images: Maintain one set of images on CD-ROM in the field office at Project site, available at all times for reference. Identify images same as for those submitted to Landscape Architect and Project Manager.

E. Preconstruction Photographs: Before commencement of excavation, commencement of demolition, and starting construction, take color, digital photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as directed by Landscape Architect and Project Manager.

1. Flag excavation areas and construction limits before taking construction photographs.
2. Take eight photographs to show existing conditions adjacent to property before starting the Work.
3. Take eight photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction.
4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

F. Periodic Construction Photographs: Take 12 color, digital photographs monthly, coinciding with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.

G. Landscape Architect- or Project Manager-Directed Construction Photographs: From time to time, Landscape Architect or Project Manager will instruct photographer about number and frequency of color, digital photographs, and general directions on vantage points. Select actual vantage points and take photographs to show the status of construction and progress since last photographs were taken.

H. Time-Lapse Sequence Construction Photographs: Take color, digital photographs as indicated, to show status of construction and progress since last photographs were taken.

1. Frequency: Take photographs weekly, with timing each month adjusted to coincide with the cutoff date associated with each Application for Payment.
2. Vantage Points: Following suggestions by Landscape Architect and Contractor, photographer to select vantage points. During project construction, take not less than two shots from same vantage point each time to create a time-lapse sequence as follows:

    a. Commencement of the Work, through date of Substantial Completion.

    b. From the same vantage point, elevated to view the entire Project site.

I. Final Completion Construction Photographs: Take eight color photographs after date of Substantial Completion for submission as Project Record Documents. Landscape Architect or Project Manager will direct photographer for desired vantage points.

J. Additional Photographs: Landscape Architect or Project Manager may issue requests for additional photographs, in addition to periodic photographs specified. Additional photographs will be paid for by Change Order and are not included in the Contract Sum**.**

1. Three days' notice will be given, where feasible.
2. In emergency situations, take additional photographs within 24 hours of request.
3. Circumstances that could require additional photographs include, but are not limited to, the following:

    a. Special events planned at Project site.
    b. Immediate follow-up when on-site events result in construction damage or losses.
    c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
    d. Substantial Completion of a major phase or component of the Work.
    e. Extra record photographs at time of final acceptance.
    f. Owner's request for special publicity photographs.

END OF SECTION 013233

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Sections include the following:

1. Division 01 Section "Payment Procedures" for submitting Applications for Payment and the Schedule of Values.
2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes and for submitting Coordination Drawings.
3. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule and the Submittals Schedule.
4. Division 01 Section "Photographic Documentation" for submitting construction photographs.
5. Division 01 Section "Quality Requirements" for submitting test and inspection reports and for mockup requirements.
6. Division 01 Section "Closeout Procedures" for submitting warranties.
7. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
8. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
9. Division 01 Section "Demonstration and Training" for submitting videotapes of demonstration of equipment and training of Owner's personnel.
10. Divisions 02 through 49 Sections for specific requirements for submittals in those Sections.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information that requires Landscape Architect's and Project Manager's responsive action.

B. Informational Submittals: Written information that does not require Landscape Architect's and Project Manager's responsive action. Submittals may be rejected for not complying with requirements.

1.4 SUBMITTAL PROCEDURES

A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Landscape Architect for Contractor's use in preparing submittals.

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

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Landscape Architect and Project Manager reserve the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.

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

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Landscape Architect will advise Contractor when a submittal being processed will be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Landscape Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.

E. Identification: Place a permanent label or title block on each submittal for identification.

1. Indicate name of firm or entity that prepared each submittal on label or title block.
2. Provide a space approximately 6 by 8 inches on label or beside title block to record Contractor's review and approval markings and action taken by Landscape Architect and Project Manager.
3. Include the following information on label for processing and recording action taken:

    a. Project name.
    b. Date.
    c. Name and address of Landscape Architect and Project Manager.
    d. Name and address of Contractor.
    e. Name and address of subcontractor.
    f. Name and address of supplier.

g. Name of manufacturer.
h. Submittal number or other unique identifier, including revision identifier.

1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06100.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06100.01.A).

i. Number and title of appropriate Specification Section.
j. Drawing number and detail references, as appropriate.
k. Location(s) where product is to be installed, as appropriate.
l. Other necessary identification.

F. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.

G. Additional Copies: Unless additional copies are required for final submittal, and unless Landscape Architect or Project Manager observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.

1. Submit one copy of submittal to concurrent reviewer in addition to specified number of copies to Landscape Architect and Project Manager.
2. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.

H. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Landscape Architect and Project Manager will return submittals, without review, discard submittals received from sources other than Contractor.

1. Transmittal Form: Use AIA Document G810 or CSI Form 12.1A. Use the same form selected throughout the project.
2. Transmittal Form: Provide locations on form for the following information:

a. Project name.
b. Date.
c. Destination (To:).
d. Source (From:).
e. Names of subcontractor, manufacturer, and supplier.
f. Category and type of submittal.
g. Submittal purpose and description.
h. Specification Section number and title.
i. Drawing number and detail references, as appropriate.
j. Transmittal number, numbered consecutively.
k. Submittal and transmittal distribution record.
l. Remarks.
m. Signature of transmitter.

3. On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Landscape Architect and Project Manager on previous submittals, and deviations from requirements

in the Contract Documents, including minor variations and limitations. Include same label information as related submittal.

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

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with Landscape Architect's action stamp.

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

K. Use for Construction: Use only final submittals with Landscape Architect's action stamp.

1.5 CONTRACTOR'S USE OF LANDSCAPE ARCHITECT'S CAD FILES

A. General: At Contractor's written request, copies of Landscape Architect's CAD files will be provided to Contractor for Contractor's use in connection with Project, subject to the following conditions:
1. Only site-related CAD files will be made available for Contractor’s use.

PART 2 - PRODUCTS

2.1 ACTION SUBMITTALS

A. General: Prepare and submit Action Submittals required by individual Specification Sections.

1. Submit electronic submittals directly to Project Website.

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

1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

a. Manufacturer's written recommendations.
b. Manufacturer's product specifications.
c. Manufacturer's installation instructions.
d. Standard color charts.
e. Manufacturer's catalog cuts.
f. Wiring diagrams showing factory-installed wiring.
g. Printed performance curves.
h. Operational range diagrams.

i. Mill reports.
j. Standard product operation and maintenance manuals.
k. Compliance with specified referenced standards.
l. Testing by recognized testing agency.
m. Application of testing agency labels and seals.
n. Notation of coordination requirements.

4. Submit Product Data before or concurrent with Samples.
5. Number of Copies: Submit three copies of Product Data, unless otherwise indicated. Landscape Architect will return two copy. Mark up and retain one returned copy as a Project Record Document.

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

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

a. Dimensions.
b. Identification of products.
c. Fabrication and installation drawings.
d. Roughing-in and setting diagrams.
e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
f. Shopwork manufacturing instructions.
g. Templates and patterns.
h. Schedules.
i. Design calculations.
j. Compliance with specified standards.
k. Notation of coordination requirements.
l. Notation of dimensions established by field measurement.
m. Relationship to adjoining construction clearly indicated.
n. Seal and signature of professional engineer if specified.
o. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 30 by 40 inches.
3. Number of Copies: Submit two opaque (bond) copies of each submittal. Landscape Architect will return one copy.
4. Number of Copies: Submit three opaque copies of each submittal, unless copies are required for operation and maintenance manuals. Submit five copies where copies are required for operation and maintenance manuals. Landscape Architect retain two copies; remainder will be returned.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.

2. Identification: Attach label on unexposed side of Samples that includes the following:

    a. Generic description of Sample.
    b. Product name and name of manufacturer.
    c. Sample source.
    d. Number and title of appropriate Specification Section.

3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

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

4. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

    a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Landscape Architect will return submittal after options are selected.

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

    a. Number of Samples: Submit three sets of Samples. Landscape Architect will retain two Sample sets; remainder will be returned.

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

E. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product.
2. Number and name of room or space.
3. Location within room or space.

4. Number of Copies: Submit three copies of product schedule or list, unless otherwise indicated. Landscape Architect will return two copies.

    a. Mark up and retain one returned copy as a Project Record Document.

F. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation" for Project Manager's action.

G. Submittals Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

H. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."

I. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."

J. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.
4. Number of Copies: Submit three copies of subcontractor list, unless otherwise indicated. Landscape Architect will return two copies.

    a. Mark up and retain one returned copy as a Project Record Document.

2.2 INFORMATIONAL SUBMITTALS

A. General: Prepare and submit Informational Submittals required by other Specification Sections.

1. Number of Copies: Submit copies of each submittal, unless otherwise indicated. Landscape Architect will not return copies.
2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."

B. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."

C. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

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

E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.

F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

H. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

I. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

J. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

K. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

L. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

M. Schedule of Tests and Inspections: Comply with requirements specified in Division 01 Section "Quality Requirements."

N. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

O. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

P. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

Q. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 01 Section "Operation and Maintenance Data."

R. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

S. Manufacturer's Instructions: Prepare written or published information that documents manufacturer's recommendations, guidelines, and procedures for installing or operating a product or equipment. Include name of product and name, address, and telephone number of manufacturer. Include the following, as applicable:

1. Preparation of substrates.
2. Required substrate tolerances.
3. Sequence of installation or erection.
4. Required installation tolerances.
5. Required adjustments.
6. Recommendations for cleaning and protection.

T. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:

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

U. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.

V. Construction Photographs and Videotapes: Comply with requirements specified in Division 01 Section " Photographic Documentation."

W. Material Safety Data Sheets (MSDSs): Submit information directly to Owner; do not submit to Landscape Architect.

1. Landscape Architect will not review submittals that include MSDSs and will return the entire submittal for resubmittal.

2.3 DELEGATED DESIGN

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Landscape Architect.

B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit three copies of a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Landscape Architect.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 LANDSCAPE ARCHITECT'S / ACTION

A. General: Landscape Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.

B. Action Submittals: Landscape Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Landscape Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken.

C. Informational Submittals: Landscape Architect will review each submittal and will not return it or will return it if it does not comply with requirements. Landscape Architect will forward each submittal to appropriate party.

D. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.

E. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 014000 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
   1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
   3. Requirements for Contractor to provide quality-assurance and -control services required by Landscape Architect, Owner, Program Manager, or authorities having jurisdiction are not limited by provisions of this Section.

C. Related Sections:
   1. Division 01 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
   2. Divisions 02 through 49 Sections for specific test and inspection requirements.

1.2 DEFINITIONS

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

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Landscape Architect or Program Manager.

C. Mockups: Full size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
   1. Integrated Exterior Mockups: Mockups of the exterior envelope erected separately from the building but on Project site, consisting of multiple products, assemblies, and subassemblies.
   2. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.

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

E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

F. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.

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

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

I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
   1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade or trades.

J. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
   1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Landscape Architect.

B. Delegated-Design Services Statement: Submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services.
   1. The design professional shall be licensed to perform professional design services In the jurisdiction of the project location.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Landscape Architect for a decision before proceeding.

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

1.5 ACTION SUBMITTALS

A. Shop Drawings: For integrated exterior mockups, provide plans, sections, and elevations, indicating materials and size of mockup construction.

1. Indicate manufacturer and model number of individual components.
2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.

1.6 INFORMATIONAL SUBMITTALS

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

B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
1. Specification Section number and title.
2. Entity responsible for performing tests and inspections.
3. Description of test and inspection.
4. Identification of applicable standards.
5. Identification of test and inspection methods.
6. Number of tests and inspections required.
7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.7 REPORTS AND DOCUMENTS

A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and re-inspecting.

B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

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

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

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

1.8 QUALITY ASSURANCE

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

B. Manufacturer Qualifications: A firm with **5** years' experience in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
1. Manufacturer shall have a record of [5] years' experience

C. Fabricator Qualifications: A firm with **5** years' experience in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual with **5** years' experience in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

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

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of

manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
   1. Contractor responsibilities include the following:
      a. Provide test specimens representative of proposed products and construction.
      b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
      c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
      d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
      e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
      f. When testing is complete, remove test specimens, assemblies, mockups; do not reuse products on Project.
   2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Landscape Architect, through Program Manager, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
   1. Build mockups in location indicated or, if not indicated, as directed by Landscape Architect or Program Manager.
   2. Notify Landscape Architect and Program Manager seven days in advance of dates and times when mockups will be constructed.
   3. Employ supervisory personnel who will oversee mockup construction. Employ workers who will be employed to perform same tasks during the construction at Project.
   4. Demonstrate the proposed range of aesthetic effects and workmanship.
   5. Obtain Landscape Architect's and Program Manager's approval of mockups before starting corresponding Work, fabrication, or construction.
      a. Allow seven days for initial review and each re-review of each mockup.
   6. Promptly correct unsatisfactory conditions noted by Landscape Architect's preliminary review, to the satisfaction of the Architect, before completion of final mockup.
   7. Approval of mockups by the Landscape Architect does not constitute approval of deviations from the Contract Documents contained in mockups unless Landscape Architect specifically approves such deviations in writing.
   8. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
   9. Demolish and remove mockups when directed unless otherwise indicated.

L. Integrated Exterior Mockups: Construct integrated exterior mockup according to approved as indicated on Drawings. Coordinate installation of exterior envelope materials and products for which mockups are required in individual Specification Sections, along with supporting materials. Comply with requirements in "Mockups" Paragraph.
   1. Coordinate construction of the mockup to allow observation of air barrier installation, flashings, air barrier integration with fenestration systems, and other portions of the building air/moisture barrier and drainage assemblies, prior to installation of veneer, cladding elements, and other components that will obscure the work.

M. Room Mockups: Construct room mockups as indicated on Drawings, incorporating required materials and assemblies, finished according to requirements. Provide required lighting and additional lighting where required to enable Architect to evaluate quality of the Work. Comply with requirements in "Mockups" Paragraph.

1.9 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
   1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
   2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
   1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
   2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
   3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
   4. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
   5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
   6. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."

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

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

F. Testing Agency Responsibilities: Cooperate with Landscape Architect, Program Manager, and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
   1. Notify Landscape Architect, Program Manager, and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.

2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
6. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.10 QUALITY-CONTROL PLAN

A. Contractors Quality-Control Plan, The Contractor shall submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities and to coordinate Owner's quality-assurance and quality-control activities. Coordinate with Contractor's Construction Schedule.

B. Quality-Control Personnel Qualifications: Engage qualified personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:
1. Contractor-performed tests and inspections, including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections. Distinguish source quality-control tests and inspections from field quality-control tests and inspections.
2. Special inspections required by authorities having jurisdiction and indicated on the Statement of Special Inspections.
3. Owner-performed tests and inspections indicated in the Contract Documents.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring the Work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports, including log of approved and rejected results. Include Work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming Work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.11 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner, and as follows:

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

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Landscape Architect’s, Program Manager’s, and Construction Manager's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible

as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."

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

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

END OF SECTION 014000

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 KEY DEFINITIONS

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

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

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

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

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

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

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

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

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

J. Where the word or words "as directed", "as required", "as approved", "as permitted" “as selected”, “as requested”, “as authorized”, or words of like effect are used ln the specifications or on the drawings, the Contractor shall understand that direction, requirement, approval or permission of the Landscape Architect is intended. Similar words "approved", "acceptable", "satisfactory", or words of like import mean approved by, acceptable to or satisfactory to the Landscape Architect.

1.2 DEFINITIONS

A. Air Handling Unit: A blower or fan used for the purpose of distributing supply air to a room, space or area.

B. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved according to the requirements established in this Section and as required by the Code Official having jurisdiction over this project.

C. Architect: Other terms including “Architect/Engineer” and “Engineer” have the same meaning as "Architect".

D. Company Field Adviser: An employee of the Company which lists and markets the primary components of the system under the name who is certified in writing by the Company to be technically qualified in design, installation, and servicing of the required products or an employee of an organization certified by the foregoing Company to be technically qualified in design, installation, and serving of the required products. Personnel involved solely in sales do not qualify.

E. Concealed Location: A location that cannot be accessed without damaging permanent parts of the building structure or finish surface. Spaces above, below or behind readily removable panels or doors shall not be considered as concealed.

F. Concealed Piping: Piping that is located in a concealed location. (See "concealed location".)

G. Connect: A term contraction and unless otherwise specifically noted is to mean “The labor and materials necessary to join or attach equipment, materials or systems to perform the functions intended”.

H. Construction Manager: Lee Croy, P.E. on behalf of the City.

I. Drain: Any pipe that carries wastewater or water-borne wastes in a building drainage system.

J. Drainage Fittings: Type of fitting or fittings utilized in the drainage system. Drainage fittings are similar to cast-iron fittings, except that instead of having a bell and spigot, drainage fittings are recessed and tapped to eliminate ridges on the inside of the installed pipe.

K. Drainage System: Piping within a public or private premise that conveys sewage, rainwater or other liquid wastes to a point of disposal. A drainage system does not include the mains of a public sewer system or a private or public sewage treatment or disposal plant.
   1. Building Gravity: A drainage system that drains by gravity into the building sewer.
   2. Sanitary: A drainage system that carries sewage and excludes storm, surface and ground water.
   3. Storm: A drainage system that carries rainwater, surface water, condensate, cooling water or similar liquid wastes.

L. Duct: A tube or conduit utilized for conveying air. The air passages of self-contained systems are not to be construed as air ducts.

M. Duct System: A continuous passageway for the transmission of air that, in addition to ducts, includes duct fittings, dampers, plenums, fans and accessory air-handling equipment and appliances.

N. Experienced: When used with an entity, "experienced" means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

O. Headroom: Minimum clearance between the floor and the underside of the point of lowest installed mechanical construction above. In case of stairways and walkways, the minimum clearance between the step or surface of the walkway and the lowest installed mechanical construction above the stairway or the walkway.

P. Include: When used in any form other than “inclusive”, is non-limiting and is not intended to mean “all-inclusive.”

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

R. Inspection Certificate: Identification applied on a product by an approved agency containing the name of the manufacturer, the function and performance characteristics, and the name and identification of an approved agency that indicates that the product or material has been inspected and evaluated by an approved agency.

S. Installer: An installer is the Contractor, or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, or similar operations. Installers are required to be experienced in the operations they are engaged to perform.

1. Trades: Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespersons of the corresponding generic name.
2. Assigning Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. The specialists must be engaged for those activities, and their assignments are requirements over which the Contractor has no option. However, the ultimate responsibility for fulfilling contract requirements remains with the Contractor.
3. This requirement shall not be interpreted to conflict with enforcing building codes and similar regulations governing the Work. It is also not intended to interfere with local trade-union jurisdictional settlements and similar conventions.
4. The term “experienced”, when used with the term “installer”, means being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.

T. Label: An identification applied on a product by the manufacturer that contains the name of the manufacturer, the function and performance characteristics of the product or material, and the name and identification of an approved agency and that indicates that the representative sample of the product or material has been tested and evaluated by an approved agency.

U. Location:
1. Damp Location: Partially protected locations under canopies, marquees, roofed open porches and like locations, and interior locations subject to moderate degrees of moisture, such as some basements, some barns and some cold-storage warehouses.
2. Dry Location: A location not normally subject to dampness or wetness. A location classified as dry may be temporarily subject to dampness or wetness, as in the case of a building under construction.
3. Wet Location: Installations underground or in concrete slabs or masonry in direct contact with the earth and locations subject to saturation with water or other liquids, such as vehicle-washing areas, and locations exposed to weather and unprotected.

V. Manufacturer’s Designation: Identification applied on a product by the manufacturer indicating that a product or material complies with a specified standard or set of rules (see also "Inspection Certificate," "Label" and "Mark").

W. Mark: An identification applied on a product by the manufacturer indicating the name of the manufacturer and the function of a product or material (see also "Inspection Certificate," "Label" and "Manufacturer's Designation").

X. Mechanical: Other terms including “HVAC”, “Plumbing”, “Sprinkler”, “Laboratory Equipment”, “Food Service Equipment”, “Laundry Equipment”, and “Refrigeration” have the same meaning as "Mechanical".

Y. Owner: The City of Brookhaven.

Z. Piping: This term includes pipe, tube and appurtenant fittings, flanges, valves, traps, hangers and supports.

AA. Piping, Concealed: Piping built into construction and not accessible without removal of construction Work such as masonry, plaster or other finish material, and piping installed in floors, furred spaces, suspended ceilings, non-walk-in tunnels, conduits, and behind removable panels and cabinet doors.

BB. Piping, Distribution: Domestic water supply piping, starting with a connection to service piping, and continuing throughout the building to point of connection to equipment and fixture supply piping.

CC. Piping, Exposed: Piping directly accessible by normal accesses without removal of any construction Work or material.

DD. Piping, Service: Underground domestic water supply piping with a connection to a water main or supply as noted, and continuing to and into a building and terminating with the exposed fitting inside the building.

EE. Piping, Tunnel: Piping installed in walk-in or non-walk-in tunnels or conduits up to first shut-off valve inside building.

FF. Plumbing System: Includes the water supply and distribution pipes; plumbing fixtures and traps; water-treating or water-using equipment; soil, waste and vent pipes; and sanitary and storm sewers and building drains, in addition to their respective connections, devices and appurtenances within a structure or premises.

GG. Product: As used includes materials, systems, and equipment.

HH. Program Manager: Lee Croy, P.E. on behalf of the City.

II. Project Manager: Lee Croy, P.E. on behalf of the City.

JJ. Project Site: The space available to the Contractor for performing construction activities, either exclusively or in conjunction with others performing work as part of the project. The extent of the project site is shown on the Construction Drawings and may not be identical with the description of the land on which the project is to be built.

KK. Registered Design Professional: An individual who is a registered landscape architect (RLA), architect (RA), or professional engineer (PE) in accordance with state law.

LL. Space, Finished: A space which has a finishing material applied to walls or ceilings, such as paint, plaster, ceramic tile, enamel glazing, face brick, vinyl wall covering, etc. to provide a finished appearance or which will have such finishes applied under a related Contract.

MM. Space, Unfinished: A space which does not meet the definition of a finished space.

NN. Special Inspection: Inspection as herein required of the materials, installation, fabrication, erection, or placement of components and connections requiring special expertise to ensure compliance with approved construction documents and referenced standards.

OO. Steam-Heating Boiler: A boiler operated at pressures not exceeding 15 psi for steam.

PP. Supplier: Any person or organization who supplies materials or equipment for the work, including that fabricated to a special design.

QQ. Utility: Any gas, steam, water, sanitary sewer, storm sewer, electrical or other such service.

RR. Water Supply System: The water service pipe, water distribution pipes, and the necessary connecting pipes, fittings, control valves and all appurtenances in or adjacent to the structure or premises.

1. Chilled: Water-cooled by refrigeration.
2. Cold: Water with at temperature between 33 degrees F and 80 degrees F and which is neither cooled nor heated mechanically.
3. Domestic: Water for use in buildings, except water used in connection with space heating and space cooling.
4. High Temperature: Water with a supply water temperature above 350 degrees.
5. Hot: Water at a temperature greater than or equal to 110ºF.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied

directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

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

C. Conflicting Requirements: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Architect for a decision before proceeding.
   1. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

D. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
   1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

AA	Aluminum Association, Inc. (The)
AABC	Associated Air Balance Council
AAALAC	Association for Assessment and Accreditation of Laboratory Animal Care
AAMA	American Architectural Manufacturers Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	ACI International (American Concrete Institute)
ACPA	American Concrete Pipe Association
AF&PA	American Forest & Paper Association
AGA	American Gas Association
AGC	Associated General Contractors of America (The)
AHA	American Hardboard Association (part of CPA)
AI	Asphalt Institute
AIA	American Institute of Architects (The)
AISC	American Institute of Steel Construction

AISI	American Iron and Steel Institute
ALSC	American Lumber Standard Committee, Incorporated
AMCA	Air Movement and Control Association International, Inc.
ANSI	American National Standards Institute
AOSA	Association of Official Seed Analysts, Inc.
APA	Architectural Precast Association
APA	APA - The Engineered Wood Association
ARI	Air-Conditioning & Refrigeration Institute
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	ASME International
ASSE	American Society of Sanitary Engineering
ASTM	ASTM International
AWCMA	American Window Covering Manufacturers Association (WCSC)
AWI	Architectural Woodwork Institute
AWPA	American Wood-Preservers' Association
AWS	American Welding Society
AWWA	American Water Works Association
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association (The)
CBM	Certified Ballast Manufacturers
CCC	Carpet Cushion Council
CDA	Copper Development Association
CISCA	Ceilings & Interior Systems Construction Association
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute

CPA	Composite Panel Association
CRI	Carpet & Rug Institute (The)
CRSI	Concrete Reinforcing Steel Institute
CSI	Cast Stone Institute
CSI	Construction Specifications Institute (The)
CTI	Cooling Technology Institute
DHI	Door and Hardware Institute
EIA	Electronic Industries Alliance
EIMA	EIFS Industry Members Association
EJCDC	Engineers Joint Contract Documents Committee
EJMA	Expansion Joint Manufacturers Association, Inc.
ESD	ESD Association
FM Approvals	Factory Mutual Approvals
FSA	Fluid Sealing Association
GA	Gypsum Association
GANA	Glass Association of North America
GSI	Geosynthetic Institute
HI	Hydraulic Institute
HI	Hydronics Institute
HMMA	Hollow Metal Manufacturers Association
HPVA	Hardwood Plywood & Veneer Association
ICEA	Insulated Cable Engineers Association, Inc
ICRI	International Concrete Repair Institute, Inc.
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The)
IESNA	Illuminating Engineering Society of North America
IEST	Institute of Environmental Sciences and Technology

IGCC	Insulating Glass Certification Council
IGMA	Insulating Glass Manufacturers Alliance
ILI	Indiana Limestone Institute of America, Inc.
IPCEA	Insulated Power Cable Engineer Associates
ISO	International Organization for Standardization
ISSFA	International Solid Surface Fabricators Association
ITU	International Telecommunication Union
KCMA	Kitchen Cabinet Manufacturers Association
LEED	Leadership in Energy and Environmental Design
MBMA	Metal Building Manufacturers Association
MFMA	Maple Flooring Manufacturers Association, Inc.
MFMA	Metal Framing Manufacturers Association, Inc.
MIA	Marble Institute of America
MPI	Master Painters Institute
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc.
NAAMM	National Association of Architectural Metal Manufacturers
NACE	NACE International
NADCA	National Air Duct Cleaners Association
NAIMA	North American Insulation Manufacturers Association
NCMA	National Concrete Masonry Association
NCPI	National Clay Pipe Institute
NCTA	National Cable & Telecommunications Association
NEBB	National Environmental Balancing Bureau
NECA	National Electrical Contractors Association
NeLMA	Northeastern Lumber Manufacturers' Association

NEMA	National Electrical Manufacturers Association
NETA	National Electrical Testing Association
NFHS	National Federation of State High School Associations
NFPA	National Fire Protection Association
NFRC	National Fenestration Rating Council
NGA	National Glass Association
NHLA	National Hardwood Lumber Association
NLGA	National Lumber Grades Authority
NOFMA	NOFMA: The Wood Flooring Manufacturers Association
NRCA	National Roofing Contractors Association
NRMCA	National Ready Mixed Concrete Association
NSF	NSF International (National Sanitation Foundation International)
NSSGA	National Stone, Sand & Gravel Association
NTMA	National Terrazzo & Mosaic Association, Inc. (The)
NWWDA	National Wood Window and Door Association (WDMA)
PCI	Precast/Prestressed Concrete Institute
PDCA	Painting & Decorating Contractors of America
PDI	Plumbing & Drainage Institute
PGI	PVC Geomembrane Institute
PTI	Post-Tensioning Institute
RCSC	Research Council on Structural Connections
RFCI	Resilient Floor Covering Institute
SAE	SAE International
SDI	Steel Deck Institute
SDI	Steel Door Institute
SEFA	Scientific Equipment and Furniture Association
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers

SGCC	Safety Glazing Certification Council
SIA	Security Industry Association
SIGMA	Sealed Insulating Glass Manufacturers Association
SJI	Steel Joist Institute
SMA	Screen Manufacturers Association
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association
SPIB	Southern Pine Inspection Bureau (The)
SPRI	Single Ply Roofing Industry
SSINA	Specialty Steel Industry of North America
SSPC	SSPC: The Society for Protective Coatings
STI	Steel Tank Institute
SWRI	Sealant, Waterproofing, & Restoration Institute
TCA	Tile Council of America, Inc.

1.5 FEDERAL GOVERNMENT AGENCIES:

A. Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CE	Army Corps of Engineers
CPSC	Consumer Product Safety Commission
DOC	Department of Commerce
DOD	Department of Defense
DOE	Department of Energy
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FCC	Federal Communications Commission
FDA	Food and Drug Administration

GSA	General Services Administration
HUD	Department of Housing and Urban Development
NIST	National Institute of Standards and Technology
OSHA	Occupational Safety & Health Administration
PHS	Office of Public Health and Science
SD	State Department
TRB	Transportation Research Board
USDA	Department of Agriculture
USPS	Postal Service

B. Codes, Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list.

ADAAG	Americans with Disabilities Act (ADA) Accessibility Guidelines
BCNYS	Building Code of New York State
CFR	Code of Federal Regulations
DOD	Department of Defense Military Specifications and Standards
FS	Federal Specification
MILSPEC	Military Specification and Standards

1.6 OTHER TERMS OR ACRONYMS:

A. Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name in the following list.

ACM	Asbestos Containing Materials
ACT	Acoustical Tile
ICRA	Infection Control Risk Assessment
RVT	Resilient Vinyl Tile
SAT	Suspended Acoustical Tile
SFRM	Spray on Fire Resistive Materials
TSI	Thermal Systems Insulation
VAT	Vinyl Asbestos Tile
VCT	Vinyl Composition Tile

1.7 OTHER TERMS OR ACRONYMS:

A. Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name in the following list.

ACM	Asbestos Containing Materials
ACT	Acoustical Tile
ICRA	Infection Control Risk Assessment
RVT	Resilient Vinyl Tile
SAT	Suspended Acoustical Tile
SFRM	Spray on Fire Resistive Materials
TSI	Thermal Systems Insulation
VAT	Vinyl Asbestos Tile
VCT	Vinyl Composition Tile

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 014200

SECTION 015639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

B. Related Sections:

1. Section 015000 "Temporary Facilities and Controls" for temporary site fencing.
2. Section 311000 "Site Clearing" for removing existing trees and shrubs.

1.2 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape at 6 inches above the ground for trees up to, and including, 4-inch size; and 12 inches above the ground for trees larger than 4-inch size.

B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings defined by a circle concentric with each tree with a radius 1 times the diameter of the surveyed diameter, per City code.

D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.3 ACTION SUBMITTALS

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

B. Samples for Verification: For each type of the following:

1. Organic Mulch: 1-quart volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
2. Protection-Zone Fencing: Assembled Samples of manufacturer's standard size made from full-size components, full height and 3’ long.
3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.

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

1. Species and size of tree.
2. Location on site plan. Include unique identifier for each.
3. Reason for pruning.
4. Description of pruning to be performed.
5. Description of maintenance following pruning.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified arborist and tree service firm.

B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

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

D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed photographs or videotape.
2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.5 QUALITY ASSURANCE

A. Arborist Qualifications: Certified Arborist as certified by ISA Licensed arborist in jurisdiction where Project is located.

B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work. The Contractor shall provide at least one person who shall be present always during tree clearing and grubbing operations and who shall direct the trimming of roots and limbs where required. The Contractor shall provide at least one person who is qualified in the various other trades involved including demolition, protection of property and erosion control.

C. Preinstallation Conference: Conduct conference at Project site, located at 3360 Osborne Road, Brookhaven, GA.

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:

a. Construction schedule. Verify availability of materials, personnel, and equipment needed to make progress and avoid delays.
b. Enforcing requirements for protection zones.
c. Arborist's responsibilities.
d. Field quality control.
e. Code compliance.

1.6 PROJECT CONDITIONS

A. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

B. Do not direct vehicle or equipment exhaust toward protection zones.

C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; 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 nonsoil materials.

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

B. Topsoil: Imported or manufactured topsoil complying with ASTM D 5268.

C. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood.
2. Size Range: 3 inches maximum, 1/2 inch minimum.
3. Color: Natural.

D. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements.

1. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch maximum opening in pattern and weighing a minimum of 0.4 lb./ft.; remaining flexible from minus 60 to plus 200 deg F; inert to most chemicals and acids; minimum tensile yield strength of 2000 psi and ultimate tensile strength of 2680 psi; secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 8 feet apart.

    a. Height: 4 feet.
    b. Color: High-visibility orange, nonfading.

2. Gates: Single swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches.

E. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes pre-punched and reinforced; legibly printed with nonfading lettering and as follows:

1. Size and Text: As shown on Drawings.
2. Lettering: 1-inch minimum, black characters on white background.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

B. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

A. Locate and clearly identify trees, shrubs, and other vegetation to remain. Tie a 1-inch blue-vinyl tape around each tree trunk at 54 inches above the ground.

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. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated.

1. Trees to be protected shall have a 3” layer of organic mulch covering their root zones out to the driplines. Do not place mulch within 6 inches of tree trunks.

2. 1” topping of pine straw shall be placed as mulch in all disturbed areas within the limits of the work without digging into or breaking up the surface roots of trees.

D. Clearing:

1. Clear the site of brush, rubbish, grass, weeds and any other plants designated by the Landscape Architect to be removed. No trees shall be removed, or limbs and roots cut without prior approval of Landscape Architect or Owner’s Representative.

2. Remove all stumps, roots and root clusters having a diameter of one inch or larger to a depth of at least two feet below subgrade elevation for concrete structures and at least one foot below the subgrade under walks, asphalt roadway and in areas to receive heavy grading. Do not remove stumps in areas to remain natural.

E. Staking:

1. All lines, grades, levels and benchmarks shall be established and maintained by the Contractor.

2. Before commencing any work, the Contractor shall verify all grades, lines, levels and dimensions as indicated on the Drawings. He shall report any errors or inconsistencies to the Landscape Architect and Owner’s Representative before commencing work.

3. The Contractor shall stake the entire site, both as to location of all construction items as well as finish grades. This stakeout may be accurate or rough, depending on the Contractor’s preference. This stakeout may be made early in the construction process and preserved for reference during construction.

4. The purpose of the staking, with inspection and adjustment by the Landscape Architect, is to adapt the design to the site rather than allow the design to be forced upon the site. Staking is subject to various degrees of adaptation, which can only be

determined by the Landscape Architect. This variation is an aesthetic decision, the amount of adjustment most often determined by the existing trees, terrain, soil conditions, sub-surface water and by other intangibles which are impractical to survey in absolute accuracy.

5. The Contractor shall notify the Landscape Architect at least five (5) working days before inspection of the stakeout must be made. During the inspection the Landscape Architect will adjust the stakeout as necessary to fit the trees, topography and all other objects and conditions on the site. At this time the Landscape Architect will clearly mark all trees and other vegetation to be removed. This staking-inspection process must take place prior to any tree removal, grading, construction, or any other work on the site.

6. During the inspection, the Contractor shall be at the site along with the person who will superintend the work under this contract.

7. The staking-inspection process shall be repeated for any work not staked and approved or adjusted during the first site visit. No work shall ever be done without the stakeout first being adjusted and approved by the Landscape Architect. All alignment, dimensions and elevation of any grading, excavation, construction and planting is subject to adjustment to save trees and other vegetation.

3.3 TREE- AND PLANT-PROTECTION ZONES

A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.
2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
3. Access Gates: Install where needed; adjust to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Landscape Architect. Install one sign spaced approximately every 50 feet on protection-zone fencing, but no fewer than four signs with each facing a different direction.

C. Maintain protection zones free of weeds and trash.

D. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Landscape Architect.

E. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete, and equipment has been removed from the site.

1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Earth Moving."

B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.

C. 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 and as required for root pruning.

D. 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.

3.5 ROOT PRUNING

A. Prune roots that are affected by temporary and permanent construction. Prune roots as follows:

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
2. Cut Ends: Do not paint cut root ends. Coat cut ends of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other coating formulated for use on damaged plant tissues and that is acceptable to arborist.
3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
4. Cover exposed roots with burlap and water regularly.
5. Backfill as soon as possible according to requirements in Section 312000 "Earth Moving."

B. Root Pruning at Edge of Protection Zone: Prune roots flush with the edge of the protection zone, by cleanly cutting all roots to the depth of the required excavation.

C. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches as follows:

1. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
2. Pruning Standards: Prune trees according to ANSI A300 (Part 1) and the following:

    a. Type of Pruning: Cleaning and Thinning.
    b. Specialty Pruning: Restoration.

3. Cut branches with sharp pruning instruments; do not break or chop.
4. Do not apply pruning paint to wounds.

B. Chip removed branches and [spread over areas identified by Architect] [stockpile in areas approved by Architect] [dispose of off-site].

3.7 REGRADING

A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

B. Lowering Grade within Protection Zone: 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: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

D. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

E. Major Fill Over Tree Roots: Where fill dirt is necessary to establish acceptable finished grades over tree roots, contractor shall use the following method:

1. Rake away the existing mulch and humus.
2. Cover the area with #57 stone to within 3” of finish grade.
3. Lay filter fabric over top of the #57 Stone
4. Layer 3” of Topsoil over the filter cloth.
5. Cover the topsoil with 3” of pine straw or aged hardwood mulch.

3.8 FIELD QUALITY CONTROL

A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed root cutting and tree and shrub repairs.
2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
3. Treat damaged trunks, limbs, and roots according to arborist's written instructions.

4. Perform repairs within 24 hours.
5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Landscape Architect determines are incapable of restoring to normal growth pattern.

1. Provide new trees of same size and species as those being replaced for each tree that measures 4 inches or smaller in caliper size.
2. Provide two new tree(s) of 4-inch caliper size for each tree being replaced that measures more than 4 inches in caliper size.

    a. Species: Species selected by Landscape Architect.

3. Plant and maintain new trees as specified in Section 329300 "Plants."

C. Soil Aeration: Where directed by Landscape Architect, aerate surface soil compacted during construction. Aerate 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 augered soil and sand.

D. All the natural mulch areas disturbed by the construction activity shall be repaired by raking back to natural grade and covering with 1”-layer pine straw mulch. All pruning rubbish shall be removed from the site or ground and spread as mulch in the natural areas.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 015639

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

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

B. Related Sections include the following:

1. Division 01 Section "References" for applicable industry standards for products specified.
2. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.
3. Divisions 02 through 49 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.3 DEFINITIONS

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

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

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

C. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service

performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

D. Materials: Products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.

E. Equipment: Product with operational parts, whether motorized or manually operated, that requires service connections, such as wiring or piping.

1.4 SUBMITTALS

A. Product List: Submit a list, in tabular from, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.

1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
2. Form: Tabulate information for each product under the following column headings:

    a. Specification Section number and title.
    b. Generic name used in the Contract Documents.
    c. Proprietary name, model number, and similar designations.
    d. Manufacturer's name and address.
    e. Supplier's name and address.
    f. Installer's name and address.
    g. Projected delivery date or time span of delivery period.
    h. Identification of items that require early submittal approval for scheduled delivery date.

3. Initial Submittal: Within 30 days after date of commencement of the Work, submit 3 copies of initial product list. Include a written explanation for omissions of data and for variations from Contract requirements.

    a. At Contractor's option, initial submittal may be limited to product selections and designations that must be established early in Contract period.

4. Completed List: Within 60 days after date of commencement of the Work, submit 3 copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
5. Architect's Action: Architect will respond in writing to Contractor within 2 weeks of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.

B. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A.

2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

   a. Statement indicating why specified material or product cannot be provided.
   b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
   c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
   e. Samples, where applicable or requested.
   f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
   g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
   h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
   i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
   j. Cost information, including a proposal of change, if any, in the Contract Sum.
   k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
   l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within **7** days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

   a. Form of Acceptance: Change Order.
   b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

C. Comparable Product Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable

product request within 15 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.

a. Form of Approval: As specified in Division 01 Section "Submittal Procedures."
b. Use product specified if Architect cannot make a decision on use of a comparable product request within time allocated.

D. Basis-of-Design Product Specification Submittal: Comply with requirements in Division 01 Section "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

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

1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

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

B. Delivery and Handling:

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

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Store cementitious products and materials on elevated platforms.
5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.

6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
7. Protect stored products from damage and liquids from freezing.
8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

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

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
3. Refer to Divisions 02 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Landscape Architect will make selection.

5. Where products are accompanied by the term "match sample," sample to be matched is Landscape Architect's.
6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. To the fullest extent possible, provide products of the same kind from a single source.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

    a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.

10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.

    a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern,

density, or texture from manufacturer's product line that does not include premium items.

b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 PRODUCT SUBSTITUTIONS

A. Timing: Architect will consider requests for substitution if received within 60 days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.

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

1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
2. Requested substitution does not require extensive revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work.
8. Requested substitution has been coordinated with other portions of the Work.
9. Requested substitution provides specified warranty.
10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

2.3 COMPARABLE PRODUCTS

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

1. Evidence that the proposed product does not require extensive revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.

4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION

3.1 Nameplates: Except for required labels and operating data, do not attach manufacturer's nameplates or trademarks on surfaces exposed to view in occupied spaces or on the exterior.

1. Labels: Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
2. Equipment Nameplates: Provide a permanent nameplate on each item of service-connected or power-operated equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
   a. Name of product and manufacturer.
   b. Model and serial number.
   c. Capacity.
   d. Speed.
   e. Ratings.

END OF SECTION 016000

SECTION 017300 - EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

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

1. Construction layout.
2. Field engineering and surveying.
3. Installation of the Work.
4. Cutting and patching.
5. Coordination of Owner-installed products.
6. Progress cleaning.
7. Starting and adjusting.
8. Protection of installed construction.
9. Land survey work to locate easements, utilities, and subterranean objects.
10. Civil engineering services to assure positive drainage.
11. Location of underground utilities.
12. Geotechnical monitoring.
13. Field adjustments to layout.
14. Structure installations.
15. Design/Build services.

B. Related Requirements:

1. Division 01 "Summary" for limits on use of Project site.
2. Division 01 "Submittal Procedures" for submitting surveys.
3. Division 01 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

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 construction to original conditions after installation of other work.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For land surveyor and professional engineer.

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

C. Project Record Documents: Submit a record of Work performed and record copy of survey data collected in the field. TerraMark has surveyed the entire site and the survey is available to the contractor in CAD format upon request.

D. Cutting and Patching Plan: Submit plan describing procedures at least 15 days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

    a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

E. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.4 QUALITY ASSURANCE

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

B. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.

2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety.

3. Other Construction Elements: Do not cut and patch other construction elements or 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.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction 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.

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

PART 2 - PRODUCTS

2.1 MATERIALS

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

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

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

C. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

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

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

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

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

3.3 CONSTRUCTION LAYOUT

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

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

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

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

D. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

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

3.4 FIELD ENGINEERING

A. Identification: The surveyor will identify existing benchmarks, control points, and property corners. Boundaries are indicated on the existing survey by TerraMark.

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

1. Do not change or relocate existing benchmarks or control points without prior written approval. Report lost or destroyed permanent benchmarks or control points promptly. Report the need to relocate permanent benchmarks or control points to Architect before proceeding.
2. Replace lost or destroyed permanent benchmarks and control points promptly. Base replacements on the original survey control points.

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

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

D. Certified Survey: On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and sitework.

E. Field locate adjacent street right-of-way lines, adjacent property lines, and easements on the ground to use as reference during staking and construction.

F. Existing Utilities: The existence of underground utilities and construction is not guaranteed. Verify location of underground utilities and other construction before beginning site work or excavation.
1. Prior to construction, verify location and invert elevation at points of connection to storm sewers, water-service piping, and underground utility boxes.
2. Locate existing sanitary sewer manholes and lines. Contractor shall submit verified information to the Engineer for redesign per the plans.

G. Work from lines and levels established by the property survey. Establish benchmarks and markers to set lines and levels at each story of construction and to locate each element. Calculate and measure required dimensions within indicated or recognized tolerances. Do not scale Drawings to determine dimensions.
1. Advise entities engaged in construction activities of marked lines and levels provided for their use.
2. As construction proceeds, check every element for line, level and plumb.

H. Surveyor’s Log: Maintain a surveyor’s log of control and other survey work. Make this log available for reference.
1. Record deviations from lines and levels. Advise the Architect when deviations exceed tolerances. On Project Record Drawings, record deviations that are accepted and not corrected.

2. On completion of foundation walls, major site improvements, and other work requiring field-engineering services, prepare a certified survey showing dimensions, locations, angles, and elevations of construction and site work.

I. Site Improvements: Locate and lay out site improvements, including pavements, stakes grading, fill and topsoil placement, conduit locations, utility slopes, and invert elevations.

J. Existing Utilities: Furnish information necessary to adjust, move, or relocate existing curbs, structures, utility poles, lines, services, or other appurtenances located in or affected by construction. Coordinate with local authorities and utility providers having jurisdiction.

K. Geotechnical Monitoring: Contractor shall coordinate the services of the Owner's Geotechnical Engineer to take the soil borings necessary to verify the construction requirements for the following project elements are acceptable:
1. Sidewalk stabilization.
2. Pavement stabilization.
3. Retaining wall foundations.
4. Splash pad foundations.
5. Pool foundations.
6. Structure foundations.
7. Underground stormwater detention system foundation.

L. Geotechnical Data: When required, engage a qualified Geotechnical Engineer familiar with the conditions of the site and approved by the Owner.

M. Professional Design Services: When required, secure design consultants and engineers licensed in the state and approved by Owner.

N. Subsurface Conditions: Contractor is responsible to correct all subsurface conditions necessary to ensure the structural integrity of all elements of the project. Reference each section of the Technical Specifications for detailed execution requirements.

O. Design/Build Services: Design, permit, and construct segmented retaining walls per the plans.

3.5 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.

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

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

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

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

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

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

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.
3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

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

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 CUTTING AND PATCHING

A. Cutting and Patching Proposal: Submit a proposal describing procedures in advance of the time cutting and patching will be performed. Request written approval by the Project Landscape Architect/Engineer to proceed. Include the following:
1. Describe extent of cutting and patching. Describe how action will be performed and indicate why it cannot be avoided.
2. Describe changes to existing construction. Include changes to structural elements, operating components, changes to the building's appearance and/or other significant visual elements.
3. List products to be used and firms that will perform work.
4. Indicate dates and completion timeline for cutting and patching to be performed.
5. Utilities: List utilities that will be disturbed or relocated and those that will be temporarily out-of-service. Indicate dates and timeline of service that will be disrupted.
6. Where cutting and patching involves adding reinforcement to structural elements, submit details and engineering calculations showing integration of reinforcement with the original structure.
7. Approval to proceed does not waive the Project Landscape Architect/ Engineer's right to later require complete removal and replacement of unsatisfactory work.

B. Cutting and Patching, 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.

C. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would affect their load-carrying capacity or load-deflection ratio.
1. Obtain written approval from the Project Engineer before cutting and patching the following structural elements:

a. Foundation construction.
b. Bearing and retaining walls.
c. Asphalt roads and parking.
d. Utility lines or storm pipes.
e. Brickwork or sidewalks.
f. Free standing walls or fences.

D. Operational Limitations: Do not cut and patch operating elements in a manner that would reduce their capacity to perform as intended. Do not cut and patch operating elements in a manner that would increase maintenance or decrease operational life or safety.
1. Obtain permission for operating utility provider before cutting a utility.
2. Advise the Property Officer and tenants of any utility shut down before work begins.
3. Obtain written approval from the Landscape Architect before cutting and patching the following operating elements or safety related systems:
a. Primary operational systems and equipment.
b. Fire protection systems.
c. Electrical wiring systems.
d. Public address system.
e. Traffic control systems.
f. Gas, water, phone, power, cable or other utility systems.

E. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

F. Temporary Support: Provide temporary support of work to be cut.

G. 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.

H. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 011000 "Summary."

I. 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 prevent interruption to occupied areas.

J. 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 neatly to minimum 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 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.

K. 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 practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical 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 minimize evidence of patching and refinishing.

    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch extending to an inside or outside corner of a wall. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

L. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces. Clean piping, conduit, and similar features before applying paint or finishing materials. Restore damaged pipe covering to is original condition.

3.7 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.

2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.8 PROGRESS CLEANING

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

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 90 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

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

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

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

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

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

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

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

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls" and Section 017419 "Construction Waste Management and Disposal".

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.9 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 019113 "General Commissioning Requirements."

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

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

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

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

3.10 PROTECTION OF INSTALLED CONSTRUCTION

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

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

END OF SECTION 017300

SECTION 017419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

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

1. Salvaging nonhazardous demolition and construction waste.
2. Recycling nonhazardous demolition and construction waste.
3. Disposing of nonhazardous demolition and construction waste.

B. Related Requirements:

1. Section 024116 "Structure Demolition" for disposition of waste resulting from demolition of buildings, structures, and site improvements.
2. Section 042000 "Unit Masonry" for disposal requirements for masonry waste.
3. Section 044313 "Anchored Stone Masonry Veneer" for disposal requirements for excess stone and stone waste.
4. Section 311000 "Site Clearing" for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.2 DEFINITIONS

A. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

B. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

C. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

D. Recycle: Recovery of demolition or construction waste for subsequent processing in preparation for reuse.

E. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

F. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

1.3 PERFORMANCE REQUIREMENTS

A. General: Achieve end-of-Project rates for salvage/recycling of 50 percent by weight of total non-hazardous solid waste generated by the Work. Practice efficient waste management in the use of materials in the course of the Work. Use all reasonable means to divert construction and demolition waste from landfills and incinerators. Facilitate recycling and salvage of materials including the following:

1. Demolition Waste:

a. Asphalt paving.
b. Concrete.

c. Concrete reinforcing steel.
d. Brick.
e. Concrete masonry units.
f. Wood studs.
g. Wood joists.
h. Plywood and oriented strand board.
i. Wood paneling.
j. Wood trim.
k. Structural and miscellaneous steel.
l. Rough hardware.
m. Roofing.
n. Insulation.
o. Doors and frames.
p. Door hardware.
q. Windows.
r. Glazing.
s. Metal studs.
t. Gypsum board.
u. Acoustical tile and panels.
v. Carpet.
w. Carpet pad.
x. Demountable partitions.
y. Equipment.
z. Cabinets.
aa. Plumbing fixtures.
bb. Piping.
cc. Supports and hangers.
dd. Valves.
ee. Sprinklers.
ff. Mechanical equipment.
gg. Refrigerants.
hh. Electrical conduit.
ii. Copper wiring.
jj. Lighting fixtures.
kk. Lamps.
ll. Ballasts.
mm. Electrical devices.
nn. Switchgear and panelboards.
oo. Transformers.

2. Construction Waste:

a. Masonry and CMU.
b. Lumber.
c. Wood sheet materials.
d. Wood trim.
e. Metals.
f. Roofing.
g. Insulation.
h. Carpet and pad.
i. Gypsum board.

j. Piping.
k. Electrical conduit.
l. Packaging: Regardless of salvage/recycle goal indicated in "General" Paragraph above, salvage or recycle 100 percent of the following uncontaminated packaging materials:

1) Paper.
2) Cardboard.
3) Boxes.
4) Plastic sheet and film.
5) Polystyrene packaging.
6) Wood crates.
7) Plastic pails.

1.4 ACTION SUBMITTALS

A. Waste Management Plan: Submit plan within 30 days of date established for the Notice to Proceed.

1.5 INFORMATIONAL SUBMITTALS

A. Waste Reduction Progress Reports: Concurrent with each Application for Payment, submit report. Use Form CWM-7 for construction waste and Form CWM-8 for demolition waste. Include the following information:

1. Material category.
2. Generation point of waste.
3. Total quantity of waste in tons.
4. Quantity of waste salvaged, both estimated and actual in tons.
5. Quantity of waste recycled, both estimated and actual in tons.
6. Total quantity of waste recovered (salvaged plus recycled) in tons.
7. Total quantity of waste recovered (salvaged plus recycled) as a percentage of total waste.

B. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.

C. Records of Donations: Indicate receipt and acceptance of salvageable waste donated to individuals and organizations. Indicate whether organization is tax exempt.

D. Records of Sales: Indicate receipt and acceptance of salvageable waste sold to individuals and organizations. Indicate whether organization is tax exempt.

E. Recycling and Processing Facility Records: Indicate receipt and acceptance of recyclable waste by recycling and processing facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

F. Landfill and Incinerator Disposal Records: Indicate receipt and acceptance of waste by landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices.

G. Qualification Data: For waste management coordinator and refrigerant recovery technician.

H. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery

was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.6 QUALITY ASSURANCE

A. Waste Management Coordinator Qualifications: Experienced firm, with a record of successful waste management coordination of projects with similar requirements.

B. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

C. Regulatory Requirements: Comply with hauling and disposal regulations of authorities having jurisdiction.

D. Waste Management Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination." Review methods and procedures related to waste management including, but not limited to, the following:

1. Review and discuss waste management plan including responsibilities of waste management coordinator.
2. Review requirements for documenting quantities of each type of waste and its disposition.
3. Review and finalize procedures for materials separation and verify availability of containers and bins needed to avoid delays.
4. Review procedures for periodic waste collection and transportation to recycling and disposal facilities.
5. Review waste management requirements for each trade.

1.7 WASTE MANAGEMENT PLAN

A. General: Develop a waste management plan according to ASTM E 1609 and requirements in this Section. Plan shall consist of waste identification, waste reduction work plan, and cost/revenue analysis. Indicate quantities by weight or volume but use same units of measure throughout waste management plan.

B. Waste Identification: Indicate anticipated types and quantities of demolition, site-clearing, and construction waste generated by the Work. Use Form CWM-1 for construction waste and Form CWM-2 for demolition waste. Include estimated quantities and assumptions for estimates.

C. Waste Reduction Work Plan: List each type of waste and whether it will be salvaged, recycled, or disposed of in landfill or incinerator. Use Form CWM-3 for construction waste and Form CWM-4 for demolition waste. Include points of waste generation, total quantity of each type of waste, quantity for each means of recovery, and handling and transportation procedures.

1. Salvaged Materials for Reuse: For materials that will be salvaged and reused in this Project, describe methods for preparing salvaged materials before incorporation into the Work.
2. Salvaged Materials for Sale: For materials that will be sold to individuals and organizations, include list of their names, addresses, and telephone numbers.
3. Salvaged Materials for Donation: For materials that will be donated to individuals and organizations, include list of their names, addresses, and telephone numbers.
4. Salvaged Materials for Owner: For materials that will be turned over to the Owner for storage and use, delivered to a location specified by Owner.
5. Recycled Materials: Include list of local receivers and processors and type of recycled materials each will accept. Include names, addresses, and telephone numbers.

6. Disposed Materials: Indicate how and where materials will be disposed of. Include name, address, and telephone number of each landfill and incinerator facility.
7. Handling and Transportation Procedures: Include method that will be used for separating recyclable waste including sizes of containers, container labeling, and designated location where materials separation will be performed.

D. Cost/Revenue Analysis: Indicate total cost of waste disposal as if there was no waste management plan and net additional cost or net savings resulting from implementing waste management plan. Use Form CWM-5 for construction waste and Form CWM-6 for demolition waste. Include the following:

1. Total quantity of waste.
2. Estimated cost of disposal (cost per unit). Include hauling and tipping fees and cost of collection containers for each type of waste.
3. Total cost of disposal (with no waste management).
4. Revenue from salvaged materials.
5. Revenue from recycled materials.
6. Savings in hauling and tipping fees by donating materials.
7. Savings in hauling and tipping fees that are avoided.
8. Handling and transportation costs. Include cost of collection containers for each type of waste.
9. Net additional cost or net savings from waste management plan.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PLAN IMPLEMENTATION

A. General: Implement approved waste management plan. Provide handling, containers, storage, signage, transportation, and other items as required to implement waste management plan during the entire duration of the Contract.

1. Comply with operation, termination, and removal requirements in Section 015000 "Temporary Facilities and Controls."

B. Training: Train workers, subcontractors, and suppliers on proper waste management procedures, as appropriate for the Work.

1. Distribute waste management plan to everyone concerned within three days of submittal return.
2. Distribute waste management plan to entities when they first begin work on-site. Review plan procedures and locations established for salvage, recycling, and disposal.

C. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Designate and label specific areas on Project site necessary for separating materials that are to be salvaged, recycled, reused, donated, and sold.
2. Comply with Section 015000 "Temporary Facilities and Controls" for controlling dust and dirt, environmental protection, and noise control.

3.2 SALVAGING DEMOLITION WASTE

A. Salvaged Items for Reuse in the Work: Salvage items for reuse and handle as follows:

1. Clean salvaged items.
2. Pack, palletize, or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until installation.
4. Protect items from damage during transport and storage.
5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.

B. Salvaged Items for Sale: Not permitted on Project site.

C. Salvaged Items for Owner's Use: Salvage items for Owner's use and handle as follows:

1. Clean salvaged items.
2. Pack, palletize, or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

D. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

E. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.

F. Plumbing Fixtures: Separate by type and size.

G. Lighting Fixtures: Separate lamps by type and protect from breakage.

H. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.

3.3 RECYCLING [DEMOLITION] [AND] [CONSTRUCTION] WASTE, GENERAL

A. General: Recycle paper and beverage containers used by on-site workers.

B. Recycling Incentives: Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

C. Preparation of Waste: Prepare and maintain recyclable waste materials according to recycling or reuse facility requirements. Maintain materials free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process.

D. Procedures: Separate recyclable waste from other waste materials, trash, and debris. Separate recyclable waste by type at Project site to the maximum extent practical according to approved construction waste management plan.

1. Provide appropriately marked containers or bins for controlling recyclable waste until removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.

a. Inspect containers and bins for contamination and remove contaminated materials if found.

2. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
3. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
4. Store components off the ground and protect from the weather.
5. Remove recyclable waste from Owner's property and transport to recycling receiver or processor.

3.4 RECYCLING DEMOLITION WASTE

A. Asphalt Paving: Break up and transport paving to asphalt-recycling facility.

B. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.

1. Pulverize concrete to maximum 4-inch size.

C. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.

1. Pulverize masonry to maximum 4-inch size.

2. Clean and stack undamaged, whole masonry units on wood pallets.
   a. Salvage cleaned granite masonry units and provide to Owner for storage.

D. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.

E. Metals: Separate metals by type.

1. Structural Steel: Stack members according to size, type of member, and length.
2. Remove and dispose of bolts, nuts, washers, and other rough hardware.

F. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.

G. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.

H. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.

I. Metal Suspension System: Separate metal members including trim, and other metals from acoustical panels and tile and sort with other metals.

J. Carpet: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.

1. Store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

K. Carpet Tile: Remove debris, trash, and adhesive.

1. Stack tile on pallet and store clean, dry carpet in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.

L. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.

M. Conduit: Reduce conduit to straight lengths and store by type and size.

3.5 RECYCLING CONSTRUCTION WASTE

A. Packaging:

1. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
2. Polystyrene Packaging: Separate and bag materials.
3. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
4. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.

B. Wood Materials:

1. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
2. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.

    a. Comply with requirements in Section 329300 "Plants" for use of clean sawdust as organic mulch.

C. Gypsum Board: Stack large clean pieces on wood pallets or in container and store in a dry location.

1. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.

3.6 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Burning: Do not burn waste materials.

C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

3.7 ATTACHMENTS

A. Form CWM-1 for construction waste identification.

B. Form CWM-2 for demolition waste identification.

C. Form CWM-3 for construction waste reduction work plan.

D. Form CWM-4 for demolition waste reduction work plan.

E. Form CWM-5 cost/revenue analysis of construction waste reduction work plan.

F. Form CWM-6 cost/revenue analysis of demolition waste reduction work plan.

G. Form CWM-7 for construction waste

H. Form CWM-8 for demolition waste.

END OF SECTION 017419

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

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

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

B. Related Requirements:
1. Section 017300 "Execution" for progress cleaning of Project site.
2. Section 017823 "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Section 017839 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
4. Section 017900 "Demonstration and Training" for requirements for instructing Owner's personnel.
5. Divisions 02 through 49 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.2 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

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

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete. The Landscape Architect will not perform a punch list inspection until the contractor’s punch list is received and reviewed.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 30 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

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

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Project Manager's signature for receipt of submittals.

5. Submit test/adjust/balance records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 30 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
2. Complete startup and testing of systems and equipment
3. Submit test/adjust/balance records.
4. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
5. Perform preventive maintenance on equipment used prior to Substantial Completion. Complete startup testing of systems.
6. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
7. Touch up paint and otherwise repair and restore damaged finishes.
8. Complete final cleaning requirements, including touchup painting

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 3**0** days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Landscape Architect and Project Manager will either proceed with inspection or notify Contractor of unfulfilled requirements. Landscape Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on

Contractor's list or additional items identified by Landscape Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
   a. The Landscape Architects basic services include (1) initial punch list and (1) follow-up punch list inspection to insure all corrective action and or incomplete work has been finished. The Contractor is responsible to the Owner for all costs incurred by the Landscape Architect for additional services to provide multiple punch lists for the same work area. The cost for these additional services, may be deducted from the Contractors Contract by deduct Change Order.

2. Results of completed inspection will form the basis of requirements for final completion.

1.6 FINAL COMPLETION PROCEDURES

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

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Landscape Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Landscape Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Submit pest-control final inspection report.
4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
5. Advise Owner of pending insurance changeover requirements.
6. Advise Owner of changeover in heat and other utilities.
7. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
8. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
9. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
10. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
11. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
12. Prepare and submit Project Record Documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.

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

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

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A.

1. Organize list of spaces in sequential order.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Landscape Architect.
    d. Name of Contractor.
    e. Page number.

4. Submit list of incomplete items in the following format:

    a. MS Excel electronic file. Landscape Architect, through Construction Manager, will return annotated file.
    b. Web-Based Project Software Upload: Utilize software feature for creating and updating list of incomplete items (punch list).
    c. Three paper copies.

1.8 SUBMITTAL OF PROJECT WARRANTIES

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

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

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

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

    a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
    b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
    c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
    d. Remove tools, construction equipment, machinery, and surplus material from Project site.
    e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
    f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    g. Sweep concrete floors broom clean in unoccupied spaces.
    h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
    i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
    j. Remove labels that are not permanent.
    k. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.

n. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.

o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.

p. Groom artificial turf field.

q. Fill swimming pool and splash pad, clean and properly treated, ready for use.

r. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls" and Section 017419 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

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

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

END OF SECTION 017700

SECTION 017823 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

B. Related Requirements:

1. Section 013300 "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
2. Divisions 02 through 49 Sections for any specific closeout requirements for the Work in those Sections.

1.2 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Project Manager will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Project Manager.

    a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
    b. Enable inserted reviewer comments on draft submittals.

2. Three paper copies. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves.

C. Initial Manual Submittal: Submit draft copy of each manual at least **30** days before commencing demonstration and training. Project Manager will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Project Manager will return copy with comments.

1. Correct or revise each manual to comply with Project Manager's comments. Submit copies of each corrected manual within 15 days of receipt of Project Manager's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Bookmark individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

C. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

F. Manuals, Paper Copy: Submit manuals in the form of hard copy, bound and labeled volumes.

1. Binders: Heavy-duty, three-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.

a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, subject matter of

contents, and indicate Specification Section number on bottom of spine. Indicate volume number for multiple-volume sets.

2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section of the manual. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software storage media for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.

    a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format,

identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Section 017839 "Project Record Documents."

G. Comply with Section 017700 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

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

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

B. Related Requirements:

1. Division 01 "Execution" for final property survey.
2. Division 01 "Closeout Procedures" for general closeout procedures.
3. Division 01 "Operation and Maintenance Data" for operation and maintenance manual requirements.
4. Divisions 02 through 49 Sections for specific requirements for project record documents of the Work in those Sections.

1.2 CLOSEOUT SUBMITTAL

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:

1) Submit one paper-copy set of marked-up record prints.
2) Submit PDF electronic files of scanned record prints.
3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

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

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

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

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit one paper copy and an annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report monthly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.3 RECORD DRAWINGS

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

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

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

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

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

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

6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
7. Submit as indicated in the Article 1.2 final submittal.

1.4 RECORD SPECIFICATIONS

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

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders, record Product Data, and record Drawings where applicable.
6. Submit as indicated in the Article 1.2 final submittal

1.5 RECORD PRODUCT DATA

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

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.
4. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.
5. Submit as indicated in the Article 1.2 final submittal

1.6 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.
2. Submit as indicated in the Article 1.2 final submittal

PART 2 - EXECUTION

2.1 RECORDING AND MAINTENANCE

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

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Landscape Architect's and Project Manager's reference during normal working hours.

END OF SECTION 017839

SECTION 017900 - DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:

1. Demonstration of operation of systems, subsystems, and equipment.
2. Training in operation and maintenance of systems, subsystems, and equipment.
3. Demonstration and training video recordings.

1.2 INFORMATIONAL SUBMITTALS

A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.

1. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.

B. Qualification Data: For instructor.

C. Attendance Record: For each training module, submit list of participants and length of instruction time.

D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 CLOSEOUT SUBMITTALS

A. Demonstration and Training Video Recordings: Submit one copy within seven days of end of each training module.

1. Identification: On each copy, provide an applied label with the following information:

a. Name of Project.
b. Name and address of videographer.
c. Name of Landscape Architect.
d. Name of Construction Manager.
e. Name of Contractor.
f. Date of video recording.

2. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals in PDF electronic file format on compact disc.

1.4 QUALITY ASSURANCE

A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and

whose work has resulted in training or education with a record of successful learning performance.

B. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Section 014000 "Quality Requirements," experienced in operation and maintenance procedures and training.

1.5 COORDINATION

A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations and to ensure availability of Owner's personnel.

B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.

C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Landscape Architect.

1.6 INSTRUCTION PROGRAM

A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections.

B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:

1. Basis of System Design, Operational Requirements, and Criteria: Include the following:

    a. System, subsystem, and equipment descriptions.
    b. Performance and design criteria if Contractor is delegated design responsibility.
    c. Operating standards.
    d. Regulatory requirements.
    e. Equipment function.
    f. Operating characteristics.
    g. Limiting conditions.
    h. Performance curves.

2. Documentation: Review the following items in detail:

    a. Emergency manuals.
    b. Operations manuals.
    c. Maintenance manuals.
    d. Project record documents.
    e. Identification systems.
    f. Warranties and bonds.
    g. Maintenance service agreements and similar continuing commitments.

3. Emergencies: Include the following, as applicable:

    a. Instructions on meaning of warnings, trouble indications, and error messages.

b. Instructions on stopping.
c. Shutdown instructions for each type of emergency.
d. Operating instructions for conditions outside of normal operating limits.
e. Sequences for electric or electronic systems.
f. Special operating instructions and procedures.

4. Operations: Include the following, as applicable:

a. Startup procedures.
b. Equipment or system break-in procedures.
c. Routine and normal operating instructions.
d. Regulation and control procedures.
e. Control sequences.
f. Safety procedures.
g. Instructions on stopping.
h. Normal shutdown instructions.
i. Operating procedures for emergencies.
j. Operating procedures for system, subsystem, or equipment failure.
k. Seasonal and weekend operating instructions.
l. Required sequences for electric or electronic systems.
m. Special operating instructions and procedures.

5. Adjustments: Include the following:

a. Alignments.
b. Checking adjustments.
c. Noise and vibration adjustments.
d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:

a. Diagnostic instructions.
b. Test and inspection procedures.

7. Maintenance: Include the following:

a. Inspection procedures.
b. Types of cleaning agents to be used and methods of cleaning.
c. List of cleaning agents and methods of cleaning detrimental to product.
d. Procedures for routine cleaning
e. Procedures for preventive maintenance.
f. Procedures for routine maintenance.
g. Instruction on use of special tools.

8. Repairs: Include the following:

a. Diagnosis instructions.
b. Repair instructions.
c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
d. Instructions for identifying parts and components.

e. Review of spare parts needed for operation and maintenance.

1.7 PREPARATION

A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a training manual organized in coordination with requirements in Section 017823 "Operation and Maintenance Data."

B. Set up instructional equipment at instruction location.

1.8 INSTRUCTION

A. Facilitator: Engage a qualified facilitator to prepare instruction program and training modules, to coordinate instructors, and to coordinate between Contractor and Owner for number of participants, instruction times, and location.

B. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.

1. The Contractor will furnish an instructor to describe basis of system design, operational requirements, criteria, and regulatory requirements.
2. Owner will furnish Contractor with names and positions of participants.

C. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.

1. Schedule training with Owner, through Project Manager, with at least seven days' advance notice.

D. Training Location and Reference Material: Conduct training on-site in the completed and fully operational facility using the actual equipment in-place. Conduct training using final operation and maintenance data submittals.

E. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.

F. Cleanup: Collect used and leftover educational materials and remove from Project site. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

1.9 DEMONSTRATION AND TRAINING VIDEO RECORDINGS

A. General: Engage a qualified commercial videographer to record demonstration and training video recordings. Record each training module separately. Include classroom instructions and demonstrations, board diagrams, and other visual aids, but not student practice.

1. At beginning of each training module, record each chart containing learning objective and lesson outline.

B. Video: Provide minimum 1080 video resolution converted to file type acceptable to Owner, on electronic media.

1. Electronic Media: Read-only format compact disc with commercial-grade graphic label or flash drive as acceptable to Owner,
2. File Hierarchy: Organize folder structure and file locations according to project manual table of contents. Provide complete screen-based menu.

3. File Names: Utilize file names based upon name of equipment generally described in video segment, as identified in Project specifications.
4. Contractor and Installer Contact File: Using appropriate software, create a file for inclusion on the Equipment Demonstration and Training DVD that describes the following for each Contractor involved on the Project, arranged according to Project table of contents:

    a. Name of Contractor/Installer.
    b. Business address.
    c. Business phone number.
    d. Point of contact.
    e. E-mail address.

C. Recording: Mount camera on tripod before starting recording, unless otherwise necessary to adequately cover area of demonstration and training. Display continuous running time.

1. Film training session(s) in segments not to exceed 15 minutes.

    a. Produce segments to present a single significant piece of equipment per segment.
    b. Organize segments with multiple pieces of equipment to follow order of Project Manual table of contents.
    c. Where a training session on a particular piece of equipment exceeds 15 minutes, stop filming and pause training session. Begin training session again upon commencement of new filming segment.

D. Light Levels: Verify light levels are adequate to properly light equipment. Verify equipment markings are clearly visible prior to recording.

1. Furnish additional portable lighting as required.

E. Narration: Describe scenes on video recording by audio narration by microphone while dubbing audio narration off-site after video recording is recorded. Include description of items being viewed.

F. Preproduced Video Recordings: Provide video recordings used as a component of training modules in same format as recordings of live training.

END OF SECTION 017900

SECTION 019113 - GENERAL COMMISSIONING REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. OPR and BoD documentation are included by reference for information only.

1.2 SUMMARY

A. Section includes general requirements that apply to implementation of commissioning without regard to specific systems, assemblies, or components.

B. Related Sections:

1. Section 230800 "Commissioning of HVAC" for commissioning process activities for HVAC&R systems, assemblies, equipment, and components.

1.3 DEFINITIONS

A. BoD: Basis of Design. A document that records concepts, calculations, decisions, and product selections used to meet the OPR and to satisfy applicable regulatory requirements, standards, and guidelines. The document includes both narrative descriptions and lists of individual items that support the design process.

B. Commissioning Plan: A document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

C. CxA: Commissioning Authority.

D. OPR: Owner's Project Requirements. A document that details the functional requirements of a project and the expectations of how it will be used and operated. These include Project goals, measurable performance criteria, cost considerations, benchmarks, success criteria, and supporting information.

E. Systems, Subsystems, Equipment, and Components: Where these terms are used together or separately, they shall mean "as-built" systems, subsystems, equipment, and components.

1.4 COMMISSIONING TEAM

A. Members Appointed by Contractor(s): Individuals, each having the authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated action. The commissioning team shall consist of, but not be limited to, representatives of the Contractor, including Project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.

B. Members Appointed by Owner:

1. CxA: The designated person, company, or entity that plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the CxA under a separate contract.
2. Representatives of the facility user and operation and maintenance personnel.
3. Architect and engineering design professionals.

1.5 OWNER'S RESPONSIBILITIES

A. Provide the OPR documentation to the CxA and Contractor for information and use.

B. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.

C. Provide the BoD documentation, prepared by Architect and approved by Owner, to the CxA and Contractor for use in developing the commissioning plan, systems manual, and operation and maintenance training plan.

1.6 CONTRACTOR'S RESPONSIBILITIES

A. Contractor shall assign representatives with expertise and authority to act on its behalf and shall schedule them to participate in and perform commissioning process activities including, but not limited to, the following:

1. Evaluate performance deficiencies identified in test reports and, in collaboration with entity responsible for system and equipment installation, recommend corrective action.
2. Cooperate with the CxA for resolution of issues recorded in the Issues Log.
3. Attend commissioning team meetings held on a monthly basis.
4. Integrate and coordinate commissioning process activities with construction schedule.
5. Review and accept construction checklists provided by the CxA.
6. Complete electronic construction checklists as Work is completed and provide to the Commissioning Authority on a weekly basis.
7. Review and accept commissioning process test procedures provided by the Commissioning Authority.
8. Complete commissioning process test procedures.

1.7 CxA'S RESPONSIBILITIES

A. Organize and lead the commissioning team.

B. Provide commissioning plan.

C. Convene commissioning team meetings.

D. Provide Project-specific construction checklists and commissioning process test procedures.

E. Verify the execution of commissioning process activities using random sampling. The sampling rate may vary from 1 to 100 percent. Verification will include, but is not limited to, equipment submittals, construction checklists, training, operating and maintenance data, tests, and test reports to verify compliance with the OPR. When a random sample does not meet the requirement, the CxA will report the failure in the Issues Log.

F. Prepare and maintain the Issues Log.

G. Prepare and maintain completed construction checklist log.

H. Witness systems, assemblies, equipment, and component startup.

I. Compile test data, inspection reports, and certificates; include them in the systems manual and commissioning process report.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 019113

SECTION 024116 - STRUCTURE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
1. Demolition and removal of buildings and site improvements.
2. Removing below-grade construction.

B. Related Sections include the following:
1. Division 01 Section "Summary" for use of the premises and phasing requirements.
2. Division 01 Section "Temporary Facilities and Controls" for temporary construction, protection facilities, and environmental-protection measures for building demolition operations.
3. Division 02 Section "Selective Structure Demolition" for partial demolition of buildings, structures, and site improvements.
4. Division 02 Section “Asbestos Abatement” for related Asbestos demolition work
5. Division 22 Sections for demolishing or relocating site plumbing items.
6. Division 26 Sections for demolishing or relocating site electrical items.
7. Division 31 Section "Site Clearing" for site clearing and removal of above- and below-grade site improvements not part of building demolition.
1. Division 33 "Common Work Results for Utilities" for shutting off, disconnecting, removing, and sealing or capping utilities.
2.

1.2 DEFINITIONS

A. Demolish: Completely remove and legally dispose of off-site.

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, and deliver to Owner. Include fasteners or brackets needed for reattachment elsewhere.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.
1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, 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 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified refrigerant recovery technician.

B. Permit: Obtain all required permits prior to beginning demolition work.

C. Proposed Protection Measures: Submit informational report, including Drawings, that indicates the measures proposed for protecting individuals and property for environmental protection, dust control, and noise control. Indicate proposed locations and construction of barriers.
1. Adjacent Buildings: Detail special measures proposed to protect adjacent buildings to remain including means of egress from those buildings.

D. Schedule of Building 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. Shutoff and capping of utility services.

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

F. Predemolition Photographs: Show existing conditions of adjoining construction and site improvements, including finish surfaces, which might be misconstrued as damage caused by demolition operations. Comply with Section 013233 "Photographic Documentation." Submit before the Work begins.

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

H. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

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. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.

D. Predemolition Conference: Conduct conference at Project site.
   1. Inspect and discuss condition of construction to be demolished.
   2. Review structural load limitations of existing structures.
   3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
   4. Review and finalize protection requirements.
   5. Review procedures for noise control and dust control.
   6. Review procedures for protection of adjacent buildings.
   7. Review items to be salvaged and returned to Owner.

1.6 PROJECT CONDITIONS

A. Buildings to be demolished will be vacated and their use discontinued before start of the Work.

B. Buildings immediately adjacent to demolition area will be occupied. Conduct building demolition so operations of occupied buildings will not be disrupted.
   1. Maintain access to existing walkways, exits, and other facilities used by occupants of adjacent buildings.
      a. Do not close or obstruct walkways, exits, or other facilities used by occupants of adjacent buildings without written permission from authorities having jurisdiction.

C. Owner assumes no responsibility for buildings and structures to be demolished.
   1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
   1. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Landscape Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

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

1.7 COORDINATION

A. Arrange demolition schedule so as not to interfere with operations of adjacent occupied buildings.

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. Review Project Record Documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

3.2 PREPARATION

A. Refrigerant: Remove refrigerant from mechanical equipment according to 40 CFR 82 and regulations of authorities having jurisdiction before starting demolition.

B. Existing Utilities: Refer to Divisions 22 and 26 Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

C. 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.
   4. Salvage telephone service line for reconnection.
   5. Salvage data service line for reconnection.

D. 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.

E. 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 walkways, loading docks, 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. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
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 01 Section "Temporary Facilities and Controls."
1. Protect adjacent buildings and facilities from damage due to demolition activities.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.

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 buildings and site improvements completely. Use methods required to complete the Work within limitations of governing regulations and as follows:
1. Do not use cutting torches until work area is cleared of flammable materials. Maintain portable fire-suppression devices during flame-cutting operations.
2. Maintain fire watch during and for at least two hours after flame cutting operations.
3. Maintain adequate ventilation when using cutting torches.
4. Locate building demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
5. Demolition activities shall only take place weekdays, between 9am and 5pm EST.

B. Engineering Surveys: During demolition, perform surveys to detect hazards that may result from building demolition activities.

C. Site Access and Temporary Controls: Conduct building demolition and 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.

2. 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.

D. Explosives: Use of explosives is not permitted.

3.5 DEMOLITION BY MECHANICAL MEANS

A. Below-Grade Construction: Demolish foundation walls and other below-grade construction.

1. Remove below-grade construction, including basements, foundation walls, and footings, completely.

B. Existing Utilities: Demolish or abandon existing utilities and below-grade utility structures to the limits indicated in Drawings. Cut abandoned utilities 2’ below grade.

1. Fill abandoned utility structures with satisfactory soil materials according to backfill requirements in Section 312000 "Earth Moving."
2. Piping: Disconnect piping at unions, flanges, valves, or fittings.
3. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

C. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

D. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.

E. [Salvage: Items to be removed and salvaged are indicated on Drawings.

3.6 SITE RESTORATION

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

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

3.8 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved landfill acceptable to authorities having jurisdiction.
   1. Do not allow demolished materials to accumulate on-site.
   2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

B. Do not burn demolished materials.

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 building demolition operations began.
   1. Clean roadways of debris caused by debris transport.

END OF SECTION 024116

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, finishes, and testing for the following:
   1. Footings.
   2. Foundation walls.
   3. Slabs-on-grade.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with fly ash; subject to compliance with requirements.

1.4 SUBMITTALS

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

B. Design Mixtures: For each concrete mixture, indicating quantity of each ingredient and admixtures proposed or required. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
   1. For mix designs based on field experience, include individual strength test results, standard deviation, and required average compressive strength calculations.
   2. For mix designs based on trial, include proportions, test results, and graphic analysis indicating average compressive strength.
   3. Indicate amounts of mixing water to be withheld for later addition at Project site.

C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, assembly, and support of formwork.

E. Schedule for Concrete Placement: Order-of-construction schedule by location in structure.
   1. Include shop drawings indicating all construction joints required, including any anticipated joints due to placement schedule.

F. Submit description of planned procedures and protective measures for cold weather or hot weather concreting.

G. Qualification Data: For Installer.

H. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
   1. Aggregates. Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

I. Material Certificates: For each of the following, signed by manufacturers; indicate compatibility with application of surface applied flooring products where applicable:
   1. Cementitious materials.

2. Aggregates.
3. Admixtures.
4. Form materials and form-release agents.
5. Steel reinforcement and accessories.
6. Curing compounds.
7. Bonding agents.
8. Adhesives.
9. Vapor retarders.
10. Joint-filler strips.
11. Repair materials.

J. Floor surface flatness and levelness measurements to determine compliance with specified tolerances.

K. Field quality-control test and inspection reports.
1. Include copies of delivery tickets complying with ASTM C 94 for each load of concrete delivered to the site.

L. Minutes of preinstallation conference.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs on Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94 requirements for production facilities and equipment.
1. Comply with requirements of the Concrete Manufacturers Association “Concrete Plant Standards.”

C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.

D. Welding: Qualify procedures and personnel according to AWS D1.4, "Structural Welding Code--Reinforcing Steel."

E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5, Section 7, "Lightweight Concrete", and Section 8.
2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
3. ACI 305, "Hot Weather Concreting".
4. ACI 306, "Cold Weather Concreting".
5. ACI 308, "Guide to Curing Concrete".
6. ACI 302, "Guide for Concrete Floor and Slab Construction".
7. ACI 315 “Details and Detailing of Concrete Reinforcement.”
8. ACI 347 “Formwork for Concrete”; and
9. Concrete Repair Manual, by ACI and ICRI.

F. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1. Before submitting design mixtures, review concrete design mixture and examine procedures for ensuring quality of concrete materials. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
   a. Contractor's superintendent.
   b. Independent testing agency responsible for concrete design mixtures.
   c. Ready-mix concrete manufacturer.
   d. Concrete subcontractor.
2. Review the following:
   a. Coordination with special inspection and testing and inspecting agency procedures for field quality control.
   b. Concrete finishes and finishing.
   c. Cold- and hot-weather concreting procedures.
   d. Curing procedures.
   e. Construction contraction and isolation joints and joint-filler strips.
   f. Forms and form removal limitations.
   g. Vapor-retarder installation.
   h. Anchor rod and anchorage device installation tolerances.
   i. Steel reinforcement installation.
   j. Floor and slab flatness and levelness measurement.
   k. Concrete repair procedures.
   l. Concrete protection.

J. The Contractor is responsible for correction of concrete work which does not conform to the specified requirements, including strength, tolerances, and finishes. The Contractor shall correct deficient concrete as directed by the Architect.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
   1. Store steel reinforcement off ground, under suitable cover or enclosed.
   2. Maintain ease of access for inspection and identification of materials.

PART 2 - PRODUCTS

2.1 FORM-FACING MATERIALS

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Metal or other approved panel materials.
   2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      a. High-density overlay, Class 1 or better.
      b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
      c. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
   1. Include supplementary requirement S1.

B. Plain-Steel Wire: ASTM A 82, as drawn.

C. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A 615, Grade 60, plain-steel bars, cut bars true to length with ends square and free of burrs.

B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
2. Supporting devices for slabs-on-grade shall have sand plates.

C. Tie Wire: 16 gauge annealed type.

2.4 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
1. Portland Cement: ASTM C 150, Type I or II. Supplement with the following:
a. Fly Ash: ASTM C 618, Class F.

B. Aggregates, General: Tested and passed within 6 months of use for the following:
1. Gradation: ASTM C 136.
2. Material Passing No. 200 Sieve: ASTM C 117.
3. Organic Impurities: ASTM C 40.
4. Soundness: ASTM C 88.
5. Clay Lumps: ASTM C 142.
6. Lightweight Constituents: ASTM C 123.
7. Abrasiveness of Coarse Materials: ASTM C 131.
8. Soft Particles: ASTM C 235.
9. Freeze/Thaw Resistance: ASTM C 66, ASTM C 682.

C. Normal-Weight Aggregates: ASTM C 33, 3M South coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.
1. Maximum Coarse-Aggregate Size:
a. Percentage passing No. 200 sieve shall be less than 0.7%.
b. Nominal size 1 1/2": ASTM Size No. 467.
c. Nominal size 1": ASTM Size No. 57.
d. Nominal size 1/2": ASTM Size No. 7.
2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
a. Percentage passing No. 200 sieve shall be less than 3%.

D. Water: ASTM C 94 and potable.

2.5 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

Admixtures which result in more than 0.1% of soluble chloride ions by weight of cement are prohibited.

1. Water-Reducing Admixture: ASTM C 494, Type A.
2. Retarding Admixture: ASTM C 494, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
5. Plasticizing and Retarding Admixture: ASTM C 1017, Type II.

C. Set-Accelerating Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete and complying with ASTM C 494, Type C.

1. Products:
   a. Euclid Chemical Company (The); Eucon CIA.
   b. Grace Construction Products, W. R. Grace & Co.; DCI.
   c. Master Builders, Inc.; MasterLife CI 30.
   d. Sika Corporation; Sika CNI.

2.6 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E 1745, Class A. Product shall have a permeance rating of 0.01 perms maximum. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products:
   a. Fortifiber Corporation; Moistop Ultra A.
   b. Raven Industries Inc.; Vapor Block 15.
   c. Reef Industries, Inc.; Griffolyn Type 105.
   d. Stego Industries, LLC; Stego Wrap, 15 mils.

B. Plastic Vapor Retarder: ASTM E 1745, Class B. Include manufacturer's recommended adhesive or pressure-sensitive tape.

1. Products:
   a. Fortifiber Corporation; Moistop Ultra.
   b. Raven Industries Inc.; Vapor Block 15.
   c. Stego Industries, LLC; Stego Wrap, 15 mils.

C. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

D. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

2.7 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

1. Products:
   a. Burke by Edoco; BurkeFilm.
   b. ChemMasters; Spray-Film.
   c. Euclid Chemical Company (The); Eucobar.
   d. L&M Construction Chemicals, Inc.; E-Con.
   e. Meadows, W. R., Inc.; Sealtight Evapre.
   f. Sika Corporation, Inc.; SikaFilm.
   g. Symons Corporation, a Dayton Superior Company; Finishing Aid.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. when dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, 18 to 25 percent solids, nondissipating, certified by curing compound manufacturer to not interfere with bonding of floor covering.
1. Characteristics: Acrylic polymer blend; non-yellowing from ultraviolet exposure; dustproofs concrete.
2. Products:
   a. ChemMasters; Safe-Cure Clear.
   b. Euclid Chemical Company (The); Diamond Clear VOX.
   c. L&M Construction Chemicals, Inc.; Dress & Seal WB.
   d. MBT Protection and Repair, Div. of ChemRex; MasterKure-N-Seal VOC.
   e. Meadows, W. R., Inc.; Vocomp-20.
   f. Sonneborn, Div. of ChemRex; Kure-N-Seal.
   g. Tamms Industries, Inc.; Clearseal WB STD.

F. Clear, Solvent-Borne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.
1. Products:
   a. Burke by Edoco; Cureseal 1315.
   b. ChemMasters; Spray-Cure & Seal Plus.
   c. Conspec Marketing & Manufacturing Co., Inc., a Dayton Superior Company; Sealcure 1315.
   d. Euclid Chemical Company (The); Super Diamond Clear.
   e. L&M Construction Chemicals, Inc.; Lumiseal Plus.
   f. Meadows, W. R., Inc.; CS-309/30.
   g. Sonneborn, Div. of ChemRex; Kure-N-Seal 5.
   h. Tamms Industries, Inc.; LusterSeal 300.

G. Evaporation Retarder:
Products:
   a. BASF Construction Chemicals; Master Builders, Confilm.

2.8 RELATED MATERIALS

A. Expansion-Joint-Filler and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber for pavements and sidewalks, and ASTM D 1752, cork or self-expanding cork for slabs-on-grade.

B. Preformed Control Joint Former for joints to receive sealant or for sawcut type joints. To be used only with approval of the Architect.

C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.

D. Burlap: AASHTO M 182, Class 2 jute or kenaf cloth.

2.9 REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
1. Cement Binder: ASTM C 150, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.

3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109.

2.10 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, on the basis of laboratory trial mixture or field test data, or both, according to ACI 301. Proportion design mixes per the recommendations of ACI 211.1 for normal weight concrete and ACI 211.2 for structural lightweight concrete.
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
2. Design mixes to meet or exceed each requirement specified. Adjust mix design to meet the most stringent requirement.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Fly Ash: 15 percent.
2. Combined Fly Ash and Pozzolan: 15 percent.

C. Limit water-soluble, chloride-ion content in hardened concrete to 0.06 percent by weight of cement.

D. Admixtures: Use admixtures according to manufacturer's written instructions.
1. Use water-reducing, high-range water-reducing or plasticizing 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.
3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
4. Use set-accelerating corrosion-inhibiting admixture in concrete mixtures where indicated.

2.11 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings and Buried Foundations: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 3,500 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio by Weight: 0.50.
3. Minimum Cementitious Materials Content: 475 lb/cu. yd.
4. Maximum Nominal Aggregate Size: 1 inch.
5. Maximum Slump Limit: 3-1/2 inches, plus or minus 1 inch.

B. Slabs-on-Grade (Interior): Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 3000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio by Weight: 0.45.
3. Minimum Cementitious Materials Content: 540 lb/cu. yd.
4. Maximum Nominal Aggregate Size: 1 inch.
5. Maximum Slump Limit: 3-1/2 inches, plus or minus 1 inch.

C. Exposed Foundation, Exterior Walks and Retaining Walls: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 5,000 psi at 28 days.
2. Maximum Water-Cementitious Materials Ratio by Weight: 0.45.
3. Minimum Cementitious Materials Content: 590 lb./cu.yd.
4. Minimum Nominal Aggregate Size: 1/2 inch.
5. Maximum Nominal Aggregate Size: 1-1/2 inches.
6. Maximum Slump Limit: 3-1/2 inches, plus or minus 1 inch.

7. Air Content: 5.5 percent, plus or minus 1.0 percent.

G. Controlled Low Strength Material (CLSM)
1. Permanent Material
a. Material shall meet the requirements of ACI 229R with a minimum compressive strength of 400 lb./sq. in.
2. Removable Material
a. Material shall meet the requirements of ACI 229R with a minimum compressive strength of 50 to 100 lb./sq. in.

2.12 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

B. Bend steel reinforcement in accordance with ACI 318.
1. Do not heat steel reinforcement for bending. Bend or straighten bars cold.
2. Do not bend partially embedded steel reinforcement, except as approved.

2.13 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, paragraphs 1 to 15 and 18 only, and furnish batch ticket information.
1. When air temperature is between 85 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.

B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.
1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released.
2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mixture type, mixture time, quantity, and amount of water added. Record approximate location of final deposit in structure.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. 1. Where elevated concrete thickness exceeds 8 inches, contractor to provide Design Plans and Calculations of formwork shoring and bracing for review.

C. 2. Earth forms are not permitted.

D. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

E. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
1. Class A, 1/8 inch for smooth-formed finished surfaces.
2. Class C, 1/2 inch for rough-formed finished surfaces.

F. Construct forms tight enough to prevent loss of concrete mortar.

G. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   1. Install keyways, reglets, recesses, and the like, for easy removal.
   2. Do not use rust-stained steel form-facing material.

H. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

I. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

J. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

K. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

L. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

M. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
   1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges." Misplaced or damaged anchor rods will be subject to re-engineering fees.
   2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
   3. Installed penetrating conduits and embedded pipes in concrete shall comply with Section 6.3 of ACI 318.
      a. No conduits or embedded pipes shall be located within supported slabs or slab-on-grade.

3.3 REMOVING AND REUSING FORMS

A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
   1. Leave formwork for beam soffits, joists, slabs, and other structural elements that supports weight of concrete in place until concrete has achieved at least 70 percent of its 28-day design compressive strength.
   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

3.4 VAPOR RETARDERS

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions.
   1. Lap joints 6 inches and seal with manufacturer's recommended tape.

3.5 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
   1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
   2. Allow six hours between completion of reinforcement installation and placement of concrete for special inspection.

B. Clean reinforcement of dirt, grease, scale, loose rust, oil, paint and other foreign matter prior to installation.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
   1. Weld reinforcing bars according to AWS D1.4, where indicated.

D. Splicing and Embedment of Reinforcement: Conform to ACI 318 Chapter 12 for wired lap splices and embedment lengths.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

G. 1. "Hooking-up" or "Walking-in" of any reinforcement will not be permitted.

H. Maintain required concrete cover dimensions indicated. Coordinate placement of conduit and inserts with reinforcement. Protect installed reinforcement from damage or displacement prior to and during concrete placement.

I. 1. The Contractor shall repair or replace damaged, distorted, or displaced reinforcement.

3.6 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
   1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints, unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
   2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
   3. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   4. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   5. Space vertical joints in walls as indicated. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

6. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Contraction Joints in Slabs-on-Grade: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness or a minimum of 1-inch as follows:

1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of contraction joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
2. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch-wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
3. Spacing of joints shall not exceed 30 times (20 times for exposed concrete floor surface) the thickness of the slab nor 12 feet on center. All panels should be square or nearly so. Joints shall typically isolate columns and run between columns, with intermediate joints located at equal spaces between column lines.
4. Joints produced using conventional processes shall be made within 4 or 12 hours after the slab in that area has been finished- within 4 hours in hot weather and within 12 hours in cold weather.
5. Joints produced using early-entry dry-cut saws shall be made within 1 or 4 hours after the slab in that area has been finished- within 1 hour in hot weather and within 4 hours in cold weather.
6. Hand tooled joints shall be done immediately following edging, or at the same time.
7. For floors to be covered with quarry tile, ceramic tile, or terrazzo, the joints shall be aligned with joints in the rigid floor coverings.

D. Contraction Joints in Walls: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Provide adequate shear reinforcement as indicated or directed. Construct contraction joints as follows:

E. 1. Joints shall be constructed to provide for the installation of watertight joint and sealant, and filled with sealant.

F. 3. Spacing of joints shall be located about 4 feet from corners and intersections, and then at 25 feet on center thereafter.

G. Isolation Joints in Slabs-on-Grade: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.

H. Doweled Joints: Install dowel bars and support assemblies at joints where indicated. Lubricate or asphalt coat one-half of dowel length to prevent concrete bonding to one side of joint.

3.7 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed and corrections made.

B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect.

C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
   1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
   2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
      a. Do not supplement mechanical consolidation by hand, spading, rodding, or tamping unless approved by Architect.
   3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
   1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   2. Maintain reinforcement in position on chairs during concrete placement.
   3. Screed slab surfaces with a straightedge and strike off to correct elevations.
   4. Slope surfaces uniformly to drains where required.
   5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

F. Provide sufficient time for excess water to evaporate prior to placement of floor coverings.

G. 1. Refer to floor covering product manufacturer submittals for requirements.

H. Cold-Weather Placement: Comply with ACI 306 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 average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
   2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
   3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

I. Hot-Weather Placement: Comply with ACI 305 and as follows:
   1. 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. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.8 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defects. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.9 FINISHING SLABS

A. General: Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/8 inch in one direction.
   1. Apply scratch finish to surfaces to receive concrete floor toppings, or to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
   1. Apply float finish to surfaces to receive trowel finish, or to be covered with fluid-applied or sheet waterproofing, built-up or membrane roofing, or sand-bed terrazzo.

D. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   1. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
   2. Finish surfaces to the following tolerances, according to ASTM E 1155, for a randomly trafficked floor surface:
   3. Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-foot-long straightedge resting on 2 high spots and placed anywhere on the surface does not exceed 1/8 inch.

E. Broom Finish: Apply a broom finish to exposed concrete platforms, steps, and ramps, and elsewhere as indicated.
   1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Architect before application.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-

place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on Drawings. Set anchor bolts for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment. Misplaced or damaged anchor bolts will be subject to re-engineering fees.

3.11 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306 for cold-weather protection and ACI 305 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.

D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including floors and slabs, concrete floor toppings, and other surfaces.

E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    a. Water.
    b. Continuous water-fog spray.
    c. 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. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
    a. Moisture cure or use moisture-retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments as recommended by manufacturer.
    b. Cure concrete surfaces to receive floor coverings with either a moisture-retaining cover or a curing compound that the manufacturer certifies will not interfere with bonding of floor coverings used on Project.
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.
    a. After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor covering used on Project.
    b. Curing compound to be applied only in locations permitted or required.

4. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a 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. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.
   a. Curing and sealing compound to be applied only in locations permitted or required.

3.12 JOINT FILLING

A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least [**one**] [**six**] month(s). Do not fill joints until construction traffic has permanently ceased.

B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints. Overfill joint and trim joint filler flush with top of joint after hardening.

3.13 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
   1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. After concrete has cured at least 14 days, correct high areas by grinding.
   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.

4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Exposed reinforcing steel shall be mechanically cleaned using sandblasting or waterblasting methods. Reinforcing steel shall be free from rust, grease, or other bond-inhibiting coating.

F. Repairs of depths greater than 3 inches are not covered by this specification. Notify Architect if such conditions are discovered for further direction of repair methods and products.

G. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

H. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.14 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage a special inspector and qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections:
1. Steel reinforcement placement.
2. Steel reinforcement welding.
3. Headed bolts and studs.
4. Verification of use of required design mixture.
5. Concrete placement, including conveying and depositing.
6. Curing procedures and maintenance of curing temperature.
7. Verification of concrete strength before removal of shores and forms from beams and slabs.

C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
2. Slump: ASTM C 143; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.

3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; ASTM C 173, volumetric method, for structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. 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.
5. Unit Weight: ASTM C 567, equilibrium unit weight of structural lightweight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
6. Compression Test Specimens: ASTM C 31.
   a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
   b. Cast and field cure two sets of two standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
   a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
   b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three 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.
10. 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.
11. 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.
12. 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. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42 or by other methods as directed by Architect.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate dos not comply with the Contract Documents.

D. Measure floor and slab flatness and levelness according to ASTM E 1155 within 72 hours of finishing.

END OF SECTION 033000

SECTION 03 3714 - SHOTCRETE FOR AQUATIC FEATURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section relates to all New Construction

B. Related work items include:
1. Aquatic Feature structures.
2. Preparation of surfaces to receive shotcrete.
3. Forms and ground wires.
4. Furnishing and placing reinforcing steel for shotcrete.
5. Mixing, delivery, placing, finishing and curing of shotcrete.
6. Protection and cleaning of adjacent surfaces.

C. Related Sections:
1. 07 1417 – Cold Fluid-Applied Waterproofing for Aquatic Features
2. 09 3014 – Tiling for Aquatic Features
3. 09 9727 – Cementitious Coating for Aquatic Features
4. 13 1123 – On Grade Aquatic Features
5. 13 1225 – Pumped Concrete for Splash Pad

1.2 SUBMITTALS

A. Information Submittals
1. Submit shotcrete mixture proportions.
2. Submit compressive strength test results based on specified F’c of 4,000 psi.
3. Submit water-cementitious materials ratio (w/cm).
4. Submit admixture types, brand names, producers, manufacturer’s technical data sheets describing technical properties and performance in shotcrete and showing compatibility with the project cementitious materials.
5. Submit aggregate source, producers’ names, gradations, specific gravities, compliance with ASTM C33/C33M, and evidence that this data is not more than I year old.
6. Submit qualifications and experience of the proposed workers including the supervisor, nozzleman, and crew. Include ACI certification of nozzlemen (Vertical Placement) proposed for the work.
7. Submit proof of experience for the contractor and the shotcrete crew foreman to include at least five (5) projects of similar size and complexity. Proof shall include a description of previous projects size, density of reinforcing materials; volume of shotcrete placed; and the name, address and current phone number of person(s) representing the Owner or Architect/Engineer.
8. Submit curing materials and curing procedures for shotcrete.
9. Submit name of proposed contractor’s testing agency and documentation of the agency’s certification to ASTM C1077

1.3 PROVIDED DOCUMENTS

A. Aqua Design International providing Structural plans approved for commercial Aquatic Features carrying approval and stamp of Structural Engineer registered in the State of Georgia.
   1. If determined by contractor that provided sealed plans need to be revised, a full set of structural and reinforcement set of plans, approved and stamped by structural engineer registered in the State of Utah to be submitted to General Contractor in route to Aqua Design International for submittal review. Provide a written narrative as to what and why revisions are required.

1.4 QUALITY ASSURANCE

A. Qualifications of shotcrete subcontractor: proposed subcontractor shall have at least 5 years experience in structural shotcrete construction and have constructed at least 20 significant structural shotcrete aquatic features which, on investigation, have been found to be completed in satisfactory manner.

B. Reference standards: Except as modified by requirements of contract documents, shotcrete work shall conform to current requirements of ACI 506.

C. ACI Shotcrete Nozzleman Examiner for this project. Contractor shall provide “Inspection of Record” detailing shotcrete placement and reinforcement verification. Submit Certified Examiner contact info to General Contractor and to Aqua Design International.

PART 2 - PRODUCTS

2.1 PRODUCT TYPE

A. Shotcrete (Wet Mix Process)

2.2 FORMING MATERIALS

A. Form lumber: WCLIB “Construction” grade or better, WWPA No. 1 or better.

B. Form plywood: PS 1-83, Group 1, Exterior grade B_B ply form or better, minimum 5 ply and 5/8 inch thickness.

C. Form Ties: Prefabricated rod, flat band, wire, internally threaded disconnecting type or equal, not leaving metal within 1 ½” of shotcrete surface.

D. Form coatings: Resin-type coating free of oil, silicone, wax, and non-drying material.

2.3 REINFORCING STEEL

A. Reinforcing bars, ASTM A615, including supplementary requirement (S1), Grade 40, deformed.

B. Welded wire fabric: ASTM A185, wire fabric size and gauge as shown. 60 ksi minimum tensile strength.

C. Tie Wire: annealed copper-bearing steel, 16-gauge minimum.

D. Welding electrodes: AWS D1.4, Table 5.1, low hydrogen electrodes, E9018 for grade 40 steel.

2.4 SHOTCRETE MATERIALS

A. Cement
1. Approved Wet Mix Shotcrete Distributer:
a. CEMEX
2. Mix shall be at least minimum, equal to:

Material	**Description**	**ASTM**	**Spec. Grav.**	**Vol. (CF)**
Cement	Type II-V	C 150	3.15	2.78
Fly Ash	Class F	C 618	2.17	1.35
Course Aggregate	3/8 CR AGG	C 33	2.63	3.98
Fine Aggregate	Conc Sand	C 33	2.63	11.94
Water reducer	Type A/D	C 494	1.00	0.00
Air Entrainer	AEA	C 260	1.00	0.00
Viscosity Modifier	VMAR3		1.00	0.00
Potable Water	Water	C 94	1.00	5.61
Air				1.35
Material	**Description**	**ASTM**	**Spec. Grav.**	**Vol. (CF)**
Specified F’c	4000 PSI			
Specified Slump	1.00 To 3.00 in.			
Designed Air	5.0 %			
Designed Volume	27.00 cu. ft.			

2.5 QUALITY ASSURANCE/CONTROL

A. Test Panels
1. Concrete design strength is based on cast concrete cylinders. Shotcrete design strength, however, is based on cores or sawed cubes taken from sample test panel. Core sample strength, however, is expected to be 0.85 of cast cylinder strength (ACI 318 paragraph 5.6) since core samples are disturbed due to coring or cutting process. Testing should be done in accordance with ASTM C 1140-98 Preparing and Testing Specimens from Shotcrete Test Panels.

PART 3 - EXECUTION

3.1 PREPARATION OF SURFACES

A. If sloughing or caving of earth banks occurs, fill resulting voids with shotcrete at no extra cost to owner, back-filling voids with earth is not permitted. Dampen concrete and earth surfaces before shotcrete is deposited, but not so wet as to overcome suction.

3.2 PROTECTION

A. Protect surfaces not receiving shotcrete from over spray. Repair damages as required by owner at no cost to owner.

3.3 SHOTCRETE QUALITY

A. Accurately control proportion of water to Portland cement to produce thorough and uniform hydration of shotcrete that, when shot, forms homogeneous mass containing neither sags nor dry sand formation.

B. Strength: Minimum 4,000 psi 28-day compressive strength unless otherwise indicated.

C. Slump: Measured at point of discharge from mixer shall be minimum 1 ½ inches and maximum 2 ½ inches.

3.4 CURING

A. Provide moisture cure. Apply constant water coating in fog-mist spray without damage to surface texture. Keep shotcrete continuously moist for not less than 7 days after placing. Use sealed curing sheeting or other approved curing method where water curing is not feasible. Use of curing compounds is prohibited.

3.5 DEFECTIVE SHOTCRETE

A. Cut out and replace defective shotcrete including rebound, sand pockets, sags, sloughing, and other defects at no extra cost to owner.

END OF SECTION 033714

SECTION 04 2000 - UNIT MASONRY

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. Concrete masonry units.
2. Concrete building brick.
3. Face brick.
4. Mortar and grout.
5. Steel reinforcing bars.
6. Masonry joint reinforcement.
7. Ties and anchors.
8. Embedded flashing.
9. Miscellaneous masonry accessories.
10. Masonry-cell insulation.

1.3 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.4 SUBMITTALS

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

B. Shop Drawings: For the following:
1. Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.
2. Reinforcing Steel: Detail bending and placement of unit masonry reinforcing bars. Comply with ACI 315, "Details and Detailing of Concrete Reinforcement."
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

C. Samples for Initial Selection:
1. Pre-faced CMUs.
2. Concrete facing brick, in the form of small-scale units.
3. Face brick.
4. Colored mortar.
5. Weep holes/vents.

D. Samples for Verification: For each type and color of the following:
1. Decorative CMUs.
2. Pre-faced CMUs.
3. Face brick.
4. Special brick shapes.
5. Pigmented mortar. Make Samples using same sand and mortar ingredients to be used on Project.
6. Weep holes and vents.

E. List of Materials Used in Constructing Mockups: List generic product names together with manufacturers, manufacturers' product names, model numbers, lot numbers, batch numbers, source of supply, and other information as required to identify materials used. Include mix proportions for mortar and grout and source of aggregates.
   1. Submittal is for information only. Neither receipt of list nor approval of mockup constitutes approval of deviations from the Contract Documents unless such deviations are specifically brought to the attention of Architect and approved in writing.

F. Material Certificates: For each type and size of the following:
   1. Masonry units.
   2. Cementitious materials. Include brand, type, and name of manufacturer.
   3. Grout mixes. Include description of type and proportions of ingredients.
   4. Reinforcing bars.
   5. Joint reinforcement.
   6. Anchors, ties, and metal accessories.

G. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

H. Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type used in load-bearing wall construction, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to Tables 1 and 2 in ACI 530.1/ASCE 6/TMS 602.

I. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.5 QUALITY ASSURANCE

A. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

C. Masonry Standard: Comply with ACI 530.1/ASCE 6/TMS 602 unless modified by requirements in the Contract Documents.

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

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

B. Do not apply uniform floor for at least 12 hours and concentrated loads for at least three days after building load-bearing masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 MASONRY UNITS, GENERAL

A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Fire-Resistance Ratings: Where indicated, provide units that comply with requirements for fire-resistance ratings indicated as determined by testing according to ASTM E 119, by equivalent masonry thickness, or by other means, as acceptable to authorities having jurisdiction.

2.2 CONCRETE MASONRY UNITS

A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
1. Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
2. Provide bullnose units for outside corners unless otherwise indicated.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units and where indicated.
   1. Integral Water Repellent: Liquid polymeric, integral water-repellent admixture that does not reduce flexural bond strength. Units made with integral water repellent, when tested according to ASTM E 514 as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, shall show no visible water or leaks on the back of test specimen.
      a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
         1) ACM Chemistries; RainBloc.
         2) BASF Aktiengesellschaft; Rheopel Plus.
         3) Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block.

C. CMUs: ASTM C 90 for load-bearing CMU; ASTM C 129 for non-load-bearing CMU.
   1. Density Classification: [Lightweight] or [Normal weight] unless otherwise indicated.
   2. Size (Width): Manufactured to dimensions 3/8 inch less than nominal dimensions.
   3. Exposed Faces: Provide color and texture matching the range represented by Architect's sample.
   4. Faces to Receive Plaster: Where units are indicated to receive a direct application of plaster, provide textured-face units made with gap-graded aggregates.
   5. Specified compressive strength shall be:
      a) f'm = 1,350 psi for partially grouted construction,
      b) f'm = 1,500 psi for fully grouted construction,
      c) Minimum average net-area compressive strength of units shall be 1,900 psi.

D. Concrete Building Brick: ASTM C 55.
   1. Density Classification: [Lightweight] or [Normal weight].
   2. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.

E. Decorative CMUs: ASTM C 90.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. "Trendstone Plus" by Trenwyth Industries, and Oldcastle company.
   2. Density Classification: Normal weight.
   3. Size (Width): Manufactured to dimensions specified in "CMUs" Paragraph.
   4. Pattern and Texture:
      a. Filled and polished, standard pattern, ground-face finish.
      b. Scored vertically so units laid in running bond appear as square units laid in stacked bond, standard finish.
   5. Colors: As selected by Architect from manufacturer's full range.
   6. Special Aggregate: Provide units made with aggregate matching aggregate in Architect's sample.

F. Pre-faced CMUs: Lightweight hollow concrete units complying with ASTM C 90, with manufacturer's standard smooth resinous facing complying with ASTM C 744.
   1. Products: Subject to compliance with requirements, provide the following:
      a. "Astra-Glaze" by Trenwyth Industries, an Oldcastle company.
   2. Size: Manufactured to dimensions specified in "CMUs" Paragraph but with pre-faced surfaces having 1/16-inch-wide returns of facing to create 1/4-inch-wide mortar joints with modular coursing.
   3. Colors and Patterns: Match existing units.

2.3 CONCRETE AND MASONRY LINTELS

A. General: Where shown provide one of the following:

B. Concrete Lintels: Precast or formed-in-place concrete lintels complying with requirements in Division 03 Section "Cast-in-Place Concrete" and with reinforcing bars indicated.

C. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.4 BRICK

A. General: Provide shapes indicated and as follows, with exposed surfaces matching finish and color of exposed faces of adjacent units:
   1. For ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces, provide units without cores or frogs and with exposed surfaces finished.
   2. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
   3. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

B. Face Brick: Facing brick complying with ASTM C 216.
   1. Products: Brick to be selected by Owner. Verify suitability of Grade and Type with selection of face brick for climatic conditions.
   2. Grade: SW.
   3. Type: FBX.
   4. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."
   5. Size (Actual Dimensions): 3-5/8 inches wide by 2-1/4 inches high by 7-5/8 inches long.
   6. Application: Use where brick is exposed unless otherwise indicated.
   7. Where shown to "match existing," provide face brick matching color range, texture, and size of existing adjacent brickwork as approved by Architect.

2.5 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C 207, Type S.

C. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979. Use only pigments with a record of satisfactory performance in masonry mortar.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Davis Colors; True Tone Mortar Colors.
      b. Lanxess Corporation; Bayferrox Iron Oxide Pigments.
      c. Solomon Colors, Inc.; SGS Mortar Colors.
   2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.
   3. Pigments shall not exceed 10 percent of portland cement by weight.

D. Aggregate for Mortar: ASTM C 144.
1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored-Mortar Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

E. Aggregate for Grout: ASTM C 404.

F. Water-Repellent Admixture: Liquid water-repellent mortar admixture intended for use with CMUs containing integral water repellent by same manufacturer.
1. Products: Subject to compliance with requirements, provide one of the following:
a. ACM Chemistries; RainBloc for Mortar.
b. BASF Aktiengesellschaft; Rheopel Mortar Admixture.
c. Grace Construction Products, W. R. Grace & Co. - Conn.; Dry-Block Mortar Admixture.

G. Water: Potable.

2.6 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A 615 or ASTM A 996, Grade 60.

B. Masonry Joint Reinforcement, General: ASTM A 951.
1. Interior Walls: Mill- galvanized, carbon steel.
2. Exterior Walls: Hot-dip galvanized, carbon steel.
3. Wire Size for Side Rods: 0.148-inch diameter.
4. Wire Size for Cross Rods: 0.148-inch diameter.
5. Wire Size for Veneer Ties: 0.148-inch diameter.
6. Spacing of Cross Rods, Tabs, and Cross Ties: Not more than 16 inches o.c.
7. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

C. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

D. Masonry Joint Reinforcement for Veneers Anchored with Seismic Masonry-Veneer Anchors: Single 0.187-inch- diameter, hot-dip galvanized, carbon-steel continuous wire.

2.7 TIES AND ANCHORS

A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated.
1. Mill-Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 641, Class 1 coating.
2. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.
3. Steel Sheet, Galvanized after Fabrication: ASTM A 1008, Commercial Steel, with ASTM A 153, Class B coating.
4. Steel Plates, Shapes, and Bars: ASTM A 36.

B. Corrugated Metal Ties: Metal strips not less than 7/8 inch wide with corrugations having a wavelength of 7.6 to 12.7 mm and an amplitude of 0.06 to 0.10 inch made from 0.030-inch-thick, steel sheet, galvanized after fabrication.

C. Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
   1. Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire.
   2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch- diameter, hot-dip galvanized steel wire.

D. Adjustable Anchors for Connecting to Concrete: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.
   1. Connector Section: Dovetail tabs for inserting into dovetail slots in concrete and attached to tie section; formed from 0.060-inch- thick, steel sheet, galvanized after fabrication.
   2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch of masonry face, made from 0.187-inch- diameter, hot-dip galvanized steel wire.

E. Partition Top anchors: 0.105-inch- thick metal plate with 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

F. Rigid Anchors: Fabricate from steel bars 1-1/2 inches wide by 1/4 inch thick by 24 inches long, with ends turned up 2 inches or with cross pins unless otherwise indicated.
   1. Corrosion Protection: Hot-dip galvanized to comply with ASTM A 153.

G. Adjustable Masonry-Veneer Anchors:
   1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
      a. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
   2. Contractor's Option: Unless otherwise indicated, provide any of the following types of anchors:
   3. Screw-Attached, Masonry-Veneer Anchors: Units consisting of a wire tie and a metal anchor section.
      a. Anchor Section: Rib-stiffened, sheet metal plate with screw holes top and bottom, 2-3/4 inches wide by 3 inches high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section.
      b. Anchor Section: Sheet metal plate, 1-1/4 inches wide by 9 inches long, with screw holes top and bottom and with raised rib-stiffened strap, 5/8 inch wide by 5-1/2 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie.
      c. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, 5/8 inch wide by 6 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.
      d. Anchor Section: Corrosion-resistant, self-drilling, eye-screw designed to receive wire tie. Eye-screw has spacer that seats directly against framing and is same thickness as sheathing and has gasketed, washer head that covers hole in sheathing.
      e. Fabricate sheet metal anchor sections and other sheet metal parts from 0.075-inch-thick, steel sheet, galvanized after fabrication.

f. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.187-inch- diameter, hot-dip galvanized steel wire.

4. Polymer-Coated, Steel Drill Screws for Steel Studs: ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours per ASTM B 117.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) ITW Buildex; Teks Maxiseal with Climaseal finish.
      2) Textron Inc., Textron Fastening Systems; Elco Dril-Flex with Stalgard finish.
5. Stainless-Steel Drill Screws for Steel Studs: Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954 except manufactured with hex washer head and neoprene or EPDM washer, No. 10 diameter by length required to penetrate steel stud flange with not less than three exposed threads.
   a. Products: Subject to compliance with requirements, provide one of the following:
      1) Dayton Superior Corporation, Dur-O-Wal Division; Stainless Steel SX Fastener.
      2) ITW Buildex; Scots long life Teks.

2.8 MISCELLANEOUS ANCHORS

A. Postinstalled Anchors: Chemical anchors.
   1. Load Capacity: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
   2. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 unless otherwise indicated.
   3. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.9 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual" and as follows:
   1. Stainless Steel: ASTM A 240, Type 304, 0.016 inch thick.
   2. Copper: ASTM B 370, Temper H00, cold-rolled copper sheet, 16-oz./sq. ft. weight or 0.0216 inch thick or ASTM B 370, Temper H01, high-yield copper sheet, 12-oz./sq. ft. weight or 0.0162 inch thick.
   3. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
   4. Fabricate through-wall metal flashing embedded in masonry from stainless steel, with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.
      a. Products: Subject to compliance with requirements, provide one of the following:
         1) Cheney Flashing Company; Cheney 3-Way Flashing (Sawtooth).
         2) Keystone Flashing Company, Inc.; Keystone 3-Way Interlocking Thruwall Flashing.
         3) Sandell Manufacturing Co., Inc.; Mechanically Keyed Flashing.
   5. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
   6. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.

7. Fabricate through-wall flashing with sealant stop unless otherwise indicated. Fabricate by bending metal back on itself 3/4 inch at exterior face of wall and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
8. Fabricate metal drip edges and sealant stops for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam will shed water.

B. Flexible Flashing: Use the following unless otherwise indicated:
1. Copper-Laminated Flashing: 5-oz./sq. ft. copper sheet bonded between 2 layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.
a. Products: Subject to compliance with requirements, provide one of the following:
1) Dayton Superior Corporation, Dur-O-Wal Division; Copper Fabric Thru-Wall Flashing.
2) Hohmann & Barnard, Inc.; H & B C-Fab Flashing.
3) Phoenix Building Products; Type FCC-Fabric Covered Copper.
4) Sandell Manufacturing Co., Inc.; Copper Fabric Flashing.
5) York Manufacturing, Inc.; Multi-Flash 500.

C. Application: Unless otherwise indicated, use the following:
1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge.
4. Where flashing is fully concealed, use metal flashing or flexible flashing.

D. Solder and Sealants for Sheet Metal Flashings:
1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. Solder for Copper: ASTM B 32, Grade Sn50, 50 percent tin and 50 percent lead.

E. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

A. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

B. Weep/Vent Products: Use one the following unless otherwise indicated:
1. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch OD by 4 inches long.

C. Cavity Drainage Material: Pea gravel, or proprietary free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Advanced Building Products Inc.; Mortar Break or Mortar Break II.
b. Archovations, Inc.; CavClear Masonry Mat.
c. Dayton Superior Corporation, Dur-O-Wal Division; Polytite MortarStop.
d. Mortar Net USA, Ltd.; Mortar Net.
2. Provide one of the following configurations:

a. Strips, full-depth of cavity and 10 inches high, with dovetail shaped notches 7 inches deep that prevent clogging with mortar droppings.
b. Strips, not less than 3/4 inch thick and 10 inches high, with dimpled surface designed to catch mortar droppings and prevent weep holes from clogging with mortar.
c. Sheets or strips full depth of cavity and installed to full height of cavity.
d. Sheets or strips not less than 3/4 inch thick and installed to full height of cavity with additional strips 4 inches high at weep holes and thick enough to fill entire depth of cavity and prevent weep holes from clogging with mortar.

D. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.
1. Products: Subject to compliance with requirements, provide one of the following:
a. Dayton Superior Corporation, Dur-O-Wal Division; D/A 810, D/A 812 or D/A 817.
b. Heckmann Building Products Inc.; No. 376 Rebar Positioner.
c. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
d. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

2.11 MASONRY-CELL INSULATION

A. Loose-Granular Fill Insulation: Perlite complying with ASTM C 549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).

2.12 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Diedrich Technologies, Inc.
b. EaCo Chem, Inc.
c. ProSoCo, Inc.

2.13 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
1. Do not use calcium chloride in mortar or grout.
2. Use portland cement-lime mortar unless otherwise indicated.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated.
1. For masonry below grade or in contact with earth, use Type S.
2. For reinforced masonry, use Type S
3. For exterior, above-grade, load-bearing and non-load-bearing walls and parapet walls; for interior load-bearing walls; for interior non-load-bearing partitions; and for other applications where another type is not indicated, use Type N.
4. For interior non-load-bearing partitions, Type O may be used instead of Type N.

C. Pigmented Mortar: Select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.
   1. Pigments shall not exceed 10 percent of portland cement by weight.
   2. Mix to match Architect's sample.
   3. Application: Use pigmented mortar for exposed mortar joints with the following units:
      a. Decorative CMUs.
      b. Pre-faced CMUs.
      c. Face brick.
      d. Cast stone trim units.

D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.
   1. Mix to match Architect's sample.
   2. Application: Use colored aggregate mortar for exposed mortar joints with the following units:
      a. Decorative CMUs.
      b. Pre-faced CMUs.
      c. Face brick.
      d. Cast stone trim units.

E. Grout for Unit Masonry: Comply with ASTM C 476.
   1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with Table 1.15.1 in ACI 530.1/ASCE 6/TMS 602 for dimensions of grout spaces and pour height.
   2. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping connections.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Thickness: Build cavity and composite walls and other masonry construction to full thickness shown. Build single-wythe walls to actual widths of masonry units, using units of widths indicated.

B. Build chases and recesses to accommodate items specified in this and other Sections.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to opening.

D. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.
   1. Mix units from several pallets or cubes as they are placed.

F. Matching Existing Masonry: Match coursing, bonding, color, and texture of existing masonry.

G. Wetting of Brick: Wet brick before laying if initial rate of absorption exceeds 30 g/30 sq. in. per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at time of laying.

3.3 TOLERANCES

A. Dimensions and Locations of Elements:
   1. For dimensions in cross section or elevation do not vary by more than plus 1/2 inch or minus 1/4 inch.
   2. For location of elements in plan do not vary from that indicated by more than plus or minus 1/2 inch.
   3. For location of elements in elevation do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

B. Lines and Levels:
   1. For bed joints and top surfaces of bearing walls do not vary from level by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
   2. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   3. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
   4. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.
   5. For lines and surfaces do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch maximum.
   6. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2 inch maximum.
   7. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch except due to warpage of masonry units within tolerances specified for warpage of units.

C. Joints:
   1. For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.
   2. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
   3. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
   4. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch. Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch.
   5. For exposed bed joints and head joints of stacked bond, do not vary from a straight line by more than 1/16 inch from one masonry unit to the next.

3.4 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4-inches. Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch horizontal face dimensions at corners or jambs.

D. Stopping and Resuming Work: Stop work by racking back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

F. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.

G. Where built-in items are to be embedded in cores of hollow masonry units, place a layer of metal lath, wire mesh, or plastic mesh in the joint below and rod mortar or grout into core.

H. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.

I. Build non-load-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
   1. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Division 07 Section "Fire-Resistive Joint Systems."

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:
   1. With face shells fully bedded in mortar and with head joints of depth equal to bed joints.
   2. With entire units, including areas under cells, fully bedded in mortar at starting course on footings where cells are not grouted.

B. Lay solid masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Set cast-stone trim units in full bed of mortar with full vertical joints. Fill dowel, anchor, and similar holes.
   1. Clean soiled surfaces with fiber brush and soap powder and rinse thoroughly with clear water.
   2. Allow cleaned surfaces to dry before setting.
   3. Wet joint surfaces thoroughly before applying mortar.

D. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
   1. For glazed masonry units, use a nonmetallic jointer 3/4 inch or more in width.

E. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

3.6 MASONRY-CELL INSULATION

A. Pour granular insulation into cavities to fill void spaces. Maintain inspection ports to show presence of insulation at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of insulation to 1 story high, but not more than 20 feet.

3.7 MASONRY JOINT REINFORCEMENT

A. General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches.
   1. Space reinforcement not more than 16 inches o.c.
   2. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings.

B. Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

C. Provide continuity at wall intersections by using prefabricated T-shaped units.

D. Provide continuity at corners by using prefabricated L-shaped units.

E. Cut and bend reinforcing units as directed by manufacturer for continuity at[**corners,**] returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.8 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

A. Anchor masonry to structural steel and concrete where masonry abuts or faces structural steel or concrete to comply with the following:
   1. Provide an open space not less than 1/2 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.
   2. Anchor masonry with anchors embedded in masonry joints and attached to structure.
   3. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.9 ANCHORING MASONRY VENEERS

A. Anchor masonry veneers to wall framing with masonry-veneer anchors to comply with the following requirements:
   1. Fasten screw-attached anchors through sheathing to wall framing with metal fasteners of type indicated. Use two fasteners unless anchor design only uses one fastener.
   2. Insert slip-in anchors in metal studs as sheathing is installed. Provide one anchor at each stud in each horizontal joint between sheathing boards.
   3. Embed connector sections and continuous wire in masonry joints. Provide not less than 1-3/4 inches of air space between back of masonry veneer and face of sheathing.
   4. Locate anchor sections to allow maximum vertical differential movement of ties up and down.

5. Space anchors as indicated, but not more than 18 inches o.c. vertically and 24 inches o.c. horizontally, with not less than 1 anchor for each 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings and at intervals, not exceeding 8 inches, around perimeter.

3.10 CONTROL AND EXPANSION JOINTS

A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

B. Form control joints in concrete masonry as follows:
1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
2. Locate vertical control joints to accommodate horizontal movement:
   a) At changes in wall height and thickness,
   b) Above / below movement joints in foundations, floors and roofs that bear on a wall,
   c) Not to exceed the lesser of 1.5 times wall height or 25’-0” o.c.,
   d) Within 1/2 of the joist spacing adjacent to corners or intersections,
   e) Near one or both sides of openings.

C. Form expansion joints in brick as follows:
1. Form open joint full depth of brick wythe and of width indicated, but not less than 3/8 inch for installation of sealant and backer rod specified in Division 07 Section "Joint Sealants."
2. Locate vertical control joints to accommodate horizontal movement:
   d) At changes in wall height and thickness,
   e) Above / below movement joints in foundations, floors and roofs that bear on a wall,
   f) Not to exceed the lesser of 1.5 times wall height or 20’-0” o.c.,
   g) Within 1/2 of the joist spacing adjacent to corners or intersections,
   h) Near one or both sides of large openings.

D. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 07 Section "Joint Sealants," but not less than 3/8 inch.
1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.11 LINTELS

A. Install steel lintels where indicated.

B. Provide concrete or masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

C. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.12 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated. Install vents at

shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.

B. Install flashing as follows unless otherwise indicated:
   1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
   2. At masonry-veneer walls, extend flashing through veneer, across air space behind veneer, and up face of sheathing at least 8 inches; with upper edge tucked under building paper or building wrap, lapping at least 4 inches.
   3. At lintels and shelf angles, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
   4. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
   5. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Division 07 Section "Joint Sealants" for application indicated.
   6. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal drip edge.
   7. Install metal flashing termination beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall and adhere flexible flashing to top of metal flashing termination.
   8. Cut flexible flashing off flush with face of wall after masonry wall construction is completed.

C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.

D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

E. Install weep holes in head joints in exterior wythes of first course of masonry immediately above embedded flashing and as follows:
   1. Use specified weep/vent products or open head joints to form weep holes.
   2. Space weep holes 24 inches o.c. unless otherwise indicated.
   3. Space weep holes formed from plastic tubing 16 inches o.c.

F. Place pea gravel in cavities as soon as practical to a height equal to height of first course above top of flashing, but not less than 2 inches, to maintain drainage.

G. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

H. Install vents in head joints in exterior wythes at spacing indicated. Use specified weep/vent products or open head joints to form vents.

3.13 REINFORCED UNIT MASONRY INSTALLATION

A. Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.
   1. Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
   2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

B. Placing Reinforcement: Comply with requirements in ACI 530.1/ASCE 6/TMS 602.

C. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.
   1. Comply with requirements in ACI 530.1/ASCE 6/TMS 602 for cleanouts and for grout placement, including minimum grout space and maximum pour height.
   2. Limit height of vertical grout pours to not more than 60 inches.

3.14 FIELD QUALITY CONTROL

A. Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

B. Inspections Level 2 special inspections according to the "International Building Code."
   1. Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.
   2. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
   3. Place grout only after inspectors have verified proportions of site-prepared grout.

C. Testing Prior to Construction: One set of tests.

D. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.

E. Clay Masonry Unit Test: For each type of unit provided, according to ASTM C 67 for compressive strength.

F. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.

G. Mortar Aggregate Ratio Test (Proportion Specification): For each mix provided, according to ASTM C 780.

H. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.

I. Prism Test: For each type of construction provided, according to ASTM C 1314 at [**7 days and at**]28 days.

3.15 PARGING

A. Parge exterior faces of below-grade masonry walls, i.e. sump pit, in 2 uniform coats to a total thickness of 3/4 inch. Dampen wall before applying first coat and scarify first coat to ensure full bond to subsequent coat.

B. Use a steel-trowel finish to produce a smooth, flat, dense surface with a maximum surface variation of 1/8 inch per foot. Form a wash at top of parging and a cove at bottom.

C. Damp-cure parging for at least 24 hours and protect parging until cured.

3.16 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
4. Clean brick by bucket-and-brush hand-cleaning method described in BIA Technical Notes 20.
5. Clean masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.
6. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2A applicable to type of stain on exposed surfaces.

3.17 MASONRY WASTE DISPOSAL

A. Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

B. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.
1. Crush masonry waste to less than 4 inches in each dimension.
2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 31 Section "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 2000

SECTION 044313 ANCHORED STONE MASONRY VENEER

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. Stone masonry anchored to concrete backup.
2. Stone masonry anchored to unit masonry backup.
3. Stone masonry anchored to wood framing and sheathing.
4. Stone masonry anchored to cold-formed metal framing and sheathing.

B. Products Installed but Not Furnished under This Section Include:

1. Steel lintels in unit masonry.
2. Steel shelf angles for supporting unit masonry.

C. Related Requirements:

1. Section 04 "Unit Masonry"

1.3 SUBMITTALS

A. Comply with pertinent provisions of Section 013323

B. Product Data: For each variety of stone, stone accessory, and manufactured product.

C. Samples for Initial Selection:

1. For colored mortar and other items involving color selection.

D. Samples for Verification:

1. For each stone type indicated. Include at least 1 (one) sample in each set and show the full range of color and other visual characteristics in completed Work.

E. Material Test Reports:

1. Stone Test Reports: For each stone variety proposed for use on Project, by a qualified testing agency, indicating compliance with required physical properties, other than abrasion resistance, according to referenced ASTM standards. Base

reports on testing done within previous five years.

2. Sealant Compatibility and Adhesion Test Report: From sealant manufacturer indicating that sealants will not stain or damage stone. Include interpretation of test results and recommendations for primers and substrate preparation needed for adhesion.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs experienced stonemasons and stone fitters.

B. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.

1. Build mockup of typical wall area as shown on Drawings.
2. Build mockups for each type of stone masonry / typical exterior wall in sizes approximately 48” long by 72” high by full thickness, including face and backup wythes and accessories.

   a. Include stone coping at top of mockup.
   b. Include a sealant-filled joint at least 16 inches long in mockup.
   c. Include through-wall flashing installed for a 24-inch length in corner of mockup approximately 16 inches down from top of panel.
   d. Include studs, sheathing, veneer anchors, flashing, and weep holes in exterior masonry-veneer wall mockup.

3. Protect accepted mockups from the elements with weather-resistant protection as required. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

C. Deliver preblended, dry mortar mix in moisture-resistant containers designed for use with dispensing silos. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, in a dry location, or in covered weatherproof dispensing silos.

D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 FIELD CONDITIONS

A. Protection of Stone Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed stone masonry when construction is not in progress.

1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining stone masonry face.

1. Protect base of walls from rain-splashed mud and mortar splatter using coverings spread on the ground and over the wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at end of each day to prevent rain from splashing mortar and dirt on completed stone masonry.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace stone masonry damaged by frost or freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than seven days after completing cleaning.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

1.7 COORDINATION

A. Advise installers of adjacent Work about specific requirements for placement of reinforcement, veneer anchors, flashing, and similar items to be built into stone masonry.

B. Coordinate locations of dovetail slots installed in concrete that are to receive stone anchors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Stone: Obtain each variety of stone, regardless of finish, from single quarry, whether specified in this Section or in another Section of the Specifications, with resources to provide materials of consistent quality in appearance

and physical properties.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of uniform quality for each cementitious component from single manufacturer and each aggregate from single source or producer.

C. Stone Veneer:

1. Basis of Design:
   a. Manufacturer: Willis Dimensional Stone
      Elberton, GA
   b. Product: Savannah Gray Granite – Natural Stone veneer.
   c. Color: Gray/White/ with Black Flecks
   d. Size: Random sizes 2”-9” Height, 4”-12” Length, 2”-3” Average Thickness
   e. Contact: Dale Willis
      Owner – 706-213-8031
   f. City of Brookhaven Approved Product Confirm all information with supplier

D. Material Standards:

1. Maximum Absorption per ASTM C 97: 7.5 percent.
2. Minimum Compressive Strength per ASTM C 170: 4000 psi.

E. Match Architect's samples for color, finish, and other stone characteristics relating to aesthetic effects.

2.2 MORTAR MATERIALS

A. Portland Cement: ASTM C 150, Type I or Type II, except Type III may be used for cold-weather construction; natural color or white cement may be used as required to produce mortar color indicated.

1. Low-Alkali Cement: Not more than 0.60 percent total alkali when tested according to ASTM C 114.

B. Hydrated Lime: ASTM C 207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Mortar Cement: ASTM C 1329.

E. Masonry Cement: ASTM C 91.

F. Mortar Pigments: Natural and synthetic iron oxides and chromium oxides, compounded for use in mortar mixes and complying with ASTM C 979/C 979M. Use only pigments with a record of satisfactory performance in stone masonry mortar.

G. Colored Portland Cement-Lime Mix: Packaged blend of portland cement, hydrated lime, and mortar pigments. Mix shall produce color indicated or, if not indicated, as selected from manufacturer's standard colors. Pigments shall not exceed 10 percent of portland cement by weight.

H. Colored Masonry Cement Mix: Packaged blend of masonry cement and mortar pigments. Mix shall produce color indicated or, if not indicated, as selected from manufacturer's standard colors. Pigments shall not exceed 5 percent of masonry cement by weight.

I. Aggregate: ASTM C 144 and as follows:

1. For pointing mortar, use aggregate graded with 100 percent passing No. 16 sieve.
2. White Aggregates: Natural white sand or ground white stone.
3. Colored Aggregates: Natural-colored sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.

J. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

K. Water: Potable.

2.3 VENEER ANCHORS

A. Materials:

1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 1064; with ASTM A 153, Class B-2.
2. Stainless-Steel Wire: ASTM A 580, Type 304.
3. Hot-Dip Galvanized-Steel Sheet: ASTM A 1008, cold-rolled, carbon-steel sheet, hot-dip galvanized after fabrication to comply with ASTM A 153, Class B-2.
4. Stainless-Steel Sheet: ASTM A 240 or ASTM A 666, Type 304.

B. Size: Sufficient to extend at least halfway, but not less than 1-1/2 inches, through stone masonry and with at least a 5/8-inch cover on exterior face.

C. Provide anchors to appropriately anchor stone type, shape and pattern to all substrates on project, as required - refer to drawings for stone pattern.

D. Wire Veneer Anchors: Wire ties formed from W1.7 or 0.148-inch diameter, hot-dip galvanized steel wire.

1. Ties are bent in the form of loops with legs not less than 15 inches in length and with last 2 inches bent at 90 degrees.
2. Ties are bent in the form of rectangular loops with ends bent downward for inserting into eyes projecting from masonry joint reinforcement specified in Section 042000 "Unit Masonry."
3. Ties are bent in the form of triangular loops designed to be attached to masonry

joint reinforcement specified in Section 042000 "Unit Masonry" with vertical wires passing through ties and through eyes projecting from masonry joint reinforcement.

E. Corrugated-Metal Veneer Anchors:

1. Not less than 0.030-inch thick by 7/8-inch wide hot-dip galvanized steel sheet with corrugations having a wavelength of 0.3 to 0.5 inch and an amplitude of 0.06 to 0.10 inch.

F. Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist a 100-lbf load in both tension and compression perpendicular to plane of wall without deforming or developing play in excess of 1/16 inch.
2. Fabricate sheet metal anchor sections and other sheet metal parts from 0.075-inch-thick steel sheet, galvanized after fabrication
3. Fabricate wire ties from 0.187-inch diameter, hot-dip galvanized-steel wire unless otherwise indicated.
4. Fabricate wire connector sections from 0.187-inch diameter, hot-dip galvanized-steel wire.
5. Contractor's Option: Unless otherwise indicated, provide any of the adjustable masonry- veneer anchors specified.

G. Adjustable, Screw-Attached Veneer Anchors:

Units consisting of a wire tie section and a metal anchor section for attachment over sheathing to wood or metal studs, and as follows:

1. Anchor Section: Rib-stiffened, sheet metal plate with screw holes in top and bottom, 2-3/4 inches wide by 3 inches high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit veneer anchor section.

H. Adjustable, Screw-Attached Veneer Anchors:

Units consisting of a wire tie section and a metal anchor section for attachment over sheathing to wood or metal studs, and as follows:

1. Anchor Section: Sheet metal plate, 1-1/4 inches wide by 9 inches long, with screw holes in top and bottom and with raised rib-stiffened strap, 5/8 inch wide by 5-1/2 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie.

I. Adjustable, Screw-Attached Veneer Anchors:

Units consisting of a wire tie section and a metal anchor section for attachment over sheathing to wood or metal studs, and as follows:

a. Anchor Section: Sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes in top and bottom and with raised rib-stiffened strap, 5/8 inch

wide by 3-5/8 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie.

J. Adjustable, Screw-Attached Veneer Anchors:

Units consisting of a wire tie section and a metal anchor section for attachment over sheathing to wood or metal studs, and as follows:

1. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes in top and bottom; top and bottom ends bent to form pronged legs of length to match thickness of insulation or sheathing; and raised rib-stiffened strap, 5/8 inch wide by 6 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering, modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.

K. Adjustable, Screw-Attached Veneer Anchors:

Units consisting of a wire tie section and a metal anchor section for attachment over sheathing to wood or metal studs, and as follows:

1. Anchor Section: Zinc-alloy barrel section with flanged head with eye and corrosion- resistant, self-drilling screw. Eye designed to receive wire tie and to serve as head for drilling fastener into framing. Barrel length to suit sheathing thickness, allowing screw to seat directly against framing with flanged head covering hole in sheathing.

L. Adjustable, Seismic Veneer Anchors:

Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in stone masonry mortar joint, complying with the following requirements:

1. Anchor Section: Rib-stiffened, sheet metal plate with screw holes in top and bottom, 2-3/4 inches wide by 3 inches high; with projecting tabs having slotted holes for inserting vertical legs of wire tie specially formed to fit anchor section. Size wire tie to extend at least 1-1/2 inches into stone masonry but with at least a 5/8-inch cover on exterior face.
2. Connector Section: Sheet metal clip welded to wire tie with integral tabs designed to engage continuous wire.
3. Continuous Wire: 0.188-inch diameter, hot-dip galvanized steel wire.

M. Adjustable, Seismic Veneer Anchors:

Units consisting of a metal anchor section and a connector section designed to engage a continuous wire embedded in stone masonry mortar joint, complying with the following requirements:

1. Anchor Section: Gasketed sheet metal plate, 1-1/4 inches wide by 6 inches long, with screw holes in top and bottom; top and bottom ends bent to form pronged legs to bridge insulation or sheathing and contact studs; and raised rib-stiffened strap, 5/8 inch wide by 6 inches long, stamped into center to provide a slot between strap and plate for inserting wire tie. Provide anchor manufacturer's standard, self-adhering,

modified bituminous gaskets manufactured to fit behind anchor plate and extend beyond pronged legs.

2. Connector Section: Triangular wire tie and rigid PVC extrusion with snap-in grooves for inserting continuous wire.
3. Continuous Wire: 0.188-inch diameter, hot-dip galvanized steel wire.

N. Polymer-Coated, Steel Drill Screws for Steel Studs:

ASTM C 954 except manufactured with hex washer head and neoprene washer, No. 10 by length required to penetrate steel-stud flange with not less than three exposed threads, and with organic polymer coating with salt-spray resistance to red rust of more than 800 hours per
ASTM B 117.

O. Stainless-Steel Drill Screws for Steel Studs:

Proprietary fastener consisting of carbon-steel drill point and 300 Series stainless-steel shank, complying with ASTM C 954, except manufactured with hex washer head and neoprene washer, No. 10 by length required to penetrate steel-stud flange with not less than three exposed threads.

P. Polymer-Coated, Steel Drill Screws for Wood Studs:

Self-drilling, wood screws recommended by veneer anchor manufacturers for fastening to wood studs; not less than No. 10, 1-1/2 inches long, and with organic polymer coating with more than 500-hour, salt-spray resistance to red rust per ASTM B 117.

Q. Polymer-Coated, Steel Tapping Screws for Concrete Masonry:

Self-tapping screws with specially designed threads for tapping and wedging into masonry, with hex washer head and neoprene washer, 3/16-inch diameter by 1-1/2-inch length, and with organic polymer coating with more than 800-hour, salt-spray resistance to red rust per ASTM B 117.

2.4 STONE TRIM ANCHORS

A. Stone Trim Anchors: Units fabricated with tabs or dowels designed to engage kerfs or holes in stone trim units and holes for fasteners or postinstalled anchor bolts for fastening to substrates or framing as indicated.

B. Materials: Fabricate anchors from stainless steel, ASTM A 240 or ASTM A 666, Type 304. Fabricate dowels from stainless steel, ASTM A 276, Type 304

C. Fasteners for Stone Trim Anchors: Annealed stainless-steel bolts, nuts, and washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.

D. Postinstalled Anchor Bolts for Fastening Stone Trim Anchors: Chemical anchors or

torque- controlled expansion anchors made from stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or Type 316, for anchors.

2.5 EMBEDDED FLASHING MATERIALS

A. Metal Flashing: Provide metal flashing, where flashing is exposed or partly exposed and where indicated, complying with SMACNA's "Architectural Sheet Metal Manual and Section 076200 "Sheet Metal Flashing and Trim" and as follows:

1. Stainless Steel: ASTM A 240, Type 304, 0.016 inch thick.
2. Copper: ASTM B 370, Temper H00 or H01, cold-rolled copper sheet, 10-oz./sq. ft. weight or 0.0135 inch thick for fully concealed flashing; 16-oz./sq. ft.) weight or 0.0216 inch thick elsewhere.
3. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.
4. Fabricate through-wall metal flashing embedded in masonry from stainless steel or copper, with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.
5. Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.
6. Fabricate through-wall flashing with drip edge where indicated and otherwise needed. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed if exposed to view.
7. Fabricate through-wall flashing with sealant stop where indicated and otherwise needed. Fabricate by bending metal back on itself 3/4 inch at exterior wall face and down into joint 3/8 inch to form a stop for retaining sealant backer rod.
8. Fabricate metal drip edges and sealant stops for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam will shed water.
9. Metal Drip Edges: Fabricate from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees hemmed if exposed to view.
10. Metal Sealant Stops: Fabricate from stainless steel. Extend at least 3 inches into wall and out to exterior wall face. At exterior wall face, bend metal back on itself for 3/4 inch and down into joint 3/8 inch to form a stop for retaining sealant backer rod.
11. Metal Expansion-Joint Strips: Fabricate from stainless steel to shapes indicated.

B. Flexible Flashing: For flashing unexposed to the exterior, use one of the following unless otherwise indicated:

1. Copper-Laminated Flashing: 5-oz./sq. ft. copper sheet bonded with asphalt between two layers of glass-fiber cloth. Use only where flashing is fully concealed in masonry.

2. Asphalt-Coated Copper Flashing: 5-oz./sq. ft. copper sheet coated with flexible asphalt. Use only where flashing is fully concealed in masonry.

3. Rubberized-Asphalt Flashing: Composite flashing product consisting of a pliable, adhesive, rubberized-asphalt compound, bonded to a high-density, cross-laminated, polyethylene film to produce an overall thickness of not less than 0.030 inch.[

4. Elastomeric Thermoplastic Flashing: Composite flashing product consisting of a polyester- reinforced ethylene interpolymer alloy as follows:
   a. Monolithic Sheet: Elastomeric thermoplastic flashing, 0.040 inch thick.
   b. Self-Adhesive Sheet: Elastomeric thermoplastic flashing, 0.025 inch thick, with a 0.015-inch thick coating of rubberized-asphalt adhesive.
   c. Self-Adhesive Sheet with Drip Edge: Elastomeric thermoplastic flashing, 0.025 inch thick, with a 0.015-inch thick coating of rubberized-asphalt adhesive. Where flashing extends to masonry face, rubberized-asphalt coating is held back approximately 1-1/2 inches from edge.

      1) Color: Black

   d. Accessories: Provide preformed corners, end dams, other special shapes, and seaming materials produced by flashing manufacturer.

5. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637/D 4637M, 0.040 inch thick.

C. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond wall face, use metal flashing.
3. Where flashing is partly exposed and is indicated to terminate at wall face, use metal flashing with a drip edge with a sealant stop.
4. Where flashing is fully concealed, use metal flashing or flexible flashing.

D. Solder and Sealants for Sheet Metal Flashings: As specified in Section 076200 "Sheet Metal Flashing and Trim."

1. Solder for Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. Solder for Copper: ASTM B 32, Grade Sn50.
3. Elastomeric Sealant: ASTM C 920, chemically curing polysulfide or silicone sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

E. Adhesives, Primers, and Seam Tapes for Flexible Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.6 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene, urethane, or PVC.

B. Cementitious Dampproofing]: Cementitious formulation recommended by ILI and nonstaining to stone, compatible with joint sealants, and noncorrosive to veneer anchors and attachments.

C. Asphalt Dampproofing: Cut-back asphalt complying with ASTM D 4479, Type I or asphalt emulsion complying with ASTM D 1227, Type III or Type IV.

D. Weep/Vent Products: Use one of the following unless otherwise indicated:
1. Wicking Material:
Absorbent rope, made from cotton or UV-resistant synthetic fiber, 1/4 to 3/8 inch in diameter, in length required to produce 2-inch exposure on exterior and 18 inches in cavity behind stone masonry. Use only for weeps.
2. Round Plastic Tubing:
Medium-density polyethylene, 3/8-inch OD by thickness of stone masonry.
3. Rectangular Plastic Tubing:
Clear butyrate, 3/8 by 1-1/2 inches by thickness of stone masonry.
4. Mesh Weep Holes/Vents:
Free-draining mesh; made from polyethylene strands, full width of head joint and 2 inches high by thickness of stone masonry; in color selected from manufacturer's standard.
5. Aluminum Weep Holes/Vents:
One-piece, L-shaped units made from painted sheet aluminum, designed to fit into head joint and consisting of vertical channel with louvers stamped in web and with top flap to keep mortar out of head joint.
6. Vinyl Weep Holes/Vents:
One-piece, offset, T-shaped units made from flexible, injection-molded PVC, designed to fit into head joint and consisting of louvered vertical leg, flexible wings to seal against ends of stone units, and top flap to keep mortar out of head joint; in color approved by Architect to match that of mortar.

E. Cavity Drainage Material: Free-draining mesh, made from polymer strands that will not degrade within the wall cavity.
1. Provide one of the following configurations:
a. Strips, full depth of cavity and 10 inches wide, with dovetail-shaped notches 7 inches deep that prevent mesh from being clogged with mortar droppings.
b. Strips, not less than 3/4 inch thick and 10 inches wide, with dimpled surface designed to catch mortar droppings and prevent weep holes from being clogged with mortar.
c. Sheets or strips full depth of cavity and installed to full height of cavity.
d. Sheets or strips not less than 3/4 inch thick and installed to full height of cavity with additional strips 4 inches high at weep holes and thick enough to fill entire depth of cavity and prevent weep holes from being clogged with mortar.

2.7 MASONRY CLEANERS

A. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar and grout stains, efflorescence, and other new construction stains from stone masonry surfaces without discoloring or damaging masonry surfaces; expressly approved for intended use by cleaner manufacturer and stone producer.

2.8 FABRICATION

A. General: Fabricate stone units in sizes and shapes required to comply with requirements indicated.

1. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."
2. For limestone, comply with recommendations in ILI's "Indiana Limestone Handbook."

B. Cut, split, select stone to produce pieces of thickness, size, and shape indicated, including details on Drawings and pattern specified in "Setting Stone Masonry" Article.

1. Shape stone specified to be laid in three-course, random range ashlar pattern with sawed and / or split beds.

C. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated. Shape beds to fit supports.

D. Cut and drill sinkages and holes in stone for anchors and supports.

E. Carefully inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.

1. Clean sawed backs of stone to remove rust stains and iron particles.

F. Thickness of Stone: Provide thickness indicated, but not less than the following:

1. Thickness: 4 inches plus or minus 1/4 inch
   Note: Thickness does not include projection of pitched faces.

G. Finish exposed stone faces and edges to comply with requirements indicated for finish and to match approved samples and mockups.
1. Finish for Stone:

   Split face, Rock face (pitched face), Natural cleft, Mixed split face and seam face, Mixed split face, seam face, and rock face (pitched face), Smooth, Sand rubbed, As indicated in specifications and drawings.
2. Finish for Sills:
   Smooth, Sand rubbed, Split face with sand-rubbed washes, Rock face (pitched face) with sand-rubbed washes, Rock face (pitched face) with tooled (boasted) washes.
3. Finish for Lintels:
   Smooth, Sand rubbed, Split face, Rock face (pitched face).
4. Finish for Copings:

Smooth, Sand rubbed, Split face, Rock face (pitched face), front and back; sand-rubbed top, Rock face (pitched face), front and back; tooled (boasted) top.

a. Finish exposed ends of copings same as front and back faces.

2.9 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride.
2. Use portland cement-lime mortar, masonry cement mortar or mortar cement mortar unless otherwise indicated.
3. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.
4. Mixing Pointing Mortar: Thoroughly mix cementitious and aggregate materials together before adding water. Then mix again, adding only enough water to produce a damp, unworkable mix that will retain its form when pressed into a ball. Maintain mortar in this dampened condition for one to two hours. Add remaining water in small portions until mortar reaches required consistency. Use mortar within 30 minutes of final mixing; do not retemper or use partially hardened material.

B. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

C. Mortar for Stone Masonry: Comply with ASTM C 270, Proportion Specification.

1. Mortar for Setting Stone: Type S and Type N as required per location.
2. Mortar for Pointing Stone: Type N.

D. Pigmented Mortar: Use colored cement product or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products.

1. Pigments shall not exceed 10 percent of portland cement by weight.
2. Pigments shall not exceed 5 percent of masonry cement or mortar cement by weight.
3. Mix to match Architect's sample.

E. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance

with requirements for installation tolerances and other conditions affecting performance of stone masonry.

B. Examine substrate to verify that dovetail slots, inserts, reinforcement, veneer anchors, flashing, and other items installed in substrates and required for or extending into stone masonry are correctly installed.

C. Examine wall framing, sheathing, and weather-resistant sheathing paper to verify that stud locations are suitable for spacing of veneer anchors and that installation will result in a weatherproof covering.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Accurately mark stud centerlines on face of weather-resistant sheathing paper before beginning stone installation.

B. Coat concrete and unit masonry backup with asphalt dampproofing.

C. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 SETTING STONE MASONRY

A. Perform necessary field cutting and trimming as stone is set.

1. Use power saws to cut stone that is fabricated with saw-cut surfaces. Cut lines straight and true, with edges eased slightly to prevent snipping.
2. Use hammer and chisel to split stone that is fabricated with split surfaces. Make edges straight and true, matching similar surfaces that were shop or quarry fabricated.
3. Pitch face at field-split edges as needed to match stones that are not field split.

B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.

C. Arrange stones in range ashlar pattern with course heights as indicated, [uniform] [random] lengths, and uniform joint widths, with offset between vertical joints as indicated.

D. Arrange stones in broken-range ashlar pattern with uniform course heights, random lengths, and uniform joint widths.

E. Arrange stones in three-course, random-range ashlar pattern with random course

heights, random lengths (interrupted coursed), and uniform joint widths.

F. Arrange stones in coursed or uncoursed rubble pattern with joint widths within tolerances indicated. Insert small stones into spaces between larger stones as needed to produce joints as uniform in width as practical.

G. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.

H. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place.

I. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

J. Install steel lintels where indicated. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

K. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment if any. Lay walls with joints not less than 1/4 inch at narrowest points or more than 3/8 inch at widest points.

L. Provide sealant joints of widths and at locations indicated.

1. Keep sealant joints free of mortar and other rigid materials.
2. Sealant joints are specified in Section 079200 "Joint Sealants."

M. Install metal expansion strips in sealant joints at locations indicated. Build flanges of expansion strips into masonry by embedding in mortar between stone masonry and backup wythe.
Lap each joint 4 inches in direction of water flow. Seal joints below grade and at junctures with horizontal expansion joints if any.

N. Install embedded flashing and weep holes at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.

1. At stud-framed walls, extend flashing through stone masonry, up sheathing face at least 8 inches and behind weather barrier.
2. At multiwythe masonry walls, including cavity walls, extend flashing through stone masonry, turned up a minimum of 8 inches, and extend into or through inner wythe to comply with requirements in Section 042000 "Unit Masonry."
3. At concrete backing, extend flashing through stone masonry, turned up a minimum of 8 inches and insert in reglet. Reglets are specified in Section 076200 "Sheet Metal Flashing and Trim."
4. At lintels and shelf angles, extend flashing full length of angles but not less than 6 inches into masonry at each end.
5. At sills, extend flashing not less than 4 inches at ends.
6. At ends of head and sill flashing, turn up not less than 2 inches to form end dams.
7. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 079200 "Joint

Sealants" for application indicated.

8. Install metal drip edges and sealant stops with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 079200 "Joint Sealants" for application indicated.
9. Extend sheet metal flashing 1/2 inch beyond masonry face at exterior, and turn flashing down to form a drip.
10. Install metal drip edges beneath flexible flashing at exterior wall face. Stop flexible flashing 1/2 inch back from exterior wall face and adhere flexible flashing to top of metal drip edge.
11. Install metal flashing termination beneath flexible flashing at exterior wall face. Stop flexible flashing 1/2 inch back from exterior wall face and adhere flexible flashing to top of metal flashing termination.
12. Cut flexible flashing flush with wall face after completing masonry wall construction.

O. Place weep holes and vents in joints where moisture may accumulate, including at base of cavity walls, above shelf angles, and at flashing.

1. Use wicking material, round plastic tubing, rectangular plastic tubing, mesh weep holes/vents, aluminum weep holes/vents, or vinyl weep holes/vents to form weep holes.
2. Use wicking material to form weep holes above flashing in stone sills. Turn wicking down at lip of sill to be as inconspicuous as possible.
3. Space weep holes at 16 inches or 24 inches o.c.
4. Space weep holes formed from plastic tubing or wicking material 16 inches o.c.
5. Trim wicking material used in weep holes flush with exterior wall face after mortar has set.
6. Place pea gravel in cavities as soon as practical to a height of not less than 2 inches above top of flashing, to maintain drainage.
7. Place cavity drainage material in cavities to comply with configuration requirements for cavity drainage material in "Miscellaneous Masonry Accessories" Article.

P. Install vents in head joints at top of each continuous cavity at spacing indicated. Use wicking material, round plastic tubing, rectangular plastic tubing, mesh weep holes/vents, aluminum weep holes/vents, or vinyl weep holes/vents to form vents.

1. Close cavities off vertically and horizontally with blocking in manner indicated. Install through-wall flashing and weep holes above horizontal blocking.

Q. Coat limestone with cementitious dampproofing as follows:

1. Stone at Grade: Beds, joints, and back surfaces to at least 12 inches above finish-grade elevations.
2. Stone Extending below Grade: Beds, joints, back surfaces, and face surfaces below grade.
3. Allow cementitious dampproofing formulations to cure before setting dampproofed stone. Do not damage or remove dampproofing in the course of handling and setting stone.

3.4 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet , or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/8 inch in 10 feet , 1/4 inch in 20 feet , or 1/2 inch maximum.

B. Variation from Level: For bed joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2 inch maximum.

C. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet or more.

D. Measure variation from level, plumb, and position shown in plan as a variation of the average plane of each stone face from level, plumb, or dimensioned plane.

E. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.

F. Variation in Plane between Adjacent Stones: Do not exceed one-half of tolerance specified for thickness of stone.
   1. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet , or 1/2 inch maximum.

3.5 INSTALLATION OF ANCHORED STONE MASONRY

A. Anchor stone masonry to concrete with corrugated-metal veneer anchors unless otherwise indicated. Secure anchors by inserting dovetailed ends into dovetail slots in concrete.

B. Anchor stone masonry to unit masonry with corrugated-metal or individual wire veneer anchors unless otherwise indicated. Embed anchors in unit masonry mortar joints or grouted cells at a distance of at least one-half of unit masonry thickness.

C. Anchor stone masonry to unit masonry with wire anchors unless otherwise indicated. Connect anchors to masonry joint reinforcement by inserting pintles into eyes of masonry joint reinforcement projecting from unit masonry.

D. Anchor stone masonry to unit masonry with wire anchors unless otherwise indicated. Connect anchors to masonry joint reinforcement with vertical rods inserted through anchors and through eyes of masonry joint reinforcement projecting from unit masonry.

E. Anchor stone masonry to unit masonry with adjustable, screw-attached seismic veneer anchors unless otherwise indicated. Fasten anchors to unit masonry with two screws.

F. Anchor stone masonry to stud framing with adjustable, screw-attached seismic veneer anchors unless otherwise indicated. Fasten anchors through sheathing to framing with two screws.

G. Anchor stone masonry to stud framing with screw-attached veneer anchors unless

otherwise indicated.

H. Anchor stone masonry to wood-stud framing with corrugated-metal veneer anchors unless otherwise indicated. Fasten anchors through sheathing to studs with corrosion-resistant roofing nails.

I. Anchor stone masonry to wood-stud framing with wire anchors unless otherwise indicated. Fasten anchors through sheathing to wood studs with corrosion-resistant roofing nails.

J. Anchor stone masonry to metal-stud framing with wire anchors unless otherwise indicated. Tie anchors to studs.

K. Embed veneer anchors in mortar joints of stone masonry at least halfway, but not less than 1-1/2 inches, through stone masonry and with at least a 5/8-inch cover on exterior face.

1. Install continuous wire reinforcement in horizontal joints and attach to seismic veneer anchors as stone is set.

L. Space anchors to provide not less than one anchor per 2 sq. ft. of wall area. Install additional anchors within 12 inches of openings, sealant joints, and perimeter at intervals not exceeding 12 inches.

M. Space anchors not more than 16 inches o.c. vertically and 24 inches o.c. horizontally. Install additional anchors within 12 inches of openings, sealant joints, and perimeter at intervals not exceeding 12 inches.

N. Space anchors not more than 18 inches o.c. vertically and 32 inches o.c. horizontally, with not less than one anchor per 2.67 sq. ft. of wall area. Install additional anchors within 12 inches of openings, sealant joints, and perimeter at intervals not exceeding 12 inches.

O. Anchor stone trim with stone trim anchors where indicated. Install anchors by fastening to substrate and inserting tabs and dowels into kerfs and holes in stone units. Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on stone. Fill remainder of anchor holes and kerfs with mortar.

P. Set stone in full bed of mortar with full head joints unless otherwise indicated. Build anchors into mortar joints as stone is set.

Q. Fill collar joint / space between back of stone masonry and weather-resistant sheathing paper with mortar as stone is set.

R. Provide 2-inch cavity between stone masonry and backup construction unless otherwise indicated. Keep cavity free of mortar droppings and debris.

1. Slope beds toward cavity to minimize mortar protrusions into cavity.
2. Do not attempt to trowel or remove mortar fins protruding into cavity.

S. Rake out joints for pointing with mortar to depth of not less than 1/2 inch before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

3.6 POINTING

A. Prepare stone-joint surfaces for pointing with mortar by removing dust and mortar particles. Where setting mortar was removed to depths greater than surrounding areas, apply pointing mortar in layers not more than 3/8 inch deep until a uniform depth is formed.

B. Point stone joints by placing and compacting pointing mortar in layers of not more than 3/8 inch deep. Compact each layer thoroughly and allow to it become thumbprint hard before applying next layer.

C. Tool joints, when pointing mortar is thumbprint hard, with a smooth jointing tool to produce the following joint profile:

1. Joint Profile:

   Concave; Smooth, flat face slightly below edges of stone; Smooth, flat face recessed 1/4 inch below edges of stone (raked joint); Flush, with a 3/8-inch half-round raised bead in middle of joint; or as indicated on drawings.

3.7 ADJUSTING AND CLEANING

A. Remove and replace stone masonry of the following description:

1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.
2. Defective joints.
3. Stone masonry not matching approved samples and mockups.
4. Stone masonry not complying with other requirements indicated.

B. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean stone masonry as work progresses. Remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone masonry.
3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
4. Wet wall surfaces with water before applying cleaner; remove cleaner promptly by rinsing thoroughly with clear water.
5. Clean stone masonry by bucket and brush hand-cleaning method described in

BIA Technical Note No. 20, Revised II, using job-mixed detergent solution.

6. Clean stone masonry with proprietary acidic cleaner applied according to manufacturer's written instructions.
7. Clean limestone masonry to comply with recommendations in ILI's "Indiana Limestone Handbook."

3.8 EXCESS MATERIALS AND WASTE

A. Excess Stone: Stack excess stone where directed by Owner for Owner's use.

B. Disposal as Fill Material: Dispose of clean masonry waste, including mortar and excess or soil- contaminated sand, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in greatest dimension.
2. Mix masonry waste with at least 2 parts of specified fill material for each part of masonry waste. Fill material is specified in Section 312000 "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other waste, and legally dispose of off Owner's property.

END OF SECTION 044313

SECTION 047200 - ARCHITECTURAL PRECAST CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Scope: Provide all of the labor, materials, equipment and services required to furnish and install the architectural precast concrete.

B. This Section includes, but not limited to the following:

1. Wall caps.
2. Architectural precast low wall cap.
3. Architectural precast column and pilaster cap.

C. Related Sections include the following:

1. Division 04 Section "Unit Masonry".
2. Division 04 Section “Anchored Stone Masonry Veneer”.
3. Division 07 Section "Water Repellents".
4. Division 08 Section "Aluminum Windows".

1.3 SUBMITTALS

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

B. Design Mixtures: For each precast concrete mixture. Include compressive strength and water absorption tests.

C. Shop Drawings: Detail fabrication and installation of architectural precast concrete units. Indicate locations, plans, elevations, dimensions, shapes, and cross sections of each unit. Indicate joints, reveals, and extent and location of each surface finish. Indicate details at building corners.

1. Indicate separate face and backup mixture locations and thicknesses.
2. Indicate welded connections by AWS standard symbols. Detail loose and cast-in hardware and connections.
3. Indicate locations, tolerances, and details of anchorage devices to be embedded in or attached to structure or other construction.
4. Indicate locations, extent, and treatment of dry joints if two-stage casting is proposed.
5. Include plans and elevations showing unit location and sequence of erection for special conditions.
6. Indicate location of each architectural precast concrete unit by same identification mark placed on panel.

7. Indicate relationship of architectural precast concrete units to adjacent materials.

D. Samples: For each type of finish indicated on exposed surfaces of architectural precast concrete units, in sets of 3, illustrating full range of finish, color, and texture variations expected; approximately 4 by 4 by 2 inches.

E. Material Test Reports: For aggregates.

F. Material Certificates: For the following items, signed by manufacturers:

1. Cementitious materials.
2. Reinforcing materials and prestressing tendons.
3. Admixtures.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: A firm that assumes responsibility for engineering architectural precast concrete units to comply with performance requirements. This responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Design Standards:

1. Comply with ACI 318 (ACI 318M) and design recommendations of PCI MNL 120, "PCI Design Handbook - Precast and Pre-stressed Concrete," applicable to types of architectural precast concrete units indicated.
2. Comply with detail recommendation of Cast Stone Institute® Technical Manual (Current Edition)

C. Quality-Control Standard: For manufacturing procedures and testing requirements, quality control recommendations, and dimensional tolerances for types of units required, comply with PCI MNL 117, "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products."

D. Samples: After sample approval and before fabricating architectural precast concrete units, produce a minimum of 2 sample units, of actual size of each specified type of unit for review by Architect. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample units.

E. Mock-up: Prior to precast erection, construct in association with other trades whose materials are to be installed adjacent to or in conjunction with the precast, a sample mock-up.

1. Mock-up shall demonstrate aesthetic effects as well as quality of materials and execution. Demonstrate the proposed attachments system, sealant materials (in color selected by the Architect), damp-proofing and any associated finish material.
2. Provide all support and back-up materials for stabilization of the mock-up.
3. Other materials not specified as materials inherent to this Section shall be furnished and installed into the mock-up by other trades.
4. The entire approved mock-up shall remain for the duration of the construction and may

be part or the construction upon approval by the Architect.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver architectural precast concrete units in such quantities and at such times to limit unloading units temporarily on the ground or other rehandling.

B. Support units during shipment on non-staining shock-absorbing material.

C. Store units with adequate dunnage and bracing and protect units to prevent contact with soil, to prevent staining, and to prevent cracking, distortion, warping or other physical damage.

D. Place stored units so identification marks are clearly visible, and units can be inspected.

E. Handle and transport units in a manner that avoids excessive stresses that cause cracking or damage.

F. Lift and support units only at designated points indicated on Shop Drawings.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Limestone: to the approval of the Architect.

1. Color: white
2. Finish of faces, edges and undersides: smooth

B. Portland Cement: ASTM C 150, Type I or Type III, gray, unless otherwise indicated.

1. For surfaces exposed to view in finished structure, mix gray with white cement, of same type, brand, and mill source.

C. Supplementary Cementitious Materials:

1. Fly Ash: ASTM C 618, Class C or F, with maximum loss on ignition of 3 percent.
2. Metakaolin Admixture: ASTM C 618, Class N.
3. Silica Fume Admixture: ASTM C 1240, with optional chemical and physical requirement.
4. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.

D. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

1. Face-Mixture-Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match selected finish sample.

a. Gradation: Uniformly graded

2. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand of same material as coarse aggregate, unless otherwise approved by Architect.

E. Coloring Admixture: ASTM C 979, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and non-fading.

F. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

G. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 117.

H. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.

2.2 GROUT MATERIALS

A. Sand-Cement Grout: Portland cement, ASTM C 150, Type I, and clean, natural sand, ASTM C 144, or ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

B. Nonmetallic, Nonshrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30- minute working time.

C. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C 881/C 881M, of type, grade, and class to suit requirements.

2.3 CONCRETE MIXTURES

A. Prepare design mixtures for each type of precast concrete required.

B. Limit use of fly ash and silica fume to 20 percent of portland cement by weight; limit metakaolin and silica fume to 10 percent of portland cement by weight.

C. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at architectural precast concrete fabricator's option.

D. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 (ACI 318M) or PCI MNL 117 when tested according to ASTM C 1218/C 1218M.

E. Normal-Weight Concrete Mixtures: Proportion mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:

1. Compressive Strength (28 Days): 5000 psi (34.5 MPa) minimum.
2. Maximum Water-Cementitious Materials Ratio: 0.45.

F. Water Absorption: 6 percent by weight or 14 percent by volume, tested according to ASTM C 642, except for boiling requirement.

G. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 117.

H. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.

2.4 ACCESSORIES

A. Anchors and dowels: Non-corrosive type, sized for conditions. Type 304 stainless steel.

1. Size: 1/2 inch diameter by 8 inches long
2. Location: 16 inches on centers and not more than 12 inches from each end.

B. Precast Accessories: Provide steel lintels, shelf angles, clips, hangers, plastic or steel shims, and other accessories required to install architectural precast concrete units. Refer to Division 05 Section “Metal Fabrications” for compliance requirements.

C. Sealant: ASTM C 920, low-modulus, multicomponent, nonsag urethane sealant complying with requirements in Division 07 Section "Joint Sealant" and that is nonstaining to stone substrate.

D. Cleaner: Prosoco Sure Klean Custom Masonry Cleaner, Prosoco Sure Klean 600 Detergent, or Prosoco Sure Klean Vana Trol.

2.5 BEARING PADS

A. Provide elastomeric bearing pads of vulcanized, chloroprene elastomeric compound which is molded to size or cut form a molded sheet. Bearing pads shall have a surface hardness of 50 to 70 Shore A durometer according to ASTM D-2214, minimum tensile strength 2250 psi per ASTM D-412.

2.6 FABRICATION

A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.

1. Weld headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."

B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing architectural precast

concrete units to supporting and adjacent construction.

C. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete units as indicated on the Contract Drawings.

D. Reinforcement: Comply with recommendations in PCI MNL 117 for fabricating, placing, and supporting reinforcement.

E. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses.

F. Comply with requirements in PCI MNL 117 and requirements in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.

G. Place face mixture to a minimum thickness after consolidation of the greater of 1 inch (25 mm) or 1.5 times the maximum aggregate size, but not less than the minimum reinforcing cover specified.

H. Place concrete in a continuous operation to prevent seams or planes of weakness from forming in precast concrete units.

1. Place backup concrete mixture to ensure bond with face-mixture concrete.

I. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air on surfaces. Use equipment and procedures complying with PCI MNL 117.

1. Place self-consolidating concrete without vibration according to PCI TR-6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."

J. Comply with PCI MNL 117 for hot- and cold-weather concrete placement. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each architectural precast concrete unit on a surface that will not show in finished structure.

K. Cure concrete, according to requirements in PCI MNL 117, by moisture retention without heat or by accelerated heat curing using low-pressure live steam or radiant heat and moisture. Cure units until compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

L. Discard and replace architectural precast concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 117 and Architect's approval.

2.7 FABRICATION TOLERANCES

A. Fabricate architectural precast concrete units straight and true to size and shape with exposed edges and corners precise and true so each finished panel complies with PCI MNL 117 product tolerances as well as position tolerances for cast-in items.

2.8 FINISHES

A. Panel faces shall be free of joint marks, grain, and other obvious defects. Corners, including false joints shall be uniform, straight, and sharp. Finish exposed-face surfaces of architectural precast concrete units to match approved design reference sample and as follows:

1. Design Reference Sample: smooth finish, no visible aggregate.

B. Finish exposed top, bottom, and back surfaces of architectural precast concrete units to match face-surface finish.

2.9 SOURCE QUALITY CONTROL

A. Quality-Control Testing: Test and inspect precast concrete according to PCI MNL 117 requirements. If using self-consolidating concrete, also test and inspect according to PCI TR- 6, "Interim Guidelines for the Use of Self-Consolidating Concrete in Precast/Prestressed Concrete Institute Member Plants."

B. Owner will employ an independent testing agency to evaluate architectural precast concrete fabricator's quality-control and testing methods.

C. Defective Units: Discard and replace recast architectural concrete units that do not comply with acceptability requirements in PCI MNL 117, including concrete strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval. Architect reserves the right to reject precast units that do not match approved samples, sample panels, and mockups. Replace unacceptable units with precast concrete units that comply with requirements.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Proceed with installation only after any unsatisfactory conditions have been corrected.

B. Do not install precast units until the concrete has attained its design strength.

C. Install clips, hangers, bearing pads, and other accessories required for connecting architectural precast concrete units to supporting members and backup materials.

D. Erect architectural precast concrete level, plumb, and square within specified allowable tolerances. Provide temporary supports and bracing as required to maintain position, stability, and alignment as units are being permanently connected.

1. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.

2. Unless otherwise indicated, provide for uniform joint widths of 3/8 inch.

E. Connect architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.

F. At dowel connections, use stainless steel dowels, to prevent loosening or movement of units after final adjustment.

G. Install clips, hangers, and other accessories required for the erection of precast units to supporting members and back materials.

H. Grouting Connections: Grout connections where required or indicated. Retain grout in place until hard enough to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, level, and plumb with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it affects finishes or hardens.

I. Erect architectural precast concrete units level, plumb, square, true, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 117, Appendix I.

3.2 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections and prepare reports:

1. Erection of precast concrete members.

B. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

C. Field welds will be subject to visual inspections and nondestructive testing according to ASTM E 165 or ASTM E 709. High-strength bolted connections will be subject to inspections.

D. Testing agency will report test results promptly and in writing to Contractor and Architect.

E. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.3 REPAIRS

A. Repair damaged architectural precast concrete units if permitted by Architect. The Architect reserves the right to reject repaired units that do not comply with requirements.

B. Mix patching materials and repair units so cured patches blend with color, texture, and

uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.

C. Prepare and repair damaged galvanized coatings with galvanizing repair paint according to ASTM A 780.

D. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.

E. Remove and replace damaged architectural precast concrete units when repairs do not comply with requirements.

3.4 CLEANING

A. Clean surfaces of precast concrete units exposed to view.

B. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.

C. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.

1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's recommendations. Clean soiled precast concrete surfaces with detergent and water, using stiff fiber brushes and sponges, and rinse with clean water. Protect other work from staining or damage due to cleaning operations.
2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 047200

SECTION 051200 - STRUCTURAL STEEL FRAMING

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. This Section includes the following:
1. Structural steel.
2. Grout.

1.3 DEFINITIONS

A. Structural Steel: Elements of structural-steel frame, as classified by AISC's "Code of Standard Practice for Steel Buildings and Bridges," that support design loads.

1.4 SUBMITTALS

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

B. Shop Drawings: Show fabrication of structural-steel components.
1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
2. Include embedment drawings.
3. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.
4. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. .
5. For structural-steel connections indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

C. Welding certificates.

D. Qualification Data: For Installer, fabricator, professional engineer and testing agency.

E. Mill and Product Test Reports: Signed by manufacturers certifying that the following products comply with requirements:
1. Structural steel including chemical and physical properties.
2. Bolts, nuts, and washers including mechanical properties and chemical analysis.
3. Shop primers.
4. Nonshrink grout.

F. Source quality-control test reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who participates in the AISC Quality Certification Program and is designated an AISC-Certified Erector, Category ACS].

B. Fabricator Qualifications: A qualified fabricator who participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category STD.

C. Fabricators certified under the AISC Quality Certification Program in a category of structural steel work appropriate to the work defined are exempt from Special Inspection requirements for “On premises inspection of fabricated items”, and “Review each Fabricator’s quality control procedures” as listed in Division 01 Section “Code Required Special Inspections and

Procedures." Non-AISC fabricators shall be subject to these special inspections, and shall be responsible for the inspection costs associated with these inspections.

D. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

E. Comply with applicable provisions of the following specifications and documents:
1. AISC's "Code of Standard Practice for Steel Buildings and Bridges."
2. AISC's "Seismic Provisions for Structural Steel Buildings" and "Supplement No. 2."
3. AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
4. AISC's "Specification for the Design of Steel Hollow Structural Sections."
5. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
6. RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

F. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

G. Survey of existing conditions,

H. Field quality-control and special inspection reports.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from erosion and deterioration.
1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.7 COORDINATION

A. Furnish anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.
1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repairs or replace damaged materials or structures as directed.

B. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

C. Coordinate installation on anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Connections: Provide details of connections required by the Contract Documents to be selected or completed by structural-steel fabricator to withstand ASD-service loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated and AISC's "Manual of Steel Construction – 13th Edition, Allowable Stress Design," Part 9.
2. Engineering Responsibility: Fabricator's responsibilities include using a qualified professional engineer to prepare structural analysis data for structural-steel connections.

B. Moment Connections: [Type PR, partially] [Type FR, fully] restrained.

2.2 STRUCTURAL-STEEL MATERIALS

A. W-Shapes: ASTM A 992 **[and ASTM A 572, Grade 50]**.

B. Channels, Angles-Shapes: ASTM A 36 **[and ASTM A 572, Grade 50]**.

C. Plate and Bar: ASTM A 36 **[and ASTM A 572, Grade 50]**.

D. Cold-Formed Hollow Structural Sections: ASTM A 500, Grade B, structural tubing.

E. Steel Pipe: ASTM A 53, Type E or S, Grade B.
1. Weight Class: Standard.
2. Finish: Black, except where indicated to be galvanized.

F. Welding Electrodes: Comply with AWS requirements.

2.3 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength Bolts, Nuts, and Washers: ASTM A 325, Type 1, heavy hex steel structural bolts; ASTM A 563, Grade C, heavy hex carbon-steel nuts; and ASTM F 436, Type 1, hardened carbon-steel washers; all with plain finish.
1. Direct-Tension Indicators: ASTM F 959, Type 325 compressible-washer type with plain finish.

B. Unheaded Anchor Rods: ASTM A 36.
1. Configuration: Straight.
2. Nuts: ASTM A 563 heavy-hex carbon steel.
3. Plate Washers: ASTM A 36 carbon steel.
4. Washers: ASTM F 436, Type 1, hardened carbon steel.
5. Finish: Plain.

C. Threaded Rods: ASTM A 36.
1. Nuts: ASTM A 563 heavy-hex carbon steel.
2. Washers: ASTM F 436 Type 1, hardened carbon steel.
3. Finish: Plain.

2.4 PRIMER

A. Primer: Comply with Division 09 Sections “Exterior Painting,” “Interior Painting,” and “High Performance Painting.”

B. Primer: Fabricator’s standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible topcoat.

C. Galvanizing Repair Paint: MPI#18, MPI#19, or SSPC-Paint 20.

2.5 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 FABRICATION

A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and AISC's "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."
   1. Camber structural-steel members where indicated.
   2. Identify high-strength structural steel according to ASTM A 6 and maintain markings until structural steel has been erected.
   3. Mark and match-mark materials for field assembly.
   4. Complete structural-steel assemblies, including welding of units, before starting shop-priming operations.
   5. Fabricate beam with rolling camber up.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.B

C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
   1. Do not thermally cut bolt holes or enlarge holes by burning.

D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted according to SSPC-SP 2, "Hand Tool Cleaning

F. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's written instructions.

G. Holes: Provide holes required for securing other work to structural steel and for passage of other work through steel framing members.
   1. Cut, drill, or punch holes perpendicular to steel surfaces.
   2. Base-Plate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.
   3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

2.7 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened, except slip critical at wind frames and moment connections.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
   1. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
   2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
   3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent weld show-through on exposed steel surfaces.
      a. Grind butt welds flush.
      b. Grind or fill exposed fillet welds to smooth profile. Dress exposed welds.

2.8 SHOP PRIMING

A. Shop prime steel surfaces except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.

2. Surfaces to be field welded.
3. Surfaces to receive sprayed fire-resistive materials (Applied fireproofing).
4. Galvanized surfaces.
5. Machined or milled surfaces.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
1. SSPC-SP 3, "Power Tool Cleaning."
2. SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning."
3. SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
4. SSPC-SP 10/NACE No. 2, "Near-White Blast Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils and an average thickness of 2.0 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Prepare steel and apply a one-coat, nonasphaltic primer complying with SSPCPS Guide 7.00, “Painting System Guide 7.00: Guide for Selecting One-Coat Shop Painting Systems,” to provide a dry film thickness of not less than 1.5 mils.

2.9 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123.
1. Fill vent and drain holes by plugging with zinc solder and filing off smooth.
2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.

2.10 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop tests and inspections and prepare test reports.
1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
2. AISC Quality-Certified Fabricator: Owner will waive testing and inspection.

B. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

C. Bolted Connections: Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: In addition to visual inspection, shop-welded connections will be tested and inspected according to AWS D1.1 and the following inspection procedures, at testing agency's option:
1. Ultrasonic Inspection: ASTM E 164.

E. In addition to visual inspection, shop-welded shear connectors will be tested and inspected according to requirements in AWS D1.1 for stud welding and as follows:
1. Bend tests will be performed if visual inspections reveal either a less-than- continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments, with steel erector present, for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.
   1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION

A. Set structural steel accurately in locations and to elevations indicated and according to AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design."

B. Base and Bearing Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
   1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
   2. Weld plate washers to top of base plate.
   3. Snug-tighten anchor rods after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate before packing with grout.
   4. Promptly pack grout solidly between bearing surfaces and base or bearing plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.

C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."

D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure.
   2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members only where indicated.

F. Do not use thermal cutting during erection unless approved by Architect. Finish thermally cut sections within smoothness limits in AWS D1.1.

G. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened, except slip critical for wind frames and moment connections.

B. Weld Connections: Comply with AWS D1.1 for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding work.
   1. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" and "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
   2. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
   3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.

3.5 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
   1. Verify structural –steel materials and inspect steel frame joint details.
   2. Verify weld materials and inspect welds.
   3. Verify connection materials and inspect high-strength bolted connections.

B. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

C. Bolted Connections: Bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts."

D. Welded Connections: Field welds will be visually inspected according to AWS D1.1.
   1. In addition to visual inspection, field welds will be tested according to AWS D1.1 and the following inspection procedures, at testing agency's option:
      a. Ultrasonic Inspection: ASTM E 164.

3.6 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists and accessories, bearing plates, and abutting structural steel.
   1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
   2. Apply a compatible primer of same type as shop primer used on adjacent surfaces.

C. Touchup Painting: Cleaning and touchup painting are specified in Division 09 Sections “Exterior Painting” and “Interior Painting”.

D. Touchup Priming: Cleaning and touchup priming are specified in Division 09 Sections “High Performance Coatings,” “Exterior Painting,” and “Interior Painting.”

END OF SECTION 051200

SECTION 05 1213 - ARCHITECTURALLY EXPOSED STRUCTURAL STEEL FRAMING

PART 1 - GENERAL REQUIREMENTS

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. Architecturally exposed structural steel (AESS).
2. Section 051200 "Structural Steel Framing" requirements that also apply to AESS.

1.3 DEFINITIONS

A. AESS: Architecturally exposed structural steel.

B. Category AESS 1: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 1 and may be designated AESS 1 or Category AESS 1 in the Contract Documents.

C. Category AESS 2: Structural steel that is categorized by ANSI/AISC 303, Section 10, as AESS 2 and is designated as AESS 2 or Category AESS 2 in the Contract Documents.

D. SEAC/RMSCA Guide Specification: SEAC/RMSCA's "Sample Specification, Section 05 02 13: Architecturally Exposed Structural Steel."

1.4 COORDINATION

A. Coordinate surface preparation requirements for shop-primed items.

B. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at [Project site] <Insert location>.

1.6 ACTION SUBMITTALS

A. Product Data:
1. Tension-control, high-strength, bolt-nut-washer assemblies.
2. Corrosion-resisting (weathering steel), tension-control, high-strength, bolt-nut-washer assemblies.
3. Filler.
4. Primer.
5. Galvanized-steel primer.
6. Etching cleaner.
7. Galvanized repair paint.

B. Shop Drawings: Show fabrication of AESS components.
1. Identify AESS category for each steel member and connection, including transitions between AESS categories and between AESS and non-AESS.

2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
3. Include embedment Drawings.
4. Indicate orientation of mill marks and HSS seams.
5. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
6. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections. Indicate orientation and location of bolt heads.
7. Indicate exposed surfaces and edges and surface preparation being used.
8. Indicate special tolerances and erection requirements.
9. Indicate weep holes for HSS and vent holes for galvanized HSS.
10. Indicate surface preparation, primer, and coating requirements, including systems specified in other Sections.

C. Samples: Submit Samples to set quality standards for AESS.
1. End weld a HSS 4x4x1/4 tube to a 6x6x1/4 plate with fillet weld ground smooth and blended.
2. Side weld a HSS 4x4x1/2 to a 6x6x1/4 plate with J weld ground smooth and blended.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, fabricator

1.8 QUALITY ASSURANCE

A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU, or is accredited by the IAS Fabricator Inspection Program for Structural Steel (AC 172) and is experienced in fabricating AESS similar to that indicated on this Project.

B. Installer Qualifications: A qualified Installer who participates in the AISC Quality Certification Program, is designated an AISC-Certified Erector, and is experienced in erecting AESS similar to that indicated on this Project.

C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint [Endorsement P1] [Endorsement P2] [Endorsement P3] or SSPC-QP 3.

D. Mockups: Build mockups of AESS to set quality standards for fabrication and installation.
1. Build mockup of typical portion of AESS as shown on Drawings.
2. Coordinate painting requirements with [Section 099113 "Exterior Painting."] [Section 099123 "Interior Painting."]
3. Coordinate high-performance coatings requirements with Section 099600 "High-Performance Coatings."

4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Use special care in handling AESS to prevent twisting, warping, nicking, and other damage during fabrication, delivery, and erection. Store materials to permit easy access for inspection and identification. Keep AESS members off ground and spaced by using pallets, dunnage, or other

supports and spacers. Protect AESS members and packaged materials from corrosion and deterioration.

1. Do not store AESS materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.10 FIELD CONDITIONS

A. Field Measurements: Where AESS is indicated to fit against other construction, verify actual dimensions by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with requirements of ANSI/AISC 303, Sections 1 through 9 and as modified in Section 10, "Architecturally Exposed Structural Steel."

2.2 BOLTS, CONNECTORS, AND ANCHORS

A. High-Strength, Bolt-Nut-Washer Assemblies: ASTM F3125/F3125M, Grade F1852, Type 1, round-head assemblies consisting of steel structural bolts with splined ends; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.

1. Finish: Mechanically deposited zinc coating.

2.3 PRIMER

A. Steel Primer:

1. Comply with [Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."] [Section 099600 "High-Performance Coatings."] [Section 099113 "Exterior Painting," Section 099123 "Interior Painting," and Section 099600 "High-Performance Coatings."]
2. SSPC-Paint 23, latex primer.
3. Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI#79 and compatible with topcoat.

B. Galvanized-Steel Primer: [MPI#26] [MPI#80] [MPI#134].

1. Etching Cleaner: MPI#25, for galvanized steel.
2. Galvanizing Repair Paint: [MPI#18, MPI#19, or SSPC-Paint 20] [ASTM A780/A780M].

2.4 FABRICATION

A. Shop fabricate and assemble AESS to the maximum extent possible. Locate field joints at concealed locations if possible. Detail assemblies to minimize handling and to expedite erection.

1. Use special care handling and fabricating AESS before and after shop painting to minimize damage to shop finish.

B. Category AESS 1: (welds 15’ above grade)

1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.

3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
4. Make intermittent welds appear continuous, using filler or additional welding.
5. Seal weld open ends of hollow structural sections with 3/8-inch closure plates.
6. Limit butt and plug weld projections to 1/16 inch.
7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
8. Remove weld spatter, slivers, and similar surface discontinuities.
9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
10. Grind tack welds smooth unless incorporated into final welds.
11. Remove backing and runoff tabs, and grind welds smooth.

C. Category AESS 2: (welds within 15’ of grade)
1. Comply with overall profile dimensions of AWS D1.1/D1.1M for welded built-up members. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
2. Prepare surfaces according to Part 2 "Shop Priming" Article and SSPC-SP 6 (WAB)/NACE WAB-3.
3. Grind sheared, punched, and flame-cut edges to remove burrs and provide smooth surfaces and eased edges.
4. Make intermittent welds appear continuous, using filler or additional welding.
5. Seal weld open ends of hollow structural sections with 3/8-inch closure plates.
6. Limit butt and plug weld projections to 1/16 inch.
7. Install bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
8. Remove weld spatter, slivers, and similar surface discontinuities.
9. Remove blemishes and surface irregularities resulting from temporary braces or fixtures by filling or grinding, before cleaning, treating, and shop priming.
10. Grind tack welds smooth unless incorporated into final welds.
11. Remove backing and runoff tabs, and grind welds smooth.
12. Limit as-fabricated straightness tolerance to one-half that permitted for structural-steel materials in ANSI/AISC 303.
13. Limit as-fabricated curved structural steel tolerance to that permitted for structural-steel materials in ANSI/AISC 303.
14. Limit as-fabricated straightness tolerance of welded built-up members to one-half that permitted by AWS D1.1/D1.1M.
15. Conceal fabrication and erection markings from view in the completed structure.
16. Make welds uniform and smooth.

2.5 SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
1. Joint Type: [Snug tightened] [Pretensioned]

B. Weld Connections: Comply with AWS D1.1/D1.1M[and AWS D1.8/D1.8M] for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

2.6 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A123/A123M.
   1. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
   2. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
   3. Galvanize AESS [lintels] <Insert description> attached to structural-steel frame and located in exterior walls.

2.7 SHOP PRIMING

A. Shop prime steel surfaces, except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches .
   2. Surfaces to be field welded.
   3. Surfaces to be high-strength bolted with slip-critical connections.
   4. Corrosion-resisting (weathering) steel surfaces.
   5. Galvanized surfaces [unless indicated to be painted].

B. Surface Preparation: Clean nongalvanized surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:
   1. SSPC-SP 2.
   2. SSPC-SP 3.
   3. SSPC-SP 7 (WAB)/NACE WAB-4.
   4. SSPC-SP 14 (WAB)/NACE WAB-8.

C. Preparing Galvanized Steel for Shop Priming: After galvanizing, thoroughly clean steel of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner [or according to SSPC-SP 16].

D. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
   1. Stripe paint corners, crevices, bolts, welds, and eased edges.
   2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify, with steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.
   1. Prepare a certified survey of bearing surfaces, anchor rods, bearing plates, and other embedments, showing dimensions, locations, angles, and elevations.

B. Examine AESS for twists, kinks, warping, gouges, and other imperfections before erecting.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep AESS secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3 ERECTION

A. Take special care during erection to avoid marking or distorting the AESS and to minimize damage to shop painting. Set AESS accurately in locations and to elevations indicated and according to ANSI/AISC 303 and ANSI/AISC 360.
   1. Remove welded tabs that were used for attaching temporary bracing and safety cabling and that are exposed to view in the completed Work. Take care to avoid any blemishes, holes, or unsightly surfaces resulting from the use or removal of temporary elements.
   2. Grind tack welds smooth.
   3. Remove backing and runoff tabs, and grind welds smooth.
   4. Orient bolt heads on the same side of each connection and maintain orientation consistently from one connection to another.
   5. filler and grind, or sand smooth to achieve surface quality as approved by Architect.
   6. Conceal fabrication and erection markings from view in the completed structure.

B. In addition to ANSI/AISC 303, Section 10 requirements, comply with the following.
   1. Erection of [Category AESS 1] [and Category AESS 2]:
      a. Erect AESS to the standard frame tolerances specified in ANSI/AISC 303 for non-AESS.
      b. Comply with AWS D1.1/D1.1M. Keep appearance and quality of welds consistent. Maintain true alignment of members without warp exceeding specified tolerances.
      c. Remove weld spatter, slivers, and similar surface discontinuities.
      d. Grind off butt and plug weld projections larger than 1/16 inch.
      e. Continuous welds shall be of uniform size and profile.
      f. Ream holes that must be enlarged. Use of drift pins or burning is not permitted. Replace misaligned connection plates where holes cannot be aligned with acceptable appearance.
      g. Splice members only where indicated on Drawings.
      h. No torch cutting or field fabrication is permitted.

3.4 FIELD CONNECTIONS

A. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using High-Strength Bolts" for type of bolt and type of joint specified.
   1. Joint Type: Snug tightened

B. Weld Connections: Comply with AWS D1.1/D1.1M[and AWS D1.8/D1.8M] for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

3.5 REPAIR

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and touchup galvanizing to comply with ASTM A780/A780M.

B. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting, to comply with SSPC-PA 1 for touching up shop-painted surfaces.
   a. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
2. Cleaning and touchup painting are specified in [Section 099113 "Exterior Painting."] [Section 099123 "Interior Painting."] [Section 099600 "High-Performance Coatings."]

C. Touchup Priming: Cleaning and touchup priming are specified in Section 099600 "High-Performance Coatings."

3.6 FIELD QUALITY CONTROL

A. Testing Agency: [Owner will engage] [Engage] a qualified testing agency to inspect AESS as specified in Section 051200 "Structural Steel Framing." The testing agency is not responsible for enforcing requirements relating to aesthetic effect.

B. Architect will observe AESS in place to determine acceptability relating to aesthetic effect.

END OF SECTION 051213

SECTION 055213 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel pipe and tube railings.

B. Related Sections:
   1. Division 06 Section "Miscellaneous Rough Carpentry" for wood blocking for anchoring railings.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design railings, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:
   1. Steel: 72 percent of minimum yield strength.

C. Structural Performance: Railings shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails and Top Rails of Guards:
      a. Uniform load of 50 lbf/ ft. applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Infill of Guards:
      a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
      b. Infill load and other loads need not be assumed to act concurrently.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
   1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

E. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.3 SUBMITTALS

A. Product Data: For the following:
   1. Manufacturer's product lines of mechanically connected railings.
   2. Railing brackets.
   3. Grout, anchoring cement, and paint products.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

C. Delegated-Design Submittal: For installed products indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

D. Qualification Data: For qualified professional engineer.

E. Welding certificates.

F. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers certifying that shop primers are compatible with topcoats.

G. The Contractor shall submit to the Project Landscape Architect written evidence that the handrail and accessories are in conformance with the material and mechanical requirements specified herein. Certified copies of independent laboratory test results or mill test results from the handrail supplier may be considered evidence of compliance provided such tests are performed in accordance with the appropriate ASTM testing standards by experienced, competent personnel. In case of doubt as to the accuracy or adequacy of mill tests, the Project Landscape Architect may require that the Contractor furnish test reports from an independent testing laboratory on certified samples of handrail stock.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of railing from single source from single manufacturer.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code - Steel."

1.5 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication.

1.6 COORDINATION AND SCHEDULING

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

C. Schedule installation so attachments are made only to completed cheek walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.

2.2 STEEL

A. Recycled Content of Steel Products: Provide products with average recycled content of steel products so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

B. Tubing: ASTM A 500 (cold formed) or ASTM A 513.

C. Pipe: ASTM A 53, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
   1. Provide galvanized finish for exterior installations and where indicated.

D. Plates, Shapes, and Bars: ASTM A 36.

2.3 FASTENERS

A. General: Provide the following:
   1. Ungalvanized-Steel Railings: Plated steel fasteners complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5 for zinc coating.
   2. Hot-Dip Galvanized Railings: Type 316 stainless-steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153 or ASTM F 2329 for zinc coating.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:
   1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.

D. Post-Installed Anchors: Chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
   1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
   2. Material for Exterior Locations and Where Stainless Steel is Indicated: Alloy Group 2 stainless-steel bolts, ASTM F 593, and nuts, ASTM F 594.

2.4 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

B. Etching Cleaner for Galvanized Metal: Complying with MPI#25.

C. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it. Color: Satin Black.

D. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.

E. Shop Primer for Galvanized Steel: Cementitious galvanized metal primer complying with MPI#26.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

G. Non-shrink, Nonmetallic Grout: Factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

H. Galvanized Steel Skateboard Deterrents: Space 2’ o.c.

2.5 FABRICATION

A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.

D. Form work true to line and level with accurate angles and surfaces.

E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.

G. Connections: Fabricate railings with welded connections unless otherwise indicated.

H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove flux immediately.
   4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.

I. Form changes in direction as follows:
   1. As detailed.
   2. By radius bends of radius indicated or by inserting prefabricated elbow fittings of radius indicated.

J. Bend members in jigs to produce uniform curvature for each configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.

K. Close exposed ends of railing members with prefabricated end fittings.

L. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
   1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers, or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.

M. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.

N. For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.7 STEEL FINISHES

A. Galvanized Railings:
1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
2. Comply with ASTM A 123 for hot-dip galvanized railings.
3. Comply with ASTM A 153 for hot-dip galvanized hardware.
4. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
5. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.

D. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.

E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."

F. Primer Application: Apply shop primer to prepared surfaces of railings. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

C. Adjust railings before anchoring to ensure matching alignment at abutting joints.

D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.

B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

A. Use metal sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with non-shrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

B. Form or core-drill holes not less than 10 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

C. Leave anchorage joint exposed.
   1. Exterior Posts: Provide with 1/8-inch buildup, sloped away from post.

3.5 ADJUSTING AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.6 PROTECTION

A. Prior to Installation: Handrail, posts and accessories shall be stored above ground on suitable wood blocking so as not to bend or deflect excessively under their own weight. Handrail and posts will be stored with one end elevated to facilitate drainage. Handrail shall be kept free of dirt, grease, asphalt and other injurious materials. Materials with evidence of corrosion or rust shall not be used.

B. During and After Installation: Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

END OF SECTION 055213

SECTION 061000 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing with dimension lumber.
2. Sheathing for walls, roofs
3. angers and other hardware.
4. Framing with engineered wood products.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

C. Exposed Framing: Framing not concealed by other construction.

D. OSB: Oriented strand board.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For dimension lumber specified to comply with minimum allowable unit stresses. Indicate species and grade selected for each use and design values approved by the ALSC Board of Review.

B. Evaluation Reports: For the following, from ICC-ES:

1. Engineered wood products.
2. Shear panels.
3. Power-driven fasteners.
4. Post-installed anchors.
5. Metal framing anchors.

1.4 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber 19% unless otherwise indicated.

C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 WOOD-PRESERVATIVE-TREATED LUMBER

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2[for interior construction not in contact with ground,

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium
2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Application: Treat items indicated on Drawings, and the following:
1. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
2. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
3. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 DIMENSION LUMBER FRAMING

A. Non-Load-Bearing Interior Partitions: Construction or No. 2 grade.
1. Species:
   a. Spruce-pine-fir; NLGA.
   b. Hem-fir; WCLIB, or WWPA.

B. Load-Bearing Partitions: Construction or No. 2 grade.

1. Application: load-bearing Exterior walls and interior earing partitions.
2. Species:

a. Spruce-pine-fir; NLGA.
b. Hem-fir; WCLIB or WWPA.

F'b = 875 psi (single member usage).
F'b = 1000 psi (repetitive member usage).
Fv = 75 psi
E = 1,000,000 psi

C. Ceiling Joists: Construction or No. 2 grade.

1. Species:
a. Hem-fir; WCLIB or WWPA.
b. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

D. Joists, Rafters, and Other Framing Not Listed Above: Select Structural Construction

1. Species:
a. Hem-fir; WCLIB or WWPA.
b. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

F'b = 1200 psi (single member usage).
F'b = 1380 psi (repetitive member usage).
Fv = 75 psi
E = 1,400,000 psi

2.4 PLYWOOD SHEATHING

A. Sheathing shall conform to U.S. Commercial Standard CS45-60, and U.S. Product Standard SPI-74.

B. Wall sheathing 1/2" APA structural 1 rated exposed 1, span rating 32/16

C. Roof sheathing 5/8" APA structural 1 rated exposed 1, span rating 40/20

D. Adhesive shall conform to APA approved elastomeric construction adhesive (B.F. Goodrich PL400).

2.5 ENGINEERED WOOD PRODUCTS

A. Source Limitations: Obtain each type of engineered wood product from single source from a single manufacturer.

B. Laminated-Veneer Lumber: Structural composite lumber made from wood veneers with grain primarily parallel to member lengths, evaluated and monitored according to ASTM D5456 and manufactured with an exterior-type adhesive complying with ASTM D2559.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Boise Cascade Corporation.
b. Georgia-Pacific Gypsum LLC.
c. Louisiana-Pacific Corporation.

d. Weyerhaeuser Company.

F'b = 2,800 psi
Fv = 285 psi
E = 2,000,000 psi

2.6 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 as appropriate for the substrate.

1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.
2. Material: Stainless steel with bolts and nuts complying with ASTM F593 and ASTM F594, Alloy Group 1 or 2.

2.7 METAL FRAMING ANCHORS

A. Subject to compliance with requirements, provide products by one of the following:

1. Cleveland Steel Specialty Co.
2. Simpson Strong-Tie Co., Inc.

B. Allowable design loads, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency. Framing anchors shall be punched for fasteners adequate to withstand same loads as framing anchors.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

D. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; structural steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.

1. Use for wood-preservative-treated lumber and where indicated.

E. Stainless-Steel Sheet: ASTM A666, Type 304.

1. Use for exterior locations and where indicated.

F. Joist Hangers: U-shaped joist hangers with 2-inch-long seat and 1-1/4-inch-wide nailing flanges at least 85 percent of joist depth.

1. Thickness: 0.062 inch.

G. Top Flange Hangers: U-shaped joist hangers, full depth of joist, formed from metal strap with tabs bent to extend over and be fastened to supporting member.

1. Strap Width: 1-1/2 inches.
2. Thickness: 0.062 inch.

H. Bridging: Rigid, V-section, nailless type, 0.050 inch thick, length to suit joist size and spacing.

I. Post Bases: Adjustable-socket type for bolting in place with standoff plate to raise post 1 inch above base and with 2-inch-minimum side cover, socket 0.062 inch thick, and standoff and adjustment plates 0.108 inch thick.

J. Joist Ties: Flat straps, with holes for fasteners, for tying joists together over supports.

1. Width: 1-1/4 inches
2. Thickness: 0.062 inch.
3. Length: 24 inches

K. Rafter Tie-Downs: Bent strap tie for fastening rafters or roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick.

L. Rafter Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening rafters or roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of rafter or truss and fastens to both sides of rafter or truss, face of top plates, and side of stud below.

2.8 MISCELLANEOUS MATERIALS

A. Sill-Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to suit width of sill members indicated.

B. Adhesives for Gluing to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

C. Water-Repellent Preservative: NWWDA-tested and -accepted formulation containing 3-iodo-2-propynyl butyl carbamate, combined with an insecticide containing chloropyrifos as its active ingredient.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Framing with Engineered Wood Products: Install engineered wood products to comply with manufacturer's written instructions.

C. Set rough carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate similar supports to comply with requirements for attaching other construction.

D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

E. Install sill sealer gasket to form continuous seal between sill plates and foundation walls.

F. Do not splice structural members between supports unless otherwise indicated.

G. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

H. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.
3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o.c.

I. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

J. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

K. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
3. ICC-ES evaluation report for fastener.

L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

M. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

3.2 WALL AND PARTITION FRAMING INSTALLATION

A. General: Provide single bottom plate and double top plates using members of 2-inch nominal thickness whose widths equal that of studs, except single top plate may be used for non-load-bearing partitions Retain one of two stud sizes and one of four spacings.

1. For exterior walls, provide 2-by-6-inch nominal size wood studs spaced 16 inches o.c. unless otherwise indicated.
2. For interior partitions and walls, provide 2-by-4-inch nominal size wood studs spaced 16 inches o.c. unless otherwise indicated.
3. Provide continuous horizontal blocking at mid-height of partitions more than 72 inches high, using members of 2-inch nominal thickness and of same width as wall or partitions.

B. Construct corners and intersections with three or more studs**,** frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.

3.3 CEILING JOIST AND RAFTER FRAMING INSTALLATION

A. Ceiling Joists: Install with crown edge up and complying with requirements specified above for floor joists. Face nail to ends of parallel rafters.

1. Where ceiling joists are at right angles to rafters, provide additional short joists parallel to rafters from wall plate to first joist; nail to ends of rafters and to top plate, and nail to first joist or anchor with framing anchors or metal straps. Provide 1-by-8-inch nominal-size or 2-by-4-inch nominal-size stringers spaced 48 inches o.c. crosswise over main ceiling joists.

B. Rafters: Notch to fit exterior wall plates and use metal framing anchors. Double rafters to form headers and trimmers at openings in roof framing, if any, and support with metal hangers. Where rafters abut at ridge, place directly opposite each other and nail to ridge member or use metal ridge hangers.

C. Provide special framing as indicated for eaves, overhangs, dormers, and similar conditions if any.

END OF SECTION 061000

SECTION 061600 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Roof sheathing.
2. Wall sheathing

B. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1.2 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.
1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory.".

2.2 WOOD PANEL PRODUCTS

A. Emissions: Products shall meet the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Thickness: See wood sheet notes.

C. Factory mark panels to indicate compliance with applicable standard.

D. Plywood: DOC PS 1.

2.3 ROOF SHEATHING

A. Plywood Roof Sheathing: Exterior, Structural I sheathing.
1. Span Rating: APA Structural 1 Exposure 1 40/20 .
2. Nominal Thickness: Not less than 5/8 inch.

2.4 WALL SHEATHING

A. Plywood Wall Sheathing: Exterior, Structural I sheathing.
1. Span Rating: APA Structural 1 Exposure 1 32/16
2. Nominal Thickness: Not less than 1/2 inch.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

B. Nails, Brads, and Staples: ASTM F 1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated on the construction documents.

D. Use common wire nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections. Install fasteners without splitting wood.

E. Coordinate roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

F. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

G. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

END OF SECTION 061600

SECTION 061753 - SHOP-FABRICATED WOOD TRUSSES

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. Wood roof trusses.
2. Wood girder trusses.
3. Wood truss bracing.
4. Metal truss accessories.

B. Provide wood truss bracing under the Metal-Plate-Connected Truss Bracing.

1.3 DEFINITIONS

A. Metal-Plate-Connected Wood Trusses: Planar structural units consisting of metal-plate-connected members fabricated from dimension lumber and cut and assembled before delivery to Project site.

B. Shop Drawings: Show fabrication and installation details for trusses.

1. Show location, pitch, span, camber, configuration, and spacing for each type of truss required.
2. Indicate sizes, stress grades, and species of lumber.
3. Indicate locations of permanent bracing required to prevent buckling of individual truss members due to design loads.
4. Indicate locations, sizes, and materials for permanent bracing required to prevent buckling of individual truss members due to design loads.
5. Indicate type, size, material, finish, design values, orientation, and location of metal connector plates.
6. Show splice details and bearing details.

C. Delegated-Design Submittal: For metal-plate-connected wood trusses indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For metal connector-plate manufacturer

B. Material Certificates: For dimension lumber specified to comply with minimum specific gravity. Indicate species and grade selected for each use and specific gravity.

C. Product Certificates: For metal-plate-connected wood trusses, signed by officer of truss fabricating firm.

D. Evaluation Reports: For the following, from ICC-ES:
1. Metal-plate connectors.
2. Metal truss accessories.

1.5 QUALITY ASSURANCE

A. Metal Connector-Plate Manufacturer Qualifications: A manufacturer that is a member of TPI and that complies with quality-control procedures in TPI 1 for manufacture of connector plates.

1. Manufacturer's responsibilities include providing professional engineering services needed to assume engineering responsibility.
2. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

B. Fabricator Qualifications: Shop that participates in a recognized quality-assurance program that complies with quality-control procedures in TPI 1 and that involves third-party inspection by an independent testing and inspecting agency acceptable to Architect and authorities having jurisdiction

C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Handle and store trusses to comply with recommendations in TPI BCSI**,** "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

1. Store trusses flat, off the ground, and adequately supported to prevent lateral bending.
2. Protect trusses from weather by covering with waterproof sheeting, securely anchored.
3. Provide for air circulation around stacks and under coverings.

B. Inspect trusses showing discoloration, corrosion, or other evidence of deterioration. Discard and replace trusses that are damaged or defective.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design metal-plate-connected wood trusses.

B. Structural Performance: Provide metal-plate-connected wood trusses capable of withstanding design loads within limits and under conditions indicated. Comply with requirements in TPI 1 unless more stringent requirements are specified below.

1. Design Loads: As indicated.
2. Maximum Deflection Under Design Loads:

a. Roof Trusses: Vertical deflection of **1/240** of span.

C. Comply with applicable requirements and recommendations of the following publications:

1. TPI 1, "National Design Standard for Metal Plate Connected Wood Truss Construction."
2. TPI DSB, "Recommended Design Specification for Temporary Bracing of Metal Plate Connected Wood Trusses."
3. TPI BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."

D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 DIMENSION LUMBER

A. Certified Wood: For metal-plate-connected wood trusses and permanent bracing, provide materials produced from wood obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001, "FSC Principles and Criteria for Forest Stewardship."

B. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, omit grade stamp and provide certificates of grade compliance issued by grading agency.
3. Provide dressed lumber, S4S.
4. Provide dry lumber with 19 percent maximum moisture content at time of dressing.

C. Minimum Chord Size for Roof Trusses: 2 by 6 inches nominal Retain "Minimum Specific Gravity for Top Chords" Paragraph below if required for diaphragm construction.

D. Minimum Specific Gravity for Top Chords: 0.50

E. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 06 1000 "Rough Carpentry

2.3 METAL CONNECTOR PLATES

A. Manufacturers: Subject to compliance with requirements,

1. Alpine Engineered Products, Inc.; an ITW company.
2. Eagle Metal Products.
3. Jager Building Systems, Inc.; a Tembec/SGF Rexfor company.
4. MiTek Industries, Inc.; a subsidiary of Berkshire Hathaway Inc.

B. Source Limitations: Obtain metal connector plates from single manufacturer.

C. General: Fabricate connector plates to comply with TPI 1.

D. Hot-Dip Galvanized-Steel Sheet: ASTM A 653/A 653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G60 coating designation.

1. Use for interior locations unless otherwise indicated.

2.4 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. Provide fasteners for use with metal framing anchors that comply with written recommendations of metal framing manufacturer.
2. Where trusses are exposed to weather, in ground contact, made from pressure-preservative treated wood, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A 153/A 153M

B. Nails, Brads, and Staples: ASTM F 1667.

2.5 METAL FRAMING ANCHORS AND ACCESSORIES

A. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:

1. Cleveland Steel Specialty Co.
2. KC Metals Products, Inc.
3. Phoenix Metal Products, Inc.
4. Simpson Strong-Tie Co., Inc.
5. USP Structural Connectors.

B. Allowable Design Loads: Provide products with allowable design loads, as published by manufacturer, that meet or exceed those. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

C. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A 653/A 653M, G60 coating designation.

1. Use for interior locations unless otherwise indicated.

D. Truss Tie-Downs: Bent strap tie for fastening roof trusses to wall studs below, 1-1/2 inches wide by 0.050 inch thick. [**Tie fastens to one side of truss, top plates, and side of stud below.**]

E. Truss Tie-Downs (Hurricane or Seismic Ties): Bent strap tie for fastening roof trusses to wall studs below, 2-1/4 inches wide by 0.062 inch thick. Tie fits over top of truss and fastens to both sides of truss, top plates, and one side of stud below.

F. Roof Truss Clips: Angle clips for bracing bottom chord of roof trusses at non-load-bearing walls, 1-1/4 inches wide by 0.050 inches thick. Clip is fastened to truss through slotted holes to allow for truss deflection.

G. Roof Truss Bracing/Spacers: U-shaped channels, 1-1/2 inches wide by 1 inch deep by 0.040 inch thick, made to fit between two adjacent trusses and accurately space them apart, and with tabs having metal teeth for fastening to trusses.

2.6 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: SSPC-Paint 20, with dry film containing a minimum of 94 percent zinc dust by weight.

2.7 FABRICATION

A. Cut truss members to accurate lengths, angles, and sizes to produce close-fitting joints.

B. Fabricate metal connector plates to sizes, configurations, thicknesses, and anchorage details required to withstand design loads for types of joint designs indicated.

C. Assemble truss members in design configuration indicated; use jigs or other means to ensure uniformity and accuracy of assembly with joints closely fitted to comply with tolerances in TPI 1. Position members to produce design camber indicated.

1. Fabricate wood trusses within manufacturing tolerances in TPI 1.

D. Connect truss members by metal connector plates located and securely embedded simultaneously in both sides of wood members by air or hydraulic press.

2.8 SOURCE QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform special inspections.

1. Provide special inspector with access to fabricator's documentation of detailed fabrication and quality-control procedures that provide a basis for inspection control of the workmanship and the fabricator's ability to conform to approved construction documents and referenced standards.
2. Provide special inspector with access to places where wood trusses are being fabricated to perform inspections.

B. Correct deficiencies in Work that special inspections indicate does not comply with the Contract Documents.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wood trusses only after supporting construction is in place and is braced and secured.

B. If trusses are delivered to Project site in more than one piece, assemble trusses before installing.

C. Hoist trusses in place by lifting equipment suited to sizes and types of trusses required, exercising care not to damage truss members or joints by out-of-plane bending or other causes.

D. Install and brace trusses according to TPI recommendations and as indicated.

E. Install trusses plumb, square, and true to line and securely fasten to supporting construction.

F. Space trusses; as indicated; adjust and align trusses in location before permanently fastening.

G. Anchor trusses securely at bearing points; use metal truss tie-downs or floor truss hangers as applicable. Install fasteners through each fastener hole in metal framing anchors according to manufacturer's fastening schedules and written instructions.

H. Securely connect each truss ply required for forming built-up girder trusses.

1. Anchor trusses to girder trusses as indicated.

I. Install and fasten permanent bracing during truss erection and before construction loads are applied. Anchor ends of permanent bracing where terminating at walls or beams.

1. Install bracing to comply with Section 061000 "Rough Carpentry Retain subparagraph below if floor trusses are required.
2. Install and fasten strongback bracing vertically against vertical web of parallel-chord floor trusses at centers indicated.

J. Install wood trusses within installation tolerances in TPI 1.

K. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.

L. Replace wood trusses that are damaged or do not meet requirements.

1. Field damaged trusses may be repaired according to truss repair details signed and sealed by the qualified professional engineer responsible for truss design, when approved by Architect.

3.2 REPAIRS AND PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect wood trusses from weather. If, despite protection, wood trusses become wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

C. Repair damaged galvanized coatings on exposed surfaces with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

D. Protective Coating: Clean and prepare exposed surfaces of metal connector plates. Brush apply primer, when part of coating system, and one coat of protective coating.

1. Apply materials to provide minimum dry film thickness recommended by coating system manufacturer.

END OF SECTION 06 1753

SECTION 062013 - EXTERIOR FINISH CARPENTRY

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. Exterior wood trim.
2. Lumber and Plywood soffits.
3. Exterior wood columns.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for furring, blocking, and other carpentry work not exposed to view and for framing exposed to view.
2. Section 099113 "Exterior Painting" for priming and back priming of exterior finish carpentry.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details.

1. Include data for wood-preservative treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained. Include chemical-treatment manufacturer's written instructions for finishing treated material.
2. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced before shipment to Project site to levels specified.
4. Include copies of warranties from chemical-treatment manufacturers for each type of treatment.

B. Samples for Initial Selection: For each type of product involving selection of colors, profiles, or textures.

C. Samples for Verification:

1. For each species and cut of lumber and panel products, with half of exposed surface finished; 50 sq. in. for lumber and 8 by 10 inches for panels.
2. For exterior wood columns, include quarter-section Samples of cap, base, plinth, and 6-inch long quarter-section Sample of shaft. Samples need not be same diameter as required columns.

1.4 INFORMATIONAL SUBMITTALS

A. Compliance Certificates:

1. For lumber that is not marked with grade stamp.
2. For preservative-treated wood that is not marked with treatment-quality mark.
3. For fire-retardant-treated wood that is not marked with classification marking of testing and inspecting agency.

B. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated wood.
2. Fire-retardant-treated wood.

C. Sample Warranties: For manufacturer's warranties.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Stack lumber, plywood, and other panels flat with spacers between each bundle to provide air circulation. Protect materials from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

1.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecast weather conditions permit work to be performed and at least one coat of specified finish can be applied without exposure to rain, snow, or dampness.

1. For exterior ornamental wood columns, comply with manufacturer's written instructions and warranty requirements.

B. Do not install finish carpentry materials that are wet, moisture damaged, or mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.8 WARRANTY

A. Manufacturer's Warranty for Cellular PVC Trim: Manufacturer agrees to repair or replace trim that fails due to defects in manufacturing within specified warranty period. Failures include, but are not limited to, deterioration, delamination, and excessive swelling from moisture.

1. Warranty Period: 25 years from date of Substantial Completion.

B. Manufacturer's Warranty for Hardboard Siding and Trim: Manufacturer agrees to repair or replace siding that fails in materials or workmanship within specified warranty period. Failures include, but are not limited to, deformation or deterioration beyond normal weathering.

1. Warranty Period for Factory-Applied Finish: Five years from date of Substantial Completion.
2. Warranty Period for Siding and Trim (Excluding Finish): 25 years from date of Substantial Completion.

C. Manufacturer's Warranty for Columns: Manufacturer agrees to repair or replace columns that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Columns: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

A. Lumber: DOC PS 20 and the following grading rules:

1. NeLMA: Northeastern Lumber Manufacturers' Association, "Standard Grading Rules for Northeastern Lumber."
2. NLGA: National Lumber Grades Authority, "Standard Grading Rules for Canadian Lumber."
3. SPIB: The Southern Pine Inspection Bureau, "Standard Grading Rules for Southern Pine Lumber."

B. Factory mark each piece of lumber with grade stamp of inspection agency, indicating grade, species, moisture content at time of surfacing, and mill.

1. For exposed lumber, mark grade stamp on end or back of each piece.

C. Softwood Plywood: DOC PS 1.

D. Hardboard: ANSI A135.4

2.2 WOOD-PRESERVATIVE-TREATED MATERIALS

A. Water-Repellent Preservative Treatment by Non-pressure Process: AWPA N1; dip, spray, flood, or vacuum-pressure treatment.

1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC), combined with an insecticide containing chloropyrifos (CPF)].
2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.

B. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC3a**.**

1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 18 percent, respectively.
2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
3. For exposed items indicated to receive transparent finish, do not use chemical formulations that contain colorants or that bleed through or otherwise adversely affect finishes.
4. Do not use material that is warped or does not comply with requirements for untreated material.
5. Mark lumber with treatment-quality mark of an inspection agency approved by the American Lumber Standard Committee's Board of Review.

    a. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

6. Mark plywood with appropriate classification marking of an inspection agency acceptable to authorities having jurisdiction.

    a. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.

7. Application: All exterior lumber and plywood.

2.3 LINEAR WOOD CEILING PANELS AND SUSPENSION SYSTEM

A. General: The following manufacturer is basis of design:

9 Wood, Inc. (www.9wood.com): 2400 T&G Linear. Or equal, as prior approved by architect.

B. LINEAR WOOD CEILING PANELS
   a. Basis of Design: 9Wood, Inc. Linear, Series 2000
   b. Wood Panels: 2400 T&G Linear,
   c. Species: Western Hemlock
   d. Member Size: 3 ¼” x ¾”
   e. Edge Profile: V Groove
   f. Reveal: Closed

g. Members/LF: 3.7 Members/LF”
h. Assembly Style: T-Bar Z Clip
i. Fire Rating: Class 1(A) Fire Rating
j. Finish: Mahogany Stain - Clear Interior Finish

2.4 EXTERIOR TRIM

A. Lumber Trim for Semitransparent-Stained Finish and/or Painted Finish see drawings.
1. Species and Grade: Hem-fir, pressure-preservative treated, 1 Common; NLGA, WCLIB, or WWPA.
2. Species and Grade: Southern pine, pressure-preservative treated, B & B; SPIB.
3. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
4. Finger Jointing: Not allowed.
5. Face Surface: Surfaced (smooth)

B. Lumber Trim for Painted Finish:
1. Species and Grade: Hem-fir, 1 Common; NLGA, WCLIB, or WWPA.
2. Species and Grade: Eastern white pine, eastern hemlock-balsam fir-tamarack, eastern spruce, or white woods, Finish or 1 Common (Colonial); NeLMA, NLGA, WCLIB, or WWPA.
3. Species and Grade: Northern white cedar,1 Common; NeLMA or NLGA.
4. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
5. Finger Jointing: Not allowed.
6. Face Surface: Surfaced (smooth) or Saw textured – see drawings.
7. Factory Priming: Factory coated on faces and edges, with exterior primer compatible with topcoats specified.

C. Moldings for Semitransparent-Stained Finish or Clear Finish: MMPA WM 4, N-grade wood moldings, without finger jointing. Made from kiln-dried stock to patterns included in MMPA's "WM/Series Wood Moulding Patterns."

1. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine.
2. Brick-Mold Pattern: WWMPA WM 180, 1-1/4 by 2 inches.
3. Drip-Cap Pattern: WWMPA WM 197, 11/16 by 1-5/8 inches.
4. Bed-Mold Pattern: WWMPA WM 75, 9/16 by 1-5/8 inches.
5. Screen-Bead Pattern: WWMPA WM 144, 1/4 by 3/4 inch.

D. Moldings for Painted Finish: MMPA WM 4, P-grade wood moldings. Made from kiln-dried stock to patterns included in MMPA's "WM/Series Wood Moulding Patterns."

1. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine.
2. Finger Jointing: Not allowed.
3. Factory Priming: Factory coated on faces and edges, with exterior primer compatible with topcoats specified.
4. Brick-Mold Pattern: WWMPA WM 180, 1-1/4 by 2 inches.
5. Drip-Cap Pattern: WWMPA WM 197, 11/16 by 1-5/8 inches.
6. Bed-Mold Pattern: WWMPA WM 75, 9/16 by 1-5/8 inches.
7. Screen-Bead Pattern: WWMPA WM 144, 1/4 by 3/4 inch.

2.5 PLYWOOD SOFFITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Georgia-Pacific Gypsum LLC.
2. Hardel Mutual Plywood Corporation.
3. Hood Industries.
4. Roseburg Forest Products.
5. SDS Lumber Company.
6. Weyerhaeuser Company.
   Or approved equal

B. Plywood Type: Exterior, Grade A-B.

1. Face Grade: 303-OC.
2. Face Grade: 303-6-W

C. Thickness: 1/2 inch or as indicated.

D. Face Species: Southern pine or Douglas fir

E. Pattern: Plain; Channel groove; Grooves 4 inches o.c.; Texture 1-11; Grooves 4 inches o.c. – See Drawings.

F. Surface: Smooth or as noted on drawings.

2.6 EXTERIOR ORNAMENTAL WOOD COLUMNS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Architectural Mall, Inc.
2. Chadsworth's Incorporated.
3. Hartmann-Sanders.
4. Melton Classics, Incorporated.
5. Somerset Door & Column Company.
6. Worthington Millwork.
7. Or approved equal

B. Factory fabricate columns from clear stock, either solid or finger jointed, with a moisture content of not more than 15 percent.

1. Wood Species: Eastern white, Idaho white, lodgepole, ponderosa, or sugar pine.

C. Shafts: Built up from tongue-and-groove staves joined with waterproof glue. Lathe turn shafts to provide base diameter indicated and true architectural entasis taper to match existing.

D. Capital and Base: Built up from wood components with waterproof glue. Turn circular elements on lathes to match existing.

E. Plinths: Cast-aluminum or molded glass-fiber-reinforced plastic, constructed to ventilate the interior of column shaft.

F. Treatment and Finishing:

1. Treat wood columns with water-repellant preservative by non-pressure process.
2. Coat inside of column shafts with bituminous mastic.
3. Prime columns with two coats of exterior wood primer compatible with specified topcoats.

2.7 MISCELLANEOUS MATERIALS

A. Fasteners for Exterior Finish Carpentry: Provide nails or screws, in sufficient length to penetrate not less than 1-1/2 inches into wood substrate.

1. For face-fastening siding, provide ringed-shank siding nails or hot-dip galvanized-steel siding nails.
2. For redwood, provide stainless-steel or hot-dip galvanized-steel fasteners.
3. For prefinished items, provide matching prefinished aluminum fasteners where face fastening is required.
4. For pressure-preservative-treated wood, provide stainless-steel or hot-dip galvanized-steel fasteners.
5. For applications not otherwise indicated, provide stainless-steel or hot-dip galvanized-steel fasteners.

B. Wood Glue: Waterproof resorcinol glue recommended by manufacturer for exterior carpentry use.

C. Adhesive for Cellular PVC Trim: Product recommended by trim manufacturer.

D. Flashing: Comply with requirements in Section 076200 "Sheet Metal Flashing and Trim" for flashing materials installed in exterior finish carpentry.

E. Insect Screening for Soffit Vents: Aluminum, 18-by-16-inch mesh.

F. Continuous Soffit Vents: Aluminum hat channel shape with perforations, 2 inches wide and in lengths not less than 96 inches.

1. Net-Free Area: 4 sq. in./linear ft.
2. Finish: White paint.

G. Sealants: Latex, complying with ASTM C 834 Type OP, Grade NF and As complying with applicable requirements in Section 079200 "Joint Sealants" and recommended by sealant and substrate manufacturers for intended application.

2.8 FABRICATION

A. Back out or kerf backs of standing and running trim wider than 5 inches, except members with ends exposed in finished work.

B. Ease edges of lumber less than 1 inch in nominal thickness to 1/16-inch radius and edges of lumber 1 inch or more in nominal thickness to 1/8-inch radius.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine finish carpentry materials before installation. Reject materials that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

B. Prime lumber and moldings to be painted, including both faces and edges, unless factory primed. Cut to required lengths and prime ends. Comply with requirements in Section 099113 "Exterior Painting."

3.3 INSTALLATION, GENERAL

A. Do not use materials that are unsound, warped, improperly treated or finished, inadequately seasoned, or too small to fabricate with proper jointing arrangements.

1. Do not use manufactured units with defective surfaces, sizes, or patterns.

B. Install exterior finish carpentry level, plumb, true, and aligned with adjacent materials. Use concealed shims where necessary for alignment.

1. Scribe and cut exterior finish carpentry to fit adjoining work. Refinish and seal cuts as recommended by manufacturer.
2. Install to tolerance of 1/8 inch in 96 inches for level and plumb. Install adjoining exterior finish carpentry with 1/32-inch maximum offset for flush installation and 1/16-inch maximum offset for reveal installation.
3. Install stairs with no more than 3/16-inch variation between adjacent treads and risers and with no more than 3/8-inch variation between largest and smallest treads and risers within each flight.
4. Coordinate exterior finish carpentry with materials and systems in or adjacent to it. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

3.4 STANDING AND RUNNING TRIM INSTALLATION

A. Install flat-grain lumber with bark side exposed to weather.

B. Install cellular PVC trim to comply with manufacturer's written instructions.

C. Install trim with minimum number of joints as is practical, using full-length pieces from maximum lengths of lumber available. Do not use pieces less than 24 inches long, except where necessary.

1. Use scarf joints for end-to-end joints.
2. Stagger end joints in adjacent and related members.

D. Fit exterior joints to exclude water. Cope at returns and miter at corners to produce tight-fitting joints, with full-surface contact throughout length of joint. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.

E. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

3.5 COLUMN INSTALLATION

A. Install columns to comply with manufacturer's written instructions. Comply with requirements below unless manufacturer's written instructions state otherwise.

B. Lay out column locations on soffits and beams, and plumb down to locate column locations at supports.

C. Set plinths in location, shim as required to temporarily level, and scribe and trim as required so that top of plinths sit level without use of shims. Fasten plinths in place to support using pins or fasteners as recommended by manufacturer.

D. Scribe and trim tops of columns to fit to soffits and beams. Maintain ventilation passages to column interiors.

E. Seal ends of columns with two coats of wood sealer or primer.

F. Install column caps and flashing on columns and fasten to columns. Install caps and flashing, so that loads are not imposed on caps and so that ventilation of column interior is not blocked.

G. Secure columns in place at top and bottom with fasteners recommended by manufacturer.

3.6 ADJUSTING

A. Replace exterior finish carpentry that is damaged or does not comply with requirements. Exterior finish carpentry may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing. Adjust joinery for uniform appearance.

3.7 CLEANING

A. Clean exterior finish carpentry on exposed and semi-exposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

3.8 PROTECTION

A. Protect installed products from damage from weather and other causes during construction.

B. Remove and replace finish carpentry materials that are wet, moisture damaged, and mold damaged.

1. Indications that materials are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that materials are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 062013

SECTION 062023 - INTERIOR FINISH CARPENTRY

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. Interior standing and running trim.
2. Closet and utility shelving.
3. Interior frames and jambs.
4. Interior stairs and railings.
5. Interior ornamental woodwork.
6. Wood furring, blocking, shims, and hanging strips for installing interior architectural woodwork items that are not concealed within other construction.
7. Shop priming of interior architectural woodwork.
8. Shop finishing of interior architectural woodwork.

B. Related Requirements:

1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing interior architectural woodwork that are concealed within other construction before interior architectural woodwork installation.
2. Section 062013 "Exterior Finish Carpentry" for exterior carpentry exposed to view that is not specified in this Section.

1.3 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

1.4 PREINSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Wood-Preservative Treatment: Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative

retained. Include chemical-treatment manufacturer's written instructions for finishing treated material and manufacturer's written warranty.

2. Fire-Retardant Treatment: Include data and warranty information from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
3. Waterborne Treatments: For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

B. Shop Drawings: For interior architectural woodwork.

1. Include plans, elevations, sections, and attachment details.
2. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including blocking and reinforcement concealed by construction and specified in other Sections.
4. Apply AWI Quality Certification and/or WI Certified Compliance Program label to Shop Drawings.

C. Samples: For each exposed product and for each color and finish specified, in manufacturer's or fabricator's standard size.

D. Samples for Initial Selection: For each type of exposed finish.

E. Samples for Verification: For the following:

1. Lumber for Transparent Finish: Not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.
2. Veneer Leaves: Representative of and selected from flitches to be used for transparent-finished interior architectural woodwork.
3. Lumber and Panel Products with Shop-Applied Opaque Finish: 5 inches wide by 12 inches long for lumber and 8 by 10 inches for panels, for each finish system and color.

a. Finish entire exposed surface.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer and/or fabricator.

B. Product Certificates: For the following:

1. Composite wood and agrifiber products.
2. Adhesives.

C. Quality Standard Compliance Certificates: AWI Quality Certification Program and/or[WI Certified Compliance Program.

D. Evaluation Reports: For preservative-treated and fire-retardant-treated wood materials, from ICC-ES.

1.7 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

1. Shop Certification: AWI's Quality Certification Program accredited participant and/or WI's Certified Compliance Program licensee.

B. Installer Qualifications: Fabricator of products AWI's Quality Certification Program accredited participant and/or WI's Certified Compliance Program licensee.

C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.

1. Build mockups of typical interior architectural woodwork as shown on Drawings.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver interior architectural woodwork until painting and similar finish operations that might damage woodwork have been completed in installation areas. Store woodwork in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.9 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.

B. Environmental Limitations: Do not deliver or install interior architectural woodwork until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during the remainder of the construction period.

C. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field measurements before being concealed by construction, and indicate measurements on Shop Drawings.

D. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 INTERIOR ARCHITECTURAL WOODWORK FABRICATORS

A. Fabricators: Subject to compliance with requirements, provide products by available fabricators offering products that may be incorporated into the Work. Fabricators must meet Quality Assurance requirements.

2.2 INTERIOR ARCHITECTURAL WOODWORK, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of interior architectural woodwork indicated for construction, finishes, installation, and other requirements.

1. Provide inspections of fabrication and installation together with labels and certificates from AWI and/or WI certification program indicating that woodwork complies with requirements of grades specified.
2. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

2.3 LINEAR WOOD CEILING PANELS AND SUSPENSION SYSTEM

A. General: The following manufacturer is basis of design:

9 Wood, Inc. (www.9wood.com): 2400 T&G Linear. Or equal, as prior approved by architect.

B. LINEAR WOOD CEILING PANELS
   a. Basis of Design: 9Wood, Inc. Linear, Series 2000
   b. Wood Panels: 2400 T&G Linear,
   c. Species: Western Hemlock
   d. Member Size: 3 ¼" x ¾"
   e. Edge Profile: V Groove
   f. Reveal: Closed
   g. Members/LF: 3.7 Members/LF"
   h. Assembly Style: T-Bar Z Clip
   i. Fire Rating: Class 1(A) Fire Rating
   j. Finish: Mahogany Stain - Clear Interior Finish

2.4 INTERIOR TRIM

A. Lumber Trim for Semitransparent-Stained Finish and/or Painted Finish see drawings.
   1. Species and Grade: Hem-fir, pressure-preservative treated, 1 Common; NLGA, WCLIB, or WWPA.
   2. Species and Grade: Southern pine, pressure-preservative treated, B & B; SPIB.
   3. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
   4. Finger Jointing: Not allowed.
   5. Face Surface: Surfaced (smooth)

B. Lumber Trim for Painted Finish:
   1. Species and Grade: Hem-fir, 1 Common; NLGA, WCLIB, or WWPA.
   2. Species and Grade: Eastern white pine, eastern hemlock-balsam fir-tamarack, eastern spruce, or white woods, Finish or 1 Common (Colonial); NeLMA, NLGA, WCLIB, or WWPA.
   3. Species and Grade: Northern white cedar,1 Common; NeLMA or NLGA.
   4. Maximum Moisture Content: 15 percent with at least 85 percent of shipment at 12 percent or less.
   5. Finger Jointing: Not allowed.
   6. Face Surface: Surfaced (smooth) or Saw textured – see drawings.
   7. Factory Priming: Factory coated on faces and edges, with exterior primer compatible

with topcoats specified.

C. Moldings for Semitransparent-Stained Finish or Clear Finish: MMPA WM 4, N-grade wood moldings, without finger jointing. Made from kiln-dried stock to patterns included in MMPA's "WM/Series Wood Moulding Patterns."

1. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine.
2. Brick-Mold Pattern: WWMPA WM 180, 1-1/4 by 2 inches.
3. Drip-Cap Pattern: WWMPA WM 197, 11/16 by 1-5/8 inches.
4. Bed-Mold Pattern: WWMPA WM 75, 9/16 by 1-5/8 inches.
5. Screen-Bead Pattern: WWMPA WM 144, 1/4 by 3/4 inch.

D. Moldings for Painted Finish: MMPA WM 4, P-grade wood moldings. Made from kiln-dried stock to patterns included in MMPA's "WM/Series Wood Moulding Patterns."

1. Species: Eastern white, Idaho white, lodgepole, ponderosa, radiata, or sugar pine.
2. Finger Jointing: Not allowed.
3. Factory Priming: Factory coated on faces and edges, with exterior primer compatible with topcoats specified.
4. Brick-Mold Pattern: WWMPA WM 180, 1-1/4 by 2 inches.
5. Drip-Cap Pattern: WWMPA WM 197, 11/16 by 1-5/8 inches.
6. Bed-Mold Pattern: WWMPA WM 75, 9/16 by 1-5/8 inches.
7. Screen-Bead Pattern: WWMPA WM 144, 1/4 by 3/4 inch.

2.5 PRESERVATIVE-TREATED-WOOD MATERIALS

A. Preservative-Treated-Wood Materials: Provide with water-repellent preservative treatment complying with AWPA N1 (dip, spray, flood, or vacuum-pressure treatment).

1. Preservative Chemicals: 3-iodo-2-propynyl butyl carbamate (IPBC), combined with a compatible EPA-registered insecticide.
2. Use chemical formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants in solution to distinguish treated material from untreated material.

B. Extent of Preservative-Treated Wood Materials: Treat interior architectural woodwork in contact with concrete or masonry.

1. Items fabricated from the following wood species need not be treated:

a. Redwood / All-heart redwood.
b. Western red cedar / All-heart western red cedar.
c. White oak.
d. African mahogany.
e. Honduras mahogany.
f. Ipe.
g. Dark red meranti.
h. Teak.

2.6 MISCELLANEOUS MATERIALS

A. Furring, Blocking, Shims, and Nailers: Softwood or hardwood lumber and Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

1. Preservative Treatment: Provide softwood lumber treated by pressure process, AWPA U1; Use Category UC3b.

    a. Provide where in contact with concrete or masonry.
    b. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.
    c. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
    d. Mark lumber with treatment quality mark of an inspection agency approved by the American Lumber Standards Committee's (ALSC) Board of Review.

B. Provide self-drilling screws for metal-framing supports, as recommended by metal-framing manufacturer.

C. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.

D. Installation Adhesive: Product recommended by fabricator for each substrate for secure anchorage.

2.7 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Fabricate interior architectural woodwork to dimensions, profiles, and details indicated. Ease edges to radius indicated for the following:

1. Edges of Solid-Wood (Lumber) Members: 1/16 inch unless otherwise indicated.
2. Edges of Rails and Similar Members More Than 3/4 Inch Thick: 1/8 inch.

C. Complete fabrication, including assembly, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times interior architectural woodwork fabrication will be complete.
2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that parts fit as intended and check measurements of assemblies against field measurements indicated on approved Shop Drawings before disassembling for shipment.

D. Stairs: Cut rough carriages to accurately fit treads and risers. Glue treads to risers, and glue and nail treads and risers to carriages.

1. House wall and face stringers and glue and wedge treads and risers.

2. Fabricate stairs with treads and risers no more than 1/8 inch from indicated position and no more than 1/16 inch out of relative position for adjacent treads and risers.

2.8 SHOP PRIMING

A. Interior Architectural Woodwork for Opaque Finish: Shop prime with one coat of wood primer as specified in Section 099123 "Interior Painting."

B. Interior Architectural Woodwork for Transparent Finish: Shop seal with stain (if required), other required pretreatments, and first coat of finish as specified in Section 099300 "Staining and Transparent Finishing."

C. Preparations for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to surfaces installed in contact with concrete or masonry and to end-grain surfaces.

2.9 SHOP FINISHING

A. General: Finish interior architectural woodwork with transparent finish or as indicated on Drawings at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing interior architectural woodwork, as applicable to each unit of work.

1. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of interior architectural woodwork. Apply two coats to end-grain surfaces.

C. Transparent Finish:
1. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
2. Staining: To match color selected bv architect
3. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
4. Filled Finish for Open-Grain Woods: After staining, apply wash-coat sealer and allow to dry. Apply paste wood filler and wipe off excess. Tint filler to match stained wood.
5. Sheen: To match finish selected bv architect.

D. Opaque Finish: To match existing.
1. Finish: System - To match existing..
2. Color: To match color selected bv architect
3. Sheen: To match finish selected bv architect.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition interior architectural woodwork to average prevailing humidity conditions in installation areas.

B. Before installing interior architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install interior architectural woodwork to comply with same grade as item to be installed.

B. Assemble interior architectural woodwork and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install interior architectural woodwork level, plumb, true in line, and without distortion. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut interior architectural woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Preservative-Treated Wood: Where cut or drilled in field, treat cut ends and drilled holes according to AWPA M4.

F. Anchor interior architectural woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or fasteners to match existing historic for exposed fastening, countersunk and filled flush with interior architectural woodwork.

1. For shop-finished items, use filler matching finish of items being installed.

G. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than 36 inches long except where shorter single-length pieces are necessary.

1. Scarf running joints and stagger in adjacent and related members.
2. Fill gaps, if any, between top of base and wall with plastic wood filler; sand smooth; and finish same as wood base if finished latex sealant, painted to match wall.
3. Install standing and running trim with no more variation from a straight line than 1/8 inch in 96 inches.

H. Stairs: Securely anchor carriages to supporting substrates. Install stairs with treads and risers no more than 1/8 inch from indicated position.

I. Railings: Install rails with no more than 1/8 inch in 96-inch variation from a straight line.

1. Stair Rails: Glue and dowel or pin balusters to treads and railings, and railings to newel posts.

2. Wall Rails: Support rails on indicated metal brackets securely fastened to wall framing.
   a. Space rail brackets not more than 48 inches o.c.

J. Touch up finishing work specified in this Section after installation of interior architectural woodwork. Fill nail holes with matching filler where exposed.

1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.

K. See Section 099100 "Interior Painting" and Section 099300 "Staining and Transparent Finishing" for final finishing of installed interior architectural woodwork not indicated to be shop finished.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective interior architectural woodwork, where possible, to eliminate functional and visual defects. Where not possible to repair, replace interior architectural woodwork. Adjust joinery for uniform appearance.

B. Clean interior architectural woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 062023

SECTION 064000 - MLLWORK 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. Scope: Provide all of the labor, materials, equipment and services required to furnish and install the millwork.

B. This Section includes the following:

1. Required milling, fabrication and finish for casework.
2. Finishes at countertops
3. Hardware for casework.

C. Related Sections include the following:

1. Division 06 Section “General Carpentry”.
2. Division 07 Section "Joint Sealant".
3. Division 09 Section “Resilient Base and Accessories”.
4. Division 09 Section "Painting".

1.3 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

1.4 SUBMITTALS

A. Prior to fabrication, submit to the Architect for review the following:

1. Shop drawings that at a minimum shall show the following:

a. All materials (solid wood, plywood, particleboard, fiberwood board, plastic laminate, solid surfacing and hardware).
b. All thicknesses and dimensions.
c. Species, grade and cut of woods and veneers.
d. Jointing and bolting.
e. The name of the manufacturer and the model number of all factory fabricated items.
f. Full size details drawn in related and dimensioned positions to facilitate checking of intersecting and string dimensions.
g. Clear description of work to be done in the shop and work to be done in the field.

2. Manufacturer's literature of specialty items not manufactured by the architectural woodworker.

3. Physical samples:
    a. Solid Surfacing and Plastic laminate in all colors and patterns for the Architect's selection.
    b. Samples of each wood species fully finished.
        1) This shall apply to wood receiving transparent finish only, and shall be minimally 12" square in size.
        2) Use actual wood species matched to scheduled finish, effect, sheen and color.
    c. Exposed hardware, one unit of each type and finish.
4. Certification: Submit copies of certificate signed by woodwork shop certifying that millwork complies with quality grades and other requirements indicated. Form of certificate shall be approved by the Architect.

B. Solid Surface Fabrication:
1. Product Data: For each type of process and factory-fabricated product. Indicate component materials, dimensions, profiles, textures, and colors and include construction and application details
2. Sample for Verification: approved samples will be retained as a standard for work.
    a. Submit minimum 6-inch by 6-inch sample in specified gloss.
    b. Cut Samples and seam together for representation of inconspicuous seam.
    c. Indicate a full range of color and pattern variation
3. Compliance Certificates:
    a. For each type of product, signed by product manufacturer.
    b. For fabricator/Installer qualification: provide copy of certification number.
    c. For Manufacturer certificates; signed by manufacturer certifying that they comply with requirements.
4. Maintenance Data:
    a. Submit manufacturer’s care and maintenance data including repair and cleaning instructions; maintenance kit for finishes shall be submitted.
    b. Include in project close out documents.

C. Coordination drawings:
1. Shall be prepared indicating:
    a. Plumbing work.
    b. Electrical work.
    c. Miscellaneous steel for the general work.
    d. Indicate location of all walls (rated and non-rated), blocking locations and recessed wall items, etc.
2. Content:
    a. Project-specific information, drawn accurately to scale.
    b. Do not base coordination drawings on reproductions of the contract documents or standard printed data.
    c. Indicate dimensions shown on the contract drawings and make specific note of

dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements.

d. Provide alternate sketches to designer for resolution of such conflicts.

3. Minor dimension changes and difficult installations will not be considered changes to the contract.

4. Drawings shall:

a. Be produced in not less than 1/2-inch scale for all fabricated items.

5. Drawings must be complete and submitted to the architect within 60 days after award of contract for record only.

a. No review or approval will be forthcoming.
b. Coordination drawings are required for the benefit of contractor's fabricators/installers as an aid to coordination of their work so as to eliminate or reduce conflicts that may arise during the installation of their work.

1.5 QUALITY ASSURANCE

A. In addition to complying with all pertinent codes and regulations, the "Quality Standards" of the Architectural Woodwork Institute shall apply and by reference are hereby made a part of these Contract Documents. Any reference to "premium", "custom", or "economy" shall be defined in the latest edition of AWI "Quality Standards".

B. Field measurements: Check actual locations of walls and other construction to which millwork fabrications must fit by accurate field measurements before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Qualifications: Shop that employs skilled workers who custom fabricate products similar to those required for this project and whose products have a record of successful in-service performance.

D. Fabricator/installer qualifications: Work of this section shall be by a certified fabricator/installer, certified in writing by the manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Millwork shall not be delivered until the building and storage areas are sufficiently dry so that the millwork will not be damaged by excessive changes in moisture content.

1.7 JOB CONDITIONS

A. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support woodwork by field

measurements before being concealed by construction, and indicate measurements on Shop Drawings.

B. Established Dimensions: Where interior architectural woodwork is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 WARRANTY

A. Provide manufacturer's warranty against defects in materials.

B. Damage caused by physical or chemical abuse or damage from excessive heat will not be warranted.

PART 2 - PRODUCTS

2.1 CASEWORK - PLASTIC LAMINATE FINISH

A. AWI quality grade (Section 400): Custom.

B. Exposed surfaces where shown on the drawings - plastic laminate: 1/16" high pressure plastic laminate as required by AWI quality grade and conforming to NEMA Publication No. LDl-1964, Part 3 - Abrasion Class I.

C. Interior surfaces – 3/4-inch plywood, painted.

D. All tops in which sinks occur shall have a core of exterior grade hardwood faced plywood or phenolic resin particleboard.

E. Semi-exposed surfaces: As governed by selected AWI quality grade.

F. Color: As selected by the Architect.

2.2 SOLID SURFACE COUNTERTOP

A. Manufacturers: subject to compliance with requirements, provide products by one of the followings or an approved equivalent:

a. Corian® surfaces from the DuPont company.
b. Wilsonart solid surface
c. Or approved equivalents

B. Material:

1. Solid polymer components:

a. Cast, nonporous, filled polymer, not coated, laminated or of composite construction with through body colors meeting ANSI Z124.3 or ANSI Z124.6, having minimum physical and performance properties specified.
b. Superficial damage to a depth of 0.010 inch (.25 mm) shall be repairable by sanding and/or polishing.
c. Thickness: 1/2-inch
d. Edge treatment: As indicated on drawings

e. Color and Pattern: To be selected by Architect from Manufacturer's premium range.
f. Backsplash and side splash: Applied

2. Underlayment: 3/4-inch plywood (APA exterior marine grade) or MDF full underlayment.

C. Performance characteristics:

1. Conforming with ASTM D
2. Approximate weight per square foot: 1/4-inch (6 mm) 2.2 lbs., 1/2-inch (12.3 mm) 4.4 lbs.
3. Shapes meet or exceed the ANSI Z124.3 and ANSI Z124.6 standards for plastic sinks and lavatories.
4. NEMA results based on the NEMA LD 3-2000

D. Finish:

1. Provide surfaces with a uniform finish.
2. Matte; gloss range of 5–20.
3. Pattern and color: Architect to select from Manufacturer premium color range.

2.3 STAINLESS STEEL COUNTERTOP – CONCESSIONS WINDOWS – FOOD PREP STATION

A. 304 stainless steel sheet,16 ga. reinforced and applied to countertop substrate to prevent twisting, oil-canning and buckling of the surface.

B. Backsplashes shall be made of the same material.

2.4 CASEWORK HARDWARE

A. All cabinet hardware shall be furnished and installed by the casework manufacturer.

1. Drawer slides: Knape & Vogt #1300 or approved equivalent.
2. Shelf standards and brackets: Knape & Vogt #255 & #256 or approved equivalent.
3. Hinges: Concealed casework hinge with self-closing feature.
4. Pulls: 4" brushed aluminum wire pull.
5. Locks:

a. Door: Corbin Cabinet Locks No. 0737.
b. Drawer: Corbin Cabinet Locks No. 0738.
c. Or approved equivalent

2.5 CLOSET AND STORAGE SHELVING - PAINT FINISH

A. AWI quality grade (Section 600) plywood: Custom.

B. Hardwood edge banding.

2.6 OTHER MATERIALS

A. All other materials, not specifically described, but required for a complete and proper installation of the millwork items, shall be as selected by the Contractor but subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 PREPARATION FOR FINISHING

A. Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing of concealed surfaces and similar preparations for finishing of millwork as applicable to each unit of work.

3.2 PREPARATION FOR INSTALLATION

A. Condition millwork to average prevailing humidity conditions in installation areas prior to installing.

B. Deliver concrete inserts and similar anchoring devices to be built into substrates, well in advance of the time substrates are to be built.

C. Prior to installation of architectural woodwork, examine shop fabricated work for completion, and complete work as required, including back priming and removal of packing.

D. Back prime all surfaces that shall be concealed after installation.

3.3 INSTALLATION

A. Install the work plumb, level, true and straight with no distortions. Shim as required using concealed shims. Install to a tolerance of 1/8" in 8'-0" for plumb and level; and with 1/16" maximum offset in flush adjoining surfaces, 1/8" maximum offsets in revealed adjoining surfaces.

B. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.

C. Anchor millwork to anchors or built-in blocking. Secure to grounds, stripping and blocking with countersunk, concealed fasteners and blind nailing as required for a complete installation. Except where pre-finished matching fastener heads are required, use fine finishing nails for exposed nailing, countersunk and filled flush with millwork, and matching final finish where transparent finish is indicated.

3.4 CASEWORK

A. Set and secure casework in place rigid, plumb and square.

B. Use purpose designed fixture attachments for wall mounted components. Attach wall mounted cabinets in order that they can withstand all superimposed loading.

C. Use thread steel concealed joint fasteners to align and secure adjoining cabinet units and counter tops.

D. Permanently fix cabinet and counter bases to floor using appropriate angles and anchorages.

E. Counter-sink semi-concealed anchorage devices used to wall mount components, and conceal with solid plugs of species to match surrounding wood. Place flush with surrounding surfaces.

F. Carefully scribe cabinetwork which is against other building materials leaving gaps of 1/32"

maximum. Seal gaps with sealant tinted to match adjacent surfaces. Do not use additional overlay trim for this purpose.

G. Install and adjust cabinet hardware to ensure smooth and correct operation.

3.5 ADJUSTMENT, CLEANING, FINISHING AND PROTECTION

A. Repair damaged and defective millwork wherever possible to eliminate defects functionally and visually; where not possible to repair properly, replace millwork. Adjust joinery for uniform appearance.

B. Clean hardware, lubricate and make final adjustments for proper operation.

C. Clean millwork on exposed and semi-exposed surfaces. Touch-up shop-applied finishes to restore damaged or soiled areas.

D. Provide final protection and maintain conditions, in a manner acceptable to fabricator and installer, which ensures millwork being without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 068113 – FIBERGLASS REINFORCED POLYMER (FRP) PRODUCTS AND FABRICATIONS - RAILINGS

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. This section includes the following FRP Products & Fabrications for FRP Standard Guardrail/Handrail.

1.3 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals governed by this section necessary to install the fiberglass reinforced polymer (FRP) products as specified herein.

1.4 DESIGN CRITERIA:

A. The FRP standard railing system, including connections, shall be designed to meet the configuration and loading requirements of OSHA 1910.29 and IBC with a minimum 2.0 factor of safety.

B. Additional ADA handrail to be installed where indicated on plans.

C. Temperature exposure is limited to 100°F (38°C) unless specifically stated otherwise in drawings and/or supplementary conditions.

1.5 SUBMITTALS:

A. Shop drawings of all fabricated guardrail/handrail shall be submitted to the Design Engineer for approval in accordance with the requirements of Section 013300. Fabrication shall not start until receipt of Design Engineer's approval marked "Approved As Submitted" or "Approved As Noted".

B. Manufacturer's catalog data showing:

C. Materials of construction

D. Dimensions, spacings, and construction guardrails/handrails.

E. Detail shop drawings showing:

F. Dimensions

G. Sectional assembly

H. Location and identification mark

I. Size and type of supporting frames required.

J. Samples of each type of product shall be submitted for approval in accordance with the requirements of Section 013300.

1.6 QUALITY ASSURANCE:

A. The material covered by these specifications shall be furnished by an ISO-9001 certified manufacturer of proven ability who is regularly engaged in the manufacture, fabrication and installation of FRP systems.

B. Substitution of any component or modification of system shall be made only when approved by the Architect or Design Engineer.

C. Fabricator Qualifications: Firm experienced in successfully producing FRP fabrications similar to that indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.

D. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. All systems, sub-systems and structures shall be shop fabricated and assembled into the largest practical size suitable for transporting.

B. All materials and equipment necessary for the fabrication and installation of guardrail/handrail and appurtenances shall be stored before, during, and after shipment in a manner to prevent cracking, twisting, bending, breaking, chipping or damage of any kind to the materials or equipment, including damage due to over exposure to the sun. Any material which, in the opinion of the Design Engineer, has become damaged as to be unfit for use, shall be promptly removed from the site of work, and the Contractor shall receive no compensation for the damaged material or its removal.

C. Identify and match-mark all materials, items and fabrications for installation and field assembly.

1.8 JOB CONDITIONS

A. Field Measurements: Where interior architectural woodwork is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work

PART 2 - PRODUCTS

2.1 GENERAL:

A. Materials used in the manufacture of the FRP products shall be raw materials in conformance with the specification and certified as meeting the manufacturer's approved list of raw materials.

B. All raw materials shall be as specified by the contract.

C. The visual quality of the pultruded shapes shall conform to ASTM D4385.

D. FRP guardrail/handrail shall be manufactured using a pultruded process utilizing polyester, vinyl ester or phenolic resin with flame retardant and ultraviolet (UV) inhibitor additives. Unless a phenolic resin system is utilized, a synthetic surface veil fabric shall encase the glass reinforcement. FRP shapes shall achieve a flame spread rating of 25 or less in accordance with ASTM test method E-84, the flammability characteristics of UL 94 V0 and the self-extinguishing requirements of ASTM D635. (Polyester resin is available without flame retardant and UV inhibitor additives.)

E. If required, after fabrication, all cut ends, holes and abrasions of FRP shapes shall be sealed with a compatible resin coating.

F. FRP products exposed to weather shall contain an ultraviolet inhibitor. Should additional ultraviolet protection be required, a one mil minimum UV coating may be applied. Products manufactured with a phenolic resin system must be coated with a one mil minimum UV coating.

G. All exposed surfaces shall be smooth and true to form, consistent with ASTM D4385.

H. Manufacturers:

1. Strongwell

I. Pultruded FRP products shall be manufactured and fabricated in the USA. Manufacturer shall provide a written Certificate of Compliance.

J. The materials covered by these specifications shall be furnished by an ISO-9001 manufacturer.

2.2 FRP STANDARD RAILINGS:

A. Design

1. The FRP standard railing system, including connections, shall be designed to meet the configuration and loading requirements of OSHA 1910.29 and IBC with a minimum 2.0 factor of safety.

2. Guardrail height is 42" (1067mm) from the top of walkway to the top of the guardrail.

3. Guardrail installation method shall be as indicated on plans.

B. Material

1. The rails and posts shall be (select as appropriate):

   a. 2" x 2" x .156" (51mm x 51mm x 4mm) square tube

   b. 1.90" x 0.195" (48mm x 5mm) round tube Rail and Post

   c. 2" x 2" x .156" (51mm x 51mm x 4mm) with 2.375" (60mm) Square alternative design post

   d. Channel top rail with 2" x 2" x .156" (51mm x 51mm x 4mm) square tube

   e. 2" x 2" x .156" (51mm x 51mm x 4mm) square tube, 1" (25mm) square pickets with 4" (102mm) square post or 2" x .156" (51mm x 4mm) square tube post

   f. 3" round top rail with 2" x .156" (51mm x 4mm) square tube bottom rail and 1" (25mm) round tube pickets and 4" (102mm) square post or 2" x .156" (51mm x 4mm) square tube post.

2. The pultruded parts shall be made with a fire-retardant resin that achieves a flame spread rating of 25 or less in accordance with ASTM test method E84, flammability characteristics of UL 94 V0 and meet the self-extinguishing requirement of ASTM D635. The resin matrix shall be select polyester or vinyl ester and shall contain a UV inhibitor. The parts shall be coated with an industrial grade polyurethane coating for additional UV protection and wear resistance. The color shall be chosen from manufacturer's standard colors.

Table 2-Standard Railing Fiberglass Pultruded Material Properties Typical Properties

PROPERTIES	TEST METHOD	UNITS	SQUARE TUBE VALUES	ROUND TUBE VALUES
Ultimate Flexural Stress (Full Section)	n/a	psi N/mm^2	36,000 248	60,000 414
Flexural Modulus (non-phenolic) (Full Section)	n/a	psi x 10^6 N/mm^2	3.7 25,500	4.5 31,000
Flexural Modulus (phenolic) (Full Section)	n/a	psi x 10^6 N/mm^2	6.0 41,400	6.0 41,400
Density	ASTM D792	lbs/in^3 g/cc	.065 - .075 1.80 - 2.08	.065 - .075 1.80 - 2.08
24 hr. Water Absorption (non-phenolic)	ASTM D570	% max by wt.	0.6	0.6
24 hr. Water Absorption (phenolic)	ASTM D570	% max by wt.	2.0	2.0
Coefficient Of Thermal Expansion, lengthwise	ASTM D696	10^{-6} in/in/°F 10^{-5} mm/mm/°C	7 1.2	7 1.2

C. Fabrication of Standard Railing System

1. The SAFRAIL fiberglass standard railing system shall be fabricated into finished sections by fabricating and joining together the pultruded square tube using glass-reinforced thermoset components; epoxy bonded and connected as shown in the fabrication details. Railing sections shall be fabricated to the size shown on the approved fabrication drawings and shall be piece marked with a water proof tag.

2. The STRONGRAIL Architectural fiberglass standard railing system shall be fabricated into finished sections by fabricating and joining together the pultruded square tube using molded ABS components; epoxy bonded and connected as shown in the fabrication details. Railing sections shall be fabricated to the size shown on the approved fabrication drawings and shall be piece marked with a water proof tag.

D. For Side Mount

1. Post shall be constructed with a pultruded bottom plug. Length shall be sufficient to extend a minimum of 1” (25mm) beyond the uppermost bolt hole to prevent crushing of post tubing. Bolt holes shall provide clearance of 1/16” (1.6mm) for 1/2” (12.7mm) diameter bolts/studs. On square tubes, holes shall be on longitudinal center line of post, 1” (25mm) from bottom of post (minimum) and not less than 3” (76mm) apart on center. Posts shall be fastened with stainless steel anchor bolts or studs, 1/2” (12.7mm) diameter.

2. Post locations shall be no greater than 18” (450mm), nor less than 9” (230mm) from horizontal or vertical change in handrail direction. For square tubes, post centers shall be no greater than 72” (1830mm) apart on any straight run or rail, or 48” (1220mm) apart on any inclined rail section.

E. Other Attachment Methods

1. Base mount, embedded and removable are also types of mounting procedures for railing pending design and approval by the Design Engineer.

F. Installation of Handrail Sections

1. The fabricated railing sections shall be supplied complete with fittings by the FRP manufacturer. The components used to join fabricated sections together may be shipped loose, to be epoxied and riveted, if required, together, if required in the field by the contractor.

2. The fabricated handrail sections shall be installed as shown on the approved shop drawings. The handrail sections shall be accurately located, erected plumb and level. The sections shall be fastened to the structure as shown on the approved shop drawings.

G. Approved Manufacturers

1. Strongwell

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions and directions for installation of anchorages, including concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

B. Set sleeves in concrete with tops flush with finish surface elevations; protect sleeves from infiltration of water and debris.

3.2 INSPECTION AND TESTING:

A. The Design Engineer shall have the right to inspect and test all materials to be furnished under these specifications prior to their shipment from the point of manufacture.

B. All labor, power, materials, equipment and appurtenances required for testing shall be furnished by the Contractor at no cost to the Owner.

3.3 INSTALLATION, GENERAL:

A. Fastening to in-place construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous FRP fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts and other connectors as determined by the Design Engineer.

B. Cutting, fitting and placement: Perform cutting, drilling and fitting required for installation of miscellaneous FRP fabrications. Set FRP fabrication accurately in location, alignment and elevation; with edges and surfaces level, plumb, true and free of rack; measured from established lines and levels.

C. Provide temporary bracing or anchors in form work for items that are to be built into concrete masonry or similar construction.

3.4 ALL FRP INSTALLATION:

A. If required, all field cut and drilled edges, holes and abrasions shall be sealed with a catalyzed resin compatible with the original resin as recommended by the manufacturer.

B. Install items specified as indicated and in accordance with manufacturer's instructions.

END OF SECTION

SECTION 071113 - BITUMINOUS DAMPPROOFING

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. Scope: Provide all of the labor, materials, equipment, and services required to furnish and install the bituminous dampproofing.

B. This Section includes the following:

1. Cavity side face of Concrete Unit Masonry (behind veneer).
2. Exterior face of Concrete Unit Masonry walls which are the structural substrate below grade.

C. Related Sections include the following:

1. Division 03 Section “Cast-in-Place Concrete”.
2. Division 04 Section “Architectural Concrete Masonry”.
3. Division 07 Section “Water Repellents”.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include recommendations for method of application, primer, number of coats, coverage or thickness, and protection course. B. Material Certificates: For each product, signed by manufacturers.

1.4 JOB CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit dampproofing to be performed according to manufacturers' written instructions.

B. Ventilation: Provide adequate ventilation during application of dampproofing in enclosed spaces. Maintain ventilation until dampproofing has cured.

PART 2 - PRODUCTS

2.1 BITUMINUS DAMPPROOFING

A. Source Limitations: Obtain primary dampproofing materials and primers through one source from a single manufacturer. Provide secondary materials recommended by manufacturer of primary materials.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Sonneborn Brand Products; Hydrocide 600
b. Polyguard Product Inc.; Polyguard 500 NF non-fibrated emulsion dampproofing
c. Koppers Inc.; Liquid Asphalt 480 Dampproofing Emulsion
d. Tamms Industries, Inc.; Dehydratine 75 Emulsified Asphalt Dampproofing Compounds.

C. Brush and Spray Coats: ASTM D 1227, Type III, class 1.

2.2 MISCELLANEOUS MATERIALS

A. Emulsified-Asphalt Primer: ASTM D1227, Type III, Class 1, except diluted with water as recommended by manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for surface smoothness and other conditions affecting performance of work.

1. Proceed with dampproofing application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.
2. Test for surface moisture according to ASTM D 4263.

3.2 PREPARATION

A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for dampproofing application.

B. Protection of Other Work: Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with dampproofing. Prevent dampproofing materials from entering and clogging weep holes and drains.

C. Clean substrates of projections and substances detrimental to work; fill voids, seal joints, and apply bond breakers if any, as recommended by prime material manufacturer.

3.3 APPLICATION, GENERAL

A. Comply with manufacturer's written recommendations unless more stringent requirements are indicated or required by Project conditions to ensure satisfactory performance of dampproofing.

1. Apply additional coats if recommended by manufacturer or if required to achieve coverages indicated.
2. Allow each coat of dampproofing to cure 24 hours before applying subsequent coats.

3.4 CLEANING

A. Remove dampproofing materials from surfaces not intended to receive dampproofing.

3.5 PROTECTION

A. Correct dampproofing that does not comply with requirements; repair substrates and reapply dampproofing.

END OF SECTION 071113

SECTION 07 1417 COLD FLUID-APPLIED WATERPROOFING FOR AQUATIC FEATURES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Concrete protection and waterproofing applied on positive side of all Aquatic Features Structures prior to application of finished cementitious coating.

1.2 RELATED SECTIONS

A. 03 3714 - Shotcrete for Aquatic Features

B. 09 3014 – Tiling for Aquatic Features

C. 09 9727 – Cementitious Coating for Aquatic Features

D. 13 1123 – On Grade Aquatic Features

E. 13 1225 – Pumped Concrete for Splash Pad

PART 2 - PRODUCTS

2.1 CONCRETE PROTECTION AND WATERPROOFING:

A. Concrete Pool Shell Protector CPSP: permanent, clear treatment, preservative, sealant solution for aquatic features shells.

1. AQURON Corporation International; www.aquron.com
    a. CPSP (Concrete Pool Shell Protector)

PART 3 - EXECUTION

3.1 JOB CONDITIONS:

A. Do not proceed with application of AQURON® CPSP™ when ambient temperature and/or substrate temperatures are less than 37°F/2.8°C or forecasted to drop below 37°F/2.8°C during the next 6 hours.

B. AQURON® CPSP™ only seals the concrete itself, not fractures.

3.2 APPLICATION

A. AQURON® CPSP™ must be applied with a high pressure airless sprayer with spray tip size as follows:

1. Steel Troweled Concrete & Smooth Plaster .013–.015
2. Shotcrete .015–.019
3. Gunite .019
4. Spray tip fan width should be 10”–14” wide.

B. Pre-wet area of application with water to cool concrete that is extremely hot (95ºF or higher). All pooled and puddle areas must be dispersed, continue to keep area damp until AQURON® CPSP™ has been applied.

C. Apply AQURON® CPSP™ at a rate no less than 1 liter to 3.5m2/150 sq. ft. per US gallon. Normally to achieve this rate of application of AQURON® CPSP™ at least 2 applications will be needed. First application covering area in one direction, then applying second application after first has penetrated surface (do not allow first application to dry, apply second application as soon as surface sheen has dissipated). Even coverage is achieved by applying the two applications at 90° to each other; i.e., a crisscross pattern!

D. Start application holding spray tip approximately 8”–10“/200–300mm from concrete surface, make application using overlapping spray pattern with a fanning motion at the end of each pass.

E. Entire area being treated is to be saturated, but do not allow AQURON® CPSP™ to puddle. Disperse puddle areas with broom 15–30 minutes after application is completed (do not allow puddles of AQURON® CPSP™ to dry).

F. Always start application at lowest possible area and proceed to higher elevations. On vertical application (walls) start at the bottom and proceed up the vertical surface with horizontal and vertical strokes to insure coverage.

G. When application is to weeping hydrostatic concrete, at least doubling step 3 of the Application Procedure is necessary with the second applied immediately following the first.

END OF SECTION 071417

SECTION 071900 - WATER REPELLENTS

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. Scope: Provide all of the labor, materials, equipment and services required to apply the water repellents.

B. This Section includes penetrating water-repellent coatings for the following vertical and horizontal surfaces:
1. Concrete (unpainted).
2. Cast stone.
3. Concrete unit masonry (unpainted and unglazed).

C. Related Sections include the following:
1. Division 03 Section "Cast-in-Place Concrete".
2. Division 04 Section “Architectural Concrete Masonry".
3. Division 07 Section "Joint Sealants."
4. Division 09 Section “Painting”.

1.3 PERFORMANCE REQUIREMENTS

A. Absorption: Minimum 80 percent reduction of absorption after 24 hours in comparison of treated and untreated specimens.
1. Stone: ASTM C 97.
2. Concrete Unit Masonry: ASTM C 140.
3. Hardened Concrete: ASTM C 642.

B. Water-Vapor Transmission: Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, per ASTM E 96.

C. Permeability: Minimum 80 percent water-vapor transmission in comparison of treated and untreated specimens, per ASTM D 1653.

D. Water Penetration and Leakage through Masonry: Maximum 90 percent reduction in leakage rate in comparison of treated and untreated specimens, per ASTM E 514.

E. Durability: Maximum 5 percent loss of water repellency after 2500 hours of weathering in comparison to specimens before weathering, per ASTM G 154.

F. Chloride-Ion Intrusion in Concrete: NCHRP Report 244, Series II tests.
1. Reduction of Water Absorption: 80 percent.

2. Reduction in Chloride Content: 80 percent.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Include manufacturer's printed statement of VOC content.
   2. Include manufacturer's standard colors.
   3. Manufacturer’s literature fully describing the product and the method of application for this project. The method and rate of application shall be completely outlined in order that the Architect will be fully aware of the procedure.

B. Samples: For each type of water repellent and substrate indicated, 12 by 12 inches (300 by 300 mm) in size, with specified water-repellent treatment applied to half of each Sample.

C. Manufacturer Certificates: Signed by manufacturers certifying that water repellents comply with requirements.

D. Preconstruction Testing Reports: For water-repellent-treated substrates.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for assemblies.

F. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM E 548 for testing indicated.

C. Application shall be made in the presence of an authorized representative of the manufacturer. The representative shall:
   1. Assure that the application and materials used are correct and will not violate the warranty.
   2. Ascertain that mil thickness of material(s) is in accordance with manufacturer's recommendations for this Project's specific conditions and that the warranty will not be violated.
   3. Submit a certified test report that the materials and thickness applied are correct to achieve water repellency and that a warranty can be issued.

D. Warranty: Submit a written warranty, executed by the applicator and the manufacturer covering materials and labor, agreeing to repair or replace materials that fail to provide water repellency within the warranty period. This warranty shall be in addition to, and not a limitation of, other rights the Owner may have against the Contractor under the Contract Documents.
   1. Warranty period: 5 years from Date of Substantial Completion.

1.6 PROJECT CONDITIONS

A. Limitations: Proceed with application only when the following existing and forecasted weather and substrate conditions permit water repellents to be applied according to manufacturers' written instructions and warranty requirements:
   1. Ambient temperature is above 40 deg F (4.4 deg C).
   2. Concrete surfaces and mortar have cured for more than 28 days.
   3. Concrete or brick masonry walls are not treated prior to 30 days after building close-in.
   4. Rain or snow is not predicted within 24 hours.
   5. Application proceeds more than 24 hours after surfaces have been wet.
   6. Substrate is not frozen, or surface temperature is above 40 deg F (4.4 deg C).
   7. Windy conditions do not exist that may cause water repellent to be blown onto vegetation or surfaces not intended to be treated.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer and Applicator agree(s) to repair or replace materials that fail to maintain water repellency specified in Part 1 "Performance Requirements" Article within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PENETRATING WATER REPELLENTS

A. Silane/Siloxane-Blend, Penetrating Water Repellent: Prediluted, Clear, silane and siloxane blends with 3.3 lb/gal. (400 g/L) or less of VOCs.
   1. Products: Subject to compliance with requirements, provide one of the following products:
      a. Tnemec Coating; Prime A Pell
      b. BASF Building Systems: Hydrozo 100.
      c. ProSoCo, Inc.; SL 100 Water Repeller or Weatherseal GP or Siloxane PD
      d. Euclid Chemical Co.; Chemstop WB Heavy Duty

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrate of substances that might interfere with penetration or performance of water repellents. Test for moisture content, according to water-repellent manufacturer's written instructions, to ensure that surface is dry enough.
   1. Cast-in-Place Concrete: Remove oil, curing compounds, laitance, and other substances that could prevent adhesion or penetration of water repellents.
   2. Clay Brick Masonry: Clean clay brick masonry per ASTM D 5703.

B. Test for pH level, according to water-repellent manufacturer's written instructions, to ensure chemical bond to silicate minerals.

C. Protect adjoining work, including sealant bond surfaces, from spillage or blow-over of water repellent. Cover adjoining and nearby surfaces of aluminum and glass if there is

the possibility of water repellent being deposited on surfaces. Cover live plants and grass.

D. Coordination with Sealants: Do not apply water repellent until sealants for joints adjacent to surfaces receiving water-repellent treatment have been installed and cured.
   1. Water-repellent work may precede sealant application only if sealant adhesion and compatibility have been tested and verified using substrate, water repellent, and sealant materials identical to those used in the work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATION

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect the substrate before application of water repellent and to instruct Applicator on the product and application method to be used.

B. Stir container just before using to assure the mixture of hydrophobic filler.

C. Apply directly from the container using a good quality brush, roller, airless or conventional air type sprayer. Hudson garden type sprayers are allowed. Equip all sprayers with neoprene hose. All tools and equipment shall be clean prior to and during application to prevent possible staining or discoloring.

D. Apply in a uniform manner that fully wets out the surface yet does not cause flooding or rundowns. "Pick off" any rundowns with a brush or dry roller to prevent unsightly lap or rundown marks.

E. When spray applying, spray a uniform horizontal stroke followed by a uniform overlapping vertical stroke.

F. Coverage rate: As recommended by the manufacturer.

G. Apply a heavy-saturation spray coating of water repellent on surfaces indicated for treatment using low-pressure spray equipment. Comply with manufacturer's written instructions for using airless spraying procedure, unless otherwise indicated.
   1. Precast Concrete: At Contractor's option, first application of water repellent on precast concrete units may be completed before installing units. Mask sealant-bond surfaces to prevent water repellent from migrating onto joint surfaces.

H. Apply a second saturation spray coating, repeating first application. Comply with manufacturer's written instructions for limitations on drying time between coats and after rainstorm wetting of surfaces between coats. Consult manufacturer's technical representative if written instructions are not applicable to Project conditions.

3.3 CLEANING

A. Immediately clean water repellent from adjoining surfaces and surfaces soiled or damaged by water-repellent application as work progresses. Repair damage caused by water-repellent application. Comply with manufacturer's written cleaning instructions.

B. If applied to glass or anodized aluminum, remove immediately by wiping with a clean cloth saturated with Xylene or Reducer 990 followed with a mild detergent wash.

END OF SECTION 071900

SECTION 071905 – POOL AREA DECK SEALANT

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

A. Application Area: Apply product to concrete decking surrounding swimming pool and splash pad. No not apply to pool house concrete slab.

B. Surface Preparation.

C. Application of clear, water-based water repellent sealer for concrete and masonry.

1.02 RELATED SECTIONS

A. Section 033000 – Cast-In-Place Concrete

1.03 SUBMITTALS

A. Submit the following specific items in time to allow for review by the Landscape Architect and resubmittals, if needed, without delaying the work.

1. Manufacturer' literature for all materials specified for use on this project, each properly labeled and referenced to appropriate Specification Section, in time to prevent delay of the project.

2. Safety Data Sheets (SDS) for all materials to be used.

3. Manufacturer's requirements and testing procedures for moisture conditions (moisture vapor emission rate, relative humidity, etc.) of the concrete or masonry at time of installation necessary to ensure proper bond.

1.04 REFERENCE STANDARDS

A. In general, follow all requirements, recommendations and procedures of the following standards and publications:

1. ASTM International (ASTM) standards as specified or referenced herein.

2. Manufacturer's product data, written instructions, and recommendations.

B. The contractor shall follow the material standards included in the manufacturer's technical literature.

1.05 DELIVERY, STORAGE, AND HANDLING

A. All materials to be new. Handle all materials to prevent damage. Place materials on pallets. Use waterproof and fire-retardant tarpaulins to cover all stored materials top to bottom.

B. Store all materials in original, unopened, labeled containers and packaging an in compliance with manufacturer's directions. Comply with manufacturer's recommendations for minimum and maximum time and temperature limits for storage.

C. Store unopened and sealed containers in a dry place and protect from direct sunlight or frost and any sources of fire or ignition. Do not store containers once they are opened or when the seal has been broken. Unopened and sealed containers can be stored up to twelve months in a dry location at a temperature between 45°F and 90°F.

D. Promptly remove from the site all materials rejected by the Architect or exposed to any moisture anywhere, at any time, during transportation, storage, handling and installation.

E. Materials shall be marked with the date of manufacture and shelf life. Do not use products beyond the expiration of their shelf life. Store flammable materials in a cool, dry, protected area away from sparks and open flames.

1.06 PROJECT CONDITIONS

A. Do not install water-repellent sealer if:

1. Ambient or substrate temperatures are less than 45°F or more than 90°F or if the substrate temperature is less than 5°F above the dew point at the time of application.

2. Rain is forecasted within 24 hours.

B. The primary concrete or masonry surface must be cured a minimum of twenty-eight days before the application of the water-repellent sealer.

C. Prior to and during application of the water-repellent sealer, the concrete or masonry surface must be completely dry with a minimum moisture content of 4%, as tested with a moisture meter.

D. Protect adjacent building surfaces (e.g.; window frames, glass) and landscaping by masking to protect from overspray. Any product spilled or dripped on an unwanted surface should be immediately removed by wiping with a clean cloth dipped in detergent solution and rinsed with clean water.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Water-Repellent Sealer: Thin coat, liquid applied, hydrophobic, impregnating water-repellent clear sealer consisting of a silane/siloxane aqueous emulsion designed for use on concrete or masonry substrates with 0.5% maximum water absorption with 48 hrs exposure as tested in accordance with ASTM C642; Ghostshield Siloxa-Tek® 8500 as manufactured by KreteTek Industries, Inc., or approved equal.

2.02 MANUFACTURER

B. KreteTek Industries, Inc. 1000 N West St Wilmington, DE 19801 (855) 573-8383 Website: http://ghostshield.com, or approved equal.

PART 3 – EXECUTION

3.01 GENERAL WORKMANSHIP FOR WATER-REPELLENT SEALER

A. Comply with all recommendations of the manufacturer of the water-repellent sealer for surface preparation and installation of the sealer.

B. Perform a test application on each type of surface prior to full-scale application to determine suitability and final appearance.

C. Measure and record site conditions immediately before (as applicable) and periodically during the installation of the water-repellent sealer. Measurements must include air and substrate temperatures, air and substrate relative humilities, application rate, and record general notes on product uptake and performance.

3.02 PREPARATION OF CONCRETE OR MASONRY SURFACES FOR WATER REPELLENT

A. Check concrete or masonry surfaces to ensure that they are suitable for application of water-repellent sealer. Treat unsuitable surfaces (too smooth, too rough, not dry, or contaminated by dirt, oil or any coating or other impurities) as required to make them suitable for application of sealer.

1. Remove all dirt, dust, or other foreign matter from the surface of the concrete or masonry prior to the application of the water-repellent sealer using methods

described in this section and approved by Architect based on surface preparation mockups.

2. After cleaning, if a wet method such as power washing is used, the concrete or masonry surface must be allowed to dry for not less than 24 hrs before the application of the water-repellent sealer. If good weather conditions conductive to drying are not present, a longer drying time should be allowed and the sealer should not be applied until the concrete or masonry is completely dry as described in this section. Use a moisture meter if necessary to monitor drying of the concrete or masonry.

B. Concrete or masonry substrates must be structurally sound, thoroughly dry, clean, and cured at least twenty-eight days.

C. If acid or chemical cleaning agent is used to clean the concrete, make sure to neutralize before sealing.

3.03 WATER-REPELLENT SEALER APPLICATION

A. Apply water-repellent sealer to prepared substrates within three days after completion of the surface preparation.

B. Stir and mix materials thoroughly to ensure uniformity and in accordance with the manufacturer's recommendations.

C. Apply water-repellent sealer with a sprayer or roller.

1. Application rate depends on the density of the concrete or masonry and the depth of penetration required. Apply the sealer, liberally to the surface of the concrete or masonry to achieve high penetration depth but no more than what can stay on the surface without run off.

2. For typical first coat applications, apply one coat of sealer at a rate of approximately 250 sq ft per gallon; application rate specific to the project determined by the mockup.

3. Apply a second coat wet-on-wet, or immediately after the first coat. Take care to avoid the product running or dripping off the substrate. Broom out puddles until they soak in. Do not over apply.

D. It may take up to 2 or more hours for the sealer to completely penetrate if the substrate is of high density. The treated surface may remain dark for up to twenty-four hours before it returns to normal appearance.

E. Do NOT apply the sealer to concrete or masonry surfaces:

1. That are damp or have damp repairs. If rain suddenly begins during installation, immediately stop application of sealer and cover the newly impregnated areas.

2. If the conditions (e.g.; weather or surface conditions) do not meet the requirements of Para. 1.06 above or are not expected to meet the requirements for any time within a 24 hr period after installation.

F. Do not disturb sealed surfaces for a minimum of 6 hrs after the application of the product. Early water repellence with be developed after 24 hrs; however, full curing of the sealer may take up to seven days or longer. Do not install concrete or masonry repairs for a minimum of 72 hrs after application of the sealer.

END OF SECTION

SECTION 072100 - THERMAL INSULATION

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. Scope: Provide all of the labor, materials, equipment and services required to furnish and install the thermal insulation.

B. This Section includes the following:

1. Concealed building insulation/Foam-in-Place insulation.
2. Glass-fiber blanket insulation.
3. Masonry cell fill insulation.
4. Sound attenuation insulation.
5. Vapor retarders.

C. Related Sections include the following:

1. Division 04 Section “Architectural Concrete Masonry”.
2. Division 22 Section "Plumbing Insulation".
3. Division 23 Section "Ductwork Insulation".

1.3 DEFINITIONS

A. Mineral-Fiber Insulation: Insulation composed of rock-wool fibers, slag-wool fibers, or glass fibers; produced in boards and blanket with latter formed into batts (flat-cut lengths) or rolls.

1.4 SUBMITTALS

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

B. Samples for Verification: Full-size units for each type of exposed insulation indicated.

C. Certified Test Reports: With product data, submit copies of certified test reports showing compliance with specified performance values, including R-values, fire performance and sound abatement characteristics.

D. Material Safety Data Sheet: Submit Material Safety Data Sheet complying with OSHA Hazard Communication Standard, 29 CRF 1910 1200.

1.5 PERFORMANCE REQUIREMENTS

A. Plenum Rating: Provide glass-fiber insulation where indicated in ceiling plenums whose test performance is rated as follows for use in plenums as determined by testing identical products per "Erosion Test" and "Mold Growth and Humidity Test" described in UL 181, or on comparable tests from another standard acceptable to authorities having jurisdiction.

1. Erosion Test Results: Insulation shows no visible evidence of cracking, flaking, peeling, or delamination of interior surface of duct assembly, after testing for 4 hours at 13-m/s air velocity.
2. Mold Growth and Humidity Test Results: Insulation shows no evidence of mold growth, delamination, or other deterioration due to the effects of high humidity, after inoculation with Chaetomium globosium on all surfaces and storing for 60 days at 100 percent relative humidity in the dark.

1.6 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: Provide insulation and related materials with the fire- test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency.

1. Surface-Burning Characteristics: ASTM E 84.

a. Frame spread factor: 15.
b. Fuel contributed factor: 0.
c. Smoke density factor: 75.
d. The above testing shall verify that, when these standard tests are extended to 30 min., there is no further flame progression.

2. Fire-Resistance Ratings: ASTM E 119.
3. Combustion Characteristics: ASTM E 136.

B. Foam-in-place insulation: Independent testing and evaluations shall be provided to verify that the followings:

1. Does not contain formaldehyde and is approximately 98% inorganic.
2. Free from asbestos.
3. Min. R-value required: 10.9

C. Warranty: Manufacturer’s standard warranty

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration by moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect plastic insulation as follows:

1. Do not expose to sunlight, except to extent necessary for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver plastic insulating materials to Project site before installation time.
3. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

B. Source Limitations: Obtain each type of building insulation through one source from a single manufacturer.

2.2 FOAM-IN-PLACE INSULATION

A. Product/manufacturer:

a. Core-Fill-500 as manufactured by Tailored Chemical Products, Inc.
b. PolyMaster R-501 CoreFoam by CFI Foam, Inc.
c. Thermco Foam Insulation by Thermal Corp. of America.

B. Material: Two component thermal insulation produced by combining a plastic resin and catalyst foaming agent surfactant which, when properly ratioed and mixed, together with compressed air produce a cold-setting foam insulation in the hollow cores of hollow unit masonry walls.

1. Surface Burning Characteristics: Maximum flame spread, smoke developed and fuel contributed of 0, 5 and 0 respectively.
2. Combustion Characteristics: Must be noncombustible, Class A building material.
3. Thermal Values: "R" Value of 4.91/inch @ 32 degrees F mean; ASTM C-177.
4. Insulation Values: For application on 8” CMU lightweight (not more than 105 lb density) must be R-9.1 min.
5. Sound Abatement: Minimum Sound Transmission Class ("STC") rating of 53 and a minimum Outdoor Indoor Transmission Class ("OITC") rating of 44 for 8" wall assembly (ASTM E 90-90).

2.3 GLASS-FIBER BLANKET INSULATION

A. Manufacturers:

a. CertainTeed Corporation.
b. Johns Manville.
c. Owens Corning.

B. Unfaced, Glass-Fiber Blanket Insulation: ASTM C 665, Type I; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E 84; passing ASTM E 136 for combustion characteristics.

C. Faced, Glass-Fiber Blanket Insulation: ASTM C 665.

1. Type III (reflective faced), faced with foil-scrim-kraft/foil-scrim/foil-scrim-polyethylene polypropylene-scrim-kraft vapor-retarder membrane on 1 face;
2. Class A (faced surface with a flame-spread index of 25 or less), for use in non-exposed applications only;
3. Category 1 (membrane is a vapor barrier), vapor retarder to have permeance rating of 1 perm or less in compliance with ASTM E96 (tested with dessicant method using Procedure A). Install vapor retarder on warm-side-in-winter.

D. Thermal resistance: ASTM C 764

1. 12”- R38 attic application.
2. 3 ½” – R15 for wall application.
3. 6” – R19 for floor/ceiling application.
4. Refer to Division 13 Section “Pre-Engineered Metal Building System” for insulation in metal building system.

2.4 MASONRY-CELL FILL

A. Loose-Fill Insulation: Perlite complying with ASTM C 549, Type II (surface treated for water repellency and limited moisture absorption) or Type IV (surface treated for water repellency and to limit dust generation).

B. Refer to Architectural drawings for required R-value of insulation.

C. Refer to Division 04 Section “Architectural Concrete Masonry”.

2.5 SOUND ATTENUATION INSULATION:

A. General: Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

B. Basis of Design: USG sound attenuation blankets or approved equal.

C. Non-combustible:

1. Flame spread: 15
2. Smoke spread: 0.

D. Perimeter caulking: USG Acoustical Sealant.

2.6 VAPOR RETARDERS

A. General: Provide with un-faced batt insulation that receives separate vapor retarders. Install vapor retarder on warm-side-in-winter.

B. Polyethylene Vapor Retarders: ASTM D 4397, 0.15 mm thick, with maximum permeance rating of 0.13 perm.

C. Reinforced-Polyethylene Vapor Retarders: 2 outer layers of polyethylene film laminated to an inner reinforcing layer consisting of either nylon cord or polyester scrim and weighing not less than 40 lbs/1000 sq. ft, with maximum permeance rating of 0.038 Grain / Hr•Ft2 •in.Hg

1. Products:

a. Raven Industries Inc.; DURA-SKRIM 6WW.
b. Reef Industries, Inc.; Griffolyn T-65.

D. Vapor-Retarder Tape: Pressure-sensitive tape of type recommended by vapor-retarder manufacturer for sealing joints and penetrations in vapor retarder.

E. Vapor-Retarder Fasteners: Pancake-head, self-tapping steel drill screws; with fender washers.

F. Single-Component Nonsag Urethane Sealant: ASTM C 920, Type I, Grade NS, Class 25, Use NT related to exposure, and Use O related to vapor-barrier-related substrates.

G. Adhesive for Vapor Retarders: Product recommended by vapor-retarder manufacturer and with demonstrated capability to bond vapor retarders securely to substrates indicated.

2.7 AUXILIARY INSULATING MATERIALS

A. Adhesive for Bonding Insulation: Product with demonstrated capability to bond insulation securely to substrates indicated without damaging insulation and substrates.

B. Asphalt Coating for Cellular-Glass Block Insulation: Cutback asphalt or asphalt emulsion of type recommended by manufacturer of cellular-glass block insulation.

C. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide cross ventilation between insulated attic spaces and vented eaves.

2.8 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:

1. Products:

a. AGM Industries, Inc.; Series T TACTOO Insul-Hangers.
b. Eckel Industries of Canada; Stic-Klip Type N Fasteners.
c. Gemco; Spindle Type.

2. Plate: Perforated galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.

B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of thickness indicated securely in position indicated with self-locking washer in place; and complying with the following requirements:

1. Products:

a. Gemco; 90-Degree Insulation Hangers.

2. Angle: Formed from 0.030 inch thick, perforated, galvanized carbon-steel sheet with each leg 2 inch square.
3. Spindle: Copper-coated, low carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation indicated.

C. Insulation-Retaining Washers: Self-locking washers formed from 0.016 inch thick galvanized steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1 1/2 inch square or in diameter.

1. Products:

a. AGM Industries, Inc.; RC150.
b. AGM Industries, Inc.; SC150.
c. Gemco; Dome-Cap.
d. Gemco; R-150.
e. Gemco; S-150.

2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:

a. Ceiling plenums.
b. Attic spaces.

D. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor to maintain air space of 1 inch between face of insulation and substrate to which anchor is attached.

1. Products:

a. Gemco; Clutch Clip.

E. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors

securely to substrates indicated without damaging insulation, fasteners, and substrates.

1. Products:

a. AGM Industries, Inc.; TACTOO Adhesive.
b. Eckel Industries of Canada; Stic-Klip Type S Adhesive.
c. Gemco; Tuff Bond Hanger Adhesive.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements of Sections in which substrates and related work are specified and for other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of substances harmful to insulation or vapor retarders, including removing projections capable of puncturing vapor retarders or of interfering with insulation attachment.

3.3 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and application indicated.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed at any time to ice, rain, and snow.

C. Extend insulation in thickness indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

D. Water-Piping Coordination: If water piping is located within insulated exterior walls, coordinate location of piping to ensure that it is placed on warm side of insulation and insulation encapsulates piping.

E. For preformed insulating units, provide sizes to fit applications indicated and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units to produce thickness indicated unless multiple layers are otherwise shown or required to make up total thickness.

3.4 INSTALLATION OF PERIMETER INSULATION

A. On vertical surfaces, set insulation units in adhesive applied according to manufacturer's written instructions. Use adhesive recommended by insulation manufacturer.

1. If not otherwise indicated, extend insulation a minimum of 24 inches below exterior grade line.

B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

C. Protect below-grade insulation on vertical surfaces from damage during backfilling by applying protection course with joints butted. Set in adhesive according to insulation manufacturer's written instructions.

D. Protect top surface of horizontal insulation from damage during concrete work by applying protection course with joints butted.

3.5 INSTALLATION OF GENERAL BUILDING INSULATION

A. Apply insulation units to substrates by method indicated, complying with manufacturer's written instructions. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

B. Seal joints between foam-plastic insulation units by applying adhesive, mastic, or sealant to edges of each unit to form a tight seal as units are shoved into place. Fill voids in completed installation with adhesive, mastic, or sealant as recommended by insulation manufacturer.

C. Set vapor-retarder-faced units with vapor retarder to warm side of construction, unless otherwise indicated.

1. Tape joints and ruptures in vapor retarder, and seal each continuous area of insulation to surrounding construction to ensure airtight installation.

D. Install mineral-fiber insulation in cavities formed by framing members according to the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill cavity, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3 inch clearance of insulation around recessed lighting fixtures.
4. Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
5. For wood-framed construction, install mineral-fiber blankets according to ASTM C 1320 and as follows:

a. With faced blankets having stapling flanges, secure insulation by inset, stapling flanges to sides of framing members.
b. With faced blankets having stapling flanges, lap blanket flange over flange of adjacent blanket to maintain continuity of vapor retarder once finish material

is installed over it.

3.6 INSTALLATION OF FOAMED-IN-PLACE INSULATION

A. General: Install foamed-in-place insulation from interior, or as specified, prior to installation of interior finish work and after all masonry and structural concrete work is in place; comply with manufacturer's instructions.

B. Installation: Fill all open cells and voids in hollow concrete masonry walls where shown on drawings. The foam insulation shall be pressure injected through a series of 5/8" to 7/8" holes drilled into every vertical column of block cells (every 8" on center) beginning at an approximate height of four (4) feet from finished floor level. Repeat this procedure at an approximate height of ten (10) feet above the first horizontal row of holes (or as needed) until the void is completely filled. Patch holes with mortar and score to resemble existing surface.

3.7 INSTALLATION OF MASONRY-CELL FILL

A. Pour loose-fill insulation into cavities to fill void spaces. Maintain inspection ports to show presence of fill at extremities of each pour area. Close the ports after filling has been confirmed. Limit the fall of fill to one story high, but not more than 20 feet.

B. Install molded-polystyrene insulation units into masonry unit cells before laying units.

3.8 INSTALLATION OF INSULATION IN CEILINGS FOR SOUND ATTENUATION

A. Install 3 inch thick, un-faced glass-fiber blanket insulation over suspended ceilings at partitions in a width that extends insulation 4’-0” on either side of partition.

3.9 INSTALLATION OF VAPOR RETARDERS

A. General: Extend vapor retarder to extremities of areas to be protected from vapor transmission. Secure in place with adhesives or other anchorage system as indicated. Extend vapor retarder to cover miscellaneous voids in insulated substrates, including those filled with loose-fiber insulation.

B. Seal vertical joints in vapor retarders over framing by lapping not less than two wall studs. Fasten vapor retarders to wood framing at top, end, and bottom edges; at perimeter of wall openings; and at lap joints. Space fasteners 16” o.c.

C. Before installing vapor retarder, apply urethane sealant to flanges of metal framing including runner tracks, metal studs, and framing around door and window openings. Seal overlapping joints in vapor retarders with vapor-retarder tape according to vapor-retarder manufacturer's written instructions. Seal butt joints with vapor-retarder tape. Locate all joints over framing members or other solid substrates.

D. Firmly attach vapor retarders to metal framing and solid substrates with vapor-retarder fasteners as recommended by vapor-retarder manufacturer.

E. Seal joints caused by pipes, conduits, electrical boxes, and similar items penetrating vapor retarders with vapor-retarder tape to create an airtight seal between penetrating

objects and vapor retarder.

F. Repair tears or punctures in vapor retarders immediately before concealment by other work. Cover with vapor-retarder tape or another layer of vapor retarder.

3.10 PROTECTION

A. Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 071900

SECTION 074113 - METAL ROOF PANELS

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. Scope: Provide all of the labor, materials, equipment, and services required to furnish and install the prefabricated metal roofing.

B. This Section includes Standing-Seam Metal Roof Panels.

C. Related Sections include the following:

1. Division 06 Section “Sheathing”.
2. Division 07 Section “Sheet Metal Flashing and Trim”.
3. Division 07 Section “Roof Accessories”.

1.3 SUBMITTALS

A. Prior to fabrication, submit to the Architect for review the following:

1. Complete and fully descriptive manufacturer's literature which shall include, but not be limited to, naming all materials and components and the proper method of installation for this Project.
2. Detailed Computer-generated drawings showing layout of panels, anchoring details, joint details, trim, flashing, and accessories. Show details of weatherproofing, terminations, and penetrations of metal work. Drawings shall indicate dimensions, all methods of securing. Detailed drawing shall be submitted to the Metal Panel Manufacturers for approval complying with specified warranty.
3. Physical sample for color selection: All colors and textures available for the Architect.

1.4 PERFORMANCE REQUIREMENTS

1. Air Infiltration ASTM E-1680-95
2. Water Infiltration ASTM E-1646-95
3. Wind Uplift - U.L.90
4. Uplift Resistance for Roof Assembly – UL 580 (up to 120 mph wind speed).

1.5 QUALITY ASSURANCE

A. Wind uplift: Provide roof panel system including supports meeting requirements of Underwriters Laboratories, Inc. for Class 90 wind uplift resistance.

B. Field measurements: Where possible, prior to fabrication of panels, take field measurements of structure or substrates to receive panel system. Allow for trimming panel units where final dimensions cannot be established prior to fabrication.

1.6 DELIVER, STORAGE AND HANDLING

A. Deliver panels and other components so they will not be damaged or deformed. Package wall and roof panels for protection against transportation damage.

B. Handling: Exercise care in unloading, storing, and erecting wall and roof covering panels to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering. Store metal panels so that they will not accumulate water. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

1.7 WARRANTY

A. Provide manufacturer's standard 20-years warranty stating the finish will be:

1. Free of fading or color change in excess of 5 NBS units as measured per ASTM D2244;
2. Will not chalk in excess of numerical rating of 7 when measured in accordance with standard procedures specified in ASTM D659;
3. Will not peel, crack, chip, or delaminate.

B. Provide written warranty signed by applicator for 2-years period from Date of Substantial Completion of building covering repairs required to maintain roof and flashings in a watertight condition.

C. Watertightness/weathertighness Warranty for concealed fastener panel system: Provide manufacturer's written 20-years warranty for watertightness test.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Acceptable product shall be a comparable product with the basis-of-design product.

2.2 METAL ROOF PANEL

A. Product: The basis-of-design are "Cee-Lock" for non-structural panel and "Multi-rib R-Panel" for structural panel, both as manufactured by Berridge Manufacturing Co. Refer to drawings for specific application locations.

1. Acceptable Manufacturers:

    a. Berridge Manufacturing Co.
    b. MBCI
    c. Metal Sales Manufacturing Corporation.
    d. Pac-Clad Petersen Aluminum.

2. Characteristics:

    a. Cee-Lock: Standing seam panel, 1-1/2" high, 16-1/2" o.c. Snap-on seams shall contain an extruded vinyl weather seal insert as an integral part of the seam. Manufacturer's recommended roof slope of 1 on 12 or greater.
    b. R-Panel: 36-inches coverage structural panel with or without striation. Capable to span up to 5-feet o.c. without solid sheathing. Manufacturer's recommended roof slope of 3 on 12 or greater.

3. Material: Prefinished metal shall be Aluminum-Zinc Alloy Coated (AZ-55 Galvalume®) Steel Sheet, 24-Gauge, ASTM 792-08, Grade 40, yield strength 40 ksi min.
4. Finish: Kynar 500® fluoropolymer coating applied by the manufacturer on a continuous coil coating line, with a top side dry film thickness of 0.75 ± 0.05 mil over 0.20 ± 0.05 mil prime coat, to provide a total top side dry film thickness of 0.95 ± 0.10 mil. Bottom side shall be coated with a primer and beige urethane coating with a total dry film thickness of
   0.35 ± 0.05 mil. Finish shall conform to all tests for adhesion, flexibility, and longevity as specified by the Kynar 500® finish supplier
5. Color: As selected by the Architect from Manufacturer standard/premium colors.

B. Separation barrier: Provide materials approved by the Metal Roof Manufacturer.

1. Roof Underlayment Material: 30# roofing felt to be installed over decking.
2. High temperature Protection Self-adhering Roofing Underlayment to be installed on curved roof, low-slope roof and critical details as recommended by Metal Roof Manufacturer. Critical details included but not limited to valley, ridge and all flashing condition.

    a. Carlisle WIP 300HT (40 mil).
    b. Grace Ice and Water Shield (40 mil) or Grace Ultra (30 mil)
    c. Tamko Tile and Metal Underlayment (75 mil) or Tamko TW Underlayment (40 mil)

3. Sealant: Low-modulus Single Component Silicone: ASTM C 920, Type S, Grade NS, Class 100/50. Uses NT, M, G, A and O: single component, moisture curing, nonstaining, nonbleeding, color to match roof panel.

    a. Tremco Spectrum One.
    b. Dow 790.
    c. Pecora 890-NST

C. Accessories:

1. Flashings and accessories: Provided by the Metal Roof Manufacturer.

    a. Provide all caps, trims, copings, fascias, corner units, flashings, closures and clips.
    b. Provide manufacturer's standard ridge cap.
    c. Fabricate of the same material as that of the roofing panel. Finish to match panel.

2. Gutters and downspouts:

    a. Size and profiles as indicated on the Drawings.
    b. Refer to Section 076200 Sheet Metal Flashing and Trim for additional information.
    c. Finish: As indicated in drawings.

3. Static Roof Vent: Model 750-GS as manufactured by Lomanco.

    a. Size: 16-inches wide to fit between roof panel seams. Size to allow for not less than 40 sq.in. of net free area of ventilation.
    b. Material: Galvanized Steel.
    c. Finish: Prefinish to match roof panel color.

2.3 OTHER MATERIALS

A. All other materials, not specifically described but required for a complete and proper installation that is secure, shall be as selected by the Contractor subject to the approval of the Architect.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall be in accordance with the Contract Documents, the approved submittals and the manufacturer's instructions. Additionally conform to the standards set forth in the Architectural Sheet Metal Manual published by SMACNA, in order to achieve a watertight installation.

B. Fabricate and finish panels and accessories at the factory to greatest extent possible, by manufacturer's standard procedures and processes, as required to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and dimensional requirements and with structural requirements.

    1. Field cutting of panels by torch is not permitted.

3.2 PREPARATION

A. Inspect the roof deck to verify that the deck is clean and smooth, free of depressions, waves or projections, level to ± 1/4" in 20', and properly sloped to valleys and eaves.

B. Verify roof openings, curbs, pipes, sleeves, ducts or vents through roof are solidly set, cant strips and reglets in place, and nailing strips located.

C. Verify deck is dry and free of snow or ice. Verify that deck joints are solidly supported.

3.3 INSTALLATION

A. Install separation barriers prior to application of the metal roofing:

1. At critical areas (gutters, ridge, valley, hip, rake) cover the deck with ice/water shield.

2. Over the remaining roof deck, cover the entire deck area with a layer of felt. Overlap the felt onto the ice/water shield. Lap each ply 2" with the slope and nail with large flathead nails. Install felt horizontally, starting at eave to ridge with a 6" minimum overlap and 18" endlaps. Ensure that all nail heads are totally flush with the substrate. Nails shall be galvanized roofing nails with coated felt caps.

B. Install panels in such a manner that horizontal lines are true and level and vertical lines are plumb.

C. Install starter and edge trim before installing roof panels.

D. Remove protective strippable film prior to installation of roof panels.

E. Attach panels using manufacturer’s standard clips and fasteners, spaced in accordance with approved submittals.

F. Install sealants for preformed roofing panels as approved on submittals.

G. Do not allow panels or trim to come into contact with dissimilar materials.

H. Do not allow traffic on completed roof. If required, provide cushioned walk boards.

I. Protect installed roof panels and trim from damage caused by adjacent construction until completion of installation.

J. Remove and replace any panels or components which are damaged beyond successful repair.

3.4 CLEANING AND PROTECTION

A. Replace panels and other components of the work that have been damaged or have deteriorated beyond successful repair by means of finish touch-up or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films (if any) as soon as each panel is installed. Upon completion of panel installation, clean finished surfaces as recommended by panel manufacturer, and maintain in a clean condition during construction.

C. Clean any grease, finger marks or stains from the panels per manufacturer’s recommendations.

D. Remove all scrap and construction debris from the site.

END OF SECTION 074113

SECTION 074600 - MINERAL FIBER CEMENT BOARD

PART 1 - GENERAL

1.1 RELATED DOCUMENT

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. Scope: Provide all of the labor, materials, equipment, and services required to furnish and install the mineral fiber cement board siding, trim and soffit with moulding and accessories where shown on drawings or as specified herein.

B. This Section includes the following:

1. Fiber-cement vertical panel and trim for application over wall sheathing.
2. Fiber-cement soffit panel for exterior application.

C. Related Sections include the following:

1. Division 06 Section "General Carpentry".
2. Division 06 Section "Sheathing".
3. Division 07 Section “Thermal Insulation”.
4. Division 07 Section “Sheet Metal Flashing and Trim”.
5. Division 07 Section “Joint Sealant”.
6. Division 09 Section “Painting”.

1.3 SEQUENCING AND SCHEDULING

A. Sequence and coordinate completion of mineral fiber cement board assemblies with interfacing and adjoining work for proper sequence of installation.

1.4 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Installation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Manufacturer's best practice guide.
4. Technical data sheet.
5. Standard CAD drawings

B. Shop Drawings: Provide detailed drawings of atypical non-standard applications of cladding junctions and penetrations which are outside the scope of the standard details and specifications provided by the manufacturer.

C. Research/Evaluation Reports: Based on evaluation of comprehensive tests performed

by a qualified testing agency for non-asbestos fiber-cement products.

D. Three 4 inches x 6 inches pieces of each type, color, texture, and pattern of siding, trim and soffit including related accessories, through one source from a single manufacturer.

1.5 PERFORMANCE REQUIREMENTS

A. Fiber-Cement Siding:

1. Complies with ÅSTM C 1186 Type A Grade II as panel board, trim board, soffit and siding made from fiber-cement board that does not contain asbestos.
2. Complies with ASTM E 136 as a noncombustible material.
3. Complies with ASTM E 84 Class A
   a. Flame Spread Index = 0 – 25
   b. Smoke Developed Index = 0 - 450
4. Complies with ÅSTM E 119 1 hour and 2 hour fire resistive assemblies.
5. Tested to ASTM E330 for Transverse Loads.
6. To meet the following building code compliance National Evaluation Report NER405.

1.6 DELIVERY, STORAGE AND HANDLING

A. Panels and Trim shall be kept dry. Store it off the ground, lay flat on a smooth/level surface protected from dirt, moisture and direct sunlight, and covered with a waterproof cover that permits air circulation.

B. Protect edges and corners from chipping.

C. Follow any additional storage and product handling instructions as recommended by the manufacturer.

1.7 JOB CONDITION

A. Weather Limitations: Proceed with siding installation only if substrate is completely dry and if existing and forecasted weather conditions permit siding to be installed according to manufacturer's written instructions.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace siding that does not comply with requirements or that fails within specified warranty period. Failures include, but are not limited to, cracking, deforming, fading, or otherwise deteriorating beyond normal weathering.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

B. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Acceptable product shall be a comparable product with the basis-of-design product.

a. James Hardie Inc. (Basis-of-design).
b. CertainTeed Corporation.
c. Nichiha

2.2 PANEL BOARD / SIDING

A. Product

1. HardiePanel® Vertical Siding
2. Joint; Square Channel
3. Texture: Smooth
4. Thickness: 5/16”
5. Size: Field cut, as indicated in drawings.
6. Weight: 2.3 lbs./sq.ft.
7. Finish: field painted, follow manufacturer recommendation.
8. Batten Strips: As indicated on drawings.

2.3 TRIM BOARD

A. Product

1. HardieTrim® Board
2. Texture: Smooth
3. Thickness: As indicated in drawings.
4. Size: As indicated in drawings.
5. Finish: Field painted, follow manufacturer recommendation.

2.4 ACCESSORIES

A. Trims: Trims in the following profiles supplied by Panel Manufacturer. Reveal Trims confirm to a 6063 alloy in T-5 temper with a minimum thickness of 0.050 inch. All reveal trims are 12 feet in length.

1. Horizontal trim.
2. Vertical trim.
3. Outside corner trim.
4. Inside corner trim.
5. Panel joint batten strips
6. J channel trim.
7. Drip cap trim.

B. Flashing: Provide aluminum flashing complying with Division 7 Section "Sheet Metal Flashing and Trim" at window and door heads and where indicated.

1. Finish for Aluminum Flashing: Siliconized polyester coating, same color as siding.

C. Caulking:

1. Elastomeric Joint Sealant: Comply with ASTM C920, Grade NS, Class 25 or higher
2. Latex Joint Sealant: Comply with ASTM C834
3. Caulking mush be applied in accordance with the caulking/sealant manufacturer's written instructions or ASTM C1193

2.5 FASTENERS

A. Wood framing: 6d Galvanized siding nails (min. 0.093" shank x 0.222" head corrosion resistant siding nails). Must be of length to penetrate 1" into studs.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of siding. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrates of projections and substances detrimental to application.

3.3 INSTALLATION

A. General: For fastening requirements: comply with siding manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply. Center nails in elongated nailing slots without binding siding to allow for thermal movement. Overlap joints to shed water away from direction of prevailing wind. Installation of scrap pieces is not acceptable. Provide full panel, cut to fit as required.

B. Trim Board, Siding and Soffit

1. Flashing: Install metal drip cap or flashing before applying trim and soffit. Provide drip cap "Z" flashing at all base/bottom and top trim board.
2. Maintain clearance between trim and adjacent finish grade.
3. Trim inside corner with single board.
4. Install single board of outside corner board then align second corner board to outside edge of first corner board.
5. Allow 1/8 inch gap between trim and siding.
6. Provide batten strips at each panel joint. Seal gap with high quality, paintable caulk.
7. Shim frieze board as required to align with corner trim.
8. Install trim board over structural subfascia.

C. Fasteners

1. For Trim:

a. Fasten through trim into structural framing of code complying sheathing using manufacturer's recommended fastening equipment.
b. Fastener must penetrate minimum 3/4 inch or full thickness of sheathing. Additional fasteners may be required to ensure adequate security.
c. Position fasteners no closer than 3/4 inch and no further than 2 inches from side edge of trim board and no closer than 1 inch from end.
d. Fasten maximum 16 inch on center.
e. Do not fasten trim board on trim board.

2. For Siding:

a. Fasten through siding into structural framing of code complying sheathing using manufacturer's recommended fastening equipment.
b. Locate fasteners no closer than 3/8 inch from panel edges and no more that 2 inch from panel corners. At bottom edge, fasteners shall be placed no closer than 3/4 inch and no further than 1 inch from the plank bottom edge.
c. Face fasteners to sheathing.

D. Joints

1. Butt joints shall occur only at solid backup. Adjacent pieces shall just lightly touch at butt joints; do not force or spring siding into place. Stagger butt joints so that there are at least two solid courses of siding separating butt joints occurring on the same stud.
2. Cover ALL non-perimeter butt joints with a painted 1x2 wood trim.
3. Cover ALL "inboard" perimeter edge joints with a painted 2x2 wood trim.
4. Cover ALL "outboard" perimeter edge joints with a painted 1x2 wood trim
5. Seal ALL gap with high quality, paintable caulk.

E. Finishing

1. Finish unprimed siding with minimum one coat high quality, alkali-resistant priper and one coat of either 100% acrylic or latex or oil based, exterior grade topcoat or two coats high quality, alkali-resistant, 100% acrylic or latex, exterior grade topcoat within 90 days of installation. Follow paint manufacturer's written product recommendation and application instructions.
2. Finish sidings coated by the PrimePlus system with minimum one coat high quality, either 100% acrylic or latex or oil based exterior grade paint within 180 days of installation. Follow paint manufacturer's written product recommendation and application instructions.
3. Color: See division 09 "Painting" and "Exterior Finish Schedule" on Drawings.

3.4 ADJUSTING AND CLEANING

A. Remove damaged, improperly installed, or otherwise defective materials and replace

with new materials complying with specified requirements

B. Clean finished surfaces according to siding manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 074600

SECTION 076200 - SHEET METAL FLASHING AND TRIM

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. Scope: Provide all of the labor, materials, equipment and services required to furnish and install the sheet metal flashing and trim.

B. This Section includes the following:

1. Formed roof drainage system.
2. Formed low-slope roof flashing and trim.
3. Formed steep-slope roof flashing and trim.
4. Formed wall flashing and trim.
5. Formed equipment support flashing.
6. Formed overhead-piping safety pans.

C. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete”.
2. Division 04 Section "Architectural Concrete Masonry”.
3. Division 06 Section "General Carpentry”.
4. Division 07 Section “Mineral Fiber Cement Board”.
5. Division 07 Section “Metal Roof Panels”.
6. Division 07 Section "Roof Accessories”.
7. Division 07 Section "Joint Sealant".

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show layouts of sheet metal flashing and trim, including plans and elevations. Distinguish between shop- and field-assembled work. Include the following:

1. Identify material, thickness, weight, and finish for each item and location in Project.
2. Details for forming sheet metal flashing and trim, including profiles, shapes, seams, and dimensions.
3. Details for fastening, joining, supporting, and anchoring sheet metal flashing and trim, including fasteners, clips, cleats, and attachments to adjoining work.

4. Details of expansion-joint covers, including showing direction of expansion and contraction.

C. Samples for Initial Selection: For each type of sheet metal flashing and trim indicated with factory-applied color finishes.

1. Include similar Samples of trim and accessories involving color selection.

D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Sheet Metal Flashing: 12 inches (300 mm) long. Include fasteners, cleats, clips, closures, and other attachments.
2. Trim: 12 inches (300 mm) long. Include fasteners and other exposed accessories.
3. Accessories: Full-size Sample.

1.4 PERFORMANCE REQUIREMENTS

A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.

B. Fabricate and install roof edge flashing capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:

1. Wind Zone 3: For velocity pressures of 46 to 104 lbf/sq. ft. (2.20 to 4.98 kPa): 208lbf/sq. ft. (9.96-kPa) perimeter uplift force, 312-lbf/sq. ft. (14.94-kPa) corner uplift force, and 104- lbf/sq. ft. (4.98-kPa) outward force.

C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements. Base on engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

1.5 QUALITY ASSURANCE

A. Sheet Metal Flashing and Trim Standard: Comply with SMACNA's "Architectural Sheet Metal Manual." Conform to dimensions and profiles shown unless more stringent requirements are indicated.

B. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical roof eave, including built-in gutter, fascia, fascia trim, apron flashing, at location as part of the completed work when approved, including supporting construction cleats, seams, attachments, underlayment, and accessories.
2. Approval of mockups is for other material and construction qualities specifically approved by Architect in writing.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.
4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management Coordination."

1. Meet with Owner, Architect, Owner's insurer if applicable, Installer, and installers whose work interfaces with or affects sheet metal flashing and trim including installers of roofing materials, roof accessories, unit skylights, and roof-mounted equipment.
2. Review methods and procedures related to sheet metal flashing and trim.
3. Examine substrate conditions for compliance with requirements, including flatness and attachment to structural members.
4. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1.7 COORDINATION

A. Coordinate installation of sheet metal flashing and trim with interfacing and adjoining construction to provide a leakproof, secure, and noncorrosive installation.

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. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 SHEET METALS

A. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:

1. Factory Prime Coating: Where painting after installation is indicated, provide pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat; with a minimum dry film thickness of 0.2 mil (0.005 mm).
2. Siliconized-Polyester Coating: Epoxy primer and silicone-modified, polyester-enamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and 0.8 mil (0.02 mm) for topcoat.
    a. Color: As selected by Architect from manufacturer's full range.
3. Anodized Finish: Apply the following coil-anodized finish:
    a. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

B. Prepainted, Metallic-Coated Steel Sheet: Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process to comply with ASTM A 755.

1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653, G90 (Z275) coating designation; structural quality.
2. Aluminum-Zinc Alloy-Coated Steel Sheet: ASTM A 792, Class AZ50 coating designation, Grade 40 (Class AZM150 coating designation, Grade 275); structural quality.
3. Exposed Finishes: Apply the following coil coating:
    a. Factory Prime Coating: Where painting after installation is indicated, provide pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat; with a minimum dry film thickness of 0.2 mil (0.005 mm).
    b. Siliconized-Polyester Coating: Epoxy primer and silicone-modified,

polyesterenamel topcoat; with a dry film thickness of not less than 0.2 mil (0.005 mm) for primer and
0.8 mil (0.02 mm) for topcoat.

1) Color: As selected by Architect from manufacturer's full range.

C. Stainless-Steel Sheet: ASTM A 240, Type 304.

1. Finish: No. 3 (reflective, polished directional satin)

2.3 UNDERLAYMENT MATERIALS

A. Polyethylene Sheet: 6-mil- (0.15-mm-) thick polyethylene sheet complying with ASTM D 4397.

B. Felts: ASTM D 226, Type II (No. 30), asphalt-saturated organic felt, nonperforated.

C. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft. (0.16 kg/sq. m).

2.4 MISCELLANEOUS MATERIALS

A. General: Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation.

B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads.

1. Nails for Copper Sheet: Copper, hardware bronze, or Series 300 stainless steel, 0.109 inch (2.8 mm) minimum and not less than 7/8 inch (22 mm) long, barbed with large head.
2. Exposed Fasteners: Heads matching color of sheet metal by means of plastic caps or factory-applied coating.
3. Fasteners for Flashing and Trim: Blind fasteners or self-drilling screws, gasketed, with hex washer head.
4. Blind Fasteners: High-strength aluminum or stainless-steel rivets.
5. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.

C. Solder:

1. For Stainless Steel: ASTM B 32, Grade Sn60, with acid flux of type recommended by stainless-steel sheet manufacturer.
2. For Zinc-Tin Alloy-Coated Stainless Steel: ASTM B 32, 100 percent tin.
3. For Zinc: ASTM B 32, 60 percent lead and 40 percent tin with low antimony, as recommended by manufacturer.

D. Sealing Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealing tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape.

E. Elastomeric Sealant: ASTM C 920, elastomeric silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

F. Butyl Sealant: ASTM C 1311, single-component, solvent-release butyl rubber sealant, polyisobutylene plasticized, heavy bodied for hooked-type expansion joints with limited movement.

G. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.

H. Asphalt Roofing Cement: ASTM D 4586, asbestos free, of consistency required for application.

2.5 FABRICATION, GENERAL

A. General: Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated. Shop fabricate items where practicable. Obtain field measurements for accurate fit before shop fabrication.

B. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

C. Fabricate sheet metal flashing and trim without excessiveoil canning, buckling, and tool marks and true to line and levels indicated, with exposed edges folded back to form hems.

1. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
2. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flatlock seams. Tin edges to be seamed, form seams, and solder.

D. Sealed Joints: Form non-expansion but movable joints in metal to accommodate elastomeric sealant to comply with SMACNA recommendations.

E. Expansion Provisions: Where lapped or bayonet-type expansion provisions in the Work cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.

F. Conceal fasteners and expansion provisions where possible on exposed-to-view sheet metal flashing and trim, unless otherwise indicated.

G. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

1. Thickness: As recommended by SMACNA's "Architectural Sheet Metal Manual" for application but not less than thickness of metal being secured.

2.6 STEEP-SLOPE ROOF SHEET METAL FABRICATIONS

A. General: Refer to Division 07 for material provided by the Roof System Manufacturer. Provide prepainted Metallic-Coated Steel Sheet items not provided by the Roof System Manufacturer, includes but not limited to the followings:

1. Apron, Step, Cricket, and Backer Flashing.
2. Valley Flashing.
3. Drip Edges.
4. Eave, Rake, Ridge, and Hip Flashing.
5. Base Flashing.
6. Counterflashing.
7. Flashing Receivers.
8. Roof-Penetration Flashing.

2.7 WALL SHEET METAL FABRICATIONS

A. Through-Wall Flashing: Fabricate continuous flashings in minimum 96-inch- (2400-mm-) long, but not exceeding 12 foot (3.6 m) long, sections, under copings, at shelf angles, and where indicated. Fabricate discontinuous lintel, sill, and similar flashings to extend 6 inches (150 mm) beyond each side of wall openings. Form with 2-inch- (50-mm-) high end dams. Fabricate from the following material:

1. Prepainted Metallic-Coated Steel Sheet.

B. Openings Flashing in Frame Construction: Fabricate head, sill, and similar flashings to extend 4 inches (100 mm) beyond wall openings. Form head and sill flashing with 2-inch- (50-mm-) high end dams. Fabricate from the following material:

1. Prepainted Metallic-Coated Steel Sheet.

C. Through-Wall Ribbed Sheet Metal Flashing: Manufacture through-wall sheet metal flashing for embedment in masonry with ribs at 3-inch (75-mm) intervals along length of flashing to provide an integral mortar bond. [Manufacture through-wall flashing with snaplock receiver on exterior face to receive counterflashing.

1. Copper: 10 oz. (0.34 mm thick) minimum for fully concealed flashing; 16 oz. (0.55 mm thick) elsewhere.
   a. Available Products:
      1) Advanced Building Products Inc.; Cop-R-Loc Interlocking Flashing.
      2) Cheney Flashing Company, Inc.; Cheney Flashing (Dovetail).

3) Cheney Flashing Company, Inc.; Cheney Flashing (Sawtooth).
4) Dur-O-Wal, Dayton Superior Corporation; Polytite Copper Flashing.
5) Keystone Flashing Company, Inc.; Keystone Three-Way Interlocking Thruwall Flashing.
6) Sandell Manufacturing Company, Inc.;Three-Way Saw Tooth Flashing. 7) York Manufacturing, Inc.; Cop-R-Loc Interlocking Flashing.

2. Stainless Steel: 0.0156 inch (0.4 mm) thick.

a. Available Products:

1) Cheney Flashing Company, Inc.; Cheney Flashing (Dovetail).
2) Cheney Flashing Company, Inc.; Cheney Flashing (Sawtooth).
3) Keystone Flashing Company, Inc.; Keystone Three-Way Interlocking Thruwall Flashing.

D. Reglets: Units of type, material, and profile indicated, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory- mitered and -welded corners and junctions.

1. Available Manufacturers:

a. Cheney Flashing Company, Inc.
b. Fry Reglet Corporation.
c. Heckmann Building Products Inc.
d. Hickman, W. P. Company.
e. Keystone Flashing Company, Inc.
f. Sandell Manufacturing Company, Inc.

2. Material: Aluminum, 0.024 inch (0.6 mm) thick.
3. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
4. Stucco Type: Provide with upturned fastening flange and extension leg of length to match thickness of applied finish materials.
5. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.
6. Masonry Type: Provide with offset top flange for embedment in masonry mortar joint.
7. Flexible Flashing Retainer Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where Drawings show reglet without metal counterflashing.
8. Counterflashing Wind-Restraint Clips: Provide clips tobe installed before counterflashing to prevent wind uplift of counterflashing lower edge.

2.8 ROOF DRAINAGE SHEET METAL FABRICATIONS

A. Hanging Gutters: Fabricate to cross section indicated, complete with end pieces, outlet tubes, straps and other accessories as required. Fabricate in

minimum 96-inch- (2400-mm-) long sections. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness. Fabricate expansion joints, expansion-joint covers, and gutter accessories from same metal as gutters.

1. Gutter Profile: Style: A.
2. Gutter Size: 6” Wide x 6” Deep – Confirm with drawings
3. Expansion Joints: Lap type.
4. Gutters with Girth up to 15 Inches (380 mm): Fabricate from the following material:

    a. Aluminum: 0.0320 inch (0.8 mm) thick.

5. Gutters with Girth 16 to 20 Inches (410 to 510 mm): Fabricate from the following material:

    a. Aluminum: 0.040 inch (1.0 mm) thick.

B. Downspouts: Fabricate rectangular downspouts complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Downspout Profile: Rectangular
2. Downspout Size: 5” Wide x 4” Deep – Min. size - Confirm with drawings
3. Manufactured Hanger Style: Standard.
4. Fabricate downspouts from the following material:

    a. Aluminum: 0.024 inch (0.6 mm) thick.

2.9 FINISHES

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions and other conditions affecting performance of work.

1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. General: Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement. Use fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.

1. Torch cutting of sheet metal flashing and trim is not permitted.

B. Metal Protection: Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with bituminous coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

1. Coat side of uncoated aluminum sheet metal flashing and trim with bituminous coating where flashing and trim will contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing metal flashing directly on cementitious or wood substrates, install a course of felt underlayment and cover with a slip sheet or install a course of polyethylene underlayment.
3. Bed flanges in thick coat of asphalt roofing cement where required for waterproof performance.

C. Install exposed sheet metal flashing and trim without excessive oil canning, buckling, and tool marks.

D. Install sheet metal flashing and trim true to line and levels indicated. Provide uniform, neat seams with minimum exposure of solder, welds, and elastomeric sealant.

E. Install sheet metal flashing and trim to fit substrates and to result in watertight performance. Verify shapes and dimensions of surfaces to be covered before fabricating sheet metal.

1. Space cleats not more than 12 inches (300 mm) apart. Anchor each cleat with two fasteners. Bend tabs over fasteners.

F. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (600 mm) of corner or intersection. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with elastomeric sealant concealed within joints.

G. Fasteners: Use fasteners of sizes that will penetrate substrate not less than 1-1/4 inches (32 mm) for nails and not less than 3/4 inch (19 mm) for wood screws.

1. Galvanized or Prepainted, Metallic-Coated Steel: Use stainless-steel fasteners.
2. Aluminum: Use aluminum or stainless-steel fasteners.
3. Stainless Steel: Use stainless-steel fasteners.

H. Seal joints with elastomeric sealant as required for watertight construction.

1. Where sealant-filled joints are used, embed hooked flanges of joint members not less than 1 inch (25 mm) into sealant. Form joints to completely conceal sealant. When ambient temperature at time of installation is moderate, between 40 and 70 deg F (4 and 21 deg C), set joint members for 50 percent movement either way. Adjust setting proportionately for installation at higher ambient temperatures. Do not install sealant-type joints at temperatures below 40 deg F (4 deg C).
2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealant."

I. Soldered Joints: Clean surfaces to be soldered, removing oils and foreign matter. Pretin edges of sheets to be soldered to a width of 1-1/2 inches (38 mm) except where pretinned surface would show in finished Work.

1. Do not solder prepainted sheet.
2. Pretinning is not required for zinc-tin alloy-coated stainless steel.
3. Stainless-Steel Soldering: Pretin edges of uncoated sheets to be soldered using solder recommended for stainless steel and phosphoric acid flux. Promptly wash off acid flux residue from metal after soldering.
4. Do not use open-flame torches for soldering. Heat surfaces to receive solder and flow solder into joints. Fill joints completely. Completely remove flux and spatter from exposed surfaces.

J. Aluminum Flashing: Rivet or weld joints in uncoated aluminum where necessary for strength.

3.3 ROOF FLASHING INSTALLATION

A. General: Install sheet metal roof flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, set units true to line, and level as indicated. Install work with laps, joints, and seams that will be permanently watertight.

B. Roof Edge Flashing: Anchor to resist uplift and outward forces according to recommendations in FMG Loss Prevention Data Sheet 1-49 for specified wind zone and as indicated.

1. Interlock bottom edge of roof edge flashing with continuous cleats anchored to substrate at 24-inch (600-mm) centers.

C. Counterflashing: Coordinate installation of counterflashing with installation of base flashing. Insert counterflashing in reglets or receivers and fit tightly to base flashing. Extend counterflashing 4 inches (100 mm) over base flashing. Lap counterflashing joints a minimum of 4 inches (100 mm) and bed with elastomeric sealant.

1. Secure in a waterproof manner by means of interlocking folded seam or blind rivets and sealant.

D. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Install flashing as follows:

1. Turn lead flashing down inside vent piping, being careful not to block vent piping with flashing.
2. Seal with elastomeric sealant and clamp flashing to pipes penetrating roof except for lead flashing on vent piping.

3.4 WALL FLASHING INSTALLATION

A. General: Install sheet metal wall flashing to intercept and exclude penetrating moisture according to SMACNA recommendations and as indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

B. Through-Wall Flashing: Installation of formed through-wall flashing is specified in Division 04 Section "Architectural Concrete Masonry".

C. Reglets: Installation of reglets is specified in Division 03 Section "Cast-in-Place Concrete".

D. Openings Flashing in Frame Construction: Install continuous head, sill, and similar flashings to extend 4 inches (100 mm) beyond wall openings.

3.5 MISCELLANEOUS FLASHING INSTALLATION

A. Overhead-Piping Safety Pans: Suspend pans from pipe and install drain line to plumbing waste or drain line.

B. Equipment Support Flashing: Coordinate installation of equipment support flashing with installation of roofing and equipment. Weld or seal flashing with elastomeric sealant to equipment support member.

3.6 CLEANING AND PROTECTION

A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.

B. Clean and neutralize flux materials. Clean off excess solder and sealants.

C. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain in a clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 076200

SECTION 077200 - ROOF ACCESSORIES

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. Scope: Provide all of the labor, materials, equipment and services required to furnish and install the roof accessories.

B. This Section includes the following:

1. Attic Insulation Baffles.
2. Preformed flashing sleeves.

C. Related Sections include the following:

1. Division 06 Section "General Carpentry".
2. Division 07 Section "Metal Roof Panels".
3. Division 07 Section "Sheet Metal Flashing and Trim".

1.3 SUBMITTALS

A. Product Data: For each type of roof accessory indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

C. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.

D. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof- mounted items. Show the following:

1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.
3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
4. Required clearances.

E. Closeout Submittals:

1. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.
2. Roof hatch manufacturer shall provide the manufacturer's Warranty prior to the contract closeout.

1.4 PERFORMANCE REQUIREMENTS

A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.

1.5 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

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. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Acceptable product shall be a comparable product to the basis- of-design product.

2.2 ATTIC INSULATION BAFFLE

A. Basis-of-Design: Accuvent as manufactured by Berger, or an approved equal.

B. Description:

1. Material: Non-porous, 100% recycled PVC.
2. Size: 22 ½" wide, to fit between roof truss.
3. Air Flow: 25.3 sq.in.

C. Application: To maintain continuous attic ventilation, install in pair with attic intake vent system (brick vent, soffit vent etc.) as indicated in drawings.

2.3 PREFORMED FLASHING SLEEVES

A. Vent Stack Flashing: Metal flashing sleeve, uninsulated, with integral deck flange.

1. Metal: Aluminum sheet, 0.063 inch thick.

2. Height: As indicated on Drawings
3. Diameter: As indicated on Drawings
4. Anodized Finish: Apply the following coil-anodized finish:

    a. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install roof accessories according to manufacturer's written instructions.

1. Install roof accessories level, plumb, true to line and elevation, and without warping, jogs in alignment, excessive oil canning, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Roof-Hatch Installation:

1. Install roof hatch so top surface of hatch curb is level.
2. Verify that roof hatch operates properly. Clean, lubricate, and adjust operating mechanism and hardware.
3. Attach safety railing system to roof-hatch curb.
4. Attach ladder-assist post according to manufacturer's written instructions.

C. Seal joints with factory recommended sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and

repair galvanizing according to ASTM A 780.

B. Touch up factory-primed surfaces with compatible primer ready for field painting according to Section 09 "Painting".

C. Clean exposed surfaces according to manufacturer's written instructions.

D. Clean off excess sealants.

E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 077200

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SCOPE:

A. Provide all of the labor, materials, equipment, and services to furnish and install the penetration seals.

B. Work, in general, includes, but is not limited to, providing fire and smoke barrier penetration seals for openings in floors, walls, and other elements of construction.

1.2 QUALITY ASSURANCE:

A. Applicator qualifications: Two years' experience installing UL Classified fire stopping materials.

B. Performance: Materials shall have been tested to provide fire rating equal to that of the construction.

1.3 SUBMITTALS:

A. Prior to installation, submit to the Architect for his review the following:
1. Shop drawings showing each condition requiring penetration seals in dictating proposed UL systems materials, anchorage, methods of installation, and actual adjacent construction.
2. Copy of UL illustration of each proposed system indicating manufacturer approved modifications.
3. Manufacturer's data: Specifications, recommendations, installation instructions, and maintenance data for each type of material required. Include letter indicating that each material complies with the requirements and is recommended for the applications shown.
4. Qualifications statement: Past projects indicating required experience.

1.4 DELIVERY, STORAGE AND HANDLING:

A. Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, grade, and UL label where applicable.

B. Coordinate delivery with scheduled installation date to allow minimum storage time at site.

C. Store materials in clean, dry, ventilated location. Protect from soiling, abused, and moisture. Follow manufacturer's instructions.

1.5 PROJECT CONDITIONS:

A. Existing conditions:
1. Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
2. Proceed with installation only after penetrations of the substrate and

supporting brackets have been installed.

B. Environmental requirements:
1. Furnish adequate ventilation if using solvent.
2. Furnish forced air ventilation during installation if required by manufacturer.
3. Keep flammable materials away from sparks of flame.
4. Provide masking and drop cloths to prevent contamination of adjacent surfaces by fire stopping materials.

1.6 GUARANTEE:

A. Submit copies of written guarantee agreeing to repair or replace joint sealers which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, or general durability or appear to deteriorate in any other manner not clearly specified by submitted manufacturer's data as an inherent quality of the material for the exposure indicated. The guarantee period shall be one year from the Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Subject to compliance with requirements, provide products of one of the manufacturers approved by UL for the type of installation condition listed herein.

2.2 PRODUCTS:

A. Provide materials classified by UL to provide fire stopping equal to time rating of construction being penetrated.

B. Provide asbestos free materials that comply with applicable codes and have been tested under positive pressure in accordance with UL 1479 or ASTM E814.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Clean surfaces to be in contact with penetration seal materials, of dirt, grease, oil, loose materials, rust, or other substances that may affect proper fitting, adhesion, or the required fire resistance.

3.2 INSTALLATION:

A. Install penetration seal materials in accordance with printed instructions of the UL Fire Resistance Directory in accordance with manufacturer's instruction.

B. Seal holes or voids made by penetrations to ensure an effective smoke barrier.
C. Where floor openings without penetrating items are more than 4" in width and subject

to traffic or loading, install fire stopping materials capable of supporting same loading as floor.

D. Protect materials from damage on surfaces subject to traffic.

3.3 FIELD QUALITY CONTROL:

A. Examine penetration sealed areas to ensure proper installation before concealing or enclosing areas.

B. Keep areas of work accessible until inspection by applicable code authorities.

C. Perform under this section patching and repairing of fire stopping caused by cutting or penetration by other trades.

3.4 ADJUSTING AND CLEANING:

A. Clean up spills of liquid components.

B. Neatly cut and trim materials as required.

C. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

3.5 SYSTEMS AND APPLICATION SCHEDULE INCLUDES, BUT IS NOT LIMITED TO:

A. Metal pipe or conduit through round opening.

B. Insulated metal pipe through round opening.

C. Metal pipes or conduits through large opening.

D. Busway through rectangular opening.

E. Blank opening.

F. Non-metallic (plastic) pipe or conduit through opening.

G. Metal pipe or conduit through gypsum board wall.

H. Non-metallic (plastic) pipe or conduit through gypsum board wall.

END OF SECTION 078413

SECTION 079200 - JOINT SEALANT

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. Scope: Provide all of the labor, materials, equipment, and services required to furnish and install the sealant.

B. The purpose of sealant in this Work is to provide a positive barrier against penetration of air and moisture at joints between items where sealant is essential to continued integrity of the barrier.

C. This Section includes joint sealants for the following applications:

1. General: Apply sealant at all exposed to view and exposed to weather gaps.
2. Exterior joints in the following vertical surfaces and horizontal non-traffic surfaces:

    a. Construction joints in cast-in-place concrete.
    b. Joints between plant-precast architectural concrete units.
    c. Control and expansion joints in unit masonry.
    d. Joints in glass unit masonry assemblies.
    e. Joints between siding and soffit panel.
    f. Joints between trim board.
    g. Joints between different materials listed above.
    h. Perimeter joints between materials listed above and frames of doors, windows, and louvers.
    i. Control and expansion joints in, ceilings, and other overhead surfaces.
    j. All joints that produce gap.

3. Exterior joints in the following horizontal traffic surfaces:

    a. Isolation and contraction joints in cast-in-place concrete slabs.
    b. All joints that produce gap.

4. Interior joints in the following vertical surfaces and horizontal non-traffic surfaces:

    a. Control and expansion joints on exposed interior surfaces of exterior walls.
    b. Perimeter joints of exterior wall openings, apply on both interior and exterior side.
    c. Tile control and expansion joints.
    d. Perimeter joints between interior wall surfaces and frames of interior doors and windows
    e. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    f. Fire-resistive joint system

g. All joints that produce gap.

5. Interior joints in the following horizontal traffic surfaces:

a. Isolation joints in cast-in-place concrete slabs.
b. Control and expansion joints in tile flooring.
c. Other joints as indicated.

D. Related Sections include the following:

1. Division 04 Section “Glass Unit Masonry”.
2. Division 06 Section “Millwork”.
3. Division 07 Section “Sheet Metal Flashing and Trim”.
4. Division 08 Section “Hollow Metal Doors and Frames”.
5. Division 08 Section “Aluminum Windows”.
6. Division 09 Section “Painting”.
7. Division 22 Section “Plumbing Fixtures”.

1.3 SUBMITTALS

A. Prior to installation, submit to the Architect for review the following:

1. Complete and fully descriptive manufacturer's literature for each type of sealant used naming product formulation and giving product limitations.
2. Data proving the product meets or exceeds the Fed. Spec. referenced.
3. Physical sample of all colors for the Architect's selection.
4. Submit statements by the manufacturers and installers of their acceptance of these documents and conditions and/or any modification proposed to the use of the products. Include a statement from the manufacturer that the proposed use of the product for the conditions encountered is proper.
5. Submit warranty documents as stated under warranty of this section.

1.4 QUALITY ASSURANCE

A. Compatibility and adhesion testing: Submit to joint sealant manufacturers samples of materials that will contact or affect joint sealants for compatibility and adhesion testing as indicated below:

1. Use test methods standard with manufacturer to determine if priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

a. Perform tests under normal environmental conditions that will exist during actual installation.

2. Submit not less than 9 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 analysis of results to prevent delay in the progress of the Work.
4. Investigate materials failing compatibility or adhesion tests and obtain joint

sealant manufacturer's written recommendations for corrective measures, including use of specially formulated primers.

5. Testing will not be required when joint sealant manufacturer is able to submit joint preparation data required that are acceptable to Architect and are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

B. Product testing: Provide comprehensive test data for each type of joint sealant based on tests conducted by a qualified independent testing laboratory on current product formulations with in a 24 month period preceding date of Contractor's submittal of test results to Architect.

1. Test elastomeric sealants for compliance with requirements specified by reference to ASTM C920. Include test results for hardness, stain resistance, adhesion and cohesion under cyclic movement (per ASTM C719), low-temperature flexibility, modulus of elasticity at 100% strain, effects of heat aging, and effects of accelerated weathering.

C. Engage an experienced installer who has completed joint sealant applications similar in material, design, and extent required herein. His work shall have resulted in construction with a record of successful in-service performance and shall be able to show proof of successful similar projects completed over the past 7 years.

D. Obtain joint sealant materials from a single manufacturer for each different product required.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in original unopened containers or bundles with labels indicating manufacturer product name and designation, color, expiration period for use, pot life, curing time, and mixing instructions.

B. Store and handle materials in compliance with manufacturer's recommendations to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 JOB CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions.

1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealant manufacturer.
2. When joint substrates are wet.
3. Where joint widths are less than allowed by joint sealant manufacturer for application indicated.
4. Until contaminants capable of interfering with their adhesion are removed from joint substrates.

B. Note: Typical joint width shall be 3/8" unless otherwise advised by the joint manufacturer for the joint type involved or indicated differently on the Drawings.

1.7 WARRANTY

A. Submit the following documents at the accountability of the manufacturer and installer:

1. A guarantee warranting All defects of material and/or application for a period of five (5) years from Date of Substantial Completion. Any failure that may occur within this warranty period, due to defective application and/or materials shall, upon written notification of such failure, be repaired or replaced with proper materials and/or labor as approved by the Architect, at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 SEALANT - EXPANSION JOINTS, CONTROL JOINTS, AND PERIMETER OF DOOR AND WINDOW FRAMES

A. Product/manufacturer:

1. Dynatrol II as manufactured by Pecora Corp.
2. Dymeric as manfactured by Tremco.
3. Sonloastic NP2 as manufactured by Sonneborn
4. Or approved alternate.

B. Type: Two-part, non-sag, low-modulus polyurethane rubber sealant.

1. FS TT-S-00227E, Class A, Type II.
2. ASTM C-920, Type M, Grade NS, Class 25, use NT, MA, A, G, and O.

C. Joint Backing: Closed-cell polyethylene.

D. Where joint depth does not permit use of joint backing, a release paper or bond breaker shall be used.

E. On horizontal joints, surface must be cleaned and primed using primer as recommended by the sealant manufacturer.

F. In all cases at aluminum storefront, curtain wall and windows, ensure and verify that specified sealant is compatible with aluminum finish.

1. If not, notify the Architect immediately in order that a new product may be selected.
2. Submit the aluminum storefront, curtain wall and window manufacturer’s recommendation as to the type of product that should be substituted.

2.2 SEALANT - GENERAL PERIMETER SEALING AT TOILET FIXTURES, ACCESS DOORS, DOOR FRAMES, VANITIES, ETC. IN WET AREAS

A. Product/manufacturer:

1. 898 Sanitary Silicone Sealant as manufactured by Pecora Corp.
2. Tremsil 200 as manufactured by Tremco.
3. Or approved alternate.

B. Type: One-part, neutral-curing silicone.

1. FS TT-S-001543A.
2. FS TT-S-00230C, Class A.
3. ASTM C920, Class 25.

C. Install after completion of all painting.

2.3 SETTING THRESHOLDS; FLASHING; AND GENERAL SEALING NOT OTHERWISE DELEGATED

A. Product/manufacturer:

1. AC-20 + Silicone as manufactured by Pecora Corp.
2. Tremflex 834 as manufactured by Tremco.
3. Sonolastic Sonolac as manufactured by Sonneborn.
4. Or approved alternate.

B. Type: Siliconized one-part, non-sag, acrylic latex caulk.

1. ASTM C-834.

C. Joint Backing: Round closed-cell polyethylene.

2.4 FIRE-RESISTIVE JOINT SYSTEM

A. Designation System for Joints in or between Fire-Resistance-Rated Constructions: Alphanumeric systems listed in UL's "Fire Resistance Directory" under Product Category XHBN.

B. Designation System for Joints at the Intersection of Fire-Resistance-Rated Floor or Floor/Ceiling Assembly: Alphanumeric systems listed in UL's "Fire Resistance Directory" under Product Category XHDG.

2.5 PRIMERS

A. As recommended by the sealant manufacturer for use in conjunction with the sealant for application onto the various types of materials to which the sealant applied, and complying with the requirements above. When the manufacturer's instructions make reference to use of primers and/or the construction condition requires special surface preparation, these instructions shall be complied with.

2.6 CLEANERS:

A. Where required by manufacturer's instructions in lieu of primers, shall be of the type and kind recommended by the sealant manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION:

A. Surface cleaning of joints: Clean out joints immediately before installing joint sealants to comply with recommendations of joint sealant manufacturer and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings, tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean concrete, masonry, unglazed surfaces of ceramic tile, similar porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.
3. Remove laitance and form release agents from concrete and masonry.
4. Clean metal, glass, porcelain enamel, glazed surfaces of ceramic tile, and other non- porous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.

B. Prime joint substrates where indicated and also where recommended by joint sealant manufacturer based on preconstruction joint sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's recommendations. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 CHOICE OF CAULKING MATERIAL:

A. Use only that caulking material which is best suited to the installation and is so recommended by the caulking material manufacturer.

3.3 BACK-UP MATERIALS:

A. Verify the compatibility of filler material with caulking before installation.

B. Use filler about 1/3 to ½ wider than width of joint so sufficient pressure is exerted by filler to provide substantial resistance to displacement.

C. All filler materials shall be non-oily, non-staining, back-up filler such as polyethylene foam rod, expanded polyurethane, neoprene or other filler completely compatible with the caulking material.

3.4 APPLICATION OF CAULKING:

A. Do not caulk under weather conditions or sun conditions potentially harmful to the set and curing of the caulking material.

B. Deliver materials to the job or place of application in original unopened containers bearing manufacturer's name and product designation.

C. Install caulking in strict accordance with the manufacturer's recommendations, taking care to produce beads of proper width and depth, to tool as recommended by the manufacturer, and to immediately remove all surplus caulking.

3.5 CAULKING SCHEDULE:

A. Carefully study the Drawings and furnish and install the proper caulking at each point where called for on the Drawings plus at all other points, whether specifically designated or not, where caulking is essential in maintaining the continued integrity of the intended watertight barrier.

END OF SECTION 079200

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

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. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Louvers installed in hollow metal doors.
4. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
2. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
3. Division 08 Section "Door Hardware".
4. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.

11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of anchorages, joints, field splices, and connections.
6. Details of accessories.
7. Details of moldings, removable stops, and glazing.
8. Details of conduit and preparations for power, signal, and control systems.

D. Samples for Verification:

1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40” above sill) or UL 10C.

1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
3. Smoke Control Door Assemblies: Comply with NFPA 105.

    a. Smoke "S" Label: Doors to bear “S” label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.

E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:

1. CECO Door Products (C).
2. Curries Company (CU).
3. Steelcraft (S).

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

B. Exterior Doors (Energy Efficient): Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, ANSI/SDI A250.4 for physical performance level, and HMMA 867 for door construction.

1. Design: Flush panel.
2. Core Construction: Foamed in place polyurethane and steel stiffened laminated core with no stiffener face welds, in compliance with HMMA 867 “Laminated Core”.

a. Provide 22 gauge steel stiffeners at 6 inches on-center internally welded at 5" on-center to integral core assembly, foamed in place polyurethane core chemically bonded to all interior surfaces. No stiffener face welding is permitted.

b. Thermal properties to rate at a fully operable minimum U-Factor 0.29 and R-Value 3.4, including insulated door, thermal-break frame and threshold.
c. Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.36 and R-Value 2.7, including insulated door, kerf type frame, and threshold.

3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053 inch - 1.3-mm) thick steel, Model 2.
4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

C. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Manufacturer's standard polyurethane. Where indicated, provide doors fabricated as thermal-rated assemblies with a minimum R-value of 3.2 or better.
3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
4. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
5. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
6. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Interior Doors (Energy Efficient): Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A366 or 620. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Steel stiffened laminated core with fiberglass filler with no stiffener face welds, in compliance with HMMA 867 “Laminated Core”.

a. Provide 22 gauge steel-stiffeners at 6 inches on-center internally welded at 5" on-center to integral core assembly, No stiffener face welding is permitted.
b. Acoustical sound transmission rating shall be no less than STC 38 complying with ASTM E 90 and must be visible on factory applied labels.

3. Level/Model: Level 2 and Physical Performance Level A (Heavy Duty), Minimum 18 gauge (0.042 inch - 1.1-mm) thick steel, Model 2.
4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.

    a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.

2. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), minimum 16 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
3. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
4. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
5. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

F. Manufacturers Basis of Design:

1. Curries Company (CU) - Energy Efficient - 777 Trio-E Series.

2.4 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
3. Manufacturers Basis of Design:

    a. Curries Company (CU) – M Series.

C. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
3. Manufacturers Basis of Design:

a. Curries Company (CU) - M Series.

D. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

E. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator’s shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for

use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.7 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.8 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

    a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

3. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
5. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.

6. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
7. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
8. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

    b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
        5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
9. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
10. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.9 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.

4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

END OF SECTION 081113

SECTION 082200 - FIBERGLASS REINFORCED POLYMER (FRP) DOORS AND FIBERGLASS RESIN TRANSFER MOLDED DOOR FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section Includes the following:
   1. Fiberglass Reinforced Polymer (FRP) Doors
   2. Fiberglass Resin Transfer Molded Door Frames

1.2 RELATED SECTIONS

A. Related Sections include the following:
   1. Division 0 - Bidding and Contract Requirements
   2. Division 1 - General Requirements
   3. Division 8 - Finish Hardware
   4. Division 8 – Glazing

1.3 QUALITY ASSURANCE

A. Referenced Standards:

   1. ASTM D 635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position

   2. ASTM E 84 - Standard Test Method for a Surface Burning Characteristics of Building Materials.

   3. Laminate Properties
      a) ASTM D 882 Tensile Strength
      b) ASTM D 790 Flexural Strength
      c) ASTM D 2583 Barcol Hardness
      d) ASTM D 256 Impact Resistance
      e) ASTM D 792 Density/Specific Gravity Of Laminate
      f) ASTM D 1761 Mechanical Fasteners

   4. Core Properties
      a) ASTM C 177 Thermal Properties
      b) ASTM D 1622 Density/Specific Gravity
      c) ASTM E 84 Surface Burning Characteristics
      d) WDMA TM-10 and TM-5 Firestop ASTM E 152 U.L. 10(b)

B. Qualifications
   1. Manufacturer Qualifications: A company specialized in the manufacture of fiberglass reinforced polymer (FRP) doors and frames as specified herein with a minimum of 25 years documented experience and with a record of successful in-service performance for the applications as required for this project.
   2. Installer Qualifications: An experienced installer who has completed fiberglass door and frame installations similar in material, design, and extent to those indicated and whose work has resulted in construction with a record of successful in-service performance.
   3. Source Limitations: Obtain fiberglass reinforced plastic doors and frames through one source fabricated from a single manufacturer, including fire rated fiberglass frames.
   4. Source Limitations: Hardware and accessories for all FRP doors as specified in Section 08710 should be provided and installed by the fiberglass door and frame manufacturer.
   5. Source Limitations: Glass for windows in doors shall be furnished and installed by door and frame manufacturer in accordance with related section, Division 8, Glazing.

1.4 SUBMITTALS

A. Product Technical Data Including:
   1. Acknowledgment that products submitted meet requirements of standards referenced
   2. Manufacturer shall provide certificate of compliance with current local and federal regulations as it applies to the manufacturing process.
   3. Manufacturer's installation instructions.
   4. Schedule of doors and frames indicating the specific reference numbers as used on drawings, door type, frame type, size, handing and applicable hardware.
   5. Details of core and edge construction. Include factory-construction specifications.
   6. Certification of manufacturer's qualifications.

B. Submittal Drawings for Customer Approval Shall Be Submitted Prior To Manufacture. Include The Following Information And Formatting.
   1. Summary door schedule indicating the specific reference numbers as used on owner’s drawings, with columns noting door type, frame type, size, handing, accessories and hardware.
   2. A drawing depicting front and rear door elevations showing hardware with bill of material for each door.
   3. Drawing showing dimensional location of each hardware item and size of each door.
   4. Individual part drawing and specifications for each hardware item and FRP part or product.
   5. Construction and mounting detail for each frame type.

C. Samples:
   1. Provide one 21 x 18 inch completely assembled (hinged) door and frame corner section, with faces and edges representing typical color and finish. One edge should be exposed for view of interior door and frame composition. Sample should include 6 inch lite opening as well as standard cutouts for hinges and strike plates.

D. Operation and Maintenance Manuals:
   1. Include recommended methods and frequency for maintaining optimum condition of fiberglass doors and frames under anticipated traffic and use conditions.
   2. Include one set of final as built drawings with the same requirements as mentioned in Section B above.
   3. Include certificate of warranty for door and frame listing specific door registration numbers.
   4. Include hardware data sheets and hardware manufacturer's warranties.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Each door and frame should be delivered individually crated for protection from damage in cardboard containers, clearly marked with project information, door location, specific reference number as shown on drawings, and shipping information. Each crate should contain all fasteners necessary for installation as well as complete installation instructions.
B. Doors should be stored in the original container out of inclement weather for protection against the elements.
C. Handle doors pursuant to the manufacturer's recommendations as posted on outside of crate.

1.6 WARRANTY

A. Warranty all fiberglass doors and frames for a period of 25 years against failure due to corrosion. Additionally, warranty all fiberglass doors and frames on materials and workmanship for a period of 10 years, including warp, separation or delamination, and expansion of the core.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Chem-Pruf Door Co.
2. Tiger Door
3. Corrim

4. or an approved equal.

2.2 FRP DOORS

A. Doors shall be made of fiberglass reinforced polymer (FRP) using chemically proven resins resistant to contaminants typically found in the environment for which these specifications are written. Doors shall be 1 3/4 inch thick and of flush construction, having no seams or cracks. All doors up to 4'0 x 8'0 shall have equal diagonal measurements with a maxi- mum tolerance of +/- 1/32 inch.

B. Door Plates shall be 1/8 inch thick, molded in one continuous piece, starting with a 25 mil gelcoat of the color specified, integrally molded with at least two layers of 1.5 ounce per square foot fiberglass mat and one layer of 16 ounce per square yard unidirectional rov- ing. This will yield a plate weight of 0.97 lbs per square foot at a ratio of 30/70 glass to res- in.

C. Stiles and Rails shall be constructed starting from the outside toward the inside, of a 25 mil gel coat of the color specified followed by a matrix of at least three layers of 1.5 ounce per square foot of fiberglass mat. The stile and rail shall be molded in one continuous piece to a U-shaped configuration and to the exact dimensions of the door. In this manner there will be no miter joints or disparate materials used to form the once-piece stile and rail.

D. Core material shall be 2 psf expanded polyurethane foam, which completely fills all voids between the door plates.

E. Internal Reinforcement shall be firestop of sufficient amount to adequately support re- quired hardware and function of same.

F. Finish of door and frame shall be identical in color and texture. At time of manufacture, 25 mil of resin-rich gelcoat must be integrally molded into both the door and frame. Secondary painting to achieve color is not acceptable.

G. Window openings shall be provided for at time of manufacture and shall be completely sealed so that the interior of the door is not exposed to the environment. Fiberglass retainers which hold the glazing in place shall be resin transfer molded with a profile that drains away from glazing. The retainers must match the color, texture and finish of the door plates. Glass shall be furnished and installed by door and frame manufacturer.

H. Louver openings shall be sealed in the same manner as the window openings. Louvers are to be solid fiberglass inverted "V" vanes and shall match the color, texture and finish of the door plates.

I. Transoms shall be identical to the doors in construction, materials, thickness and reinforcement.

2.3 FRAMES

A. Frames shall be heavy duty fiberglass and manufactured using the resin transfer method in closed rigid molds to assure uniformity in color and size. Beginning with a minimum 25 mil gel coat and a minimum of two layers continuous strand fiberglass mat saturated with resin, the frame will be of one-piece construction

with molded stop. All frame profiles up to 3/4" will be solid fiberglass. All frame profiles greater than 3/4" shall have a core material of 2 psf polyurethane foam. Metal frames or pultruded fiberglass frames will not be accepted.

B. Finish of frame shall be identical in color and texture to the door. 25 mil resin rich gel coat will be integrally molded into the frame at time of manufacture. Secondary painting to achieve color is not acceptable.
C. Jamb/Header connection shall be coped by CNC for tight fit.
D. Internal Reinforcement shall be continuous within the structure to allow for mounting of specified hardware. Material shall be completely non-organic with a minimum hinge screw holding value of 656 lbs. Frame screw holding value to accommodate screw shall be minimum of 1,000 lbs per screw. Documented strength of frame screw holding value after third insert must be submitted. Dissimilar materials, such as steel, will be deemed unacceptable as reinforcement for hardware attachment.
E. Mortises for hardware shall be accurately machined by CNC to hold dimensions to +/- 0.010 inch in all three axis.
F. Hinge pockets shall be accurately machined by CNC to facilitate heavy duty hinges at all hinge locations, using spacers when standard weight hinges are used.

2.4 HARDWARE

A. See division 08 Section “Finish Hardware”.
B. Due to the special nature of the material in this section, all related hardware as specified must be furnished and installed by the door and frame manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION CONDITIONS

A. Verification of Conditions
   1. Openings are correctly prepared to receive doors and frames.
   2. Openings are correct size and depth in accordance with shop drawings or submittals.
B. Installer’s Examination
   1. Have the installer examine conditions under which construction activities of this section are to be performed and submit a written report if conditions are unacceptable.
   2. Transmit two copies of the installer’s report to the architect within 24 hours of receipt.
   3. Beginning construction activities of this section before unacceptable conditions have been corrected is prohibited.

3.2 INSTALLATION

A. Install door-opening assemblies in accordance with shop drawings and manufacturer’s printed installation instructions, using installation methods and materials specified in installation instructions.
B. Field alteration of doors or frames to accommodate field conditions is strictly prohibited.
C. Site tolerances: Maintain plumb and level tolerance specified in manufacturer’s printed installation instructions.
D. Fire labeled doors and frames must be installed in strict accordance with

manufacturer's instructions and the latest revision of NFPA 80.

3.3 ADJUSTING

A. Adjust doors in accordance with door manufacturer's maintenance instructions to swing open and shut without binding and to remain in place at any angle without being moved by gravitational influence.
B. Adjust door hardware to operate correctly in accordance with hardware manufacturer's maintenance instructions.

3.4 CLEANING

A. Clean surfaces of door opening assemblies and exposed door hardware in accordance with respective manufacturer's maintenance instructions.

3.5 PROTECTION OF INSTALLED PRODUCTS

A. Protect door opening assemblies and door hardware from damage by subsequent construction activities until final inspection.

END OF SECTION 082200

SECTION 083113 - ACCESS DOORS AND FRAMES

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. Scope: Provide all of the labor, materials, equipment and services required to furnish and install the access doors and frames.

B. This Section includes the following:

1. Access Doors and Frames for walls and ceilings.

C. Related Sections include the following:

1. Division 08 Section "Door Hardware".
2. Division 09 Section "Painting".

1.3 SUBMITTALS

A. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.

1.4 QUALITY ASSURANCE

A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 that are identical to access door and frame assemblies tested for fire-test-response characteristics per the following test method and that are listed and labeled by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated. Units must fit between ceiling truss spacing.

1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access doors needed to gain

access to concealed plumbing, mechanical, or other concealed work, and indicate in the schedule specified in "Submittals" Article.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Source Limitations: Obtain access door(s) and frame(s) through one source from a single manufacturer.

B. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Acceptable product shall be a comparable product to the basis- of-design product.

2.2 ACCESS DOOR AND PANEL

A. General: Provide insulated access panel doors to allow for “personnel” access above the ceiling, provide a unit 22” x 36” to allow for clearance between the roof truss layout.

B. Provide 12” x 12” for hand holes

C. Product /Manufacturer: The basis-of-design is model FD as manufactured by J.L. Industries, Inc.

1. Other acceptable manufacturers:

a. J.L. Industries, Inc. (basis-of-design)
b. Kees.
c. Nystrom.
d. Babcock-Davis.
e. Bilco.
f. Karp Associates.

D. Description:

1. Frame and trim: 16 ga. steel with 1 in. paintable flange.
2. Door: 2-inch thick, 20 ga. steel, insulated. See drawings for door swings.
3. Finish: factory primed, field painted.
4. Lock: Mortise cylinder, keyed to remainder of building (master key).
5. Hardware: heavy duty counter-balanced motive power spring, flush mounted slot latch, continuous hinge.
6. Rating: varies, as indicated in drawings per ceiling assembly rating.

2.3 STEEL MATERIALS:

A. Steel Sheet: electrolytic zinc-coated, ASTM A 591/A 591M with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.

B. Steel Finishes: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Surface Preparation for Steel Sheet: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, or other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning," or SSPC-SP 8, "Pickling."
2. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.
3. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

2.4 FABRICATION

A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.

B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

1. Exposed Flanges: Nominal 1 to 1-1/2 inches wide around perimeter of frame.
2. Provide mounting holes in frames for attachment of units to metal or wood framing.

D. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.

1. For cylinder lock, furnish two keys per lock and key all locks alike.

E. Extruded Aluminum: After fabrication, apply manufacturer's standard protective coating on aluminum that will come in contact with concrete.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware after installation for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 083323 - OVERHEAD COILING DOORS

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. Scope: Provide all of the labor, materials, equipment and services to furnish and install the coiling and sectional doors.

B. This Section includes the following:

1. Upward Coiling Counter Shutter
2. Overhead Coiling Service Door
3. Steel Sectional Door

C. Related Sections include the following:

1. Division 08 Section “Door Hardware”.

1.3 SUBMITTALS

A. Prior to installation, submit to the Architect for review the following:

1. Complete manufacturer's literature.
2. Shop and erection drawings indicating the following:

a. Dimensions
b. Door operation
c. Gauges
d. Materials
e. Finishes
f. Hardware

B. Submit operation and maintenance manual in accordance with the requirements of Division 00 Section “Operation and Maintenance Data”.

C. All documentation relating to Product Warranties.

1.4 QUALITY ASSURANCE

A. Installation shall be by an authorized door manufacturer's authorized representative with a minimum of five years experience in the fabrication and installation of sectional doors.

B. Single-Source Responsibility: Provide doors, tracks, motors, and accessories from one manufacturer of primary components.

1.5 WARRANTY

A. 15-months Manufacturer's limited warranty for service door

B. 24-months Manufacturer's limited warranty for counter shutter

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Acceptable product shall be a comparable product to the basis- of-design product.

a. Overhead Door Corporation (basis-of-design).
b. Cornell.
c. Alpine Overhead Doors.
d. Wayne-Dalton.

2.2 UPWARD COILING COUNTER SHUTTER

A. Product/Manufacturer: The basis-of-design is Series 652 as manufactured by Overhead Door Corporation.

B. Description:

1. Curtain: Interlocking slats, Type F-158 fabricated of aluminum. Endlocks shall be attached to alternate slats to maintain curtain alignment and prevent lateral slat movement.
2. Material: Extruded aluminum.
3. Finish: Clear anodized.
4. Bottom bar: Aluminum extrusion with bottom astragal.
5. Guides: Extruded aluminum shapes with clear anodized finish with continuous silicone- treated woolpile strips.
6. Brackets: Steel to support counterbalance, curtain and hood.
7. Counterbalance: Helical torsion spring type housed in a steel tube or pipe
8. Hood: Aluminum. Provide intermediate support brackets as required.
9. Operation: Manual, push-up.
10. Lock: Slide bolt each end – coordinate lock location with service counter window Intent is to lock shutter with thumb turn from inside thru window without cylinder lock.
11. Mounting: Between the jambs.

2.3 OVERHEAD UPWARD COILING SECURITY GRILLE DOOR

A. Product/Manufacturer: The basis-of-design is Model 670 Upward Coiling Security Grille Door by Overhead Door Corporation.

B. Description:

1. Material / Finish: Aluminum, mill finish.
2. Pattern: Straight lattice (standard).
3. Bottom Bar: Extruded aluminum, mill finish.
4. Guides: Guide channels are extruded aluminum: mill finish.
5. Mounting: Between jamb.
6. Brackets: Steel with black powdercoat finish.
7. Pipe: Steel, sized for maximum deflection of .03” per liner foot.
8. Springs: Oil tempered, 20,000 cycle, torsion springs.
9. Locking: None.
10. Warranty: 12 months limited.
11. Operation: RSX standard duty commercial operator with key switch activation.
12. Hood: Mill finished.

PART 3 - EXECUTION

3.1 FABRICATION

A. Fabricate counter shutter in strict accordance with the approved Shop Drawings.

3.2 INSTALLATION

A. Install counter shutter in strict accordance with the original design, all pertinent codes and regulations, the approved shop drawings, and the manufacturer's recommendations, anchoring all components firmly in place for long life under hard use.

3.3 INSTRUCTIONS

A. Upon completion of the installation, and as a condition of its acceptance, instruct the Owner's maintenance and operation personnel with the operation and maintenance of the counter shutter.

END OF SECTION 083323

SECTION 085113 - ALUMINUM WINDOWS

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. Scope: Provide all of the labor, materials, equipment, and services required to furnish and install the aluminum windows.

B. This Section includes the following:

1. Horizontal sliding service window (pass-through window).
2. Single hung window, exterior and interior.
3. Fixed window, exterior.

C. Related Sections include the following:

1. Division 07 Section “Joint Sealant”.
2. Division 08 Section “Glazing”.
3. See Electrical for connections to accessories. (As required)

1.3 SUBMITTALS

A. Prior to installation, submit to the Architect for review the following:

1. Complete and fully descriptive manufacturer's literature.
2. Shop drawings showing the following:

a. A description of all materials, sizes, gauges, and dimensions.
b. Size of all openings.
c. Method of fabrication and assembly.
d. Method of joining.
e. Method of attachment to adjacent construction.
f. Location of sealant.
g. Location of flashing.
h. Method of glazing.

3. Physical sample: aluminum sheet for color selection to include Manufacturer’s full range finishes as specified in paragraph 2 of this section.
4. Certified Test Reports: With product data, submit copies of certified test reports showing compliance with specified performance values, including R-values, fire performance and sound abatement characteristics.

1.4 QUALITY ASSURANCE

A. Engage an experienced installer who has completed installation of windows similar in design and extent to those required for the project and whose work has resulted in construction with a record of successful in-service performance.

B. Single-source responsibility: Provide window units from one source and produced by a single manufacturer.

C. U-value certification: All exterior doors and windows shall be labeled by the manufacturer to certify compliance with the requirements of fenestration rating council per NFCR 100-91:

1. Non-operable window U-value: 0.60 or less.
2. Operable window U-value: 0.65 or less.
3. Entrance door U-value: 0.90 or less.

1.5 DELIVERY, STORAGE, AND HANDLING

A. All materials shall be protected at all times from damage and defacement of any kind including breakage, scratches, dents, stains and deformation. Damaged material shall not be incorporated in the Work and any work or material damaged after installation shall be repaired to the satisfaction of the Owner or shall be replaced.

1.6 JOB CONDITIONS

A. Field measurements: Check actual openings by accurate filed measurement before fabrication. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay of work.

1.7 WARRANTY

A. Total Window System

1. The responsible contractor shall assume full responsibility and warrant for one year the satisfactory performance of the total window installation which includes that of the windows, hardware, glass (including insulated units), glazing, anchorage and setting system, sealing, flashing, etc., as it relates to air, water, and structural adequacy as called for in the specifications and approved shop drawings.
2. Any deficiencies due to such elements not meeting the specifications shall be corrected by the responsible contractor at their expense during the warranty period.

B. Material and Workmanship

1. Per AAMA standard 601, provide written guarantee against defects in material and workmanship. Include Anodic finish in material and workmanship warranty.
2. Warranty period shall be for 5 years from the date of final shipment.

C. Glazing: refer to Division 08 Section “Glazing”.

D. Organic finish: Provide organic finish and warranty based on AAMA standard 2605.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 SINGLE HUNG ALUMINUM WINDOWS – FIXED

A. Product/manufacturer: Basis-of-Design is NX-300 Series thermal window Fixed Window. Acceptable product shall be a comparable product to the basis-of-design product. Other acceptable Manufacturers are as follows:

a. Kawneer. (basis-of-design).
b. YKK AP America.
c. CRL US Aluminum.
d. Wausau.

B. Materials:

1. Extrusions: Aluminum alloy 6063-T6 alloy and temper (ASTM B 221).
2. Aluminum sheet: ASTM B 209, 5005-H34 aluminum alloy, 0.050-inch.
3. Thermal Barrier:

a. All exterior aluminum shall be separated from interior aluminum by a rigid, structural thermal barrier. For purposes of this specification, a structural thermal barrier is defined as a system that shall transfer shear during bending and; therefore, promote composite action between the exterior and interior extrusions.
b. The thermal barrier shall be 2 thermal struts, consisting of glass reinforced polyamide nylon, mechanical crimped in raceways extruded in the exterior and interior extrusions.
c. Poured and debridged urethane thermal barriers shall not be permitted.

C. Test Procedures and Performances

1. Windows shall conform to all AAMA/WDMA/CSA 101/I.S.2/A440-05 requirements for the window type referenced in 1.01.B. In addition, the following specific performance requirements shall be met.
2. Air Infiltration Test

a. Test unit in accordance with ASTM E 283 at a static air pressure difference of 6.24 psf (299 Pa).
b. Air infiltration shall not exceed 0.3 cfm/SF. Basis-of-Design product has air

infiltration rate not exceeding 0.06 cfm/SF (.30 l/s•m²) of unit.

3. Water Resistance Test

   a. Test unit in accordance with ASTM E 331/ASTM E 547 at a static air pressure difference of 15.0 psf (718 Pa).
   b. There shall be no uncontrolled water leakage.

4. Uniform Load Structural Test

   a. Test unit in accordance with ASTM E 330 at a static air pressure difference of 112.5 psf (5386 Pa), both positive and negative.
   b. At conclusion of test there shall be no glass breakage or permanent damage.

5. Condensation Resistance Test (CRF)

   a. Test unit in accordance with AAMA 1503.1.
   b. Condensation Resistance Factor (CRF) shall not be less than 62 (frame) and 54 (glass) when glazed with 1-inch (25 mm) insulated – 1/4-inch (6 mm) clear, 1/2-inch (12 mm) air, 1/4-inch (6 mm) clear glass.

6. Thermal Transmittance Test (Conductive U-Value)

   a. Test unit in accordance with AAMA 1503.1.
   b. Conductive thermal transmittance (U-Value) shall not be more than 0.54 BTU/hr•ft^2•°F (3.06 W/m²•K) when glazed with 1-inch (25 mm) insulated – 1/4-inch (6 mm) clear, 1/2-inch (12 mm) air, 1/4-inch (6 mm) clear glass.

D. Accessories:

1. Fasteners: Zinc plated steel concealed fasteners; hardened aluminum alloys or AISI 300 series stainless steel exposed fasteners, countersunk, finish to match aluminum color.
2. Gaskets: Marine type wrap around gaskets. EPDM in accordance with ASTM C864. Color: Black
3. Sill pan:

   a. Aluminum sheet 5050 alloy with finish to match storefront/curtainwall.
   b. Break and fabricate shapes before finishing.
   c. Thickness: .073-inch.

E. Fasteners: Stainless steel screws of proper size for the application.

F. Glazing: 1-inch insulated tempered/safety glass for exterior application and 1/4-inch plate glass for interior application as specified in division 08 Section “Glazing”.

G. Fabrication:

1. General

   a. All aluminum frame extrusions shall have a minimum wall thickness of .062-

inch (1.5 mm).
b. Depth of frame shall not be less than 3 1/4-inch (82 mm).

2. Frame: Frame components shall be mechanically fastened.
3. Glazing:

a. All units shall be glazed with the manufacturer's standard sealant process provided the glass is held in place by a removable, extruded aluminum, glazing bead. The glazing bead must be isolated from the glazing material by a gasket.

H. Finish:

1. Anodic: Finish all exposed areas of aluminum windows and components with electrolytically deposited color in accordance with Aluminum Association Designation, conforming with AAMA 611. Color shall be as selected by Architect from the following manufacturer standard color::

a. Clear anodized
b. Color anodized: champagne, light bronze, medium bronze, dark bronze and black.

2.3 SLIDING SERVICE (PASS-THROUGH) ALUMINUM WINDOW

A. Product/manufacturer: Basis-of-Design is model DW Series, "Manual Standard Sliding Service Window" by C.R. Laurence Co. Acceptable product shall be a comparable product to the basis-of- design product. Other acceptable Manufacturers are as follows:

a. C.R Laurence (basis-of-design).
b. Nissen.
c. QuikServ.

B. Description: Trackless sliding service window.

1. Material: 6063-T5 Aluminum extrusions. Size shall be not more than 4-inches deep to fit assembly as indicated in drawings.
2. Finish shall be anodized 215R-1 Clear Anodized.
3. Glass: 1/2-inch insulating tempered glass.
4. Lock: Manufacturer's standard slide bolt, interior side.
5. Configuration; as indicated in drawings. Replacement and servicing of glass shall be from the clerk side of the window by means of an access panel in the top header and does not require the removal of the frame from the opening. Window glides on top-hung heavy- duty ball bearing slides. Poly-pile weather stripping and self-latching handle. Overall frame sizes are to be in accordance with the contract drawings.
6. Dimensions: As shown in drawings.
7. Accessories: Refer to Division 26 for electrical switch required for the following accessories:
8. Air Curtain: (Air Curtain requirement is based on local jurisdiction and concession equipment) NSF certified un-heated sanitation series flyfan with door switch. Acceptable manufacturers are as follow:

a. Mars.
b. Loren Cook.
c. Powered Aire Inc.
d. Marley Engineered Product

PART 3 - EXECUTION

3.1 FABRICATION

A. Fabricate all products of this Section in complete accordance with the standards of the selected manufacturer.

3.2 ERECTION

A. Inspect new and existing openings. Verify that rough or masonry opening is correct and ready to receive new window materials.

1. Masonry openings shall be visibly dry and free of excess mortar, sand, and other construction debris.
2. Metal surfaces shall be dry, clean, free of grease, oil, dirt, rust and corrosion, and welding slag; without sharp edges or offsets at joints.

B. Comply with manufacturer's specifications and recommendations for installation of window units, hardware, operators, and other components.

C. Set windows true and plumb in prepared openings. They shall be securely anchored in place with screws fastened through the frame and into lead, plastic, or fiber anchoring devices. The windows shall be thoroughly caulked between the frame and surrounding construction. All fastening devices that penetrate the window unit shall be thoroughly sealed.

D. Separate aluminum and other corrodible surfaces from sources of corrosion or electrolytic action at points of contact with other materials by complying with the requirements specified under paragraph "Dissimilar Materials" in Appendix to AAMA 101.ADJUSTING

E. Adjust operating sash and hardware to provide a tight fit at contact points and at weatherstripping for smooth operation and a weathertight closure.

3.3 CLEANING

A. Clean aluminum surfaces promptly after installation of windows. Exercise care to avoid damage to protective coatings and finishes. Remove excess glazing and sealant compounds, dirt, and other substances. Lubricate hardware and other moving parts.

1. Leave frames, glass and all adjacent surfaces clean and free of finger marks, excess sealant or other stains.

END OF SECTION 085113

SECTION 087100 – DOOR HARDWARE SCHEDULE

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 references specification sections relating to commercial door hardware for the following:

1. Swinging doors.
2. Sliding Doors.
3. Other doors to the extent indicated.

B. Commercial door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical and access control door hardware.
3. Electromechanical and access control door hardware power supplies, back-ups and surge protection.
4. Automatic operators.
5. Cylinders specified for doors in other sections.

C. Related Sections:

1. Division 08 Section “Door Hardware”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. State Building Codes, Local Amendments.

E. Standards: Reference Related Sections for requirements regarding compliance with applicable industry standards.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

a. Type, style, function, size, label, hand, and finish of each door hardware item.
b. Manufacturer of each item.
c. Fastenings and other pertinent information.
d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
e. Explanation of abbreviations, symbols, and codes contained in schedule.
f. Mounting locations for door hardware.
g. Door and frame sizes and materials.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Keying Schedule: Prepared under the supervision of the Owner, separate schedule detailing final keying instructions for locksets and cylinders in writing. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner to approve submitted keying schedule prior to the ordering of permanent cylinders.

D. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

E. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Submittals. The manual to include the name, address, and contact information of the manufacturers providing the hardware and their nearest service representatives.

The final copies delivered after completion of the installation test to include "as built" modifications made during installation, checkout, and acceptance.

F. Warranties and Maintenance: Special warranties and maintenance agreements specified in the Related Sections.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum [5] years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Installer Qualifications: Installers, trained by the primary product manufacturers, with a minimum [3] years documented experience installing both standard and electrified builders hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

C. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum [5] years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor in good standing by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

D. Door Hardware Standards and Guidelines: Prepare Door Hardware specification documents in accordance with the Owner's approved ASSA ABLOY Virtual Design Guide (VDG) standard for door opening products and applications.

E. Building Information Modeling (BIM) Qualifications: BIM software tools and processes are used to produce and support data integration of product and technical information used in specifications, submittals, project reviews, decision support, and quality assurance during all phases of Project design, construction, and facility management. Door and hardware schedules and the associated product data parameters are to be derived, updated, and fully integrated with the coordinated BIM.

1. Door Hardware BIM Software Tool: Openings Studio™ is the designated BIM software suite to be used in a coordinated effort with architects, contractors and trades to integrate Project product data and information into the coordinated Record BIMs and associated applications.

F. Source Limitations: Obtain each type and variety of Door Hardware specified in the Related Sections from a single source, qualified supplier unless otherwise indicated.

G. Regulatory Requirements: Comply with NFPA 70, NFPA 80, NFPA 101 and ANSI A117.1 requirements and guidelines as directed in the applicable model building code.

H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s),

Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door and Frame Preparation: Division 08 Sections (Steel, Aluminum and Wood) doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. Refer to “PART 3 – EXECUTION” for required specification sections.

PART 3 - EXECUTION

3.1 DOOR HARDWARE SETS

A. The door hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. The supplier is responsible for handing and sizing all products and providing the correct option for the appropriate door type and material where more than one is presented in the hardware sets. Quantities listed are for each pair of doors, or for each single door.

C. Products listed in the hardware sets shall be supplied by and in accordance with the requirements described in the specification section as noted for each item.

1. Section 08 71 00 – Door Hardware.

D. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. RO - Rockwood
4. SA - SARGENT
5. AD - Adams Rite
6. ET - Emtek
7. SU - Securitron
8. AT - Accurate Lock and Hardware
9. SC - Schlage
10. GS - ASSA ABLOY Glass Solutions
11. OT - Other
12. RF - Rixson

Hardware Sets

Set: 1.0

Doors: 105A, 105B, 113D, 114A

6	Hinge, Full Mortise	TA2314 NRP 4-1/2" x 4-1/2"	US32D	MK
2	Surface Bolt	988 / 580-8	Bright Zinc	SA
1	Storeroom Lock	ND80 RHO Everest Cylinder	626	SC

2 Door Closer	281 CPS	EN	SA
2 Armor Plate	K1050 36" X 2" LDW 4BE CSK	US32D	RO
1 Threshold (Heavy Duty)	2715AK MSES25SS		PE
1 Gasketing	S88D		PE
1 Rain Guard	346C x LAR		PE
2 Sweep	3452AV		PE
1 Astragal	357SP X S88D		PE

Set: 2.0

Doors: 104B, 113C

3 Hinge, Full Mortise	TA2314 NRP 4-1/2" x 4-1/2"	US32D	MK
1 Storeroom Lock	ND80 RHO Everest Cylinder	626	SC
1 Door Closer	281 Reg / PA	EN	SA
1 Armor Plate	K1050 36" X 2" LDW 4BE CSK	US32D	RO
1 Door Stop	409 / 446 as required	US26D	RO
1 Threshold (Heavy Duty)	2715AK MSES25SS		PE
1 Gasketing	S88D		PE
1 Rain Guard	346C x LAR		PE
1 Sweep	315CN		PE

Set: 3.0

Doors: 101A, 103A, 106A, 111A

3 Hinge, Full Mortise	TA2314 NRP 4-1/2" x 4-1/2"	US32D	MK
1 Storeroom Lock	ND80 RHO Everest Cylinder	626	SC
1 Door Closer	281 CPS	EN	SA
1 Armor Plate	K1050 36" X 2" LDW 4BE CSK	US32D	RO
1 Threshold (Heavy Duty)	2715AK MSES25SS		PE
1 Gasketing	S88D		PE
1 Rain Guard	346C x LAR		PE
1 Sweep	3452AV		PE

Set: 4.0

Doors: 109A, 110A

3 Hinge, Full Mortise	TA2314 NRP 4-1/2" x 4-1/2"	US32D	MK
1 Deadbolt	B664 Everest Cylinder	626	SC
1 Pull Plate	BF 110 x 70C	US32D	RO
1 Push Plate	70C	US32D	RO
1 Door Closer	281 PS	EN	SA

1 Armor Plate	K1050 36" X 2" LDW 4BE CSK	US32D	RO
1 Door Stop	409 / 446 as required	US26D	RO
1 Threshold (Heavy Duty)	2715AK MSES25SS		PE
1 Gasketing	S88D		PE
1 Rain Guard	346C x LAR		PE
1 Sweep	3452AV		PE

Set: 5.0

Doors: 107A, 108A

3 Hinge, Full Mortise	TA2314 NRP 4-1/2" x 4-1/2"	US32D	MK
1 Deadbolt	B664 Everest Cylinder	626	SC
1 Pull Plate	BF 110 x 70C	US32D	RO
1 Push Plate	70C	US32D	RO
1 Door Closer	281 Reg / PA	EN	SA
1 Armor Plate	K1050 36" X 2" LDW 4BE CSK	US32D	RO
1 Door Stop	409 / 446 as required	US26D	RO
1 Threshold (Heavy Duty)	2715AK MSES25SS		PE
1 Gasketing	S88D		PE
1 Rain Guard	346C x LAR		PE
1 Sweep	315CN		PE

Set: 6.0

Doors: 112A, 113B

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Storeroom Lock	ND80 RHO Everest Cylinder	626	SC
1 Door Closer	281 PS	EN	SA
1 Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1 Sweep	315CN		PE
3 Silencer	608		RO

Set: 7.0

Doors: 104A

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lock	ND70 RHO Everest Cylinder	626	SC
1 Door Closer	281 Reg / PA	EN	SA
1 Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1 Door Stop	409 / 446 as required	US26D	RO
3 Silencer	608		RO

Set: 8.0

Doors: 100A

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Classroom Lock	ND70 RHO Everest Cylinder	626	SC
1 Door Closer	281 PS	EN	SA
1 Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1 Sweep	315CN		PE
3 Silencer	608		RO

Set: 9.0

Doors: 107B, 107C, 107D, 108B, 108C, 108D

3 Hinge, Full Mortise	TA2314 4-1/2" x 4-1/2"	US26D	MK
1 Privacy Lock	L9040 L583-363 06A L283-722	626	SC
1 Surface Closer	SRI 281 CPS	EN	SA
3 Silencer	608		RO
1 Coat Hook	RM811	US26D	RO

Set: 10.0

Doors: 113A

3 Hinge, Full Mortise	TA2714 4-1/2" x 4-1/2"	US26D	MK
1 Passage Latch	ND10S RHO	626	SC
1 Door Closer	281 PS	EN	SA
1 Kick Plate	K1050 10" X 2" LDW 4BE CSK	US32D	RO
1 Sweep	315CN		PE
3 Silencer	608		RO

Set: 11.0

Doors: 105C, 105D

1 Cylinder	Cylinder as Required	US32D	SA

END OF SECTION 087100

SECTION 088000 - GLAZING

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. Scope: Provide all of the labor, materials, equipment and services to furnish and install the glass and glazing accessories.

B. It is the intent of the Documents that all units shall be glazed so that there will be no passage of air or moisture. The Contractor shall provide whatever materials are necessary, whether specified or not, to achieve this condition.

C. This Section includes the following:

1. Tempered Safety Glass
2. Plate Glass
3. Insulating Glass
4. Sealant for Glass

D. Related Sections include the following:

1. Division 07 Section “Joint Sealant”.
2. Division 08 Section “Aluminum Windows”.

1.3 SUBMITTALS

A. Prior to fabrication, submit to the Architect for review the following:

1. Physical sample: 12" square samples of each type of glass indicated (except for clear monolithic glass products) and 12" long samples of each color required (except black) for each type of sealant or gasket exposed to view. Install sealant or gasket sample between two strips of material representative in color of the adjoining framing system.
2. Manufacturer's literature completely describing each product.
3. Product certificates signed by glazing materials manufacturers certifying that their products comply with specified requirements.

    a. Separate certifications are not required for glazing materials bearing manufacturer’s permanent labels designating type and thickness of glass, provided labels represent a quality control program of a recognized certification agency or independent testing agency acceptable to authorities having jurisdiction.

4. Compatibility and adhesion test reports from sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealants. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed for adhesion.
5. Compatibility test report from manufacturer of insulating glass edge sealant indicating that glass edge sealants were tested for compatibility with other glazing materials including sealants, glazing tape, gaskets, setting blocks, and edge blocks.
6. Product test reports for each type of glazing sealant and gasket indicated, evidencing compliance with requirements specified.
7. Maintenance data for glass and other glazing materials to include in operating and maintenance manual.

1.4 PERFORMANCE REQUIREMENTS

A. Provide glazing systems that are produced, fabricated, and installed to withstand normal thermal movement, wind loading, and impact loading (where applicable), without failure including loss or glass breakage attributable to the following:

1. Defective manufacture, fabrication, and installation.
2. Failure of sealants or gaskets to remain watertight and airtight.
3. Deterioration of glazing materials.
4. Other defects resulting in construction.

1.5 QUALITY ASSURANCE

A. Codes and standards:

1. In addition to complying with all pertinent codes and regulations, comply with all pertinent recommendations contained in the "Manual of Glazing" of the Flat Glass Marketing Association (FGMA).
2. Comply with all the requirements of the Safety Standard for Architectural Glazing Materials (16 CFR 1201) as issued by the Consumer Product Safety Commission.
3. Insulating glass: SIGMA TM-3000 "Vertical Glazing Guidelines".
4. Safety glass: Products complying with ANSI Z97.1 and testing requirements of 16 CFR Part 1201 for category II materials.

B. Engage an experienced glazier who has completed glazing similar in material, design, and extent to that indicated for Project with a record of successful in-service performance.

C. Single-source responsibility: Obtain glass from one source for each product indicated below:

1. Primary glass of each type and class indicated.
2. Heat-treated glass of each condition indicated.
3. Insulating glass of each construction indicated.

D. Single source responsibility for glazing accessories: Obtain glazing accessories from one source for each product and installation method indicated.

E. U-value certification: All exterior doors and windows shall be labeled by the manufacturer to certify compliance with the requirements of fenestration rating council per NFCR 100-91:

1. Non-operable window U-value: 0.60 or less.
2. Operable window U-value: 0.65 or less.
3. Entrance door U-value: 0.90 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials to comply with manufacturer's directions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.7 JOB CONDITIONS

A. Environmental conditions: Do not proceed with glazing when ambient and substrate temperature conditions are outside the limits permitted by glazing materials manufacturer or when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.8 WARRANTY

A. Insulating glass: Submit written warranty signed by coated glass manufacturer agreeing to furnish replacements for those insulating glass units that deteriorate, f.o.b. point of manufacture, freight allowed Project site, within specified warranty period indicated below. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to glass manufacturer's published instructions.

1. Warranty period: Manufacturer's standard, but not less than 10 years after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 TEMPERED SAFETY GLASS

A. Glass so indicated and required by federal and local regulations and the authorities having jurisdiction shall be fully tempered conforming to ANSI Standard Z97.1-1972 "Performance Specifications and Methods of Test for Safety Glazing Material Used in Buildings" and Fed. Spec. DD-G-1403.

B. Provide in doors, windows and other designated locations as specified in Door and Windows sections.

2.2 INSULATING GLASS – CLEAR TINTED

A. Hermetically sealed assembly consisting of two (2) glass plies with an entrapped desiccated air space between.

1. Provide argon filled, multi-layer low-E coated unit at exterior units.
2. Metal spacer insert between plies of glass: Black.
3. Basis-of-Design Product: PPG, Solarban 70XL
   a. Overall Unit Thickness and Thickness of Each Lite: 25 and 6.0 mm.
   b. Outdoor Lite: Class 2 (tinted) float glass, tint color to be Optiblue by Vitro, fully tempered where applicable, Pyrolytic coating on first surface, to be selfcleaning, low-maintenance coating
   c. Indoor Lite: Class 1 (clear) float glass, fully tempered where applicable Apply frosted film to interior side of lite – SXWF-WM White Matte
4. Visible Light Transmittance: 50 percent minimum.
5. Winter Nighttime U-Factor: .29 maximum.
6. Summer Daytime U-Factor: .27 maximum.
7. Solar Heat Gain Coefficient: 29 percent maximum.
8. Shading Coefficient: 9%
9. Provide minimum U-Value of 0.40. SHGC of 0.20.

B. Total unit thickness: 1".

2.3 FLOAT OR PLATE GLASS - CLEAR

A. 1/4" thick (unless noted otherwise). Shall meet or exceed Fed. Spec. DD-G-451c.

2.4 SEALANT - GLASS

A. Refer to Division 07 Section “Joint Sealant” for sealant type.

B. Tape: Resilient polyisobutylene/butyl extruded tape.

   1. Physical Characteristics: Self-adhering, remaining permanently elastic even at low temperatures.

C. Adhesion capabilities shall remain constant. Shall be unaffected by ultra-violet through glass. Serviceability range - 40 degree F to 200 degree F. Shall be non-staining with no coil exudation.

PART 3 - EXECUTION

3.1 LABELING

A. Each item shall be graded and arrive at the site bearing a label setting forth the quality and type of glass and the manufacturer's name and brand designation. Labels shall remain intact until their removal is authorized by the Architect.

3.2 ENVIRONMENTAL CONDITIONS

A. Glazing shall not be done when the temperature is 40 degrees F or below.

3.3 PREPARATION FOR GLAZING

A. Check the openings to determine if they conform to the sizes shown on the Drawings and shop drawings.

B. Make certain that the glazing rabbets are clean and in proper condition to receive the sealant.

C. The glazing channel and all sealing surfaces of wood or carbon steel shall have a coat of prime paint. The sealing rabbets of all metal holding members shall have all grease, foreign matter, lacquers or other organic protective coatings removed.

D. Make certain that the corners and intersections of the framing members are properly joined or sealed so as to prevent water leakage. If they are not, advise the Architect in writing. This condition shall be rectified before commencing the glazing operation.

E. Tempered glass must be ordered from the factory by size and not altered after fabrication.

3.4 SEALANT

A. Sealing of glass shall be as recommended in the Glazing Sealing Systems Manual as published by the Flat Glass Marketing Association, latest edition.

3.5 BREAKAGE OR SURFACE DAMAGE

A. Solutions used on the surface of the building to clean and/or seal shall be applied in a manner to avoid contact with the glass. Solutions to clean the glass shall be a selected product that will not cause damage to the glass surface, exterior building surface or the sealant.

B. Remove promptly any "wash off" from pre-oxidized metal.

C. Apply tapes or banners to the framing and suspend over the glass to alert workmen that the opening has been glazed. Directly marking on glass surfaces shall not be permitted.

3.6 CLEANING

A. Remove all excess putty or compound smears.

B. Remove any excess sealant materials left on the surfaces of the glass or the surrounding members immediately during the work life of the sealant.

C. All glass at the completion of the Work shall be clean and polished to the approval of the Architect.

D. Wash, rinse and dry glass at frequent intervals during the Work. Use soft, clean, grime-free cloths, mild soap, detergent or a slightly acidic cleaning solution; follow immediately with clean rinse water, and prompt removal of excess rinse water with clean squeegee. Remove grease and glazing materials with commercial solvents such as xylene, toluene, mineral spirits or naphtha, and follow with normal wash and rinse.

Be careful not to damage glazing or insulating unit seals by over generous application of strong solvents.

E. Remove immediately any staining or leaching resulting from surrounding materials. The Contractor shall be responsible for protecting the glass against any such damage.

END OF SECTION 088000

SECTION 092900 - GYPSUM BOARD

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. Scope: Provide all of the labor, materials, equipment and services required to furnish and install the gypsum board.

B. This Section includes the following:

1. Interior gypsum wall board, rated and non-rated.
2. Interior gypsum ceiling board, rated and non-rated.
3. Substrate gypsum board, for rated UL assemblies.
4. Auxiliary materials and accessories.

C. Related Sections include the following:

1. Division 06 Section "General Carpentry".
2. Division 06 Section "Sheathing".
3. Division 07 Section "Thermal Insulation".
4. Division 09 Section “Resilient Base and Accessories”.
5. Division 09 Section “Painting”.

1.3 SUBMITTALS

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

B. Prior to installation, submit to the Architect for review the following:

1. Manufacturer's literature fully describing each product named which shall include, but not be limited to, the manufacturer's name and catalog number for each item.
2. Accompanying the materials list, submit two (2) copies of the manufacturer's current recommended method of installation for each item.
3. Trim Accessories: Full-size Sample in 12-inch- (300-mm-) long length for each trim accessory indicated.

1.4 QUALITY ASSURANCE

A. References:

1. United States Gypsum Company (Gypsum Construction Handbook)
2. Gypsum Association (GA) publications.

B. Fire-test-response characteristics: Where fire-rated assemblies are indicated, provide

materials and construction bearing the UL Classification Mark, identical to those of assemblies tested for fire resistance per ASTM E119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

C. Single-source responsibility:

1. Obtain steel framing members for gypsum board assemblies from a single manufacturer.
2. Obtain each type of gypsum board and other panel products from a single manufacturer.
3. Obtain finishing materials from either the same manufacturer that supplies gypsum board and other panel products or from a manufacturer acceptable to gypsum board manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages, containers, or bundles bearing brand name and identification of manufacturer or supplier.

B. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

C. Handle material to prevent damage to edges, ends and surfaces. Do not bend or otherwise damage metal corner beads and trim.

1.6 JOB CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install interior products until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

D. Ventilate building spaces as required for drying joint treatment materials. Avoid drafts during hot dry weather to prevent finishing materials from dying too rapidly.

PART 2 - PRODUCTS

2.1 PANELS, GENERAL

A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.2 INTERIOR GYPSUM BOARD

A. General:

1. Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
2. Complying with designated listed UL testing for fire-rated assembly applications.
3. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

   a. Georgia Pacific
   b. USG.
   c. National Gypsum/Gold Bond.

B. Gypsum Wallboard for application on rated ceiling/floor and wall assembly:

1. 5/8" Fire rated: Conform to "Specification for Gypsum Drywall", ASTM C36 for type "X" gypsum board.

2.3 SUBSTRATE SYSTEM GYPSUM BOARD

A. General:

1. Complying with ASTM C 36/C 36M or ASTM C 1396/C 1396M, as applicable to type of gypsum board indicated and whichever is more stringent.
2. Complying with ASTM D3273 for mold resistance.
3. Complying with designated listed UL testing for fire-rated assembly applications.

B. Application: Fire rated wall UL-Assembly that is used as substrate for an exterior wall veneer system.

1. Deflection of the substrate systems shall not exceed L/240.
2. Basis-of-Design: Dens-Glass Fireguard (ASTM C1177) as manufactured by Georgia Pacific, or an approved equal.
3. The substrate systems shall be engineered with regard to structural performance by others.

2.4 TRIM ACCESSORIES

A. Interior Trim: ASTM C 1047.

1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc
2. Shapes:

   a. Corner bead: USG #200 series.
   b. Bullnose bead: Dur-A-Bead/
   c. LC-Bead: J-shaped; exposed long flange receives joint compound.
   d. L-Bead: L-shaped; exposed long flange receives joint compound.
   e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
   f. Expansion (control) joint.

2.5 JOINT TREATMENT MATERIALS

A. General:

1. Comply with ASTM C 475/C 475M, “Joint Treatment Materials for Gypsum

Wallboard Construction".
2. Complying with designated listed UL testing for fire-rated assembly applications.

B. Joint Reinforcing Tape: Perf-A-Tape Reinforcing Tape

C. Joint Compound for Interior Gypsum Wallboard: USG All-Purpose Joint Compound. For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use drying-type, all-purpose compound.
   a. Use setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.

2.6 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.

1. Use screws complying with ASTM C 954 for fastening panels to steel members from
   0.033 to 0.112 inch (0.84 to 2.84 mm) thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Acoustical Sealant: As specified in Division 07 Section "Joint Sealant."

E. Thermal and Sound Attenuation Insulation: As specified in Division 07 Section "Thermal Insulation."

F. Vapor Retarder: As specified in Division 07 Section "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

A. Comply with ASTM C 840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch (1.5 mm) of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. (0.7 sq. m) in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- (6.4- to 9.5-mm-) wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- (6.4- to 12.7-mm-) wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members, or provide control joints to counteract wood shrinkage.

I. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing, unless otherwise indicated.

2. On partitions/walls, apply gypsum panels vertically (parallel to framing), unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally, unless otherwise indicated or required by fire-resistance-rated assembly.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

3.3 INSTALLING TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:
    1. Cornerbead: Use at outside corners.
    2. Bullnose Bead: Use at outside corners.
    3. LC-Bead: Use at exposed panel edges
    4. L-Bead: Use where indicated

D. Exterior Trim: Install in the following locations:
    1. Cornerbead: Use at outside corners.
    2. LC-Bead: Use at exposed panel edge.

E. Aluminum Trim: Install in locations indicated on Drawings

3.4 FINISHING GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

    1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
    2. Level 2: Panels that are substrate for tile

3. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated

    a. Primer and its application to surfaces are specified in other Division 09 Sections.

E. Glass-Mat, Water-Resistant Backing Panels: Finish according to manufacturer's written instructions.

F. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.5 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 09 3014 TILING FOR AQUATIC FEATURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Principal work items include:

1. Waterline Tile for Aquatic Features.
2. Skid-resistant Deck Depth-Marking Tile, Water-line Depth Marking Tile, Handicap Access Location Tile, No Diving Tile for all Aquatic Features.
3. Safety Step Edge Tile for all bodies of water with Steps
4. Thin set application over shotcrete and concrete substrates.
5. Frost resistant tile, grout and mortar.
6. Refer to Tile Council of America (TCA) handbook for assistance in selecting adhesives, mortar beds, grouts, and installation details and methods.

B. Sections not included in this section:

1. 03 3714 - Shotcrete for Aquatic Features
2. 07 1417 – Cold Fluid-Applied Waterproofing for Aquatic Features
3. 09 9727 – Cementitious Coating for Aquatic Features
4. 13 1123 – On Grade Aquatic Features
5. 13 1225 – Pumped Concrete for Splash Pads

1.2 SUMMARY

A. Related Documents: General and Supplementary Conditions of Contract, Division 1 General Requirements, and Drawings are applicable to this Section.

B. Section Includes:

1. Cleavage membrane and Portland cement mortar bed.
2. Tile specified for all Aquatic Features to meet local code requirements.
    a. No code requirements for Tile specified on Fountains.

1.3 REFERENCES

A. Installation:

1. Tile – ANSI A108.5.
2. Glass Tile – Manufacturer’s Direction
3. Cementitious Grout – ANSI A108.10.
4. Epoxy Grout – ANSI A108.6.

B. Materials:

1. Porcelain Tile to have “Porcelain Tile Certification” of 0.5% or less of water absorption.
   a. Per Testing Standards of ASTM C373, recommended by ANSI A137.1
2. Glass Tile - Manufacturer
3. Cementitious Grout – ANSI A118.6 or better
4. Epoxy Grout – ANSI A118.3
5. Cementitious Bond Coat – ANSI A118.4 or better

C. TCA Handbook for Porcelain and Glass Tile Installation by Tile Council of America.

1.4 SUBMITTALS

A. Submit shop drawings, product data, and samples.

B. Shop Drawings:

1. Indicate tile layout, patterns, color arrangement, perimeter conditions, and junctions with dissimilar materials, thresholds, and setting details.

C. Submit product data, specifications, and instructions for using mortars, adhesives and grouts.

D. Samples: Submit color samples illustrating full color range of each type tile.

1.5 QUALITY ASSURANCE

A. Single Source Responsibility:

1. Obtain each type and color tile material required from single source.
2. Obtain setting and grouting materials from one manufacturer to ensure compatibility.
3. Furnish a 2-year guarantee from installation material manufacturer. Guarantee is inclusive of installation materials, finish product, and labor.
4. Obtain elastomeric membrane from same manufacturer as setting material or from manufacturer approved by setting material manufacturer to ensure compatibility.

B. Manufacturer Qualifications:

1. Tile: Minimum ten (10) years experience in manufacture of tile products.
2. Setting Materials: Minimum ten (10) years experience in manufacture of setting and grout materials specified.

C. Installer Certifications: Tile Council of America recognizes the following Certifications.

1. Porcelain Tile Education Foundation (CTEF) Certified Tile Installer Program.
2. Journeyman Tile layer Apprenticeship Programs.
3. National Tile Contractors Association (NTCA) Five Star Contractor Program.
4. Tile Contractors’ Association of America (TCAA)

1.6 FIELD SAMPLES

A. Sample Installation:

1. For final review of each type tile, construct sample panel of approximately three (3) square feet. Coordinate location in field with project architect. Show workmanship of finished work and construction techniques.

2. Approved field samples may not remain as part of Work.

1.7 PRE-INSTALLATION CONFERENCE

A. Convene three weeks prior to commencing work of this section.

1. Require attendance of installation material manufacturer, tile supplier, tile installer and installers of related work. Review installation procedures and coordination required with related work.

2. Meeting agenda includes but is not limited to:

a. Surface preparation.

b. Tile and installation material compatibility.

1.8 DELIVER, STORAGE, AND HANDLING

A. Labeling: Comply with ANSI A137.1.

B. Deliver materials in manufacturer's unopened containers, fully identified with name, brand, type, and grade.

C. Protect materials from contamination, dampness, freezing, or overheating in accordance with manufacturer's instructions.

D. Broken, cracked, chipped, stained, or damaged tile will be rejected, whether built-in or not.

E. Protect mortar and grout materials against moisture, soiling, or staining.

1.9 ENVIRONMENTAL REQUIREMENTS

A. Comply with requirements of referenced standards and recommendations of material manufacturers for environmental conditions before, during, and after installation.

B. If tiling in an enclosed environment, do not begin installation until building is completely enclosed and HVAC system is operating and maintaining temperature and humidity conditions consistent with "after occupancy" conditions for minimum of 2 weeks.

1. Maintain continuous and uniform building temperatures of not less than 50 degrees F during installation.

2. Ventilate spaces receiving tile in accordance with material manufacturers' instructions.

1.10 EXTRA MATERIALS

A. At completion of project, deliver to Owner extra stock of materials used on project as follows:

1. Five (5) percent of each color of project tile selection.

B. Store in location as directed by Owner.

C. Ensure materials are boxed and identified by manufacturer, type, and color.

1.11 MAINTENANCE DATA

A. Submit maintenance data.

B. Include cleaning methods, cleaning solutions recommended; stain removal methods, and polishes and waxes recommended.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements indicated herein, provide products of one of listed manufacturers.

1. Porcelain Tile:
    a. Manufactured Tile bearing “Porcelain Tile Certification” of 0.5% or less of water absorption.
        1) DalTile Corp
2. Ceramic Tile
    a. Inlays, Inc.
3. Mortar Material:
    a. MAPEI Corporation
    b. Laticrete International
4. Grout Material:
    a. MAPEI Corporation
    b. Laticrete International
5. Thin Set Material
    a. MAPEI Corporation
    b. Laticrete International

2.2 PRODUCTS, TILE

A. Waterline Tile

1. Aquatic Features, Porcelain Tile Certification.
    a. Size: 6 -inch x 6 -inch, Frost Resistant
    b. Manufacturer Selection: Coordinate with Project Architect

c. Model/Color Selection: Coordinate with Project Architect

d. Quantity: Waterline Perimeter

B. Depth Tile Markers at Waterline

1. Aquatic Features, Porcelain Tile Certification

a. Tile Surface: Smooth, Frost Resistant, Black print on White background.

b. Tile Series:

1) "FT" 6-inch x 6-inch with 4-inch numbers

2) "IN" 6-inch x 6-inch with 4-inch numbers

c. Location and Quantity: Design per plan

C. Depth Tile Markers Placed on Deck

1. Aquatic Features, Water Absorption: less than 1.8% (DIN-EN-99)

a. Coefficient of Friction: Dry:1.02 / Wet: .94 (ASTM-C-1028)

b. Tile Surface: Skid Resistant, Frost Resistant, Black print on White background.

c. Tile Design:

1) "FT" 6-inch x 6-inch with 4-inch numbers

2) "IN" 6-inch x 6-inch with 4-inch numbers

d. Location and Quantity: Design per plan

2. Bid Alternate: Sand Blasted in Deck. See Tile Details on Plan Detail Sheets

D. Safety Tile Markers

1. Aquatic Features

a. No-Diving Tile – Placed on Deck.

1) Tile Surface: Skid Resistant

2) Tile Design: No Diving Symbol; 6-inch x 6-inch

3) Location Per Plan

b. Handicap Tile – Placed in Deck.

1) Tile Surface: Skid Resistant

2) Tile Design: Handicap Symbol; 8-inch x 8-inch

3) Location: Design per plan

2. Bid Alternate: Sand Blasted in Deck. See Tile Details on Plan Detail Sheets

E. Step Edge Safety Tile

1. Aquatic Features

a. Manufacturer: DalTile

b. Water absorption: less than 0.5% (DIN-EN-99)

c. Size: 1-inch x 1–inch, installed side-by-side to make up a 1-inch tile band

d. Color: Coordinate selection with Project Architect/Owner

e. Skid Resistant

f. Location and Quantity: Design per Plan

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that areas to receive tile installed by thin bed method have wood float finish, are true within 1/4 inch in 10'-0".

B. Condition of Surfaces to Receive Tile:

1. Firm, dry, clean and free of oily or waxy films, mortar and soil. Grounds, anchors, plugs, hangers, bucks, electrical and mechanical work in or behind tile installed.

C. Air Temperature and Surfaces in Rooms to Receive Flooring: Between 60 degrees to 90 degrees F unless otherwise recommended by manufacturers of materials being installed.

3.2 PREPARATION

A. Clean substrates, Wet down or wash dry, dusty surfaces and remove excess water immediately prior to application of tiles.

B. Prepare surfaces in strict accordance with instructions of manufacturer whose setting materials or additives are being used.

C. Acid Based Cleaners: Use not permitted.

D. Scarify concrete substrates with blast track equipment if necessary to completely remove curing compounds or other substances that would interfere with proper bond of setting materials. Clean and maintain substrate in condition required by setting material manufacturer.

E. Do not seal substrate unless required by manufacturer.

F. Prime substrate when required by manufacturer.

G. Blending: For tile exhibiting color variations within ranges selected during sample submittals, verify that tile has been blended in factory and packaged accordingly so that tile units taken from one package show same range in colors as those taken from other packages and match approved samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION

A. Field and Installation Requirements

1. Refer to “Field and Installation requirements” section in the TCNA (Tile Council North America) Handbook for Porcelain Tile Installation. www.tcnatile.com

3.4 ADJUSTING

A. Sound tile after setting. Replace hollow sounding units.

3.5 CLEANING

A. Clean excess mortar from surface with water as work progresses. Perform cleaning while mortar is fresh and before it hardens on surfaces.

B. Sponge and wash tile diagonally across joints. Polish with clean dry cloth.

C. Remove grout haze following recommendation of mortar additive manufacturer. Do not use acids for cleaning.

3.6 PROTECTION

A. Prohibit traffic from floor finish for 72 hours after installation.

B. Where temporary use of new floors is unavoidable, supply large, flat boards or plywood panels for walkways over Kraft paper.

C. Protect work so that it will be without evidence of damage or use at time of acceptance.

END OF SECTION 093014

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SECTION 096100 - CONCRETE FLOOR SEALER

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. Scope: Provide all of the labor, materials, equipment and services to furnish and install the concrete floor sealer. The product is only for application to those floors that will not receive an additional finish material (e.g.: Tile).

B. This Section includes Concrete Floor Sealer Solution.

C. Related Sections include the following:

1. Division 03 Section “Cast-in-Place Concrete”.

PART 2 - PRODUCTS

2.1 CONCRETE FLOOR SEALER

A. Product/manufacturer:

1. CT Densifyer 629 as manufactured by Chemprobe Coating Systems (a Division of Tnemec).
2. Duro-Nox as manufactured by Nox-Crete.
3. Aquapel as manufactured by L & M Construction Chemicals, Inc.

B. Description: Sodium silicate clear, penetrating, water based sealer for densifying (harden and seal) and dustproofing. The solution penetrates the substrate and chemically reacts to increase density at the surface and dustproof concrete.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Prepare the substrate the substrate and install the product in strict accordance with the original design and the manufacturer's recommendations.

B. Prepare substrate.

1. Surface shall be free of oil, grease and any extraneous matter which could interfere with product’s penetration. Pressure wash the concrete substrate to

remove contamination, lose or broken cement paste and aggregate. Remove or rework all loose or broken mortar. After pressure washing, the substrate shall readily absorb water and not show any signs of water beading.

C. Application:

1. Do not dilute or thin.
2. Apply using a low pressure rotary or gear pump sprayer with a fan tip. Applications using a commercial grade pump up spray tank, roller or brush are also acceptable (depending on the substrate and project circumstances; follow manufacturer's directions). Airless paint sprayers are not acceptable.
3. Allow product to fully cure prior to putting the substrate into service.
4. Application rate of first coat: 300 to 350 sq ft/gallon.
5. Apply using a uniform spray pattern overlapped slightly on each pass. Apply material sufficiently for a wet appearance but do not leave excess material stand in low areas. Broom out or squeegee excess material as soon as possible.
6. After completing the first coat allow at least one hour then apply a second coat at 350 to 400 sq ft/gallon.

END OF SECTION 096100

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

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. This Section includes the following:

1. Resilient base.
2. Resilient molding accessories.

B. Related Sections include the following:

1. Division 06 Section “Millwork”.
2. Division 09 Section “Gypsum Board”.

1.3 SUBMITTALS

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

B. Samples for Initial Selection: For each type of product indicated.

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F (10 deg C) or more than 90 deg F (32 deg C).

1.6 JOB CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F (21 deg C) or more than 95 deg F (35 deg C), in spaces to receive resilient products during the following time periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F (13 deg C) or more than 95 deg F (35 deg C).

C. Install resilient products after other finishing operations, including painting, have been completed.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, of each type, color, pattern, and size of resilient product installed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE

A. Resilient Base:

1. Description: 1/8” coved rubber base 4” high.
2. Length: 120-ft rolls. 48-inches section is not acceptable.
3. 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. Flexco; 700 Series (Basis-of-Design)
b. Mannington.
c. Armstrong World Industries, Inc.
d. Johnsonite.
e. Tarkett
f. Roppe Corporation, USA.

B. Resilient Base Standard: Meet Federals Specifications F-1861 for type TP Thermoplastic Rubber.

1. Thickness: 1/8-inch, per ASTM F-386.
2. Hardness: 90±5
3. Flexibility: ¼-inch mandrel, no cracking or breaking, per ASTM F137.
4. Staining: No staining, per ASTM F-1861 Section 12.
5. Light Resistance: Complies for chemical listed in ASTM F-1861, per ASTM-F925.
6. Dimensional Stability: ±25% x length, per ASTM F1861.
7. Squareness: 90 degress ±.5 degrees. C. Outside Corners: Preformed.

C. Inside Corners: Preformed.

D. Finish: As selected by Architect from manufacturer's full range.

E. Colors and Patterns: As selected by Architect from full range of industry colors.

F. Adhesives: ROP 215 (Acrylic Based Adhesive specifically formulated for the installation of 700 Series Wall Base). Provide written approval from wall base manufacturer's for other type of adhesives.

G. Application:

1. Install wall base at all casework base.

2.2 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.

1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

a. Cove Base Adhesives: Not more than 50 g/L.
b. Rubber Floor Adhesives: Not more than 60 g/L.

C. Metal Edge Strips: Extruded aluminum with mill finish of width shown, of height required to protect exposed edges of tiles, and in maximum available lengths to minimize running joints.

D. Floor Polish: Provide protective liquid floor polish products as recommended by resilient stair tread manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient products until they are same temperature as the space where they are to be installed.

1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.

E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practicable without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Outside Corners: Use straight pieces of maximum lengths possible. Form without producing discoloration (whitening) at bends.
2. Inside Corners: Use straight pieces of maximum lengths possible.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.

B. Perform the following operations immediately after completing resilient product installation:

1. Remove adhesive and other blemishes from exposed surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Cover resilient products until Substantial Completion.

END OF SECTION 096513

SECTION 096723 - HIGH PERFORMANCE EPOXY FLOORING

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. Scope: Provide all of the labor, materials, equipment and services to furnish and install the epoxy floor coating and additionally named products.

B. This Section includes High Performance Epoxy Floor Coating.

C. Related Sections include the following:

1. Division 03 Section “Cast-in-Place Concrete”.

1.3 SUBMITTALS

A. Prior to fabrication, submit to the Architect for review the following:

1. Manufacturer's literature fully describing each product, its proper installation and general recommendations for slip-retardant epoxy coating floor coating for this Project.
2. Physical sample (each product): All colors, patterns and textures for Architect’s selections.

    a. Minimum size: 4" x 4".

3. Material certificates signed by manufacturer certifying that the slip-retardant epoxy coating floor coating complies with requirements specified herein.
4. Maintenance instructions: Manufacturer’s written instructions for recommended maintenance practices.

1.4 QUALITY ASSURANCE

A. Engage an experienced installer or applicator who has specialized in installing resinous flooring types similar to that required for this Project and who is acceptable to manufacturer of primary materials.

B. Single-source responsibility: Obtain epoxy floor coating materials including primers, slipretardant aggregates, resins, hardening agents and finish coats, from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers with seals unbroken and bearing manufacturer's labels containing brand name and directions for storage and mixing with other components.

B. Store materials to comply with manufacturer's directions to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

1.6 JOB CONDITIONS

A. Environmental conditions: Comply with epoxy coating manufacturer's directions for maintenance of ambient and substrate temperature, moisture, humidity, ventilation, and other conditions required to execute and protect work.

B. Lighting: Permanent lighting shall be in place and working before installing epoxy floor coating.

C. Concrete substrate:

1. Concrete shall have been water-cured or cured using sodium silicate curing compounds only. Other types of curing compounds are not acceptable unless the epoxy flooring manufacturer has given written approval.
2. Concrete shall have been cured for a minimum of 28 days.
3. On-grade floors shall have functioning vapor retarder beneath slab.

PART 2 - PRODUCTS

2.1 EPOXY FLOOR COATING

A. Product/manufacturer:

1. Ceramic Carpet No. 400 Quartz Broadcast Flooring System (Double Broadcast) as manufactured by General Polymers.
2. Deco-Tread as manufactured by Tnemec.
3. FloroQuartz as manufactured by Florock.
4. Dur-A-Quartz (Q28 fine grade) as manufactured by Dur-A-Flex.

B. Description: Seamless application.

1. 1/8" Decorative Broadcast Epoxy Flooring System
2. Components:

a. Primer: No. 3579 Penetrating Primer.
b. Binder resin: No. 3561 Epoxy Resin Glaze.
c. Seed: No. 5900F Ceramic Granules (Fine Grade).
d. Grout: No. 3744 High Performance CR Epoxy.
e. Top coat: No. 400-CRS, 3744S High Performance CR Epoxy Satin.

3. Physical Properties:

a. Resistance elevated temperatures (MIL-D-3134J): No slip or flow at required temperature of 158 degree F.
b. Hardness at 24 hours Shore D (ASTM D-2240): 70/65.

c. Compressive strength (ASTM C-579): 11,000 psi.
d. Tensile strength:
   1) ASTM C-307: 1,800 psi.
   2) ASTM D-638: 6,000 psi.
e. Flexural strength:
   1) ASTM C-580: 3,500 psi.
   2) ASTM D-790: 10,000 psi.
f. Adhesion (ACI 503R): 350 psi, 100% concrete failure.
g. Abrasion resistance J (ASTM D-4060, CS-17 Wheel): 70-90 milligrams lost.
h. Flammability (ASTM D-635): Self-extinguishing over concrete.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine the areas and conditions where epoxy floor coating is to be installed and modify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected by the Contractor in conformance with the Contract Documents.

3.2 PREPARATION

A. Perform preparation and cleaning procedures according to flooring manufacturer's instructions for particular substrate conditions involved, and as specified. Provide clean, dry, and neutral substrate for flooring application.

B. Concrete: Prepare in accordance with the manufacturer's instructions. Remove laitance, glaze, efflorescence, and any bond-inhibiting curing compounds or form release agents. Remove grease, oil, and other penetrating contaminates. Repair damaged and deteriorated concrete to acceptable condition. Leave surface free of dust, dirt, laitance, and efflorescence.

3.3 APPLICATION

A. Install all products in strict accordance with the original design and the manufacturer's recommendations.

B. Apply each coating of the floor coating system to provide a uniform, monolithic flooring surface.

3.4 CURING, PROTECTION AND CLEANING

A. Cure epoxy floor coating materials according to manufacturer's directions, taking care to prevent contamination during application stages and before completing curing process. Close application area for a minimum of 24 hours.

END OF SECTION 096723

SECTION 099100 - PAINTING

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. Scope: Provide all labor, materials, equipment, and services required to furnish and apply the painting and staining materials.

B. This Section includes Painting and Staining Materials.

C. Related Sections include the following:

1. Division 04 Section “Architectural Concrete Masonry”.
2. Division 06 Section “General Carpentry”.
3. Division 06 Section “Sheathing”.
4. Division 06 Section “Millwork”.
5. Division 07 Section “Mineral Fiber Cement Board”.
6. Division 08 Section “Hollow Metal Doors and Frames”.
7. Division 09 Section “Gypsum Board”.
8. Division 09 Section “Epoxy Coatings”.

D. The term "paint" as used herein means coating systems materials, which includes primers, emulsions, enamels, stain, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

E. Paint exposed surfaces whether or not colors are designated in any "schedule", except where natural finish of material is specifically noted as not to be painted. Where items or surfaces are not specifically mentioned, paint these same as adjacent similar materials or areas. If color or finish is not designated, Architect will select the colors.

F. All surfaces that are left unfinished by the requirements of other Sections, whether specifically mentioned or not, shall be painted or finished as part of the work covered by this Section.

1.3 SUBMITTALS

A. Prior to application, submit to the Architect for review the following:

1. Submit a complete list of all materials proposed to be furnished and installed under this portion of the Work. This shall in no way be construed as permitting substitution of materials for those specified or approved for this Work by the Architect.

2. In each case where material proposed is not the material specified or specifically described as an acceptable alternate in this Section of these Specifications, submit for the Architect's review the current recommended method of application published by the Manufacturer of the proposed material.
3. Submit complete set of colors, color designation or formula and finishes for Architect's selections. The Architect has the option of selecting as many colors and finishes from any of the various paint or paint related products to be specified here, as he may desire without additional cost to the Owner or the Architect.
4. Submit a complete list of paint colors identified by manufacturer, room and surface location.
5. After Architect has selected colors and finishes and has furnished a schedule, prepare samples of each color for approval by the Architect before proceeding with this work. These job applied samples shall serve as a minimum acceptable standard for the finished work in color and appearance.

B. Certification that all standards and requirements have been met. These shall include, but not be limited to:

1. Delivery.
2. Storage.
3. Conditions under which the materials were installed.
4. Product complies with specified requirements.
5. Specified number coats and mil thickness have been applied.

1.4 QUALITY ASSURANCE

A. In addition to complying with all pertinent codes and regulations, comply with "Standard (Type 1)" as defined by the Painting and Decorating Contractors of America in their “Modern Guide to Paint Specifications", current edition.

B. Provide finish coats which are compatible with prime paints used. Review other Sections of these Specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates. Provide barrier coats over incompatible primers or remove and re-prime. Notify Architect in writing of any anticipated problems using coating systems as specified with substrates primed by others.

C. Single source: Unless indicated otherwise, obtain all materials from a single manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F (7 deg C).

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.6 JOB CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F (10 and 35 deg C).

B. Do not apply paints in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F (3 deg C) above the dew point; or to damp or wet surfaces.

1.7 EXTRA STOCK

A. Provide for Owner storage one unopened 1-gallon can of each color and type used. Provide written list of each color/type used and location with supplier, color name and code.

B. Provide extra materials that match products installed, are packaged with protective covering for storage, and are identified with appropriate labels.

C. Contractor provide listing of all paint colors used with manufacturer and color designation number or formula.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Approved manufacturers:

a. Sherwin Williams.
b. Duron
c. PPG/Porter Paint Company
d. ICI Paints

B. Approved manufacturers for isolated items named will be listed with the product.

C. In general and with the exception of those manufacturers named for isolated items, numbers and descriptive names used are those of the Sherwin Williams Company and are for the purpose of convenience, identification, and establishing a standard quality for the materials required. Any of the mentioned manufacturers shall be acceptable provided a submittal of finished physical sample, full description and formulation of products, list of all paint colors with color designation number and the surfaces that are to be covered are submitted.

D. All paints, stains, sealers, oils, thinners, turpentine or other materials required to accomplish the painting and finishing shall be first-quality materials.

2.2 MATERIALS COMPATIBILITY

A. All paint and stain materials and equipment shall be compatible in use; finish coats shall be compatible with prime coats; prime coats shall be compatible with

the surface to be coated; all tools and equipment shall be compatible with the coating to be applied.

B. Thinners, when used, shall be only those thinners recommended for that purpose by the manufacturer of the materials to be thinned.

C. New paint or stain materials shall be compatible with the existing coatings on existing surfaces.

PART 3 - EXECUTION

3.1 INSPECTION

A. Thoroughly examine surfaces scheduled to be painted prior to commencement of work. Report in writing to the Architect, any condition that may potentially affect proper application. Do not commence until such defects have been corrected.

B. Correct defects and deficiencies in surfaces which may adversely affect work of this Section.

C. Commencement of work shall be construed as acceptance of the surfaces and, therefore, the Contractor shall be fully responsible for satisfactory work as required herein.

3.2 PREPARATION OF SURFACES

A. Remove mildew, by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry completely.

B. Gypsum wallboard: Remove contamination and prime to show defects, if any. Paint after defects have been remedied.

C. Concrete and concrete block:

1. Remove dirt, loose mortar, scale, powder and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate, rinse well and allow to thoroughly dry.
2. Remove stains caused by weathering of corroding metals with a solution of sodium meta- silicate after being thoroughly wetted with water. Allow to thoroughly dry.
3. Apply masonry filler as required to provide even, consistent (filling of voids), with filler material. Methods of application which "bridge" voids will not be acceptable.

D. Completely mask, remove, or otherwise adequately protect all hardware, accessories, machined surfaces, plates, lighting fixtures, and similar items in contact with painted surfaces but not scheduled to receive paint.

E. Spot prime all exposed nails and other metals which are to be painted with emulsion paints, using a primer recommended by the manufacturer of the

coating system.

F. Adequate illumination shall be provided in all areas where painting and staining operations are in progress.

G. Efflorescence on any area that is scheduled to be painted shall be removed.

H. Clean shop coats that become marred. Touch-up with specified shop coats.

3.3 PREPARATION OF WOOD SURFACES

A. Wipe off dust and grit from miscellaneous wood items and millwork prior to priming. Spot coat knots, pitch streaks and sappy sections with sealer. Fill nail holes and cracks after primer has dried and sand between coats.

B. Clean wood surfaces to be painted of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off.

C. Prime, stain, or seal wood required to be job painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides.

D. When transparent finish is required, use spar varnish for back-priming.

E. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat.

F. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler.

G. Sandpaper smooth when dried.

H. Wood Doors: Pre-finished.

I. Prior to finishing glue-laminated beams, wash down surfaces with solvent and remove grease and dirt.

3.4 PREPARATION OF METAL SURFACES

A. Steel and iron:

1. Remove grease, rust, scale, dirt and dust from steel and iron surfaces. Where heavy coatings of scale are evident, remove by wire brushing, sandblasting or any other necessary method. Ensure steel surfaces are satisfactory before paint finishing.
2. Clean unprimed steel surfaces by washing with solvent. Apply at treatment of phosphoric acid solution, ensuring weld joints, bolts and nuts are similarly cleaned. Prime surfaces to indicate defects, if any. Paint after defects have been remedied.
3. Sand and scrape shop primed steel surfaces to remove loose primer and

rust. Feather out edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. (Prime steel including shop primed steels.)

B. Galvanized metal:

1. Clean all surfaces thoroughly with solvent until they are completely free from dirt, oil, and grease.
2. Thoroughly treat the cleaned surface with phosphoric acid etch.
3. Remove all excess etching solution and allow to dry completely before application of paint.

C. Remove surface contamination and oils from zinc coated surfaces and prepare for priming in accordance with metal manufacturer's recommendations.

D. Other metals:

1. Thoroughly clean all surfaces until they are completely free from dirt, oil, and grease.
2. Allow to dry thoroughly before application of paint.

3.5 APPLICATION

A. All materials shall be applied under adequate illumination, evenly spread, and smoothly flowed on with the proper type and size of brushes, roller covers, bucket grids, and spray equipment to avoid run, sags, holidays, brush marks, air bubbles, and excessive roller stipple.

B. Coverage and hide shall be complete. When color, stain, mark of any kind, dirt or undercoats show through the final schedule coat of paint to the surface, it shall be covered by additional coats until the paint film is of uniform finish, color, appearance and coverage at no additional cost to the Owner.

C. Do not add thinners to the paint or paint related products.

D. Finished areas shall be free from sags, runs, crawls, brush marks, and other defects.

E. Touch-up painting as required to provide smooth, even finish prior to final acceptance of work.

F. Do not apply finishes on surfaces that are not sufficiently dry.

G. Allow each coat of finish to dry before following coat is applied, unless directed otherwise by manufacturer.

H. Where clear finishes are required, ensure tint fillers match wood. Work fillers well into the grain before set. Wipe excess from the surface.

I. Environmental conditions:

1. Comply with the manufacturer's recommendations as to environmental conditions under which the coating systems may be applied.
2. Do not apply paint in areas where dust is being generated.

J. Moisture content:

1. Use a moisture meter approved by the Architect to test surfaces.
2. Do not apply the initial coating until moisture meter reading is within normal limits recommended by the paint materials manufacturers.

K. Defects: Sand and dust between coats to remove all defects visible to the unaided eye from a distance of five feet.

L. Color of undercoats: Slightly vary the color of succeeding coats.

3.6 OBSERVATION OF WORK

A. Do not apply additional coats until completed coat has been observed and approved by the Architect.

B. Only observed and approved coats of paint will be considered in determining the number of coats applied.

3.7 DRY FILM THICKNESS

A. DFT represents Dried Film Thickness. It shall be checked on metal surfaces with a Nordson Mikrotest Dry Film Thickness Gauge. For other surfaces, a Tooke Dry Film Thickness Gauge shall be used. Surfaces may also be checked while surface is wet by using a Nordson Wet Film Gauge. Should an average of three readings out of five show film less than specified, additional materials should be applied until the surface has the proper amount of material.

3.8 REINSTALLATION OF REMOVED ITEMS

A. Following completion of painting in each space, promptly reinstall all items removed for painting, using only workmen skilled in the particular Trade.

3.9 MECHANICAL AND ELECTRICAL EQUIPMENT

A. Coordinate with the requirements of Divisions 23 and 26.

B. Remove grilles, covers and access panels for mechanical and electrical systems from location and paint separately.

C. Finish paint primed equipment to color selected.

D. Prime and paint insulated and bare pipes, conduits, boxes, insulated and bar ducts, hangers, brackets, collars and supports, except where items are plated or covered with a pre-finished coating.

E. Replace identification markings on mechanical or electrical equipment when painted over or spattered.

F. Paint interior surfaces of air ducts, convector and baseboard heating cabinets that are visible through grilles and louvers with one coat of flat black paint, to limit of sight line. Paint dampers exposed immediately behind louvers, grilles, convector and baseboard cabinets to match face panels.

G. Paint exposed conduit and electrical equipment occurring in finished areas.

Co

lor and texture to match adjacent surfaces.

H. Paint both sides and edges of plywood backboards for electrical equipment before installing backboards and mounting equipment on them.

3.10 STENCILING RATED WALLS

A. Stencil both sides of all corridor partitions, smoke, fire, horizontal exits, exit enclosures, and other rated partitions with permanent 2" high letters.

1. Color: Bright Red.
2. Identify the name and hour rating of the partition approximately 8" above the ceiling every 25' on both sides of the partition.
3. Identify once in each space having fire-rated or smoke walls.
4. Identify walls as applicable:

a. 1 HOUR FIRE.
b. 2 HOUR FIRE.
c. 1 HOUR SMOKE.
d. 2 HOUR FIRE AND SMOKE.
e. 1 HOUR SMOKE TIGHT CORRIDOR.
f. NON-RATED SMOKE TIGHT CORRIDOR.
g. Other identifying language as necessary.

5. Identification shall be above any decorative ceiling and in concealed spaces and shall be acceptable to the authority having jurisdiction.

3.11 CLEANING

A. As work proceeds and upon completion, promptly remove paint where spilled, splashed or spattered.

B. During progress of work, keep premises free from any unnecessary accumulation of tools, equipment, surplus materials and debris.

C. Upon completion of work, leave premises neat and clean, to the satisfaction of the Architect.

3.12 PAINT SCHEDULE – EXTERIOR

A. All exposed metal surfaces not otherwise provided for below.

1. These shall include, but not be limited to, the following:

a. Hollow metal doors and frames.
b. Metal flashing (not already prefinished).
c. Piping and conduit associated with mechanical and electrical.
d. Bollards.
e. Steel lintels.
f. Any edge or surface exposed to view or the weather.

2. Paint application:

a. Clean with solvent in accordance with SSPC-SP1 to remove soluble contaminants.
b. Remove insoluble contaminants by hand or power tool cleaning (SSPC-SP2 or SP3). All surfaces shall be dry and clean.

3. Prime Coat: Primer, rust-inhibitive, water based:

a. S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet,
2.0 to 4.0 mils dry.

4. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
5. Topcoat: Light industrial coating, exterior, water based eggshell:

a. S-W Pro Industrial Eg-Shel Acrylic B66-660 Series, at 2.5 to 4.0 mils dry, per coat.

6. Verify with each metal item that shop prime coats are compatible with finish field painting.

B. CMU Substrates

1. Block Filler: Block filler, latex, interior/exterior:

a. S-W PrepRite Block Filler, B25W25, at 75 to 125 sq. ft. per gal.

2. Intermediate Coat: Latex, exterior, matching topcoat.
3. Topcoat: Latex, exterior, satin:

a. S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

C. Wood Substrates (Plywood and Trims) - Paint

1. Prime Coat: Primer, latex for exterior wood:

a. S-W Exterior Latex Primer, B42, at 4.0 mils wet, 1.4 mils dry, per coat.

2. Intermediate Coat: Latex, exterior, matching topcoat.
3. Topcoat: Latex, exterior, satin:

a. S-W A-100 Exterior Latex Satin, A82 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

D. Wood Substrates (Plywood and Trims) – Stain

1. Solid Stain:

a. 3 coats SW WoodScapes Solid Color Stain, A-15 series (Exterior Acrylic Solid color).

2. Clear/Transparent Stain: Apply sanding sealer as recommended by paint manufacturer:
    a. 1 coat SW Wood Classics Oil Stain, A49 Series (degree of stain as selected by the Architect).
    b. 2 coats SW Wood Classics FastDry Oil Varnish, Satin A66 Series.

E. Cementitious Siding and Trims.
1. Prime Coat: Primer sealer, latex:
    a. S-W Loxon Concrete & Masonry Primer Sealer, A24W8300, at 8.0 wet, 3.2 mils dry.
2. Prime Coat: Latex, exterior, matching topcoat.
3. Intermediate Coat: Latex, exterior, matching topcoat.
4. Topcoat: Latex, exterior, satin:
    a. S-W A-100 Exterior Latex Satin, A6 Series, at 4.0 mils wet, 1.2 mils dry, per coat.

3.13 PAINT SCHEDULE – INTERIOR (DRY AREA ONLY)

A. All exposed metal surfaces not otherwise provided for below.
1. These shall include, but not be limited to, the following:
    a. Hollow metal doors and frames
    b. Panel boxes
    c. Miscellaneous metal
    d. Exposed metal structure and framing
    e. Grilles and diffusers
    f. Exposed sheet metal and ductwork
    g. Access doors
    h. Exposed piping and conduit
2. Paint application:
    a. Clean with solvent in accordance with SSPC-SP1 to remove soluble contaminants.
    b. Remove insoluble contaminants by hand or power tool cleaning (SSPC-SP2 or SP3). All surfaces shall be dry and clean.
    c. Verify with each metal item that shop prime coats are compatible with finish field painting.
3. Prime Coat: Primer, rust-inhibitive, water based:
    a. S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet,
    2.0 to 4.0 mils dry.
4. Intermediate Coat: Light industrial coating, exterior, water based, matching topcoat.
5. Topcoat: Light industrial coating, exterior, water based eggshell:
    a. S-W Pro Industrial Eg-Shel Acrylic B66-660 Series, at 2.5 to 4.0 mils dry, per coat.

B. CMU Substrates

1. Block Filler: Block filler, latex, interior/exterior:
   a. S-W PrepRite Block Filler, B25W25, at 75-125 sq. ft. per gal.
2. Intermediate Coat: Latex, interior, matching topcoat.
3. Topcoat: Latex, interior, eggshell:
   a. S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat.

C. Wood Substrates

1. Prime Coat: Primer sealer, latex, interior:
   a. S-W PrepRite ProBlock Primer Sealer, B51-620 Series, at 4.0 mils wet, 1.4 mils dry.
2. Intermediate Coat: Latex, interior, matching topcoat.
3. Topcoat: Latex, interior, eggshell:
   a. S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat.

D. Gypsum Board Substrates (Ceilings/Walls)

1. Prime Coat: Primer, latex, interior:
   a. S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils wet, 1.0 mils dry.
2. Intermediate Coat: Latex, interior, matching topcoat.
3. Topcoat: Latex, interior, eggshell:
   a. S-W ProMar 200 Zero VOC Latex Eg-Shel, B20-2600 Series, at 4.0 mils wet, 1.7 mils dry, per coat.

3.14 PAINT SCHEDULE – EPOXY - INTERIOR (WET AREAS) AND AS NOTED ON DRAWINGS

A. All exposed metal surfaces not otherwise provided for below.

1. These shall include, but not be limited to, the following:
   a. Hollow metal doors and frames
   b. Panel boxes
   c. Miscellaneous metal
   d. Exposed metal structure and framing
   e. Grilles and diffusers
   f. Exposed sheet metal and ductwork
   g. Access doors
   h. Exposed piping and conduit

2. Paint application:
   a. Clean with solvent in accordance with SSPC-SP1 to remove soluble contaminants.
   b. Remove insoluble contaminants by hand or power tool cleaning (SSPC-SP2 or SP3). All surfaces shall be dry and clean.
   c. Verify with each metal item that shop prime coats are compatible with finish field painting.
3. Prime Coat: Primer, rust-inhibitive, water based:
   a. S-W Pro Industrial Pro-Cryl Universal Primer, B66-310 Series, at 5.0 to 10 mils wet,
      2.0 to 4.0 mils dry.
4. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
5. Topcoat: Light industrial coating, interior, water based, eggshell:
   a. S-W Pro Industrial Pre-Catalyzed Water Based Epoxy, K45-151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

B. CMU Substrates
1. Block Filler: Block filler, latex, interior/exterior:
   a. S-W PrepRite Block Filler, B25W25, at 75-125 sq. ft. per gal.
2. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
3. Topcoat: Light industrial coating, interior, water based, eggshell:
   a. S-W Pro Industrial Pre-Catalyzed Water Based Epoxy, K45-151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

C. Wood Substrates
1. Prime Coat: Primer sealer, latex, interior:
   a. S-W PrepRite ProBlock Primer Sealer, B51-620 Series, at 4.0 mils wet, 1.4 mils dry.
2. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
3. Topcoat: Light industrial coating, interior, water based, eggshell:
   a. S-W Pro Industrial Pre-Catalyzed Water Based Epoxy, K45-151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

D. Gypsum Board Substrates (Ceilings/Walls)
1. Prime Coat: Primer sealer, latex, interior:
   a. S-W ProMar 200 Zero VOC Latex Primer, B28W2600, at 4.0 mils wet, 1.0 mils dry.
2. Intermediate Coat: Light industrial coating, interior, water based, matching

topcoat.

3. Topcoat: Light industrial coating, interior, water based, eggshell:
    a. S-W Pro Industrial Pre-Catalyzed Waterbased Epoxy, K45-151 Series, at 4.0 mils wet, 1.5 mils dry, per coat.

E. CMU Interior Wet Areas

1. Block Filler: Block filler, latex, interior/exterior:
    a. 1 to 2 coats Kem Cati-Coat HS Epoxy at 10.0-20.0 mils dry, as required to fill voids and provide a continuous substrate.
2. Topcoat: Protective (Anti-Graffiti) Urethane, Satin:
    a. 2K WB Urethane Anti-Graffiti Satin, at 4.0 mils dry.

F. Previously Painted Substrates:

1. Topcoat: Protective (Anti-Graffiti) Urethane, Satin:
    a. 2K WB Urethane Anti-Graffiti Satin, at 4.0 mils dry.

3.15 PROTECTIVE ANTI-GRAFFITI GENERAL (AS NOTED ON DRAWINGS)

A. Surface Preparation:

1. General: Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, and other foreign material. Any paint that is peeling, flaking, cracking, blistering or lifting must be removed to ensure adequate adhesion.
2. Concrete and Masonry: Concrete and Masonry: For surface preparation, refer to SSPC- SP13/NACE 6, or ICRI No. 310.2R, CSP 2-3. Surfaces should be thoroughly clean and dry. Concrete and mortar must be cured at least 28 days @ 75°F (24°C). Remove all loose mortar and foreign material. Surface must be free of laitance, concrete dust, dirt, form release agents, moisture curing membranes, loose cement and hardeners. Previously Painted: If previously painted surface is in sound condition, clean surface of all foreign material. Smooth, hard or glossy coatings should be dulled by abrading the surface. Apply a test area, allowing to dry one week before testing adhesion. If adhesionis poor, or if this product attacks the previous finish, removal of the previous coating may be necessary.

3.16 PROTECTIVE ANTI-GRAFFITI SILOXANE

A. Bare Concrete Substrates:

1. Topcoat: Protective (Anti-Graffiti) Siloxane, Clear, Semi-Gloss
    a. 1K Siloxane Anti-Graffiti Coating 6.0 to 9.0 mils dry.

B. Porous Masonry and Stone:

1. Base Coat: Anti-Graffiti Coating Reduced 10% with Mineral Spirits
2. Topcoat: Protective (Anti-Graffiti) Siloxane, Clear, Semi-Gloss
    a. 1K Siloxane Anti-Graffiti Coating 6.0 to 9.0 mils dry.

3.17 PROTECTIVE ANTI-GRAFFITI URETHANE

A. CMU Interior/Exterior

1. Block Filler: Block filler, latex, interior/exterior:
    a. S-W Pro Industrial Heavy-Duty Block Filler, B42W150, at 10 mils dry, per coat.
2. Topcoat: Protective (Anti-Graffiti) Urethane, Satin:
    a. 2K WB Urethane Anti-Graffiti Satin, at 4.0 mils dry.

END OF SECTION 099100

SECTION 099656 - EPOXY COATINGS

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. Scope: Provide all of the labor, materials, equipment, and services required to furnish and apply the epoxy coatings.

B. This Section includes Epoxy Coatings on Walls and Ceilings.

C. Related Sections Include the following:

1. Division 04 Section “Architectural Concrete Masonry”.
2. Division 06 Section “Sheathing”.
3. Division 06 Section “General Carpentry”.
4. Division 09 Section “Gypsum Board”.
5. Division 09 Section “Painting”.

1.3 REFERENCE

1. ASTM International (ASTM):

a. ASTM C882 Standard Test Method for Bond Strength of Epoxy Resin Systems Used With Concrete By Slant Shear
b. ASTM D570 Standard Test Method for Compressive Properties of Rigid Plastics
c. ASTM D638 Standard Test Method for Tensile Properties of Plastics.
d. ASTM D645 Standard Test Method for Thickness of Paper and Paperboard.
e. ASTM D695 Standard Test Method for Compressive Properties of Rigid Plastics.
f. ASTM D2240 Standard Test Method for Rubber Property Durometer Hardness.
g. ASTM D4060 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
h. ASTM D4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

1.4 SUBMITTALS

A. Prior to applications, submit to the Architect for review the following:

1. A complete list of all materials proposed to be furnished and installed under this portion of the Work. This shall in no way be construed as permitting substitution of materials for those specified or approved for this work by the Architect.
2. In each case where material proposed is not the material specified or specifically

described as an acceptable alternate in this Section of these Specifications, submit for the Architect's review the current recommended method of application published by the manufacturer of the proposed material.

3. A complete set of available colors for the Architect's selection. Colors shall be coordinated with those of Section 099100, "Painting". The Architect shall have the option of selecting as many colors from any of the various products to be specified here, as he may desire without additional cost to the Owner or the Architect.
4. Prior to applying any epoxy wall coating, it shall be required that the applicator paint a
5. sample area (a minimum of 50 square feet) of the specified epoxy wall coating. This shall be accomplished in the presence of a representative of the manufacturer. This representative must submit certification to the Architect that the sample coating was applied properly and that the sample sets the standard for the Project. Only upon receipt of this certification will the epoxy be allowed to be applied.

B. Maintenance Material Submittals:

1. Specifier Note: Specify by type and quantity extra stock materials to be provided for the Owner’s use in facility operation and maintenance. Specify extra stock material characteristics in PART 2.
2. Deliver to Owner extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels.

C. Certification that all standards and requirements have been met. These shall include, but not be limited to:

1. Delivery.
2. Storage.
3. Conditions under which the materials were installed.
4. Product complies with specified requirements.
5. Specified number coats and mil thickness have been applied.

1.5 QUALITY ASSURANCE

A. Provide finish coats which are compatible with prime coats used. Review other Sections of these Specifications in which prime paints are to be provided to ensure compatibility of total coating system for various substrates. Provide barrier or remove and re-prime. Notify the Architect in writing of any anticipated problems using coating systems as specified with substrates primed by others.

B. Manufacturer Qualifications:

1. 10 year experience manufacturing components similar to or exceeding requirements of project.
2. Having sufficient capacity to produce and deliver required materials without causing delay in work.
3. Capable of providing field service representation during construction.

C. Installer: Acceptable to the manufacturer, experienced in performing work of this section and has specialized in installation of work similar to that required for this project.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver all materials to the job site in their original unopened containers with all labels intact and legible at time of use.

B. Store only the approved materials at the job site, and store only in a suitable and designated area restricted to the storage of epoxy wall coating materials and related equipment.

C. Use all means necessary to ensure the safe storage and use of epoxy wall coating materials and the prompt and safe disposal of waste.

D. Use all means necessary to protect the materials before, during, and after application and to protect the installed work and materials of all other Trades.

E. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Approved manufacturers:

a. Porter/International
b. Benjamin Moore and Company
c. ICI Paints
d. Sherwin Williams
e. Pittsburgh Paint
f. Elite Crete Systems, Inc.

B. Approved manufacturers for isolated items named will be listed with the product.

C. In general and with the exception of these manufacturers named for isolated items, numbers and descriptive names used are those of Porter Paint Company and are for the purpose of convenience, identification, and establishing a standard of quality for the materials required.

D. Any of the mentioned manufacturers shall be acceptable provided a submittal of finished physical sample, full description and formulation of products, and the surfaces that are to be applied to are submitted.

E. All materials shall be first-quality materials.

F. Color: as selected by the Architect.

PART 3 - EXECUTION

3.1 PREPARATION OF SURFACES, GENERAL

A. Mask surfaces, finishes and materials not receiving wall coating, to provide true juncture lines.

B. Spot prime all exposed nails and other metals which are to be painted with emulsion paints, using a primer recommended by the manufacturer of the coating system.

C. Cleaning:

1. Before applying paint or other surface treatment, thoroughly clean all surfaces involved.
2. Schedule work so that dust and other contaminants from the cleaning process will not fall on wet, newly painted surfaces.

3.2 EPOXY WALL COATING APPLICATION

A. Application shall be in strict accordance with the manufacturer's direction, this Contract Documents, and the approved submittals.

B. Exposed piping, hangers, supports, and other exposed metal suspended from the ceiling shall receive epoxy coating when the ceiling is so designated to receive epoxy coating.

C. Drying:

1. Allow sufficient drying time between coats.
2. Modify time period as recommended by the material manufacturer to suit adverse weather conditions.

D. Environmental conditions:

1. Comply with the manufacturer's recommendations as to environmental conditions under which the coating systems may be applied.
2. Do not apply paint in areas where dust is being generated.

E. Moisture content:

1. Use a moisture-meter approved by the Architect to test surfaces.
2. Do not apply the initial coating until moisture-meter reading is within limits recommended by the paint materials manufacturer.
3. Sand and dust between coats to remove all defects visible to the unaided eye.

3.3 INSPECTION

A. Do not apply additional coats until completed coat has been reviewed by the Architect.

B. Only reviewed coats of paint will be considered in determining the number of coats applied.

3.4 DRY MIL THICKNESS

A. Apply all coatings to the dry mil thickness indicated in the "Paint Schedule".

B. Provide and use a "Tooke Dry Film Thickness Gauge", or other gauge approved by the Architect, to prove the dry mil thickness of paint applied.

3.5 REINSTALLATION OF REMOVED ITEMS

A. Following completion of epoxy work in each space, promptly reinstall all items removed for application of epoxy, using only workmen skilled in the particular Trade.

3.6 CLEANING UP

A. General:

1. During progress of the Work, do not allow the accumulation of empty containers or other excess items except in areas specifically set aside for that purpose.
2. Prevent accidental spilling of materials and, in event of such spill, immediately remove all spilled material and the waste or other equipment used to clean up the spill, and wash the surfaces to their original undamaged condition, all at no additional cost to the Owner.

B. Prior to final inspection: Upon completion of this portion of the Work, visually inspect all surfaces and remove all epoxy and traces of epoxy from surfaces not scheduled to be covered.

3.7 EPOXY COATING SCHEDULE

A. Concrete Block:

1. 1 coat Sherwin Williams Heavy Duty Block Filler, B42W46,
2. 1 coat Sherwin Williams 2K Waterbased Urethane Anti-Graffiti Coating, B65 Series, 3.0 mils DFT
3. 1 coat Sherwin Williams 2K Waterbased Urethane Anti-Graffiti Coating, B65 Series, 3.0 mils DFT

B. Plywood Ceilings:

1. 1 coat Sherwin Williams Premium Wall and Wood Primer
2. 2 coats Pro Industrial Waterbased Catalyzed Epoxy, B73-300 Series

C. Gypsum Board: Ceilings/Walls:

1. 1 coat Sherwin Williams ProMar 200 Zero VOC Interior Latex Primer, B28W2600
2. 2 coats Sherwin Williams Pro Industrial Waterbased Catalyzed Epoxy, B73-300 Series

END OF SECTION 099656

SECTION 09 9727 CEMENTITIOUS COATING FOR AQUATIC FEATURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Perform work in accordance with Drawings and general provisions of Contract, including General Conditions of Contract, Supplementary Conditions, and Division 1 General Requirements.

1.2 REFERENCE

A. Requirements in Addenda, Alternates and Conditions collectively apply to this work.

1.3 DESCRIPTION

A. Principle Work Items Are:

1. Aquatic Feature Shell Waterproofing
2. Aquatic Feature White Plaster Finish (Pebble Sheen Option)
3. Start-Up & Maintenance

B. Related Work Elsewhere:

1. 03 3714 - Shotcrete for Aquatic Features
2. 07 1417 – Cold Fluid-Applied Waterproofing for Aquatic Features
3. 09 3014 – Tiling for Aquatic Features
4. 13 1123 – On Grade Aquatic Features
5. 13 1225 – Pumped Concrete for Splash Pad

1.4 SUBMITTALS

A. Samples: Prepare 12-inch square panel at site showing color and texture for White Plaster (Price Alternate Pebble Sheen®). Finished Cementitious Coating shall match approved sample panel.

B. Certificates: Submit certificates attesting that materials furnished meet requirements specified herein.

C. Test Report: Submit results of domestic water analysis.

1.5 PRODUCT DELIVERY AND STORAGE

A. Deliver manufactured materials to site in manufacturers' original unbroken packages or containers bearing manufacturers' name and brand labels. Keep cementations materials dry until ready to be used and stored off ground, under cover, and away from damp surfaces.

PART 2 - PRODUCTS

2.1 WHITE PLASTER

A. Waterproofing

1. AQURON Concrete Pool Shell Protector (CPSP): Permanent, clear treatment, preservative, sealant solution for all shotcrete shells. Shall be applied prior to installation of interior shell finish. See Section 071417 Cold Fluid-Applied Waterproofing for Pools.

B. Materials

1. Portland cement: ASTM C150, Type I white Portland Cement, Hydrated Lime: ASTM C206, Type S.
2. Sand for Pool Plaster Finish Coat: White marble dust uniformly graded within the following limits: All passing the No. 30 sieve.
3. Water: Clean, fresh, from domestic potable source.
4. Percentage retained (by weight plus or minus 2%) on each sieve.
5.

Sieve Size	Minimum	Maximum
No. 30	0	30
No. 50	40	55
No. 100		70-80
No. 200		80-100

C. Plaster Proportions And Mixing

1. Materials are specified on a volume basis and shall be measured in approved containers that shall ensure that the specified proportions shall be controlled and accurately maintained during the progress of the work. Measuring materials with shovel blade (“shovel count”) is not permitted.
2. White Marble Pool Plaster Finish Coat: Mix finish in proportion of one part by volume of white Portland Cement to not more than two parts by volume of sand (specified white marble dust).
3. Mixing: Perform mixing in approved mechanical mixers of the type in that quantity of water can be controlled accurately and uniformly. While mixer is in continuous operation, change approximately 90% of estimated quantity of water, half of sand, all cement, and the other one-half of the sand into the mixer in that sequence, and mix thoroughly with remainder of water until mixture is uniform in color and consistency. Avoid excess mixing to prevent hasty solution of cement resulting in accelerated set. Discard plaster that has begun to set before it is used
4. Re-tempering is not permitted. Do not use any caked or lumpy materials. Completely empty mixer and mixing boxes after each batch is mixed and keep free of old plaster.

D. Plaster Execution

1. Preparation of Surfaces

a. Remove existing plaster surface (if applicable) down to the structural shell of the pool. Clean base surfaces of projections, dust, loose particles, grease, bond breakers, and foreign matter; make sufficiently rough to provide a strong mechanical bond. Thoroughly wash entire surface with 6,000 psi high pressure water immediately prior to plastering (if applicable). Wet cementatious base surfaces with a fine fog water spray to produce a uniformly moist condition and check screeds, pool equipment, and accessories for correct alignment before plastering is started. Do not apply plaster to base surfaces containing frost. Install temporary coverings as required to protect adjoining surfaces from staining or damage by plaster operation.

E. Plaster Application

1. General: Apply finish plaster to minimum 5/8 inch thickness at any location. Apply finish plaster by hand or machine. If plastering machine is used, control fluidity of plaster to have a sump not exceeding 2-1/2 inches when tested using a 2" by 4" by 6" high slump cone. Do not add additional water to the mix subsequent to determining water content to meet this slump. Perform slump test according to the following procedure:

   a. Place cone on level, dry, non-absorptive base plate.

   b. While holding cone firmly against base plate, fill cone with plaster taken directly from the hose or nozzle of plaster machine, tamping with metal rod during filling to release all air bubbles.

   c. Screed off plaster level with top of cone. Remove cone by lifting it straight up with a slow and smooth motion.

   d. Place cone in a vertical position adjacent to freed plaster sample using care not to jiggle the base plate.

   e. Lay straightedge across top of cone being careful not to vibrate cone; measure slump in inches from bottom edge of straightedge to the top of the slumped plaster sample.

2. Workmanship: Apply finish plaster in two coats by "double back" method with second coat applied as soon as first coat is tamped and initially floated. Apply plaster with sufficient pressure to provide a good hold on bond bases. Work plaster to screeds at intervals from 5 feet to 8 feet or closer as required on curved surfaces. Finish plaster to tolerance of –0 to +1/8 inch in thickness and to 1/8 inch in 8 feet of straight pits, crazing, discoloration, projections, or other imperfections. Form plaster carefully around curves and angles, well up to screeds. Take special care to prevent sagging and consequent drooping of applications. Produce surfaces free of visible junction marks in finish coat where one day's work adjoins another.

   a. Curing: Fill the pool with local potable water supply. Water provided by owner. Prevent damage or staining of plaster by toweling of curing.

   b. Patching, pointing, and Cleaning-Up: Upon completion, cut out and patch loose, cracked damaged, or defective plaster; patches matching existing plaster in texture, color, and finish, flush with adjoining plaster. Perform pointing and patching of surface and plasterwork abutting or adjoining any other finish work in a neat and workmanlike manner. If 5 percent or more of the pool's plaster finish is found to be defective, the plaster shall be removed and replaced complete for the entire pool. Remove plaster droppings or spattering from all surfaces. Leave plaster surfaces in clean, unblemished condition ready for pool filling. Remove protective coverings from adjoining surfaces. Remove rubbish and debris from the site.

2.2 PEBBLE SHEEN® (Pricing Alternate).

A. Waterproofing

1. AQURON Concrete Pool Shell Protector (CPSP): Permanent, clear treatment, preservative, sealant solution for all shotcrete shells. Shall be applied prior to installation of interior shell finish. See Section 071417.

B. Materials

1. Color: Arctic White (Optional Colors available)
2. Pebble Sheen® materials shall conform to respective specifications and other requirements as follows:
   a. Cement shall be Type 1 cement.
   b. Aggregates shall be supplied by Pebble Tec Technology, Inc. and will be blended according to formulas established by Pebble Tec Technology to achieve interior finish color specified.
   c. Water shall be clean, fresh, potable, and free of oils, acids, alkalis, and organic matter injurious to cementitious material.

2.3 PROPORTIONS AND MIXING

A. Pebble Sheen® materials shall be mixed in mechanical mixers. Caked or lumped material shall not be used. Each batch shall be accurately proportioned by volume, based on color formulas established by Pebble Tec Technology, then mixed with minimum amount of water until uniform in color and consistency. Re-tempering will not be permitted and Pebble Sheen® material that has begun to “set” prior to application will be discarded.

B. Mix Proportions: Pebble Sheen® mixture is one-to-one ratio of cement and pebble. Slump should be that which is greatest to allow proper pumping through standard pool plaster pump. Additives may be used to aid in retardation or acceleration of set time and will be determined on jobsite at discretion of crew foreman, based on condition of shell, ambient temperature, and various other factors.

2.4 SURFACE PREPARATION

A. Pebble Sheen Surface preparation: Proper surface preparation is essential and shall be inspected by Owner/ Representative of construction project prior to release to and placement of Pebble Sheen® interior finish by Pebble Sheen® Applicator. Surfaces must be free of frost, paint, oil grease and foreign matter prior to release from Pebble Sheen® Applicator.

2.5 APPLICATION

A. Machine Application: Pebble Sheen® coats shall be applied by means of efficient plaster pump. Mix proportions shall be appropriate for use with these machines. Alternate means of delivery may be required due to site conditions. Alternatives must be approved by Pebble Tec Technology, Inc.

B. Pebble Sheen® Thickness: Pebble Sheen® interior shall be finished to semi-smooth finish within limits of established trade practices for hand trowel aggregate surface. Thickness of material from face of gunite/ shotcrete structure to finished Pebble Sheen® surface shall be no less than ½" average minimum thickness.

C. Application must be done by Licensed Pebble Sheen® Applicator utilizing procedures and equipment approved by Pebble Tec Technology, Inc.

1. Two-coat process shall be applied to vertical shell surfaces and one-coat process on floors.
2. Temperature: shell and ambient temperature shall be above freezing (32°F) unless special heating apparatus is used during Pebble Sheen® application.
3. Scratch Coat: Scratch coat shall not be applied until conditions under surface preparation have been met. Scratch coat thickness shall be carefully controlled to fill normal surface irregularities. Pebble Sheen® coating will follow most contours of existing shell.
4. Finish Coat: finish coat, following specified mix proportions, shall be pneumatically applied over partially dry bond coat. Finish coat shall be floated to semi-smooth surface, and trowel in manner that will achieve compaction of aggregates that meet standards for authorized Pebble Sheen® Applicator.
5. Surface Cleaning: Following application of Pebble Sheen® interior finish, surface should be washed by trained Pebble Sheen® Applicator. This will generally be performed after minimum of 12 hours and up to 3 days set time, after which fill water should be started.

PART 3 - START-UP EXECUTION

3.1 START-UP

A. Contractor shall employ a qualified water-testing agency to analyze the domestic water that the pool is to be filled with within 2 weeks of the plastering date. The contractor shall also employ a swimming pool experienced water chemistry consultant to determine types and quantities of chemicals required to ensure balanced water, per Langelier Stability Index values, immediately upon the completion of water filling. Contractor shall employ the services of this consultant for follow up visits after the pool has been turned over to the owner. Contractor shall include four (4) additional visits from the consultant for training and follow up testing of the water chemistry.

1. Have on-hand, quantities of the chemicals as determined above, plus 25% overage for follow-up treatment. These chemicals, typically including calcium chloride, bicarbonate of soda, and muriatic acid, are in addition to standard chlorine products and pH control products required elsewhere.
2. It will be the responsibility of the owner to fill the pool.
3. The pool shall not be plastered until the filtration system and chlorinating systems are complete and ready for start-up. Contractor shall notify the Owner in writing of start-up at least two weeks prior to the plaster date. The Owner is responsible for supplying chlorine products, and pH control products, for maintenance of the pool by automated treatment systems. Should these automated treatment systems fail or the Contractor fail to notify the Owner as required, the Contractor shall supply all chemicals required for the manual treatment of the pool water.

4. Contractor shall maintain swimming pool for 14 consecutive, problem free, days in conjunction with the mechanical system operational test. This maintenance period shall be extended with the mechanical system operational test if required per specifications. During this time, brush the entire pool plaster surface daily starting immediately after filling the pool for a minimum of 5 days to remove plaster dust. Periodically clean grates until no further accumulation of foreign material occurs, and add chemicals as required for acceptable water quality. In addition to brushing, the pool shall be vacuumed throughout the 14-day period starting no sooner than 5 days after the date of plaster. After successful conclusion of the mechanical system operational testing, Contractor shall clean grates and tile, vacuum pool, and leave the pool ready for use.
5. Training
    a. Contractor shall provide two separate start-up/training sessions with the owner's maintenance staff.
    b. Contractor shall inform the owner a minimum of one week prior to each of the training sessions.
    c. First session should occur once the mechanical system is operational and all bodies of water balanced.
    d. Second session shall be provided 2-3 weeks after the first session.
    e. Contractor shall provide owner with a video record of each session.

END OF SECTION 099727

SECTION 101400 - SIGNAGE

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. Scope: Provide all of the labor, materials, equipment, and services required to furnish and install the signage.

B. This Section includes Wall/Room Signage Plaques.

1.3 SUBMITTALS

A. Prior to installation, submit to the Architect for review the following:

1. Manufacturer's literature fully describing each:
    a. Product and its fabrication.
    b. Details of construction relative to materials, dimensions of individual components, profiles and finishes.
    c. Attachment and installation instructions.
2. Shop drawings, fully dimensioned, showing fabrication and erection of signs. Include plans, elevations, large-scale sections of typical members and other components.
    a. Show anchors, grounds, layout, reinforcement, accessories and installation details.
3. Physical sample for the Architect's selection of color.
4. Manufacturer's certification that Braille is correct for verbiage.
5. Schedule and layout of all signs (each location), message list and graphics.

1.4 QUALITY ASSURANCE

A. Signage shall be of type and construction as approved by American with Disabilities Act (ADA).

B. Sign fabricator: Firm experienced in producing signs similar those indicated for this Project, with a record of successful in-service performance, and sufficient production capacity to produce sign units required without causing delay in the Work.

C. Single-source responsibility: For each separate sign type required, obtain signs from one source of a single manufacturer.

D. The Drawings indicated sizes, profiles, dimensional requirements of signs and are based on the specific types and models indicated. Sign units by other manufacturers may be considered provided deviations in dimensions and profiles do not change the design concept as judged by the Architect. The burden of proof of equality is on the proposer.

1.5 JOB CONDITIONS

A. Take field measurements prior to preparation of shop drawings and fabrication to ensure proper fitting. Show recorded measurements on final shop drawings. Coordinate fabrication schedule with construction progress to avoid delay.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Acceptable product shall be a comparable product with the basis-of-design product.

a. Best Manufacturing Sign Systems (basis of design).
b. ASI
c. Gemini Inc

2.2 WALL SIGNAGE PLAQUES:

A. Description:

1. Sign style type: Best HC300 ADA System.
2. Materials:

a. Interior applications: Type Melamine Plastic "MP" two-color, scratch resistant, non- static, fire retardant, washable, 3-ply melamine surface laminate. Nonglare surface with phenolic core which shall be painted a contracting color after artwork has been carved into the surface.
b. Exterior applications: Type Fiberglass “FG” non-corrosive, 3-ply laminate with contrasting core color, UV inhibitors, non-glare surface and 20 year life expectancy. Fire resistant.

3. Color: Selected by the Architect from the manufacturer's standard colors.
4. Letter style: Helvetica Medium, upper and lower case.
5. Mounting: Counter sunk holes for screw attachment. Screw heads shall be flush with the surface of the plaque and shall be colored to match the plaque.
6. Graphic and copy:

a. Sign copy and graphic shall be as designated by the Architect.
b. Size of sign shall be as recommended by the manufacturer to accommodate the wording and the graphic.
c. ADA Compliance: Braille copy shall be Standard English Braille, Grade II.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Installation shall be in accordance with the approved submittals, the Contract Documents, and manufacturer's instructions.

B. Once installed, the signs shall be level and true. In addition, location and height on wall shall be in accordance with ADA requirements.

END OF SECTION 101400

SECTION 102313 - TOILET COMPARTMENTS

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. Scope: Provide all labor, materials, equipment and services required to furnish and install the toilet compartments.

B. This Section includes Toilet/Shower Compartments, Urinal Screens and all required hardware.

1.3 SUBMITTALS

A. Prior to fabrication, submit to the Architect for review the following:

1. Complete and fully descriptive literature.
2. Shop drawings showing layout of the compartments, dimensions, materials, sizes, thickness, gauges, product construction, hardware, accessories and installation procedure.
3. Physical sample of the following:

    a. Cross section at partition corner showing actual core material and finished exterior surface.
    b. Solid composition material in all colors and finishes for the Architect's selection.

1.4 JOB CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible, to ensure proper fitting of work. However, allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay work.

B. Coordination: Furnish inserts and anchorages which must be built into other work for installation of toilet compartments and related work; coordinate delivery with other work to avoid delay.

PART 2 - PRODUCTS

2.1 TOILET/SHOWER COMPARTMENTS AND URINAL SCREENS

A. The following are approved for this project:

a. Scranton
b. Global
c. Accurate

B. Type:

1. Toilet partitioning: Floor-mounted, headrail-braced.
2. Urinal screens: Floor/pilaster supported, wall-bracket

C. Provide panels, pilasters, and doors in one of the two following systems:

1. One-inch thick constructed from High-Density Polyethylene (HDPE) resins. Partitions shall be fabricated from polymer resins compounded under high pressure, forming a single component which is waterproof, non-absorbent and has a self-lubricating surface that resists marks from pens, pencils, markers and other writing instruments. Panels to have uniformly machined edges. Doors and panels shall be 55” high and mounted 14” above the finished floor. All plastic components shall be covered with a protective plastic masking. Provide radius edges and aluminum heat-sinc fastened to bottom of edges and full length wall brackets.
2. Or an approved alternate.

D. Headrail: Provide integral anti-grip, loafer rail, extruded aluminum heat-treated and anodized with necessary fittings.

E. Hardware and fittings:

1. Fasteners, shoe/base cover, continuous partition brackets (full partition height) and headrail mounting brackets: Heavy duty stainless steel. Mount to substrate with tamper- proof toggle bolts.
2. Door hinges: Provide 8-inch "handicap" hinge at all doors. Mount to pilasters with tamper-proof thru-bolts. Hinges shall be heavy duty type and capable of withstanding 250 lbs. of pressure from any direction.
3. Door latch/strike set: Heavy duty aluminum and fastened with tamper-proof fasteners.
4. Door coat hook/bumper: Chrome-plated zinc alloy die casting equipped with rubber bumper on end of hook, fastened with non-reversing tamper-proof screws.
5. Door pull: Chrome-plated zinc alloy die casting fastened with tamper-proof nonreversing screws.
6. Anchors: As provided by partitions manufacturer;

Anchors shall have 2700 lbs of holding strength when used in 5000 psi concrete flooring.

F. Color and Texture: As selected by the Architect from Manufacturer colors.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which toilet partitions and related items are to be installed, including supporting anchors and supports installed by others. Notify Contractor in writing of conditions detrimental to proper and timely completion of

work. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's recommended procedures and installation sequence. Install partitions rigid, straight, plumb, and level.

1. Maximum clearances:

a. Between pilasters and panels: 1/2-inch
b. Between panels and walls: 1-inch

2. Secure panels to walls with continuous extruded wall brackets and toggle bolt type anchoring device. Secure panels to pilasters with not less than two stirrup brackets. Secure panels in position with manufacturer's recommended anchoring devices.

B. Floor mounted head-rail braced:

1. Secure pilasters to floor, and level, plumb, and tighten installation with devices furnished.
2. Secure overhead brace to each pilaster with not less than two fasteners.
3. Hang doors and adjust so that tops of doors are parallel with overhead brace when doors are in closed position.

C. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUST AND CLEAN:

A. Hardware adjustment: Adjust and lubricate hardware for proper operation. Set hinges on in- swinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors (and entrance swing doors) to return to fully closed position.

B. Clean exposed surfaces of partition system using materials and methods recommended by manufacturer, and provide protection as necessary to prevent damage during remainder of construction period.

END OF SECTION 102313

SECTION 102800 - TOILET, BATH AND LAUNDRY ACCESSORIES

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. This Section includes the following:

1. Public-use washroom accessories.
2. High Velocity Warm-air dryers.
3. Childcare accessories.
4. Under-lavatory guards.
5. Custodial accessories.

B. Related Sections include the following:

1. See Electrical for connections to accessories. (As required)

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Construction details and dimensions.
2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Samples: Full size, for each accessory item to verify design, operation, and finish requirements.

1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated on Drawings.
2. Identify products using designations indicated on Drawings.

D. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.4 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.5 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same articles in Part 2, provide products of same manufacturer unless otherwise approved by Architect.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.6 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.7 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified. Acceptable product shall be a comparable product with the basis-of-design product.

2.2 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.0312-inch (0.8-mm) minimum nominal thickness, unless otherwise indicated.

B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled,

commercial steel), 0.0359inch (0.9-mm) minimum nominal thickness.

C. Galvanized Steel Sheet: ASTM A 653/A 653M, with G60 (Z180) hot-dip zinc coating.

D. Galvanized Steel Mounting Devices: ASTM A 153/A 153M, hot-dip galvanized after fabrication.

E. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamperand-theft resistant where exposed, and of galvanized steel where concealed.

F. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).

G. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 1/4 inch (6.0 mm) thick.

H. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

C. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

a. Bobrick Washroom Equipment, Inc.
b. Bradley Corporation.
c. American Specialties, Inc.
d. A & J Washroom Accessories, Inc.
e. General Accessory Manufacturing Co. (GAMCO).

D. Toilet Tissue (Jumbo Roll) Dispenser:

1. Basis-of-Design Product: Bobrick; Model B-2892.
2. Description: Dual jumbo-roll dispenser
3. Mounting: Surface mounted.
4. Capacity: Designed to hold (2) standard rolls up to 10” diameter with 3-inch diameter core. Core adapters accept 2 1/4-inch diameter core.
5. Material and Finish: Stainless steel, alloy 18-8, type 304 with No. 4 Satin finish. Inside mechanism of durable ABS with sliding bottom access panel to allow dispensing from one roll at a time. Equal products by other manufacturers meeting specifications requirements will be accepted.
6. Owner provided, Contractor installed.

E. Paper Towel Dispenser (Concession Room Sink):

1. Basis-of-Design Product: Bobrick; Model B-262
2. Description: C-Fold / Multi-Fold towel dispenser, satin finish stainless steel, vandal resistant hinged locking cover
3. Mounting: Surface mounted.
4. Owner provided, Contractor installed.

F. Sanitary Napkin Disposal:

1. Basis-of-Design Product: Bobrick; Model B-270
2. Description: Satin-finish stainless steel. Cover is drawn, one-piece construction; secured to cabinet with full-length stainless steel piano-hinge. Capacity: 1.0-gal.
3. Mounting: Surface mounted. .
4. Contractor provided, Contractor installed.

G. Liquid-Soap Dispenser:

1. Basis-of-Design Product: Bobrick; Model 818615
2. Description: Corrosion-resistant valve dispenses commercially marketed all-purpose hand soaps. Container is satin-finish Type 316 stainless steel. Capacity: 40 fl-oz
3. Mounting: Surface mounted.
4. Owner provided, Contractor installed.

H. Grab Bar:

1. Basis-of-Design Product: Bobrick; Model B-5806
2. Mounting: Flanges with concealed fasteners.
3. Material: Stainless steel type 304, 0.05 inch thick, smooth, No. 4, satin finish.
4. Outside Diameter: 1-1/4 inches.
5. Configuration and Length: As indicated on Drawings.

I. Mirror Unit (Concession / Restrooms):

1. Basis-of-Design Product: Bobrick; Model B-290 2430
2. Description: 24" W x 30" H. One-piece, roll-formed 3/4" x 3/4" (19 x 19mm) angle-frame. Type 304 stainless steel angle with satin finish. Corners heliarc welded, ground and polished smooth. Beveled frame edge at mirror for improved appearance. No. 1 quality, 1/4" (6mm) glass mirror; warranted against silver spoilage for 15 years. Galvanized steel back. Secured to concealed wall hanger with theft-resistant mounting.
3. Contractor provided, Contractor installed.

J. Clothes Hook with Bumper:

1. Basis-of-Design Product: Bobrick; Model B-212
2. Description: Solid aluminum casting, matte finish. Rubber bumper protects wall or partition surfaces.
3. Mounting: Surface mounted. .
4. Contractor provided, Contractor installed.

K. Baby Changing Station

1. Basis-of-Design Product: Koala Corporation – Model KB200-05WG, Color: White Granite.
2. Description: Baby Changing Station Horizontal Supports static loads up to 400 lbs. Steelon-Steel hinges with 12 gauge steel mounting supports ADA compliant with proper installation. Child protection straps and diaper bag hook. Molded-in liner dispenser will hold approximately 25 sanitary liners. FDA approved blow-molded high-density polyethylene with Microban Antimicrobial additive (resists odors and bacterial growth). Reinforced full-length steel-on-steel hinge mechanism, with 11-gauge steel mounting plates and mounting hardware included. Molded in graphics and safety messages in six languages and Braille. Contoured changing surface area is 442 sq in (2873 sq mm).
3. Mounting: Wall mounted
4. Contractor provided, Contractor installed.

L. Child Protection Seat

1. Basis-of-Design Product: Bobrick – Model KB102
2. Description: Koala's child protection seat allows parents to comfortably secure a child while tending to siblings and other matters in restrooms and fitting rooms. Steel pivot rod secured in aluminum tube hinge mechanism provides superior support and wear resistance. Textured seat surface with nylon safety straps that extends over child's shoulders and between legs for security. Closed unit folds to less than 6" (143 mm), and requires less than 2 sq. ft (1858 sq. cm) of wall space. Designed to support a child 50 pounds or less (22.7 kilograms). Polyethylene seat surface exclusively contains Microban® antimicrobial, reducing odor causing bacteria. Constructed with 31% recycled materials; contributes to LEED certified building requirements.
3. Mounting: Wall mounted
4. Contractor provided, Contractor installed.

M. Shower Seat

1. Basis-of-Design Product: Bobrick – Model B5181, Color: Opaque White .
2. Description:. Reversible Shower Seat – Folding.
3. Seat is constructed of durable, water-resistant, ivory-colored 1/2" (13mm) thick solid phenolic. Reversible for left- or right-hand field installation. Frame and mounting brackets are type 304 stainless steel with self-locking mechanism. Supports up to 360 lbs (163 kg) when properly installed. Seat 33" (840mm) wide, projects 22 5/16" (565mm) from wall. Complies with Planning Guide for Accessible Restrooms
4. SAFETY WARNING:
   Shower seats are no stronger than the anchors and walls to which they are attached and must be firmly secured in order to support the loads for which they are intended. Consult and comply with local building codes. To avoid potential injury, the building owner or maintenance personnel should remove the shower seat from service if the shower seat is not adequately secured to the wall. In the interests of safety and the protection of end users, this seat should not be used to support weights exceeding 360lbs (163 kg). To avoid potential seat malfunction, DO NOT use seat if weight exceeds 360 lbs (163 kg). Failure to abide by this warning may result in seat malfunctioning,

potentially causing minor to moderate injury.
5. Mounting: Wall mounted
6. Contractor provided, Contractor installed.

N. Shower Curtain

1. Basis-of-Design Product: Bobrick – Model 204-2, Color: Opaque White
2. Description: Shower Curtain - 42" W x 72" H (1065 x 1830mm), Opaque, matte white vinyl, .008" (0.2mm) thick, contains antibacterial and flame retardant agents. Nickel- plated brass grommets along top, one every 6" (150mm). Hemmed bottom and sides.
3. Mounting: Wall mounted Requires 7 hooks (not included - see below).
4. Contractor provided, Contractor installed.

O. Shower Hooks

1. Basis-of-Design Product: Bobrick – Model 204-1, Color: Stainless Steel
2. Description: Shower Curtain Hook - Type 304 stainless steel. For use on 1" and 1-1/4" (25 and 32mm) dia. shower curtain rods.
3. Mounting: Provide number required for Shower Curtain listed above
4. Contractor provided, Contractor installed.

P. Shower Rod

1. Basis-of-Design Product: Bobrick – Model 6047 x 36, Color: Stainless Steel.
2. Description: 36" (915mm) length. 1 1/4” (32mm) diameter rod is 18-gauge (1.2mm), type 304 stainless steel, satin finish. 2 1⁄2" (65mm) flanges are 304 stainless steel, satin finish; Confirm length with shower plan.
3. Mounting: Wall Brackets
4. Contractor provided, Contractor installed.

2.4 WARM-AIR DRYERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Excel Dryer Corporation.

B. High-Velocity Warm-Air Dryer:

1. Basis-of-Design Product: Excel Dryer; Xlerator series; XL-W .
2. Dimensions: 11 3/4” LG by 12 11/16” high by 6 11/16” deep.
3. Weight: 16 lbs.
4. Mounting: Semi-recessed with ADA mounting kit.
5. Operation: Infra-red sensor activated with timed power cut-off switch.
6. Operation Time: under 35 seconds.
7. High-velocity
8. Cover Material and Finish: one-piece, heavy-duty, rib-reinforced, die-cast zinc alloy. To be rust-proof, chip-proofed and tamper/vandal-proof Electrical Requirements: 115 V, 14.4 A, 1653 W.

9. Color: White
10. Contractor provided, Contractor installed.

2.5 UNDERLAVATORY GUARDS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Basis-of-Design Product: Truebro Lav Guard 2 E-Z
2. Description: Antimicrobial, molded plastic
3. Color: White
4. Mounting: undersink around exposed piping
5. Contractor provided, Contractor installed.

2.6 CUSTODIAL ACCESSORIES

A. Basis-of-Design Product: The design for accessories is based on products indicated. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

a. Bobrick Washroom Equipment, Inc.
b. Bradley Corporation.
c. American Specialties, Inc.
d. A & J Washroom Accessories, Inc.
e. General Accessory Manufacturing Co. (GAMCO).

B. Mop and Broom Holder:

1. Basis-of-Design Product: Bobrick model B-239.
2. Description: Unit with shelf, hooks, holders, and rod suspended beneath shelf.
3. Hooks: Four.
4. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
5. Material and Finish: Stainless steel, No. 4 finish (satin).

a. Shelf: Not less than nominal 0.05-inch thick stainless steel, 34-inch long, 8-inch deep.
b. Rod: Approximately 1/4-inch-diameter stainless steel.

6. Contractor provided, Contractor installed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.

B. Grab Bars: Install to withstand a downward load of at least 250 lbf (1112 N), when tested according to method in ASTM F 446.

3.2 ADJUSTING AND CLEANING

A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.

B. Remove temporary labels and protective coatings.

C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104416 - FIRE EXTINGUISHERS

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. Scope: Provide all labor, materials, equipment and services required to furnish and install the fire extinguishers.

B. This Section includes Portable Fire Extinguishers, Cabinets and Accessories.

1.3 SUBMITTALS

A. Prior to installation, submit to the Architect for review the following:

1. Shop Drawings: Show all materials, dimensions, and finishes.
2. Physical Sample: Cabinet finish proposed to be provided.
3. Manufacturer's literature fully describing the product, including installation and maintenance in accordance to section 9062006 IFC and NFPA 10 (latest edition).

1.4 QUALITY ASSURANCE

A. Provide portable fire extinguishers, cabinets, and accessories by same manufacturer.

B. Comply with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities.

1.5 DELIVERY, HANDLING, AND STORAGE

A. Products shall be delivered to job-site in original unopened packages bearing manufacturer’s labels.

B. Store and protect products in accordance with manufacturer’s recommendations.

1.6 COORDINATION

A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of wall-mounted fire extinguishers with door swings and path of travel concerns.

C. Final location of wall-mounted fire extinguishers are to be approved by agencies having jurisdiction.

PART 2 - PRODUCTS

2.1 FIRE EXTINGUISHERS

A. Types:

1. 4A-60B:C.

2.2 WALL BRACKET

A. Extinguisher manufacturer's standard.

PART 3 - EXECUTION

3.1 GENERAL

A. Install in strict accordance with the Contract Documents and the approved submittals.

B. Notify the Architect in writing of any irregularities that will adversely affect the proper installation of the cabinet. Commencement of work shall imply acceptance of the wall and opening.

C. Install square and plumb, and securely anchor mountings brackets to substrate per manufacturer's instructions.

D. Upon installation employ a certified fire suppression contractor to inspect, certify, tag and date each fire extinguisher.

E. Remove and replace damaged, defective or undercharged extinguishers.

3.2 INSTALLATION

A. Install the items of this Section in strict accordance with the original design, approved shoe drawings, and requirements of agencies having jurisdiction, anchoring all components firmly into position.

END OF SECTION 104416

SECTION 105113 – LOCKERS AND BENCHES

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. This Section includes the following:

1. All-welded, metal lockers.
2. Solid Plastic lockers.
3. Plastic Laminated Plywood Lockers.
4. Wood Lockers.
5. Locker benches.

B. Related Sections include the following:

1. Division 03 Section “Cast-in-Place Concrete” for concrete locker base.

1.3 DEFINITIONS

A. Uncoated Steel Sheet Thicknesses: Indicated as the minimum thicknesses.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of locker and bench.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Show base, sloping tops, filler panels and other accessories.
2. Include locker identification system.

C. Samples for Selection: For units with factory-applied color finishes, in manufacturer's standard sizes.

D. Qualification Data: For Installer.

E. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

F. Warranty: Special warranty specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative of metal locker manufacturer for installation and maintenance of units required for this Project.

B. Source Limitations: Obtain metal lockers and accessories through one source from a single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of metal lockers and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."

1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Regulatory Requirements: Where lockers are indicated to comply with accessibility requirements, comply with Accessibility Guidelines for Buildings and Facilities (ADAAG)."

1. Provide not less than 1 shelf located no higher than 48 inches above the floor for forward or 54 inches above the floor for side reach.
2. Provide 1 shelf located at bottom of locker no lower than 15 inches above the floor for forward or 9 inches above the floor for side] reach.
3. Provide hardware that does not require tight grasping, pinching, or twisting of the wrist, and that operates with a force of not more than 5 lbf

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for metal locker installation.

1.7 PROJECT CONDITIONS

A. Field Measurements: Verify the following by field measurements before fabrication and indicate measurements on Shop Drawings:

1. Concealed framing, blocking, and reinforcements that support metal lockers before they are enclosed.
2. Recessed openings.
3. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish recessed opening dimensions and proceed with

fabricating metal lockers without field measurements. Coordinate wall and floor construction to ensure that actual recessed opening dimensions correspond to established dimensions.

1.8 COORDINATION

A. Coordinate size and location of concrete bases for metal lockers.

B. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lockers that fail in materials or workmanship, excluding finish, within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Structural failures.
   b. Faulty operation of latches and other door hardware.
2. Damage from deliberate destruction and vandalism is excluded.
3. Warranty Period for All-Welded Metal Lockers: 10-years date of Substantial Completion.
4. Warranty Period for Solid Plastic Lockers: 25-years date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: The design for the lockers is based on a product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the manufacturers specified.

B. Acceptable Manufacturer:

1. Penco.
2. Global Industrial.
3. ASI.
4. Hadrian.
5. Scranton.
6. TreeForms.
7. Legacy Lockers

2.2 ALL-WELDED METAL LOCKERS

A. Basis-of-Design Product: All-Welded Locker as manufactured by Penco.

B. Locker Arrangement, size and configuration: As indicated on Drawings.

C. Description: All components are assembled by welding body components together. Fabricate from unperforated, prime grade mild cold-rolled steel sheet, ASTM A1008, with thicknesses as follows:

1. Tops, Bottoms, and Sides: 16-ga.
   a. Continuous sloped Top.
   b. Finish end panels.
   c. Filler panels.

2. Backs: 18-ga.

3. Door: 14-ga.
   a. Ventilation: Louvered doors in manufacturer's standard patten.
   b. 3/8-inches flange as continuous door strike.
   c. Single point latch door, reinforced by a full height 3-1/2 inches wide by 18-ga. Vertical pan welded to the top, bottom and hinge side flanges.
   d. Hinge: Continuous full-height, piano type, 16-ga.with steel rivet.
   e. Door handle: Stainless steel 304 stainless steel with no. 4 finish, recessed, ADA- compliant, with padlock staple.

4. Interior:
   a. Shelves: Flanged with double bend at front and single bend at sides and back. Install at ADA-compliant height.
   b. Hooks and Rods: zinc plated seel, 1-double prong hook and 1-hanging rod at each locker unit.

5. Integral base: 4-inches high 16-ga. steel channel, welded to the locker bottom.

6. Finish: Enamel powder coat paint finish, 2 to 2.2 mils, Architect to select color from Manufacturer full range.

2.3 SOLID PLASTIC LOCKERS

A. Basis-of-Design Product: "Solid Plastic Tufftec Lockers" by SCRANTON PRODUCTS (Santana/Comtec/Capitol).

B. Locker Arrangement, size and configuration: As indicated on Drawings.

C. Performance Requirement:

1. Fire Resistance: Partition materials shall comply with the following requirements, when tested in accordance with the ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials:
   a. Smoke Developed Index: Not to exceed 450
   b. Flame Spread Index: Not to exceed 75
   c. Material Fire Ratings:

1) National Fire Protection Association (NFPA): Class B
2) International Code Council (ICC): Class B

2. Material Testing: All solid plastic components shall resist deterioration and discoloration when subjected to any of the following: acetic acid 80%, acetone, ammonia 12%, ammonium phosphate, bleach 12%, borax, brine, caustic soda, chlorine water, citric acid, copper chloride, core oils, hydrochloric acid 40%, hydrogen peroxide 30%, isopropyl alcohol, lactic acid 25%, lime sulfur, nicotine, potassium bromide soaps, sodium bicarbonate, trisodium phosphate, urea, urine and vinegar. (Testing in accordance with corrosion testing procedure established by the United States Plastic Corporation.)

D. Description: All components are from high impact high density polyethylene (HDPE) sheets.

1. Fabrication:
   a. Locker components shall be fabricated square and rigid with a finish free of scratches and chips.
   b. Solid plastic locker components shall snap together for easy assembly and shall provide a solid and secure construction. Adjacent lockers shall share a common side panel. Locker units shall be manufactured for assembly in a group of no more than four adjacent lockers.
   c. Components shall have machined edges to accept assembly brackets.

2. Tops, Bottoms, Backs, Sides and Shelf: 3/8-inch. Out sides, insides, tops, bottoms, backs, dividers and shelves shall be natural in color.
   a. Continuous sloped Top.
   b. Finish end panels.
   c. Filler panels.

3. Base: 4-inches high, 1-inch thick base.

4. Door and Frame: Locker doors and frames shall be made from high impact, high density polyethylene (HDPE) formed under high pressure into solid plastic components ½" thick with homogeneous color throughout.
   a. Door Handles: Recessed, ADA-compliant, with padlock staple.

5. Continuous latch shall be made from high impact HDPE plastic and capable of accepting various locking mechanisms. Latch shall be securely fastened to the entire length of the door, providing a continuous latch.

6. Door hinge: Continuous door hinge shall be made from heavy duty extruded aluminum with a powder coating to match the locker door and frame. Door hinge shall be full length assembled onto the door and front.

7. Assembly profile shall be full depth, width and height of the lockers. Profile shall be made from PVC plastic and snap-fit assemble onto locker outsides, insides, backs, tops and bottoms.

8. Equipment: Each locker to receive 2 coat hooks, shall be be two-prong and made from high impact plastic and mounted to bottom of the shelf or divider, one each per door opening.

9. ADA-Compliant Locker: Locker to be A.D.A compliance.

10. Accessories:
    a. Continuous Sloping Tops, matching locker material and finish.
    b. Recess Trim/base trim, filler panel and boxed end panel: Fabricated from same material and finish as locker.

11. Finish: Factory finished. All HDPE components shall have a smooth ”orange peel” finish. Locker doors and door frames shall be the same color and selected from standard TuffTec colors, Architect to select.

2.4 WOOD AND LAMINATE LOCKER

A. Basis of Design Product: Treeforms Wood Lockers.

B. Locker Arrangement, size and configuration: As indicated on Drawings.

C. Fabrication:

1. Locker components shall be fabricated square and rigid with a finish free of scratches and chips.

2. Solid wood ash locker components shall provide a solid and secure construction. Adjacent lockers shall share a common side panel.

D. Door and Frame: Standard ¾-inch louvered door. Door panels to be solid face panel.

1. Door Handles: Recessed, ADA-compliant, with padlock staple.

E. Shelves: Manufacturers standard 5/8-inch double-sided melamine and MDF board construction.

F. Latch – Heavy-duty, gravity latch and pad lock operation.

G. Door hinge: Continuous door piano hinge shall be made from heavy duty extruded aluminum with a powder coating to match the locker door and frame. Door hinge shall be full length assembled onto the door and front.

H. Interior: Hooks and Rods: zinc plated seel, 1-double prong hook and 1-hanging rod at each locker unit.

I. A.D.A. Compliant Locker: Locker to be A.D.A compliance.

J. Accessories:
1. Slope Tope: Provide continuous Sloping Tops, matching locker material and finish.

2. Base: All lockers to sit on a 6” concrete base. Provide recess Trim/base trim, filler panel and boxed end panel: Fabricated from ¾ inch thick of same material and

finish as locker.

3. Filler Panel: provide filler panel and end panel to match locker finish.

K. Finish: Architect to select from manufacturer's full range.

2.5 METAL LOCKER BENCHES

A. General: Provide locker benches fabricated by same manufacturer as metal lockers.

B. Bench Tops: Manufacturer's standard 1-piece units, of the following material, minimum 9-1/2 inches wide by 1-1/4 inches thick, with rounded corners and edges:

1. Extruded aluminum with clear anodic finish.

2. A.D.A compliance top size to be 24 inches wide by 60 inches long by be 1½" thick with all edges rounded to a ¼ inch radius.

C. Fixed Pedestals: Manufacturer's standard supports, with predrilled fastener holes for attaching bench top and anchoring to floor, complete with fasteners and anchors, and as follows:

1. Tubular Steel: 1-1/4-inch-diameter steel tubing, with 0.1265-inch-thick steel flanges welded at top and base; with baked enamel finish; anchored with exposed fasteners.
   a. Color: As selected by Architect from manufacturer's full range.

2.6 SOLID PLASTIC LOCKER BENCH

A. Basis of Design Product: "Solid Plastic Locker Room Benches" by SCRANTON PRODUCTS (Santana/Comtec/Capitol).

B. Fabrication:

1. Locker bench tops shall be 1½" thick with a homogeneous color throughout, constructed from High Density Polyethylene (HDPE) resins.

2. Locker benches tops shall be fabricated from polymer resins compounded under high pressure, forming a single component which is waterproof, nonabsorbent and has a self lubricating surface that resists marks from pens, pencils, markers and other writing instruments.

3. All plastic components shall be covered with a protective plastic masking.

C. Size: A.D.A compliance top size to be 24 inches wide by 60 inches long by be 1½" thick with all edges rounded to a ¼ inch radius.

D. Hardware: Aluminum pedestals shall be such to provide A.D.A compliance seat and

secured to bench tops with stainless steel tamper resistant torx head screws and secured to the floor using lead expansion shields with 2" stainless steel Phillips head machine bolts.

E. Finish: To be factory finished. All HDPE components shall have a smooth ”orange peel” finish. Architect to select from Manufacturer standard colors.

2.7 WOOD LOCKER BENCH

A. Basis of Design Product: “Oak Bench” by Treeforms Wood Lockers.

B. Size:

1. A.D.A compliance top size to be 24 inches wide and 1½" thick with all edges rounded to a ¼ inch radius. Refer to drawings for length requirements of benches.

2. Typical: 12-inches wide by 60-inches long

C. Construction:

1. Seat: 3-inches solid particle board core banded with 3-inches by 1 ½-inches solid red oak. Top and bottom of bench covered with 1/16-inch plain sliced red oak veneer.

2. Legs: 1-½ inches solid aluminum T-legs

D. Finish: Architect to select from manufacturer standard finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install level, plumb, and true; shim as required, using concealed shims.Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Install anchors through backup reinforcing plates, channels, or blocking as

required to prevent metal distortion, using concealed fasteners.

1. Anchor single rows of metal lockers to walls near top and bottom of lockers of lockers and to floor.

2. Anchor back-to-back metal lockers to floor.

B. All-Welded Metal Lockers: Connect groups of all-welded metal lockers together with standard fasteners, with no exposed fasteners on face frames.

C. Equipment and Accessories: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

1. Attach hooks with at least two fasteners.

2. Attach door locks on doors using security-type fasteners.

3. Identification Plates: Identify metal lockers with identification indicated on Drawings.
   a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
   b. Attach plates to upper shelf of each open-front metal locker, centered, with a least two aluminum rivets.

4. Attach recess trim to recessed metal lockers with concealed clips.

5. Attach filler panels with concealed fasteners. Locate fillers panels where indicated on Drawings.

6. Attach sloping top units to metal lockers, with closures at exposed ends.

7. Attach boxed end panels with concealed fasteners to conceal exposed ends of nonrecessed metal lockers.

8. Attach finished end panels with fasteners only at perimeter to conceal exposed ends of nonrecessed metal lockers.

D. Fixed Locker Benches: Provide not less than 2 pedestals for each bench, uniformly spaced not more than 72 inches apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

B. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit metal locker use during construction.

C. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by metal locker manufacturer.

END OF SECTION 105113

SECTION 114000 – EQUIPMENT

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. This Section includes furnishings and equipment for food facilities and miscellaneous utilitarian facilities as indicated on the Drawings.

B. Owner-Furnished Equipment: Where indicated, Owner will furnish equipment items.

C. Related Sections include the following:

1. Division 05 Section "Metal Fabrications" for equipment supports.
2. Division 06 Section "Millwork" for counter tops and cabinetry.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include the following:

1. Manufacturer's model number.
2. Options, accessories, and components that will be included for Project.
3. Clearance requirements for access and maintenance.
4. Utility service connections for water, drainage, power, and fuel; include roughing-in dimensions.

B. Shop Drawings: For fabricated equipment. Include plans, elevations, sections, roughing-in dimensions, fabrication details, utility service requirements, and attachments to other work.

C. Coordination Drawings: For foodservice facilities.

1. Indicate locations of foodservice equipment and connections to utilities.
2. Key equipment using same designations as indicated on Drawings.
3. Include plans and elevations; clearance requirements for equipment access and maintenance; details of support for equipment; and utility service characteristics.

D. Operation and Maintenance Data: For food service equipment to include in emergency, operation, and maintenance manuals.

1.4 QUALITY ASSURANCE

A. NSF Standards: Provide equipment that bears NSF Certification Mark or UL Classification Mark certifying compliance with applicable NSF/ANSI standards.

B. UL Certification: Provide electric and fuel-burning equipment and components that are evaluated by UL for fire, electric shock, and casualty hazards according to applicable safety standards and that are UL certified for compliance and labeled for intended use.

C. Regulatory Requirements: Install equipment to comply with the following:

1. ASHRAE 15, "Safety Code for Mechanical Refrigeration."
2. NFPA 54, "National Fuel Gas Code."
3. NFPA 70, "National Electrical Code."
4. NFPA 96, "Ventilation Control and Fire Protection of Commercial Cooking Operations."

1.5 PROJECT CONDITIONS

A. Field Measurements: Indicate measurements on Coordination Drawings.

1.6 COORDINATION

A. Coordinate foodservice equipment layout and installation with other work, including lighting fixtures, HVAC equipment, and fire-suppression system components.

B. Coordinate location and requirements of utility service connections.

C. Coordinate size, location, and requirements of the following:

1. Overhead equipment supports.
2. Equipment bases.
3. Floor depressions.
4. Floor areas with positive slopes to drains.
5. Floor sinks and drains serving foodservice equipment.
6. Roof curbs, equipment supports, and penetrations.

1.7 WARRANTY

A. Refrigeration Compressor Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace compressors that fail in materials or workmanship within specified warranty period.

1. Failure includes, but is not limited to, inability to maintain set temperature.
2. Warranty Period: 1-year Parts and Labor Warranty from date of Substantial Completion.
3. Warranty Period: 5-years Compressor Warranty from date of Substantial Completion.

B. Other standard Manufacturer’s warranty: Minimum 1 year

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. Basis-of-Design Product: The design for foodservice equipment item is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product.

2.2 FABRICATED EQUIPMENT

A. Materials:

1. Stainless Steel: ASTM A 666, with No. 4 finish (directional satin finish) on exposed surfaces.
2. Galvanized Steel: ASTM A 653/A 653M, G90 (Z275) coating designation; commercial- quality, cold-rolled steel that is zinc coated by the hot-dip process and chemically treated.

B. Stainless-Steel Sink: Refer to Division 11 “Plumbing”

C. Stainless Steel Knock-down Wall Shelf

1. Basis-of-Design Product: WS-KD Series as manufactured by Advance Tabco.
2. Descriptions:
   a. Stainless steel top, bullnosed (rounded) front edge with 1 1/5 inches lip, 2-stainless steel locking brackets
   b. Material: 18-ga stainless Steel (type 304)
   c. Dimension: 12 inches deep, provide length as indicated in drawings.

D. Stainless Steel Work Tables

1. Basis-of-Design: FLG series work table by Advance Tabco,
2. Description:
   a. NSF approved.
   b. Material: 14 ga. stainless steel type 304 top, adjustable 18 ga. galvanized undershelf with wrap around corner bracing, adjustable galvanized legs (provide 6 legs for unit 96-inches or longer)..
   c. 2-inches x 1-inch square embossed no-drip countertop edge.
   d. 1½ -inch hemmed edge splash.

E. Extra High Capacity Bulk Rack

1. Basis-of-Design: Global Industries Inc. Model #504345
2. Description:
   a. Dimensions: 36-inch (D) by 72-inch (H) by 60-inch (W)
   b. Frame
      1) 14 ga upright frame
      2) 12 ga cross beams with baked enamel finish.

3) Welded base plates with floor anchor option.

c. Shelves:
1) Quantity: 3 total
2) Deck: 5/8-inch rib-formed steel deck with Galvanized Coating
3) Adjustable with Safety locking pins
4) Storage Capacity: 3800 lb. for each shelf.

F. Wall Mounted Hose Hanger
1. Basis-of-Design: SD Industries Stainless Steel Hose Hanger
2. Description:
a. General: Heavy-duty stainless steel for durability and corrosion resistance, includes keyhole slots.
b. Dimensions: 11" L x 6 1/2" H x 5" W
c. Provide Mounting accessories.

G. Wall Mounted Hose Reel
1. Basis-of-Design: Yard Butler SRM-90 Wall Mount Mighty Hose Reel.
2. Description:
a. Type: Wall Mount
b. Finish: Powder-coated finish (Gray)
c. Provide Wall Mount plate and screws

2.3 SELF-CONTAINED REFRIGERATION EQUIPMENT

A. Refrigerated Beverage Merchandiser

1. Basis-of-Design Product: True Manufacturing, GDM-26.

2. Description:
a. NSF certified.
b. Size: 26 cu.ft.,, 30 inches by 30 inches by 80 inches
c. Cabinet: Foamed-in-place high density, polyurethane insulation. Chip white laminated vinyl exterior and white aluminum interior liner with stainless steel floor.
d. Door: Single swing, low-E double pane thermal-insulated glass door with aluminum frame, self-closing, positive seal.
e. Shelving: 4 adjustable heavy duty PVC coated wire shelves with 4 chrome shelf- clips per shelf.
f. Lighting: Safety shielded fluorescent interior lighting with electronic ballast.

3. Electrical Service: 1/3 HP, 115/60/1 voltage, equip unit with plug and cord for service indicated on Electrical drawings and Schedules.

4. Refer to drawings for quantity.

B. Reach-in Refrigerator

1. Basis-of-Design Product: True Manufacturing, T-35.

2. Description:
a. Size: 35 cu.ft., 39-1/2 inches by 29-1/2 inches by 78-3/8 inches
b. NSF certified
c. Door: Double swing, self-closing, solid door.

d. Shelving: 6 adjustable heavy duty PVC coated wire shelves with 4 chrome shelf- clips per shelf.
e. Casters: 4 inches diameter with lock.
f. Finish: Stainless steel series 300

3. Electrical Service: 1/3 HP, 115/60/1 voltage, equip unit with plug and cord for service indicated on Electrical drawings and Schedules.

4. Refer to drawings for size and quantity.

C. Cube Ice Maker (Air-cooled).

1. Basis-of-Design Product: Ice-O-Matic, ICE-0320A.

2. Description:
a. Ice production: up to 355 lb. per 24 hours. Cube ice form
b. Size: 22 inches by 23 inches
c. Ice bin: B42 (of same manufacturer), 374 lbs storage capacity, 50” x 22” x 31”.
d. NSF certified

3. Electrical Service; 115/60/1 voltage, equip unit with plug and cord for service indicated on Electrical drawings and Schedules.

4. Refer to drawings for size and quantity.

2.4 MISCELLANEOUS EQUIPMENT

A. Cash Drawer Insert

1. Basis-of-Design: 10 compartment bill and coin tray BDY5444 as manufactured by Buddy Product

2. Description:
a. Material: recycled plastic
b. Size: 2 inches (H) by 11-1/2 inches (D) by 14-3/8 inches (W)
c. Lock: key-locking removable lid

B. Wall-mounted Menu Boards
1. Basis-of-Design: Wall-Mounted Menu Board as Manufactured by Fastsigns, Co.
2. Description:
a. Size: As indicated on drawings.
b. Provide order sheet and product catalog for custom order options.
c. All mounting accessories and equipment must be finished in accordance with project standards.
1) All exposed metal components should be stainless steel unless noted otherwise.
3. Provide electrical wiring as required for all Electrical Signage.

C. Candy/Chip Display
1. Basis-of-design: 5 tier candy rack waterfall merchandiser 20-252 by E System Sales, Inc.
2. Description:
a. 5 tier shelf, depth range from 4 ½” to 8 ½”.
b. Each tier includes welded sign channel 14”W x 1 ½”H
c. Color: lack case.

2.5 MISCELLANEOUS MATERIALS

A. Installation Accessories, General: NSF certified for end-use application indicated.

B. Elastomeric Joint Sealant: ASTM C 920; Type S (single component), Grade NS (nonsag), Class 25, Use NT (nontraffic) related to exposure, and Use M, G, A, or O as applicable to joint substrates indicated.

1. Public Health and Safety Requirements:

a. Sealant is certified for compliance with NSF standards for end-use application indicated.
b. Washed and cured sealant complies with the FDA's regulations for use in areas that come in contact with food.

2. Cylindrical Sealant Backing: ASTM C 1330, Type C, closed-cell polyethylene, in diameter larger than joint width.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install foodservice equipment level and plumb, according to manufacturer's written instructions.

1. Connect equipment to utilities.
2. Provide cutouts in equipment, neatly formed, where required to run service lines through equipment to make final connections.

B. Complete equipment assembly where field assembly is required.

1. Provide closed butt and contact joints that do not require a filler.
2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish.

C. Install equipment with access and maintenance clearances that comply with manufacturer's written installation instructions and requirements of authorities having jurisdiction.

D. Install closure-trim strips and similar items requiring fasteners in a bed of sealant.

E. Install joint sealant in joints between equipment and abutting surfaces with continuous joint backing, unless otherwise indicated. Produce airtight, watertight, vermin-proof, sanitary joints.

3.2 CLEANING AND PROTECTING

A. After completing installation of equipment, repair damaged finishes.

B. Clean and adjust equipment as required to produce ready-for-use condition.

C. Protect equipment from damage during remainder of the construction period.

END OF SECTION 114000

SECTION 129300 - SITE FURNISHINGS

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. Benches.
2. Standard Picnic Tables.
3. ADA Picnic Tables.
4. Trash Receptacles
5. Trash & Recycle Receptacles.
6. Standard Table with Chairs.
7. Standard ADA Table with Chairs.
8. Solar Table with Chairs.
9. Solar ADA Table with Chairs.
10. Chaise Lounge.
11. Lifeguard Chairs.
12. Bicycle Rack.
13. Drinking Fountain.
14. Outdoor Deck Shower.

B. Related Requirements:
1. Section 033000 "Cast-in-Place Concrete" for concrete pads and installing anchor bolts cast in concrete footings.
2. Section 312000 "Earth Moving" for excavation for installing concrete footings.
3. Section 220000 “Plumbing” for drinking fountain and outdoor shower connections.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.

C. Samples for Initial Selection: For units with factory-applied finishes.

D. Samples for Verification: For each type of exposed finish, not less than 6-inch-long linear components and 4-inch-square sheet components.
1. Include full-size Samples of each item listed in 1.2A. Approved samples may be incorporated into the Work.

E. Product Schedule: For site furnishings. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For Site Furnishings to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 BENCHES: As specified in Drawings.

2.2 STANDARD PICNIC TABLES: As specified in Drawings.

2.3 ADA PICNIC TABLES: As specified in Drawings.

2.4 TRASH RECEPTACLES: As specified in Drawings.

2.5 TRASH AND RECYCLE RECEPTACLES: As specified in Drawings.

2.6 STANDARD TABLE WITH CHAIRS: As specified in Drawings.

2.7 STANDARD ADA TABLE WITH CHAIRS: As specified in Drawings.

2.8 SOLAR TABLE WITH CHAIRS: As specified in Drawings.

2.9 SOLAR ADA TABLE WITH CHAIRS: As specified in Drawings.

2.10 CHAISE LOUNGE: As specified in Drawings.

2.11 LIFEGUARD CHAIRS: As specified in Drawings.

2.12 BICYCLE RACK: As specified in Drawings.

2.13 DRINKING FOUNTAIN: As specified in Drawings.

2.14 OUTDOOR DECK SHOWER: As specified in Drawings.

2.15 MATERIALS

A. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated; free of surface blemishes and complying with the following:
   1. Rolled or Cold-Finished Bars, Rods, and Wire: ASTM B 211.
   2. Extruded Bars, Rods, Wire, Profiles, and Tubes: ASTM B 221.
   3. Structural Pipe and Tube: ASTM B 429/B 429M.
   4. Sheet and Plate: ASTM B 209.
   5. Castings: ASTM B 26/B 26M.

B. Steel and Iron: Free of surface blemishes and complying with the following:
   1. Plates, Shapes, and Bars: ASTM A 36/A 36M.
   2. Steel Pipe: Standard-weight steel pipe complying with ASTM A 53/A 53M, or electric-resistance-welded pipe complying with ASTM A 135/A 135M.
   3. Tubing: Cold-formed steel tubing complying with ASTM A 500/A 500M.
   4. Mechanical Tubing: Cold-rolled, electric-resistance-welded carbon or alloy steel tubing complying with ASTM A 513/A 513M, or steel tubing fabricated from steel complying with ASTM A 1011/A 1011M and complying with dimensional tolerances in ASTM A 500/A 500M; zinc coated internally and externally.
   5. Sheet: Commercial steel sheet complying with ASTM A 1011/A 1011M.

6. Expanded Metal: Carbon-steel sheets, deburred after expansion, and complying with ASTM F 1267.
7. Malleable-Iron Castings: ASTM A 47/A 47M, grade as recommended by fabricator for type of use intended.
8. Gray-Iron Castings: ASTM A 48/A 48M, Class 200.

C. Stainless Steel: Free of surface blemishes and complying with the following:
1. Sheet, Strip, Plate, and Flat Bars: ASTM A 666.
2. Pipe: Schedule 40 steel pipe complying with ASTM A 312/A 312M.
3. Tubing: ASTM A 554.

D. Fiberglass: Multiple laminations of glass-fiber-reinforced polyester resin with UV-light stable, colorfast, nonfading, weather- and stain-resistant, colored polyester gel coat, and with manufacturer's standard finish.

E. Plastic: Color impregnated, color and UV-light stabilized, and mold resistant.
1. Polyethylene: Fabricated from virgin plastic HDPE resin.

F. Anchors, Fasteners, Fittings, and Hardware: Manufacturer's standard, corrosion-resistant-coated or noncorrodible materials; commercial quality, tamperproof, vandal and theft resistant, concealed, recessed, and capped or plugged.

G. Non-shrink, Nonmetallic Grout: Premixed, factory-packaged, non-staining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M; recommended in writing by manufacturer, for exterior applications.

H. Erosion-Resistant Anchoring Cement: Factory-packaged, non-shrink, non-staining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure without needing protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.

I. Galvanizing: Where indicated for steel and iron components, provide the following protective zinc coating applied to components after fabrication:
1. Zinc-Coated Tubing: External, zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, polymer film. Internal, same as external or consisting of 81 percent zinc pigmented coating, not less than 0.3 mil thick.
2. Hot-Dip Galvanizing: According to ASTM A 123/A 123M, ASTM A 153/A 153M, or ASTM A 924/A 924M.

2.16 FABRICATION

A. Metal Components: Form to required shapes and sizes with true, consistent curves, lines, and angles. Separate metals from dissimilar materials to prevent electrolytic action.

B. Welded Connections: Weld connections continuously. Weld solid members with full-length, full-penetration welds and hollow members with full-circumference welds. At exposed connections, finish surfaces smooth and blended, so no roughness or unevenness shows after finishing and welded surface matches contours of adjoining surfaces.

C. Pipes and Tubes: Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of handrail and railing components.

D. Exposed Surfaces: Polished, sanded, or otherwise finished; all surfaces smooth, free of burrs, barbs, splinters, and sharpness; all edges and ends rolled, rounded, or capped.

E. Factory Assembly: Factory assemble components to greatest extent possible to minimize field assembly. Clearly mark units for assembly in the field.

2.17 GENERAL FINISH REQUIREMENTS

A. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.18 ALUMINUM FINISHES

A. Powder-Coat Finish: Manufacturer's standard polyester powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness. Color: Black with Satin Finish.

2.19 STEEL AND GALVANIZED-STEEL FINISHES

A. Powder-Coat Finish: Manufacturer's standard polyester, powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

B. PVC Finish: Manufacturer's standard, UV-light stabilized, mold-resistant, slip-resistant, matte-textured, dipped or sprayed-on, PVC-plastisol finish, with flame retardant added; complying with coating manufacturer's written instructions for pretreatment, application, and minimum dry film thickness.

2.20 IRON FINISHES

A. Powder-Coat Finish: Manufacturer's standard polyester powder-coat finish complying with finish manufacturer's written instructions for surface preparation, including pretreatment, application, baking, and minimum dry film thickness.

2.21 STAINLESS-STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
   1. Run directional finishes with long dimension of each piece.
   2. Directional Satin Finish: No 4.
   3. Dull Satin Finish: No. 6.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and securely anchored at locations indicated on Drawings.

D. Restore damaged finishes and test for proper function. Clean and protect work from damage.

E. Contractor must provide anchor bolts and other hardware not provided by manufacturers to properly install all Site Furnishings.

F. Install all Site Furnishings per manufacture’s recommendations, flush and level with surrounding pavements surfaces.

G. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

H. Posts Set into Voids in Concrete: Form or core-drill holes for installing posts in concrete to depth recommended in writing by manufacturer of site furnishings and 3/4 inch larger than OD of post. Clean holes of loose material, insert posts, and fill annular space between post and concrete with non-shrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

I. Pipe Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with non-shrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

END OF SECTION 129300

SECTION 13 1123 ON GRADE AQUATIC FEATURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 DESCRIPTION

A. This Section relates to all Aquatic Features

1. Includes Aquatic Feature Contractor Qualifications and Responsibility.

1.3 SUMMARY

A. Extent of Aquatic Feature work includes complete engineering design, fabrication, and installation of fully operating aquatic feature of dimensions shown on the Drawings, and incorporating features shown and specified. Work includes but is not limited to the following:

1. Excavation
2. Rough Finish & Grading
3. Placement of Fill and Backfill
4. Reinforcing Steel
5. Shotcrete, Wet-Mix
6. Construction and Removal of Forms
7. Trimming and Finishing
8. Waterproofing
9. Tile, Design Type and Safety Type
10. Deck Equipment and Accessories
11. Cutouts for Steps, Inserts, and Mechanical Equipment
12. Interior Finish
13. Filtration and Water Treatment Systems
14. Start-Up and Initial Maintenance.

1.4 RELATED SECTIONS

A. 03 3714 - Shotcrete for Aquatic Features

B. 07 1417 – Cold Fluid-Applied Waterproofing for Aquatic Features

C. 09 3014 – Tiling for Aquatic Features

D. 09 9727 – Cementitious Coating for Aquatic Features

E. 13 1225 – Pumped Concrete for Splash Pads

1.5 AQUATIC FEATURE CONTRACTOR RESPONSIBILITY

A. The Aquatic Feature Contractor shall have control and responsibility to the General Contractor for the work required to result in a fully functioning commercial-institutional Public Use Aquatic Feature as defined in the Construction drawings provided by Aqua Design International.

1. The General Contractor shall not subcontract any part of the specified Aquatic Feature construction or Aquatic Feature equipment to anyone other than a bonded subcontractor meeting all requirements of this and related Sections.

1.6 AQUATIC FEATURE CONTRACTOR QUALIFICATION

A. Aquatic Feature Contractor shall submit evidence of qualifications to the General Contractor with or in advance of his bid to the General Contractor so that the General Contractor can be assured prior to the bid that the Aquatic Feature Contractor complies with the following qualification requirements.

1. Evidence of successful experience in the construction of multiple aquatic structures including Features similar in scope and complexity to the aquatic structures required for this project with respect to:

a. Manage construction of multiple bodies of water

b. Up to 2,200 square feet of water surface area.

c. Skimmer Type Aquatic Features

d. Automated chemistry control systems.

e. Heater Systems

2. Provide a list of not less than three (3) comparative Semi-Public/Public Use Aquatic facilities complete with verified names, addresses, telephone numbers of the Government representative, the Contracting Officer, the mechanical, electrical, and plumbing subcontractors, and the general contractor.

3. Provide narrative description of each comparative listed Aquatic Feature facility, including but not limited to date of construction start and completion, water surface area, type of deck or skim gutter system, type and size of filtration system, type and size of water treatment system, and type of automatic control and interlock system.

1.7 PRODUCT DATA SUBMITTAL

A. Includes manufacturer's material and finish data, installation instructions, and general recommendations for each specified product.

1. Submit each product item with a completed Submittal Form Cover page to Aqua Design International via the General Contractor for review to verify compliance with specified/keynoted products.

a. See Aquatic submittal form at end of this section

1.8 SHOP DRAWING SUBMITTAL

A. Shop Drawings (where requested) of item specified showing layout, profiles, methods of joining, and anchorage details.

1. Submit each shop drawing with a completed Submittal Form Cover page to Aqua Design International via General Contractor for review to verify compliance with specified/keynoted product and plan designs.

a. See Aquatic submittal form at end of this section

1.9 WARRANTY

A. The shell of the Aquatic Features and all related work shall be warranted against cracking or failure to hold water for a period of one (1) year from the date of Substantial Completion, provided the Aquatic Feature is kept full of water except for a period of 10 days per year for maintenance, the water table is not above the lowest point of the pool, the structure is not damaged by earthquake, earth or earth fill movement, or conditions not occasioned by the Contractor.

B. All equipment shall be warranted by the manufacturer for a minimum of two (2) years following the date of Substantial Completion.

C. Warrant finish surfaces and finishes for two (2) years against delamination.

D. Organize warranty documents into an orderly sequence based on the table of contents.

1. Bind warranties in heavy-duty, three-ring, vinyl-covered, loose-leaf binder, thickness as necessary to accommodate contents, and sized to receive 8-1/2 –inch by 11 –inch paper.

2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide typed description of the product or installation, including the name of the product and the name, address, and telephone number of the installer.

3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project Name, and name of Contractor.

4. Scan warranties and assemble complete warranty submittal package into a single indexed electronic PDF file. Provide table of contents at beginning of document.

1.10 OPERATION AND MAINTENANCE DELIVERABLES

A. MANUALS, GENERAL

1. Coordinate with Project Architect as to the desired media type and quantity to provide:

a. Type

1) Printed Format in Binders

2) Files on a Compact Disc

3) Files on a Flash Drive

b. Quantity

1) Six (6) Sets

2. Contents: Organize into manageable size. Arrange contents alphabetically by system, subsystem, and equipment.
    a. Include a section for Operating Standards:
        1) Operating procedures
        2) Operating logs
        3) Wiring diagrams
        4) Piped systems diagrams
        5) Precautions against improper use
    b. Include a Section for Maintenance:
        1) Product information
        2) Maintenance Procedures
        3) Repair Instructions, materials and sources
        4) Re-ordering information
        5) Spare Parts List.

1.11 TRAINING

A. Aquatic Feature Contractor is 100% responsible for all start-ups and training

B. Contractor shall provide two separate start-up/training sessions with the owner's maintenance staff.
    1. Contractor shall inform the owner a minimum of one week prior to each of the training sessions.
    2. First session should occur once the mechanical system is operational and all bodies of water balanced.
    3. Second session shall be provided 2-3 weeks after the first session.
        a. Contractor shall provide owner with a video record of each session

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 NOT USED

END OF SECTION 131123

Aquatic Submittal Form: PROJECT NAME:

ARCHITECT/ENGINEER	_____ _____ _____ _____ (Phone)
AQUATIC CONSULTANT	AQUA DESIGN INTERNATIONAL 7534 NORTH LA CHOLLA BLVD. TUCSON, ARIZONA 85741 520.219.8929
GENERAL CONTRACTOR	_____ _____ _____ _____ (Phone)
AQUATIC FEATURE CONTRACTOR	_____ _____ _____ _____ (Phone)
Drawing Sheet:	
Keynote:	
Product Name:	
Part Number:	
Product Per Keynote or Spec ?	Yes ( ) No ( ) QUANTITY:

If No, provide reason for substitution:

Name of Contact			
	(Signature)	(Print name)	Date

AQUATIC CONSULTANT REVIEW STATUS:

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SECTION 13 1125 PUMPED CONCRETE FOR SPLASH PAD

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work in this section. Principal items include:

1. Splash Pad structure.
2. Preparation of surfaces to receive concrete.
3. Forms and ground wires.
4. Furnishing and placing reinforcing steel for concrete.
5. Mixing, delivery, placing, finishing and curing of concrete.
6. Protection and cleaning of adjacent surfaces.

B. Related work not in this section:

1. 03 3714 - Shotcrete for Aquatic Features
2. 07 1417 – Cold Fluid-Applied Waterproofing for Aquatic Features
3. 09 3014 – Tiling for Aquatic Features
4. 09 9727 – Cementitious Coating for Aquatic Features
5. 13 1123 – On Grade Aquatic Features

1.2 QUALITY ASSURANCE

A. Qualifications of Concrete Subcontractor:

1. Proposed subcontractor shall have at least 5 years experience in structural concrete construction and have constructed at least 10 significant structural concrete Water Features which, on investigation, have been found to be completed in satisfactory manner.

B. Special Inspections:

1. Inspections Paid by Owner. Scheduled by Contractor.
2. Reinforcement Inspection:
    a. Inspection of reinforcement to be conducted by reinforcement engineer of record.
    b. Inspection result submitted in a report to Owner and Project Architect.
3. Concrete Placement Inspection:
    a. Inspection of concrete placement to be conducted by reinforcement engineer of record.
    b. Inspection result submitted in a report to Owner and Project Architect.

C. Reference standards:

1. Except as modified by requirements of contract documents, concrete work shall conform to requirements of American Concrete Institute.

1.3 SUBMITTALS

A. Conform to Section 131213. Submit shop drawings for complete Water Feature structure including complete and detailed reinforcing steel bending and layout diagrams. Provide structural plans approved for commercial Water Features and carrying approval and stamp of Structural Engineer registered in the State of Oklahoma.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Form lumber: WCLIB “Construction” grade or better, WWPA No. 1 or better.

B. Form plywood: PS 1-83, Group 1, Exterior grade B_B ply form or better, minimum 5 ply and 5/8 inch thickness.

C. Form Ties: Prefabricated rod, flat band, wire, internally threaded disconnecting type or equal, not leaving metal within 2-inches of concrete surface and 3-inches from sub-grade.

D. Form coatings: Resin-type coating free of oil, silicone, wax, and non-drying material.

2.2 REINFORCING STEEL

A. Reinforcing bars, ASTM A615, including supplementary requirement (S1), Grade 40, deformed.

B. Welded wire fabric: ASTM A185, wire fabric size and gauge as shown. 60 ksi minimum tensile strength.

C. Tie Wire: annealed copper-bearing steel, 16-gauge minimum.

D. Welding electrodes: AWS D1.4, Table 5.1, low hydrogen electrodes, E9018 for grade 40 steel.

2.3 CONCRETE MATERIALS

A. Cement

1. Recommended Mix Code:
    a. CEMEX Code 1556313 (as a reference standard only)
        1) 4000 PSI MAG AA 25% Ash 1" Gravel
    b. CEMEX Code 1556315 (as a reference standard only)
        1) 4000 PSI MAG AA 25% Ash Flowable 1" Gravel
2. Contractor shall determine best mix for season and application process.
3. Water Clean and potable. Mixing water for concrete shall meet requirements of ASTM C 94.

2.4 QUALITY ASSURANCE/CONTROL

A. Test Cylinders

1. Concrete design strength is based on cast concrete cylinders.
2. One (1) Test Cylinder required for every 50-yards of placed material.

3. Contact testing facility to schedule concrete cylinder test date. Coordinate with General Contractor.

PART 3 - EXECUTION

3.1 PRE-POUR CONFERENCE

A. Pre-Pour conference to be held at the project site prior to jobsite delivery. Purpose is to discuss CEMEX scheduling and project site operation.

3.2 REPORTS

A. CEMEX requests copies of all approved mix designs prior to project site delivery.

1. Aqua Design requests copies of same.

B. Per ASTM C-94 and to comply with latest version of ACI 318, CEMEX requests that it be included on the distribution list for all Concrete Test Reports.

1. Aqua Design requests to be on same distribution list.

3.3 PREPARATION OF SURFACES

A. If sloughing or caving of earth banks occurs, fill resulting voids with concrete at no extra cost to owner, back-filling voids with earth is not permitted. Dampen concrete and earth surfaces before concrete is deposited, but not so wet as to overcome suction.

3.4 PROTECTION

A. Protect surfaces not receiving concrete from over spray. Repair damages as required by owner at no cost to owner.

3.5 CONCRETE QUALITY

A. Concrete Strength: Minimum 4,000 psi 28-day compressive strength unless otherwise indicated.

B. Slump specifications per each prior listed CEMEX Mix Code.

C. Vibrate Concrete to avoid trapped air and to ensure a consistent mix of concrete product.

3.6 CURING

A. Provide moisture cure. Apply constant water coating in fog-mist spray without damage to surface texture. Keep concrete continuously moist for not less than 7 days after placing. Use sealed curing sheeting or other approved curing method where water curing is not feasible. Use of curing compounds is prohibited.

3.7 DEFECTIVE CONCRETE

A. Cut out and replace defective concrete areas at no extra cost to owner.

END OF SECTION 131125

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SECTION 220000

PLUMBING SYSTEMS AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. The General Conditions, Supplementary Conditions, and all applicable requirements of the overall project, except as otherwise amended shall apply to all work herein.

1.02 SCOPE

A. The work under this Section shall be to provide a complete plumbing system. All items of work, of cost and expense of any nature whatsoever belonging with or necessary to the completion of work called for in this Specification or in the Contract Documents are hereby specified to be included in this Contract.

B. Work covered by this Section of the specifications and accompanying drawings consists of furnishing all labor, equipment, appliances and materials and in performing all operations in connection with installation of a complete plumbing system for the new building as indicated and specified. This Section shall also include all incidental items not ordinarily specified, but necessary for the complete installation.

C. All equipment and materials mentioned in these specifications and/or shown on the Drawings shall be furnished, except where otherwise specifically noted, completely installed, adjusted, and left in a safe and satisfactory operating condition. All accessories, appliances and connections necessary for the operation of the equipment shall be furnished and installed.

D. The plumbing systems consist of the following principal items:

1. Installation of domestic hot and cold water distribution systems.

2. Installation of sanitary waste and vent piping systems.

3. Installation of plumbing fixtures, fittings, hose bibbs, hydrants, etc.

4. Installation of domestic water heating systems.

1.03 DRAWINGS AND SPECIFICATIONS

A. The commencement of work under this Section indicates that the Contractor has examined and has knowledge of the architectural, structural, electrical, mechanical, and site work Drawings and Specifications. The failure of the Contractor to acquaint himself with all available information shall not relieve him of any responsibility for performing his work properly.

B. No additional compensation shall be allowed because of conditions that occur due to the Contractor's failure to become thoroughly familiar with all of the contract documents for this project, as described above, and with the job site.

C. The Drawings and Specifications are intended to supplement one another. Any materials or labor called for in one but not the other shall be furnished as if both were mentioned in the specifications and shown on the drawings. Labor and/or materials neither shown nor specified but necessary for the completion and proper functioning of the systems, shall be furnished and installed by the Contractor.

D. The Drawings are diagrammatic and are intended to depict the approximate locations of equipment, piping, and apparatus. All dimensions, whether in figures or scales, shall be verified in the field.

E. Contractor shall keep a record of the locations of all concealed work and upon completion of the job, shall supply as-built drawings showing any deviations from the original drawings. These drawings shall indicate dimensions of buried utility lines from building walls.

1.04 ORDINANCES, PERMITS AND CODES

A. It shall be the Contractor's duty to perform the work and provide the materials covered by these specifications in conformance with all ordinances and regulations of all authorities having jurisdiction.

B. The Contractor shall obtain and pay for all permits, connection, and inspection fees as required for the complete installation of the plumbing systems.

C. All work herein shall conform to all applicable laws, ordinances and regulations of the local utility companies.

D. The work shall be in accordance with, but not limited to, the requirements of:

1. National Fire Protection Association

2. National Safety Code

3. Georgia State Energy Code for Buildings

4. International Plumbing Code

E. Codes and regulations referred to are minimum standards. Where the requirements of these specifications or drawings exceed those of the codes and regulations, the drawings and specifications govern.

1.05 COORDINATION AND CONFLICTS

A. The Contractor shall coordinate his work so that it does not interfere with the work of other trades. It shall be the Contractor's duty to see that his work is installed in a timely manner.

B. Where minor deviations from plans are required in order to conform to space limitations, such changes shall be made by the Contractor at no additional cost to the Owner and shall be subject to the approval of the Architect.

1.06 WARRANTY

A. All equipment shall be started, tested, adjusted, and placed in satisfactory operating condition by the Contractor. All equipment shall be covered for the duration of the manufacturer's guarantee or warranty and the Subcontractor shall furnish the Owner with all manufacturer's guarantees or warranties.

B. Equipment furnished shall be guaranteed for a minimum period of one (1) year from date of acceptance.

1.07 RECORD DOCUMENTS:

A. Contractor shall furnish at the time of request for final payment, copies of a brochure containing the following information as called for in these specifications.

1. Letter of guarantee.

2. Operating instructions.

3. Manufacturer's parts data and service instructions on all items of equipment.

4. Manufacturer's guarantees and warranties.

1.08 PRODUCTS AND EXECUTION:

A. All materials, equipment, fixtures and apparatus shall be new and shall bear the label of the Underwriters' Laboratories, Inc., where UL standards have been established for such material.

1.09 SUBMITTALS:

A. All materials and equipment which the Contractor proposes to furnish shall be submitted for review. Data shall be complete in all respects and shall reference, where applicable, to the unit symbol utilized on the Drawings and Specifications.

B. Submittal review is considered as general acceptance of the basic applicability of the substituted equipment. Contractor is responsible for the installation of the substituted equipment and/or alternate arrangement of the equipment within a given space. When the

Contractor desires to use substituted equipment, he shall be responsible for producing his own coordinated work drawings which depict the substituted equipment accommodated in the space. Where the substituted equipment creates the need for alterations in any portion of the work depicted in the contract documents, it shall be the Contractor's responsibility to notify all of the affected parties and coordinate these items with all other trades. Further, it shall be the Contractor's responsibility to assume any additional cost to the contract created by the substituted equipment.

C. Substituted equipment is considered to be any equipment other than the first named item in the Specifications or on the Drawings.

D. Contractor further agrees that if deviations, discrepancies or conflicts between Shop Drawings and Specifications are discovered either prior to or after Shop Drawing Submittals are processed by the Engineer, the design drawings and Specifications shall control and shall be followed. Review of submittal data shall in no way relieve the Contractor of his duty to perform all work and provide all equipment in strict compliance with the requirements set forth in the contract documents.

E. Each individual submittal item for materials and equipment shall be marked to show specification section and paragraph number which pertains to the item. Failure to mark submittals in accordance with the above format shall be considered due cause for rejection of shop drawings.

F. Submittals shall not be made in conjunction with any other systems other than plumbing.

G. Submit for review complete data and Drawings on the following items:

1. Fixtures, faucets, traps, drains, tailpieces, etc.
2. Valves
3. Water Heaters
4. Pipe supports and attachments
5. Piping
6. Insulation
7. Hydrants
8. Floor drains
9. Cleanouts

PART 2 PRODUCTS

2.01 PVC PIPE AND FITTINGS:

A. Piping:

1. Schedule 40 PVC pipe and fittings ASTM D2665-78.

B. Fittings:

1. Socket type solvent weld PVC plastic pipe fittings ASTM D2466-78.

C. Solvents:

1. Solvent cement certified compatible by piping manufacturer ASTM D2564-80.

D. Systems:

1. Soil, Waste, Vent and Rainwater piping systems throughout the building and outside the building to the point where piping intersects the site piping.

2.02 COPPER TUBING AND FITTINGS – TYPE K:

A. Piping:

1. Type "K" soft drawn copper tubing ASTM B88.

B. Fittings:

1. (Piping installed below the floor slab shall be installed without fittings or joints below the slab.)

C. Joints:

1. Joints in copper piping shall be lead-free and shall utilize 95-5 tin-antimony solder or Sil-Fos.

D. Systems:

1. Domestic water piping below grade.

2.03 COPPER TUBING AND FITTINGS – TYPE L:

A. Piping:

1. Type "L" hard drawn copper tubing ASTM B88.

B. Fittings:

1. Wrought copper sweat type ANSI B16.22.

C. Joints:

1. Joints in copper piping shall utilize 95-5 tin-antimony solder or Sil-Fos.

D. Systems:

1. Domestic water piping above grade.

2.04 COPPER TUBING AND FITTINGS – TYPE DWV:

A. Piping:

1. Type DWV copper drainage tubing ANSI B.306.

B. Fittings:

1. Cast bronze solder joint drainage fittings ANSI B16.23a.

C. Joints:

1. Joints in copper piping shall utilize 95-5 tin-antimony solder or Sil-Fos.

D. Systems:

1. Waste arm piping from lavatories, water coolers, kitchen equipment, etc.

2.05 CLEANOUTS:

A. Provide cleanouts in soil and waste lines as shown, as required by the governing code as follows:

1. At the bottom of each exposed fixture trap which is not integral with the fixture.

2. At the end of each branch drainage line.

3. At each change of horizontal direction greater than 45°.

4. At the foot of each soil and rainwater stack.

5. In horizontal drain lines at intervals of not more than 75' for inside piping and 100' for outside piping.

B. For Walls: Cleanouts shall be extra heavy cleanout tee with countersunk bronze plug trapped for machine screw, shallow stainless steel face-of-wall access cover, securing screw. Cleanouts shall be:

1. J.R. Smith 4531
2. Josam 58790-25
3. Zurn Z-1445-1
4. Wade W-8460-R

C. For Piping Concealed in Pipe Chase or Shaft: Cleanout shall have cast iron ferrule, bronze plug trapped for machine screw, shallow stainless steel face-of-wall access cover, and securing screw. Cleanouts shall be:

1. J.R. Smith 4402
2. Josam 58710
3. Zurn ZN-1440-1
4. Wade W-8550-R

D. For Concrete Floors: Cleanouts shall have cast iron body, adjustable round scoriated nickel bronze cover and rim, securing screw, and countersunk plug. Cleanouts shall be:

1. J.R. Smith 4245
2. Josam 56040
3. Zurn Z-1415-2
4. Wade W-6010-Z

E. For Tile Floors: Cleanouts shall have cast iron body, adjustable square scoriated nickel bronze cover and rim, securing screw, and countersunk plug. Cleanouts shall be:

1. J.R. Smith 4045
2. Josam 56020

3. Zurn Z-1405-3

4. Wade W-6010-S

F. For Carpeted Floors: Cleanouts shall have cast iron body, adjustable square nickel bronze cover and rim, carpet marker, and countersunk plug. Cleanouts shall be:

1. J.R. Smith 4045-Y

2. Josam 56020-14

3. Zurn Z-1405-15

4. Wade W-6010-S-NH

G. For Cleanouts to Grade: Cleanouts shall have cast iron ferrule and countersunk bronze plug. Cleanouts shall be set in a 12" x 12" x 6" deep poured concrete pad set flush with grade. Cleanouts shall be:

1. J.R. Smith 4400

2. Josam 58500-25

3. Zurn Z-1440

4. Wade W-8550-S

2.06 FLOOR DRAINS:

A. Slotted strainers, outlets same size as waste pipe. Set top flush with finished floor.

B. Drains in water-proofing membranes shall have a flashing clamping device.

C. All floor drains shall have trap primers.

D. Drains shall all be of the same manufacturer, unless otherwise specified.

E. Drains located in toilet rooms and other finished areas shall be:

1. J.R. Smith 2010-a

2. Josam 30000-A

3. Zurn ZN-415

4. Wade W-1100-STD

F. Drains located in mechanical rooms, chases and pool equipment rooms shall be:

1. J.R. Smith 2220

2. Josam 32120

3. Zurn Z-550-Y

2.07 WATER PRESSURE REDUCING VALVES:

A. Provide in the cold water service to the building. Each valve shall have capacities and characteristics as shown on drawings

B. Each PRV Station shall be provided with a strainer in the inlet of each valve and unions on both sides

C. Provide a 3-1/2" 0-200 psig dial pressure gauge at the inlet and outlet of each valve

D. Pressure reducing valves shall be:

1. Watts 2235

2. Mueller Co. Series H-9300

3. Clayton Series 90-01

2.08 BACKFLOW PREVENTER ASSEMBLIES:

A. Back flow preventers shall consist of two independently acting internally force loaded check valves; including gate valves and test cocks, with an intermediate reduced pressure zone.

B. Drain line from unit shall be DWS copper run full size to floor drain as shown on drawings.

C. Backflow preventer shall be:

1. Watts Series 909

2. Febco Series 825

3. Neptune Series 575

2.09 EXTERIOR WALL HYDRANTS:

A. Wall hydrants shall be non-freeze, box type, nickel bronze face, all brass body with brass casing, compression type with key handle, integral vacuum breaker. Install hydrants maximum 18" above finished grade. Hydrants shall be Josam 71000 series, or equal.

2.10 INTERIOR HOSE BIBBS

A. Interior hose bibs shall be polished, chrome plated brass, with integral vacuum breaker, hose threads and removable T handle. Hose bibbs shall be Chicago model 952 or equal. Provide one interior hydrant in each of four restrooms, located approximately 1'-4" above the floor below the lavatory that is closest to the center of the restroom.

2.11 HANGERS AND SUPPORTS:

A. Plumbing piping underground shall be firmly bedded on solid ground on the body of the pipe. Block cast iron water pipe with concrete to undisturbed earth to prevent blowing out joints. Provide the rods for all outside joints.

B. Where several pipes 2-1/2" and smaller run parallel and in the same plane, they may be supported on gang or multiple hangers; larger piping shall be independently hung, parallel and equally spaced.

C. Supports for steel pipe and for copper tubing 1-1/4" or larger, shall not be more than 10' apart. Supports for copper tubing 1" and smaller shall be not more than 8' apart. Pipes shall be supported within 1' of each elbow.

D. Support rainwater stacks and inside downspouts with iron riser clamps at each floor. Support each horizontal length of cast iron pipe, excluding fittings. Maximum distance between hangers shall be 5'-0".

E. Vertical pipe subject to movement shall be supported from wall by means of pipe clamp.

F. Support domestic hot and cold water piping in spaces behind plumbing fixtures by brackets and U-bolts secured to cast iron stacks. Size U-bolts to bear on the piping.

G. Hangers for copper piping shall be copper plated.

H. Hangers shall be complete with rods and supports proportioned to the size of pipe to be supported, in accordance with manufacturer's recommendations.

I. Support piping 2-1/2" and larger in new concrete construction, from adjustable type inserts. Where weight to be supported by an insert is 300 lb. or more, install two #3 reinforcing rods,

3' long through yoke of insert.

J. Inserts installed in existing concrete construction and for piping 2-1/2" and smaller shall be Rawl "SABER-TOOTH", or Phillips "RED HEAD", self-drilling shells.

K. Do not pierce waterproofing with support bolts.

L. Size hangers for insulated piping to bear on outside of insulation except for copper tubing shall be installed bearing on the pipe.

M. Provide insulation protectors at hangers bearing on outside of insulation. Provide rigid insert or rigid section of insulation at each insulation protector.

N. After hanger rods are installed in inserts in finished concrete ceiling, fill the remaining opening with cement so that no hole shows at the ceiling.

O. Pipe hangers and supports shall be installed and furnished in accordance with recommendations set forth in Manufacturers Standardization Society Standard Practices No. SP-69 and SP-58.

P. Hangers and supports shall be manufactured by:

1. Grinnell

2. Michigan

3. F&S

2.12 SLEEVES:

A. Provide where pipes pass through walls, floors and roofs, except cast iron pipe through masonry walls may be built into the walls.

B. Sleeves shall be standard weight steel pipe except sleeves for concealed piping through floors, not in structural members, and through interior drywall construction may be 26 gauge galvanized sheet metal.

C. Sleeves are not required at individual plumbing fixtures.

D. Wall sleeves shall be full thickness of walls. Sleeves may be omitted when openings are core drilled for vertical concealed piping and horizontal piping.

E. Make sleeves through outside walls watertight. Caulk between plumbing pipe and sleeve with

oakum and lead. Pack with fiberglass and caulk, 1" deep at each face, with non-hardening sealant between pipe and sleeve.

F. Size sleeves for insulated pipes to allow full thickness insulation.

G. Sleeves penetrating fire rated walls and floor shall be provided with fire proofing caulking equal to 3M Fire Barrier No. CP-25 in annular space between sleeve and piping.

2.13 INSULATION:

A. All pipe insulation material shall have a permanent composite insulation, jacket and adhesive with a fire and smoke hazard rating as tested by procedure ASTM E-84, NFPA 255 and UL 723, not exceeding:

1. flame spread - 25

2. smoke developed - 50

B. The use of staples for securing insulation will not be permitted.

C. Insulation shall be applied on clean, dry surfaces. All insulation shall be continuous through wall and ceiling openings and sleeves.

D. Unions shall not be insulated.

E. Except as specified below, aboveground cold, hot and hot water circulating piping shall be insulated.

F. Do not insulate the following lines:

1. chrome-plated piping at plumbing fixtures

G. Insulation shall be one-piece fibrous glass sectional pipe insulation with factory applied glass reinforced aluminum foil and white kraft paper flame retardant vapor barrier jacket. Longitudinal jacket laps and butt strips shall be self-sealing. Insulation shall have an average thermal conductivity not to exceed 0 23 BTU-in per square foot, per ºF, per hour, at a mean temperature of 75ºF. Insulation shall be:

1. Johns-Manville Flame Safe AP-T

2. Owens-Corning Fiberglass 25 ASJ/SSL

3. CertainTeed Fiberglass 500º Snap-On ASJ/SSL

H. Insulate all domestic water piping with 1" thick insulation.

I. Butt all joints of pipe insulation together and secure all jacket laps with lap adhesive. Seal all butt joints with joint strips furnished with insulation.

J. Insulate fittings, flanges, unions and valves (including packing nut) with preformed or mitered fiberglass fittings of equal thickness and composition to adjacent pipe insulation. Wire fittings in place and cover with a smoothing coat of finishing cement. Finish with glass fabric embedded into a coat of white breather coating. Glass fabric shall overlap adjoining insulation at least 2". White fabric and mastic shall be used on exposed fittings.

2.14 ELECTRIC WATER HEATERS:

A. Water heater shall be of glass-lined design, , high efficiency type, with electric heating elements. Heater shall have capacities as scheduled on the drawings. Pressure and temperature relief valve shall be furnished and installed. The heater shall be insulated with vermin-proof glass fiber insulation or equal. The outer jacket shall have a baked enamel finish over a bonderized undercoating. All internal surfaces of the heater exposed to water shall be glass-lined with an alkaline borosilicate composition that has been bused-to-steel by firing at a temperature range of 1400° or 1600°F. Heater tank shall have a 3 year limited warranty against corrosion.

B. Heaters shall be:

1. A.O. Smith
2. Lochinvar
3. Ruud

2.15 HOT WATER CIRCULATING PUMP:

A. The domestic hot water circulation pump shall be the in-line centrifugal type designed for 125 psi working pressure with bronze body and impeller shaft. The pump motor shall be the open drip-proof design with sleeve bearings, built-in thermal overload protectors, and shall operate at 1,750 RPM. The pump shall have the capacities as shown on the drawings and shall be:

1. Bell & Gossett Booster Series
2. Taco Circulation Series
3. Thrush Circulation Series
4. Grundfos UP Series

2.16 PLUMBING FIXTURES:

A. Fixtures shall have smooth impervious surfaces, free from defects and concealed fouling surfaces and be Grade "A" with name or trademark of the manufacturer printed on or pressed into closets and lavatories. A label which cannot be removed without destroying it, containing the manufacturer's name or trademark and the quality or class of the fixture shall be affixed to all fixtures and not removed until after the work is accepted.

B. Reinforce the wall back of wall hung fixtures with a steel plate 6"x24"x1/8" thick, securely bolted into the wall.

C. Set fixtures level and in alignment with walls.

D. Caulk between fixtures and mounting surfaces with tile cement.

E. All fixtures, except for special types, shall be the product of the same manufacturer.

F. All vitreous china fixtures shall be white.

G. The nipple connecting the cold water supply to the exposed flush valves shall be chrome-plated I.P.S. brass pipe.

H. All exposed waste and supply piping shall be chrome-plated.

I. All exposed hot water supply piping and p-traps at handicap accessible fixtures shall be insulated.

J. All faucets, controls, shower valves, etc. shall be chrome plated BRASS construction. Pot metal faucets and fittings are not acceptable.

K. Plumbing fixture types shall be as specified on the drawings.

2.17 FIXTURE SUPPLY STOPS:

A. Provide new fixture supply stops and supplies for each new lavatory.

B. Supply stops for lavatories shall be Brass Craft CS-500-A with 1/2" sweat inlets, bell escutcheons, angle stop valve, flexible tube risers with faucet sink adapters as required for faucets with female thread connections. All exposed piping and parts shall be chromium-plated.

C. Equal products - Eastman Central, Sterling Faucet (Rockwell) McGuire.

2.18 FIXTURE P-TRAPS:

A. Provide new fixture p-traps for each new lavatory. Unless otherwise indicated or specified, P-traps for lavatories shall be 17 gauge tubular chrome plated brass, size 1-1/4”, with tubing drain to wall, wall flange, cast brass slip nuts and cleanout plug.

2.19 TOILET SEATS:

A. Except as specified otherwise, all toilet seats shall be Church 9500C open front, white seat, with stainless steel hinge with check. Equal products - Olsonite, Bemis, Beneke, Kohler.

2.20 SHOCK ABSORBERS:

A. Shock absorbers shall have a stainless steel casing, flexible mechanical bellows, pressurized inert gas chamber and certification and certification stamp as conforming to standard PDI WH-201 of the Plumbing and Drainage Institute shock absorbers shall be:

1. Josam "Absorbotron" Series
2. J.R. Smith "Hydrotrol" Series
3. Zurn "Shocktrol" Series
4. Amtrol "Diatrol" Series
5. Wade "Shok-stop" Series

B. Shock absorbers shall be provided within the chase at each flush valve, as indicated on the drawings. All shock absorbers shall have a wall access panel adjacent to the shock absorber for repair purposes.

2.21 AIR CHAMBERS:

A. Air chambers shall be 12" in length and one pipe size larger than the pipe on which it is installed. All air chambers shall be installed in the vertical position. Air chambers shall not be used for shock absorbing purposes unless specifically called for on the drawings.

B. Air chambers shall be installed on all flush valves that are not specified to be provided with a shock absorber. .

PART 3 EXECUTION

3.01 GENERAL FOR PIPING INSTALLATION:

A. Install horizontal rainwater pipes with a fall of 1/4" per foot, for pipe sizes 2" and smaller and 1/8" per foot for pipe sizes 3" and larger, unless otherwise required by code or noted on the plans.

B. Use reducing fittings between different size pipe. Ream steel, alloy steel, brass and copper pipe after cutting, turn on end and knock loose dirt and scale out.

C. Make changes in horizontal direction in rainwater piping with long radius fittings or with Y-branches and 1/8 or 1/16 bends.

D. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

E. Install piping to conserve building space and not interfere with use of space.

F. Group piping whenever practical at common elevations.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Provide clearance for installation of insulation and access to valves and fittings.

I. Provide access where valves and fittings are not exposed.

J. No piping shall be concealed by building construction before the systems have been tested.

K. During construction, all pipe openings not being worked on shall be plugged or capped to prevent foreign objects from entering systems.

L. Install bell and spigot pipe with bell end upstream.

3.02 TESTS:

A. Test rainwater piping by capping or plugging and filling the system with water, allowing it to stand filled for 1 hour. If tested in sections, each section shall be subjected to not less than a 10' head.

B. Test each fixture for soundness, stability of support and operation.

3.03 PAINTING:

A. Factory painted equipment that has been scratched or marred shall be repainted to match original color.

3.04 CLEANING AND ADJUSTING:

A. All equipment, fixtures, pipe, valves and fittings shall be cleaned of grease, oil, paint spots, metal cuttings, sludge, and construction debris before final inspection.

3.05 WELDING QUALIFICATIONS:

A. Welding shall be in accordance with procedures of the National Certified Pipe Welding Bureau, or other approved procedure, and conform to requirements of the ASME Boiler and Pressure Vessel Code or the ASA Code for Pressure Piping. Welders shall be qualified under the above procedures and certified by the National Certified Pipe Welding Bureau or other recognized testing authority.

3.06 PIPE JOINTS:

A. Joints in steel, brass and alloy steel pipe, except as otherwise specified, shall be screwed. Apply Rectorseal #5 joint compound to the male threads only, or make joint with teflon tape.

B. No threads shall show in exposed chromium plated piping.

C. Slip joints of coupling joints in brass drainage pipe are permitted of fixture's side of traps only.

D. Nipples having less than one inch between threads shall be extra strong.

END OF SECTION 220000

SECTION 230100

HVAC GENERAL

PART 1 GENERAL

1.01 DESCRIPTION:

A. These mechanical general provisions specified herein apply to all HVAC sections of Division 23.

1.02 APPROVED MANUFACTURERS:

A. For all major HVAC equipment, including all equipment containing a compression refrigeration system, contractor's price shall include only products of manufacturers listed as equals.

1.03 CODES AND REGULATIONS:

A. Work in this Division shall be governed by and installed in compliance with the Standard Mechanical Code, the Georgia State Energy Code and NFPA 90A, 90B, 91, 101.

NFPA 90A	Air conditioning and ventilating systems.
NFPA 90B	Warm air heating and air conditioning systems.
NFPA 91	Blower and exhaust systems.
NFPA 101	Life Safety Code.

1.04 SPACE CONDITIONS:

A. Drawings indicate locations of fixtures, apparatus, ductwork and piping; while these are to be followed as closely as possible, if it is necessary to change the location of some to accommodate building conditions, make changes without additional cost to the Owner and as approved by the Architect.

B. Provide adequate access to equipment and apparatus requiring operation, service or maintenance within the life of the system.

C. Do not run piping or duct work, or locate equipment,(with respect to switchboards, panel boards, power panels, motor control centers or dry type transformers) within 42 inches in front of equipment, over equipment, or within 36 inches horizontally of same space.

1.05 COORDINATION:

A. Coordinate all work under this Division with work under other Divisions, providing adjustment as necessary. Every effort has been made to insure that the work of all trades will fit in the available space. Equipment, apparatus, ductwork, piping, etc., installed without regard for the space requirements of other trades will be reworked at the expense of the installing sub-contractor if it creates an unnecessary hindrance to the installation of another trade's work.

B. The products of particular manufacturers have been used as the basis of design in preparation of these documents. Any modifications to the mechanical systems and their components, the electrical systems, the building structure and architecture, or any other portion of the building that results from the use of any other than the basis of design equipment, shall be coordinated with all

trades. Such coordination shall occur prior to delivery of products from the manufacturer (typically before shop drawing submittals). Any related modification shall be performed without additions to the contract.

C. All items mounted at or below the ceiling and any item penetrating the ceiling shall be coordinated with the architectural reflected ceiling plans. If any items are not shown on these plans, or any items need to be relocated for coordination purposes, prepare a reflected ceiling plan and submit to the Architect for approval.

1.06 PROTECTION OF WORK DURING CONSTRUCTION:

A. Provide protective covers, skids, plugs or caps to protect equipment and materials from damage and deterioration during construction. Protect exposed coils with plywood or other suitable rigid covers to avoid damage to fins.

1.07 RELATED WORK DESCRIBED IN OTHER DIVISIONS:

A. Installation of access panels in wall and ceiling construction.

B. Painting, except as specified herein.

C. Electrical power, interlock and control wiring, except as specified herein.

D. Installation of starters, contactors, thermal overload switches and remote push buttons, except as specified herein.

E. Curbs, flashing and pitch pockets for equipment on roof, except as specified herein.

1.08 MAINTENANCE DATA:

A. Three weeks prior to final job observation, submit three (3) manuals covering details of operation and maintenance for all apparatus requiring service including:

B. Service telephone number of the installing contractor.

C. Manufacturer's operating and maintenance manuals, including parts lists for each piece of equipment and accessory requiring service or maintenance; the guarantee period and the name, address and phone number of the nearest sales and service organization for each item.

D. Step-by-step procedure for starting and stopping each system.

E. Temperature control diagrams.

F. Copies of inspection certificates provided by the City, County, State and insurance companies.

G. Manuals shall be bound in 3-ring binders with index and tabs. All material shall be original copies as printed by the manufacturers.

1.09 SUBMITTALS:

A. Submit shop drawings for review in accordance with the requirements of Division 01. Shop drawings shall be bound into volumes, with each volume containing one copy of all shop drawings. All shop drawings shall be submitted simultaneously; no shop drawings will be checked until all have been submitted with the following exceptions:

1. Fabrication drawings such as those for Ductwork, Piping and Controls may be submitted separately.
2. Any separate submittals shall have a tab in the binder for insertion as provided. Provide in the original submittal a sheet marked "Drawings to be submitted by (date) .

B. Product and performance data for air conditioning systems shall be presented with all data for each system grouped together on consecutive pages.

C. Submittals shall be supported by descriptive material, such as catalog cuts, diagrams, performance curves and charts published by the manufacturer, to show conformance to specification and drawing requirements; model numbers alone will not be acceptable. All literature shall clearly indicate the specified model number, dimensions, arrangement, rating and characteristics of the proposed equipment. Capacities and ratings shall be based on conditions indicated or specified herein. Any deviations from specified equipment (particularly those which require coordination with other trades) shall be clearly noted in a concise list on a separate sheet.

D. Shop drawings shall be submitted for each of the following items:

1. Air Conditioning Equipment
2. Fans
3. Electric Heaters
4. Insulation
5. Grilles, Registers, Diffusers
6. Ductwork and Accessories
7. Louvers and Dampers
8. Flexible Ductwork
9. Temperature Control Devices

1.10 CLEANING AND ADJUSTING:

A. The exterior surfaces of all mechanical equipment, piping, ducts, etc., shall be cleaned of all grease, oil, paint and other construction debris.

B. Ducts, plenums and casings shall be cleaned of all debris and blown free of all particles of rubbish and dust before installing outlet faces.

C. Bearings that require lubrication shall be lubricated in accordance with the manufacturer's recommendations.

D. All control equipment shall be adjusted to the settings indicated or required for performance as specified.

E. Remove all stickers, rust, stains, labels and temporary covers before final acceptance.

F. Remove foreign matter from equipment, piping and duct work systems and appurtenances.

G. Clean and polish identification plates.

1.11 PAINTING:

A. Factory painted equipment that has been scratched or marred shall be repainted to match original factory color.

B. The interior of all ductwork visible through the face of any grille, register or diffuser; or any ductwork, conduit or piping visible through any open return air grille, shall be painted flat black.

C. All uninsulated black ferrous metal items exposed to sight inside the building, such as steel piping, equipment hangers and supports, not provided with factory finish shall be cleaned and painted with one (1) coat of rust inhibiting primer. In addition, such items in finished spaces shall also be painted with two (2) coats of finish paint in a color to match adjacent surfaces or as otherwise selected by the Architect.

D. Black ferrous metal items exposed outside the building, such as uninsulated pipe and pipe supports not provided with factory finish, shall be cleaned and painted with one (1) coat of rust-inhibiting primer and two (2) coats of an asphaltic base aluminum paint. Insulated pipes outside the building shall be cleaned and painted with one (1) coat of rust-inhibiting primer before installing insulation.

1.12 GUARANTEE:

A. That each piece of apparatus shall be of the customary standard and quality furnished by the designed manufacturer for that catalog number.

B. That the air systems shall operate without aerodynamic noise generated from the faulty installation of duct work or any component of the air distribution system.

C. All systems and components shall be provided with a one (1) year warranty from the time of final acceptance or beneficial occupancy. The warranty shall cover all materials and workmanship. During this warranty period, all defects in materials and workmanship shall be corrected by repair or replacement without incurring additions to the contract.

D. All air conditioning compressors shall be warranted for an additional four years. This additional warranty shall include parts only.

1.13 INSTRUCTION OF OPERATING PERSONNEL:

A. Arrange formal instruction sessions for the Owner's operating personnel covering:
B. General familiarization and operating procedure for the entire mechanical installation.
C. Routine maintenance procedures for all mechanical equipment.
D. Specific operating and maintenance procedures for the automatic control systems.
E. Obtain receipt from the Owner's representative acknowledging completion of each item of instruction.

1.14 SLEEVES:

A. Provide where pipes pass through walls, except iron pipe through masonry walls, may be built into the walls.

B. Sleeves shall be standard weight steel pipe, except sleeves for concealed piping through floors not in structural members. They may be 25 gauge galvanized sheet metal.

C. Wall sleeves shall be full thickness of walls.

D. Seal between piping and sleeve with fire-rated caulk at all penetrations of fire rated walls, partitions or floors.

E. Make sleeves through outside walls watertight. Caulk between uninsulated pipe and sleeve.

F. Size sleeves for insulated pipes to allow full thickness insulation.

G. Omit pipe sleeves in concrete floor slabs on grade.

1.15 ELECTRICAL WORK:

A. All electrical equipment and installation provided under this Division shall comply with the National Electric Code and the requirements of Division 26.

B. All power wiring and final power connections to the system shall be provided under Division 26.

C. Control wiring (120V and less) shall be provided under Division 23 and extended from the 120V power circuits indicated on the Electrical Drawings. All wiring for voltages higher than 30 volts shall be done by a licensed electrician.

D. All electrical characteristics shall be taken from the Electrical Drawings and Specifications and coordinated before equipment is ordered or submitted.

1.16 MOTORS AND STARTERS:

A. Provide motors, starters, push buttons, thermal overload switches and contactors for equipment covered herein, unless otherwise specified. Installation of starters, push buttons, thermal overload switches and contactors (not factory installed) is specified under another Division.

B. Motors shall be wound for the electrical characteristics described on the electrical drawings. Nameplates shall show the above voltages. Open frame, splash proof and totally enclosed motors shall be rated on a 40º, 50º, and 55ºC temperature rise, respectively.

C. Select motors for operation within their nameplate amperage.

D. Motors shall be of the induction type, unless otherwise specified.

E. Motors not furnished with equipment shall be Allis-Chalmers, Century, Delco, General Electric, Ideal, Louis-Allis, Wagner or Westinghouse.

F. Starters shall have overload protection for all hot lines. This will require three overload relays for three-phase motors and one overload relay for single-phase line-voltage motors.

G. Unless otherwise specified, provide each motor 1/2 hp and larger with a magnetic starter providing overload and low voltage protection. Provide a control voltage transformer in each starter.

H. Equipment furnished with factory-installed motor starter units shall also be equipped with individual motor branch circuit protective devices interconnected on their line sides to lugs sized to receive a feeder with minimum ampacity of 125% of total connected load.

I. A hand-off-auto switch shall be mounted on the face of each starter.

J. Unless otherwise specified, provide for each motor smaller than 1/2 hp a manual starting switch with thermal overload protection with pilot light and stainless steel coverplate. Switches installed on finished walls shall be flush type.

K. Starters and contactors not furnished with equipment shall be Allen-Bradley, Arrow-Hart, Cutler-Hammer, General Electric, Joslyn-Clark, Siemens, Square D, Wagner or Westinghouse.

L. Coordinate all mechanical equipment requirements, including any control and interlock requirements, with work in Division 26.

1.17 EQUIPMENT IDENTIFICATION:

A. Provide labels for each equipment starter and control switch. Labels to be engraved, laminated bakelite nameplates with 1/4-inch high white cut letters; secure to starter or switch.

1.18 EQUIPMENT INSTALLATION AND START UP:

A. All equipment shall be installed in strict conformance with manufacturer's recommendations, as specified herein and as shown. If any conflict arises between these instructions, notify the Engineer immediately for guidance.

B. Start-up and testing of the air conditioning equipment shall be performed in strict accordance with the manufacturer’s installation instructions.

C. Upon completion of the start-up and testing procedures, the manufacturer shall provide written certification to the Architect that the equipment is installed and operating properly.

1.19 EQUIPMENT, MATERIALS AND BID BASIS:

A. Specified manufacturer's names and model numbers are for the purpose of describing type, capacity, function and quality of equipment and materials to be used. Unless "or equal" is specifically stated, bids shall be based on equipment named.

B. Capacities indicated take precedence over model numbers.

END OF SECTION 230100

SECTION 230500

TEST AND BALANCE

PART 1 GENERAL

1.01 DESCRIPTION OF WORK:

A. This section describes the requirements for test and balance of air distribution systems, and water systems.

1.02 TEST AND BALANCE AGENCY:

A. The contractor shall retain the services of an independent test and balance agency that is independent of any Contractor, sub-contractor, or manufacturer to perform the testing and balancing and prepare reports to the General Contractor. The independent test and balance agency shall be a certified member of the Associated Air Balance Council or the National Environmental Balancing Bureau.

1.03 OPERATION OF EQUIPMENT:

A. The contractor shall put all heating, ventilating and air conditioning systems into full operation and shall operate the systems at all times that test and balance work is in progress. The contractor's start-up, adjustment and placing in operation of the mechanical systems shall include but is not limited to assembly of all parts, alignment of drives, tightening sheaves on shafts, checking motors for correct rotation and reconnecting where necessary, providing correct starter overload heaters, removing dirt and blockage, and placing the systems in good operating condition.

B. Openings in ducts for pitot tube insertions shall be provided by the contractor at locations indicated by the balancing agency, and shall be sealed by the balancing agency with snap-in plugs when the air balance has been complete. Patching of the duct insulation if required will be the responsibility of the contractor.

C. The contractor shall provide clean filters at the beginning of the air balance, and shall replace them if necessary during the course of the balance procedure.

1.04 STANDARDS:

A. Testing and balancing shall be performed in accordance with these specifications and in accordance with the latest Associated Air Balance Council National Standards for Total System Balance, Fourth Edition.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 LEAKAGE TESTS, DUCT SYSTEMS:

A. The test and balance agency shall witness and certify to duct leakage tests for medium ducts to be performed by the Contractor. The Agency shall furnish test instruments, confirm the readings, make the calculations for percentage of leakage in accordance with AABC standard methods and submit test report.

B. Leakage is specified to be not over 1% of the design CFM at the normal operating pressure of the duct system.

3.02 BELT DRIVES:

A. Adjustable speed drives are to be adjusted by the test and balance Agency. In cases where the specified capacities cannot be obtained with the original adjustable sheave or original fixed drive sheave, the Agency is to report to the Contractor the sheave size required to obtain the specified capacity.

B. Where larger or smaller sheave sizes are required, the Contractor shall provide new sheaves and, if required, new belts.

3.03 CONTROL PERFORMANCE CHECK:

A. The results produced by the operation of automatic controls shall be checked by the testing agency; controls requiring adjustment shall be listed and reported to the Contractor. This does not reduce the responsibility of the Contractor for the checking and adjustment specified under the Temperature Control Section.

3.04 ROOM TEMPERATURE TESTS:

A. After system balance has been complete, the balancing agency shall perform an operational test over a period of eight hours. The test shall be performed only after each piece of equipment has been individually tested and adjusted to correct operating conditions. The test shall be performed at a time when the outdoor dry bulb temperature is above 85□F. (if during the cooling season), or below 50□F. (if during the heating season). The doors to all spaces shall be closed and all the lights shall be turned on if the test is performed during the cooling season. All space thermostats shall be set at 75 degrees F. during the cooling season. All space thermostats shall be set at 75 degrees F. during the cooling season test and 70 degrees F. during heating season test. The following information shall be recorded and submitted:

1. Temperature of each conditioned space with setting of controlling thermostat.

2. Date and outdoor DB and WB temperature range at the time indoor temperatures were recorded.

3.05 EQUIPMENT NAMEPLATES DATA AS INSTALLED:

A. Manufacturer, size, model, serial number, motor hp, rpm, voltage, full load amps. V-belt sheave sizes, grooves, belts, sizes, length. Starter heater size, rating and fuse size.

3.06 TESTING PROCEDURES - AIR DEVICES:

A. Test and adjust all blower and fan speeds to deliver specified CFM.

B. Test and record motor full load amperes of all motors.
C. Test and adjust each diffuser and register to within 10% of design requirements.

D. Each grille, diffuser and register shall be identified as to locations and area.

E. Size, type and manufacturer of diffusers, grilles, registers, and all tested equipment shall be identified and listed. Manufacturer's rating on all equipment shall be used to make required calculations.

F. Readings and tests of diffusers, grilles, and registers shall include design, initial test, and final adjusted FPM velocity and CFM.

G. All diffusers, grilles and registers shall be adjusted to minimize drafts in all areas.

H. Total air quantities for all air handling equipment shall be determined by pitot tube traverse of main ducts, traverse of filter banks or coils, and by totaling the readings of individual air outlets. All three methods should be employed where possible so that comparisons can be made.

I. Total air quantities shall be obtained by adjustment of fan speeds. Branch duct quantities shall be adjusted by volume or splitter dampers. Dampers shall be permanently marked after air balance is complete so that they can be restored to correct positions if disturbed at any time. Final air quantities shall be within 10 percent of those called for on the drawings.

J. Determine air quantities at grilles, register, and diffusers by using direct reading velocity meters in accordance with the recommendations of the air distribution manufacturer.

K. Minimum outside air quantities shall be established from measurements of return air, outside air, and mixed air temperatures, using a 12 inch long glass thermometer with 0.5□F divisions. Minimum outside air quantity shall be set after complete adjustment of total supply air quantity. The following formula shall be utilized to calculate percentage of outside air:

$$\%\ OA = \frac{Ts-Tr}{To-Tr}$$

Where: Ts = Mixed air temperature
Tr = Return air temperature
To = Outside air temperature

3.07 WARRANTY:

A. The Test and Balance Agency shall furnish a warranty to complete any of the test and balance of the cooling or heating that could not be done prior to final inspection due to lack of seasonable weather, and to make corrections of the test and balance work during one year after the date of Substantial Completion, without extra cost to the Owner.

B. The warranty shall be in letter form addressed to the Owner but transmitted through the General Contractor to the Architects and Engineers.

3.08 REPORT:

A. Prepare a typewritten, bound report including the following information:

1. Name and address of testing agency and name of individual responsible for the work.
2. Make, model and latest calibration date of testing equipment.
3. Sketch or written description sufficient to identify individual devices tested.
4. All amperages, pressures, temperatures, CFM, and other information required by this section.

3.09 EQUIPMENT MARKING:

A. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers and similar controls and devices, to show final settings at completion of T & B work. Provide markings with paint or other suitable permanent identification materials.

3.10 FIELD VERIFICATION:

A. Contractor shall provide a pressure differential meter and air flow hood during final job observation for engineer's use to spot verify water and air flow readings.

END OF SECTION 230500

SECTION 230700

HVAC INSULATION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK:

B. The extent of the HVAC insulation work is hereby defined as furnishing, fabricating, assembling and installing complete, permanently installed commercial and industrial insulation systems as shown on the drawings and/or as included in this specification. Applicable portions of Section 23 0100, "HVAC General Provisions", shall also be a part of this section of the specifications.

1.02 QUALITY ASSURANCE:

B. Materials furnished under this specification shall be standard, cataloged products, new and commercially available, suitable for service requiring high performance and reliability with low maintenance, and free from all defects.

C. Specified components of this insulation system, including facings, mastics, and adhesives, shall have a fire hazard rating not to exceed 25 for flame spread and 50 for smoke developed, as per tests conducted in accordance with ASTM E84 (NFPA 255) methods.

D. Provide materials by firms engaged in the manufacture of insulation products of the types and characteristics specified herein, whose products have been in use for not less than five years.

PART 2 PRODUCTS

1.03 PIPE INSULATION

A. TYPE P1

1. Flexible, closed cell elastomeric, nominal 6 PCF density, K factor 0.27 maximum at 75º F mean.

2. Approved products

Armstrong AP Armaflex
Manville Aerotube II
Nomaco Therma-Cel
Rubatex R-180-F5

2.01 DUCT INSULATION:

A. TYPE D1 ASTM C553 TYPE 1CLASS B3

2. Fiberglass, nominal 1 PCF density blanket, K factor 0.31 maximum at 75º F mean, with factory applied FSK (Foil-Scrim-Kraft) vapor barrier jacket, for temperatures to 250º F.

3. Approved products:

CertainTeed "Standard Duct Wrap"
Manville "Microlite"
Owens/Corning Fiberglass RFK-75
Knauf "Ductwrap"

B. TYPE D2 ASTMC - 1071 TYPE 1

2. Fiberglass, nominal 2.0 PCF density liner, K factor 0.26 maximum at 75º F mean, black coating, for temperatures to 250º F.

3. Approved products:

CertainTeed Ultralite Duct Liner 200
Manville Linacoustic
Knauf Duct Liner M

PART 3 EXECUTION

3.01 INSTALLATION OF PIPE INSULATION

B. Install insulation products in accordance with the manufacturer's written instructions, and in accordance with recognized industry practices.

C. Install insulation on pipe systems subsequent to testing and acceptance of test.

D. Install insulation materials with smooth and even surfaces. Insulate each continuous run of piping with full-length units of insulation, with a single cut piece to complete the run. Do no use cut pieces of scraps abutting each other.

E. Clean and dry pipe surfaces prior to insulation. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.

F. Maintain integrity of vapor-barrier jackets on pipe insulation, and protect to prevent puncture or other damage. Seal open ends of insulation with mastic. Sectionally seal all butt ends of chilled water and condensate drain piping insulation at fittings with white vapor barrier coating.

G. Cover valves, flanges, fittings, and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option). Finish cold pipe fittings with white vapor barrier coating and hot piping with white vinyl acrylic mastic, both reinforced with glass cloth.

H. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

I. Coat closed-cell elastomeric insulation exposed to weather with white vinyl lacquer-type coating.

3.02 INSTALLATION OF DUCTWORK INSULATION:

A. General: Install insulation products in accordance with the manufacturer's written instructions, and in accordance with recognized industry practices.

B. Install insulation materials with smooth and even surfaces.

C. Clean and dry ductwork prior to insulation. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

D. Maintain integrity of vapor-barrier on ductwork insulation, and protect it to prevent puncture and other damage. Tape all punctures. Seal all longitudinal and circumferential joints with FSK tape.

E. Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except where otherwise indicated.

F. External insulation shall be applied in addition to liner where liner (type D3) is specified.

G. All internal insulation shall be adhered to the duct with 100% coverage of approved fire retardant mastic. All edges shall be sealed. Any abrasions or tears repaired with mastic. Increase indicated duct sizes to compensate for liner thickness.

3.03 INSULATION REQUIREMENTS:

A. Refrigerant gas piping:
TYPE P1
3/4 INCH THICKNESS

B. Condensate Drain Piping:
TYPE P1
3/4 INCH THICKNESS

C. Ductwork, Supply, Return Air and Outside air, plus and Exhaust air ductwork within five feet of an exterior wall louver:
TYPE D1
2 INCH THICKNESS

D. Ductwork, Supply and Return within 10 feet of air conditioning unit:
TYPE D2
1 INCH THICKNESS

END OF SECTION 230700

SECTION 230900

AUTOMATIC TEMPERATURE CONTROL SYSTEM

15900.1 - GENERAL

A. DESCRIPTION OF WORK:

1. The extent of Automatic Temperature Control (ATC) work is indicated on the drawings and the schedules and by the requirement of this section and section 15050.

B. ACCEPTABLE MANUFACTURERS:

1. The major components of the Automatic Temperature Control System shall be provided by the Air Conditioning equipment manufacturers. Miscellaneous components shall be as manufactured by Johnson, Staefa or Honeywell.

C. RELATED WORK:

1. All electrical control wiring in connection with the Automatic Temperature Control (ATC) system shall be furnished and installed under this section, unless shown on the electrical drawings. Power wiring shall be provided by Division 16-Electrical.

2. All duct smoke detectors shall be furnished and wired into the Fire Alarm system under Division 16-Electrical. These detectors shall be installed and wired for fan shutdown under this section.

3. All cutting and patching necessary for the installation of Control System shall be done by the General Contractor.

D. SUBMITTALS:

1. Diagrams: Separate diagrams for each system, including power supply through starters and motors; motor starting and interlock wiring; pushbuttons; all control wiring; interior electrical circuits of control instruments with terminal designations; control motors; colors of wires; location of instruments and remote elements; horsepower of motors; normal position of valves, dampers, and relays, etc. A detailed description of the operation of the control system, including control device designation shall accompany the drawings. A copy of the appropriate approved diagram and description of operation shall be framed under glass and mounted near each system control panel.

E. WARRANTY:

1. The system shall be warranted for a period of one year following the date of beneficial use. Any manufacturing defects arising during this warranty period shall

be corrected without cost to the owner.

15900.2 - PRODUCTS

A. SENSORS:

1. Room Thermostats:

a. Thermostats shall be seven-day programmable, low voltage dual set point with sub-base, fan on-auto, and heat-off-auto-cool control. Thermostats shall have locking covers or lockable setpoints.

b. All room thermostats shall be same shape and appearance and shall have locking covers. Wall mounted thermostats shall be provided with lockable, louvered steel thermostat guards.

c. Temperature sensors shall be of the thermistor type with a high resistance change versus temperature change to insure good resolution and accuracy. Sensor shall be available for room duct and well mounting. Sensors shall connect to remote controller by means of a two-wire unshielded cable. Room type sensors shall be available in various ranges to properly suit the application.

B. DAMPER ACTUATORS:

1. Damper actuators shall be digital, oil-immersed gear type.

C. CONTROL PANELS:

1. Control panels shall be fully enclosed cabinets with all steel construction. Cabinets shall have hinged door with locking latch or bolt on cover plate. All cabinet locks shall be common keyed. Panel shall be wall mounted or free standing as located on mechanical drawings.

2. All devices shall be located within the cabinet and mounted to a sub-panel unless stated otherwise in this specification.

3. Provide nameplates for all door flush mounted devices.

15900.3 - EXECUTION

A. ELECTRIC WIRING:

1. Low voltage control wiring shall be run in EMT conduit in exposed areas and in vertical risers between floors. Plenum rated wire may be used without conduit in concealed but accessible areas.

2. Line voltage control wiring shall be run in EMT conduit.

B. TEST AND CALIBRATION:

1. After completion of installation, all controls shall be tested and calibrated to operate as required in this specification.

2. Upon request by the Architect's representative, demonstration of proper control system operation shall be provided prior to final job acceptance.

C. SEQUENCE OF OPERATION:

1. The automatic temperature control systems shall provide control functions as detailed in the following paragraphs.

2. Split system heat pump HP-1/FCU-1 shall be controlled by a wall mounted, seven-day programmable thermostat, designed for commercial applications. Thermostat shall provide fan control to allow operation of the fan in the “ON” mode during occupied hours and the “AUTO” mode during unoccupied hours, without human intervention. A two-position motorized damper, located in the outside air duct to each fan-coil unit, shall open when the unit is in the occupied mode and close when the unit is in the unoccupied mode. Operation of the outside air damper may be accomplished using a separate digital time clock that opens the damper only when the building is occupied.

3. Electric wall heaters and ceiling heaters shall be controlled by an integral, tamperproof thermostat.

4. Electric Unit Heaters shall be controlled by a wall mounted, heating-only thermostat (non-programmable).

5. Electric duct heater EDH-1 shall be controlled by a wall mounted, heating only thermostat, (non-programmable). In addition, the heater shall be interlocked with fan F-8 so that it is enabled only when the fan is running on low speed.

6. Exhaust fans shall be controlled as follows.

   a. F-1 shall be controlled by a wall mounted thermostat.
   b. F-2 shall be controlled by a wall mounted toggle switch.
   c. F-3 shall be controlled by a wall mounted thermostat.
   d. F-4 shall be controlled by a wall mounted, three position toggle switch (OFF-HIGH-LOW), located in the utility chase. (In summer mode, the fan shall run on high speed. In winter mode, the fan shall run on low speed.) A speed controller shall be provided on the fans low-speed lead to facilitate balancing of the lower air flow. In addition, the low speed power conductor shall be routed through a pair of parallel relays that are energized by the lighting occupancy sensors in restrooms 109 and 110 so that the fan, when

set to run on low speed, runs only when the lights are on in either restroom. When the toggle switch is set for high speed operation, the fan shall run continuously.

e. F-5 shall be controlled by a wall mounted toggle switch.
f. F-6 shall be controlled by a wall mounted toggle switch.
g. F-7 shall be controlled by a wall mounted toggle switch.
h. F-8 shall be interlocked with fan F-4 to run whenever F-4 is running on either high or low speed.

END OF SECTION

SECTION 233100

DUCTWORK AND ACCESSORIES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK:

A. The extent of ductwork is indicated on the drawings and in the schedules, and by the requirements of this section and section 15050.

1.02 QUALITY ASSURANCE:

A. Industry Standards: Comply with SMACNA (Sheet Metal and Air Conditioning Contractors' National Association) HVAC Duct Construction Standards, First Edition, recommendations for fabrication, gauges, construction and details, and installation procedures, except as otherwise indicated.

B. Comply with ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers) 1985 Fundamentals Handbook recommendations, except as otherwise indicated.

1.03 SUBMITTALS:

A. Submittals shall be in accordance with requirements of Section 15050, "HVAC General Provisions".

B. Shop Drawings: Low Pressure Metal Ductwork: Submit dimensioned layouts of ductwork showing both the accurately scaled ductwork and its relation to space enclosure. Show modifications of indicated requirements, made to conform to local shop practice, and how those modifications ensure that the free area, materials and weights are not reduced.

PART 2 PRODUCTS

2.01 LOW PRESSURE DUCTWORK & ACCESSORIES:

A. Ductwork Metal and Gauges: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A527, Lockforming Quality, with ASTM A525 G90 zinc coating, mill phosphatized. Gauges to comply with SMACNA standards.

B. Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant (type applicable for the fabrication/installation detail) as compounded and recommended by the manufacturer specifically for sealing joints and seams in ductwork.

C. Ductwork Support Materials: Except as otherwise indicated, provide upper attachment, hangers

of galvanized steel straps, or steel rods and lower attachment for support of ductwork. Hanging/support systems shall be in accordance with SMACNA requirements.

D. Turning Vanes: Provide double thickness turning vanes in the size and type indicated in SMACNA Standards.

E. Duct Access Doors: Provide removable duct access doors as indicated, 12 inches x 12 inches minimum or in sizes indicated, with gaskets and insulation where ductwork is indicated to be insulated. Secure with easy access window lock type latches.

F. Flexible Ductwork Low-Pressure: Unless otherwise specified, provide factory-fabricated, UL 181 Class 1 round flexible air ductwork, where shown, in size indicated. Provide with metal or nylon duct clamps. Constructed of steel helix core bonded to liner. Insulate with 1" fiberglass covered with seamless vapor barrier jacket.

G. Flexible Ductwork Fittings: Provide spin-in type fitting for connecting low-pressure flexible duct to sheet metal. Fitting to be same diameter as round duct, with fixed extractor, and damper with operator and lock nut. Fitting to be galvanized steel, gauge as recommended by manufacturer.

H. Exhaust ductwork and plenums associated with fans F-5, F-6 and F-7 shall be of aluminum construction.

PART 3 EXECUTION

3.01 DUCTWORK:

A. All ductwork shall be low pressure construction.

B. Fabricate rectangular ductwork with joints, seams and reinforcements as indicated, complying with recognized industry standards and SMACNA Standards.

C. Reinforce rectangular ductwork with angle frames to SMACNA Standards.

D. Crossbreaking: In addition to required reinforcement of rectangular work, stiffen flat duct surfaces over 12 inches wide by crossbreaking.

E. Co-ordinate duct liner requirements with HVAC insulation specifications.

F. Fabricate round ductwork with girth joints and girth reinforcements complying with recognized industry standards and SMACNA Standards.

G. Assemble and install ductwork in accordance with recognized industry practices which will achieve air tight and noiseless systems, capable to performing each indicated service. Install each run with a minimum of joints. Align ductwork accurately at connections, within 1/8 inch

misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of the type which will hold ducts true-to-shape and to prevent buckling.

H. Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in the shortest route which does not obstruct usable space or block access for servicing the building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of the building. Limit clearance to 0.5 inch where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any.

I. Where possible, locate insulated ductwork for 1.0 inch clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate the layout with suspended ceiling and lighting layouts and similar finished work.

J. Electrical Equipment Spaces: Do not run ductwork through transformer vaults and other electrical equipment spaces and enclosures.

K. Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls and other associated work of the ductwork system.

L. Support ductwork from building structure in accordance with SMACNA standards and anchor with bolts, concrete inserts, steel expansion anchors, welded studs, C-clamps or special beam clamps.

M. Connect low pressure duct branches with extractors or splitter dampers indicated.

N. Seal ductwork as follows:
   a. Low Pressure Seal Class C

O. Maximum length of low pressure flexible duct to be 6 feet. Install flexible ductwork as straight and taut as possible. Secure with duct clamps, sealant, and tape as recommended by SMACNA and flex duct manufacturer. Flexible duct may <u>not</u> be used in inaccessible locations.

3.02 <u>CLEANING AND PROTECTION</u>:

A. Clean ductwork internally, unit-by-unit as it is installed, of dust and debris. Clean external surfaces of foreign substances which might cause corrosive deterioration of the metal; or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

B. Strip protective paper from stainless ductwork surfaces, and repair finish wherever it has been damaged.

C. Temporary Closure: At ends of ducts which are not connected to equipment or air distribution devices at the time of ductwork installation, provide temporary closure of polyethylene film or other covering which will prevent the entrance of dust and debris until the time connections are to be completed.

END OF SECTION 233100

SECTION 23 3300

LOUVERS AND DAMPERS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK:

A. The extent of louver and damper requirements is indicated by the drawings (including schedules) and by this section of the specifications and section 230100.

1.02 QUALITY ASSURANCE:

A. Provide louvers and dampers with performance data certified by AMCA (Air Movement and Control Association).

PART 2 PRODUCTS

2.01 LOUVERS:

A. Provide stationary, drainable blade louvers, 6 inches deep, with a drain gutter in each blade and downspouts in jambs and mullions. Blades shall be contained within a single 6 inch frame. Louver construction shall be fully welded 12 gauge 6063 extruded aluminum alloy frame with integral caulking slots. Aluminum screen, 1/2 inch square mesh, 16 gauge, shall be contained within a removable frame. Louvers shall be mill finish. Air pressure drop shall not exceed 0.15 inch water column, and water penetration shall not exceed 0.1 ounce per square foot when tested at a free area velocity of 1000 FPM in accordance with AMCA Standard 500.

1. Ruskin ELF 6375DX
2. Airolite K6776
3. Arrow 265
4. Dowco DEB-06

2.02 DAMPERS:

A. Furnish and install, at locations shown on plans or in accordance with schedules or specifications, dampers of characteristics described herein.

B. UL labeled fire dampers shall be classified "For use in dynamic systems".

2.03 MANUAL BALANCING DAMPERS:

A. Manual Balancing Dampers shall be opposed-blade (or single-blade) type fabricated from galvanized steel. Pivot rods (axles) shall be 1/2 inch square or hexagonal with non-stick and non-corrosive bearings. Control shaft shall be 3/8 inch square plated steel with locking hand quadrant.

1. Ruskin MD35
2. Arrow 1770
3. AW&V VC-21
4. Vent Products 5201
5. United Air DO-3

2.04 FIRE DAMPERS:

A. Furnish and install, at locations shown on plans or as required by governing codes, dynamic rated fire dampers constructed and tested in accordance with UL Safety Standard 555. Each fire damper shall have a 1-1/2 hour fire protection rating, 165ºF fusible link, and shall include UL Label. Fire dampers shall be equipped for vertical or horizontal installation as required by the location indicated. Dampers shall be gravity operated for vertical installations, by closure springs and latches for horizontal installations. Dampers in return air openings or behind grilles or registers shall be type A. Dampers in low pressure ductwork shall be type B.

1. Ruskin (DIBD2)
2. Air Balance
3. Vent Products

PART 3 EXECUTION

3.01 INSPECTION:

A. Installer must examine areas and conditions under which louvers and dampers will be installed and notify Contractor in writing of conditions detrimental to proper installation.

3.02 FIELD QUALITY CONTROL:

A. Touch up paint on damaged exposed parts of devices or replace if necessary.

3.03 INSTALLATION - FIRE DAMPERS:

A. Fire dampers shall be installed utilizing steel sleeves, angles, other materials, and practices required to provide an installation equivalent to that utilized by the manufacturer when dampers were tested at UL. Installation shall be in accordance with the damper manufacturer's instructions.

B. Prove damper location and access adequacy after damper installation.

C. Provide duct access door that will allow resetting of damper and replacement of the link. Access shall be 12 x 12-in. (31 x 31-cm) minimum, except for smaller ducts, where access shall be as large as practical.

D. Ceiling access shall be coordinated with the ceiling.

END OF SECTION 233300

SECTION 233400

FANS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK:

A. The extent of fan work is shown on drawings and in schedules and by requirements of this section and section 230100.

B. Refer to automatic control sections for automatic controls required in connection with fans; not work of this section.

C. Refer to ductwork sections for materials and sheet metal work required in conjunction with fans; not work of this section.

D. Refer to electrical specifications for electrical connection work required in conjunction with fans; not work of this section.

1.02 MANUFACTURER:

A. Provide products produced by one of the following:

1. Acme
2. Ammerman
3. Carnes
4. Greenheck
5. Loren Cook Co.
6. Penn

B. Electrical Standards: Provide electric motors and products which have been listed and labeled by Underwriters Laboratories and comply with NEMA Standards.

C. NFPA Compliance: Comply with National Electrical Code (NFPA No. 70) as applicable to installation of fan motors and associated electric wiring and equipment.

D. AMCA Compliance: Comply with Air Movement and Control Association standards pertaining to testing, performance and sound ratings of fans. Fans shall bear AMCA seal.

E. Certifications, Fan Performance: Provide fans whose performance, under specified conditions, is certified by manufacturer.

PART 2 PRODUCTS:

2.01 FANS AND BLOWERS:

A. General: Except as otherwise indicated, provide fan manufacturer's standard materials and components as indicated by published product information, design and construction as recommended by manufacturer, and as required for a complete installation. Belt drives shall be adjustable, size for 150% of motor HP.

B. Fan motor enclosure shall be the drip-proof type unless specifically indicated otherwise.

C. Centrifugal Ceiling Exhaust Fans: Ceiling exhaust fans shall be constructed of a galvanized sheet metal housing with acoustical liner, inlet grille, electrical disconnect, forward curved centrifugal blower wheel and outlet duct collar with gravity shutter. Motor and fan wheel shall be isolated from the housing.

D. Centrifugal In-Line Cabinet Exhaust Fans: Centrifugal in-line exhaust fans shall be constructed of a galvanized sheet metal housing with acoustical liner, electrical disconnect, forward curved centrifugal blower wheel, inlet and outlet duct collars and gravity shutter. Motor and fan wheel shall be isolated from the housing.

E. Square Centrifugal In-Line Exhaust Fans: Square centrifugal in-line exhaust fans shall be constructed of a galvanized sheet metal housing, backwardly inclined centrifugal blower wheel, TEFC direct drive motor, inlet and outlet duct collars, and gravity shutter. Motor and fan wheel shall be isolated from the housing or the entire fan assembly shall be suspended with vibration isolation hangers, with flexible duct connections on the inlet and outlet of the fan. Fans shall be provided with a speed controller, mounted to the fan housing, for balancing purposes. Fans F-5, F-6 and F-7 shall have an epoxy coating on both the housing and the fan wheel.

PART 3 EXECUTION

3.01 INSPECTION:

A. Installer must examine areas and conditions in which fans and components are to be installed and notify Contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

3.02 INSTALLATION OF FANS:

A. Install fans where shown, in accordance with manufacturer's written instructions, requirements of NEC, and recognized industry practices, to ensure that fans comply with requirements and serve intended purposes.

B. Coordinate with other work, including ductwork and electrical connection work as necessary for interfacing installation of fans properly with other work.

C. Comply with AMCA's installation safety practices as applicable to fans.

D. Check alignment and, where necessary, realign shafts of coupled motors and fans within tolerances recommended by manufacturer.

E. Install units as shown; comply with manufacturer's indicated installation method, if any, and with vibration isolation sections of these specifications.

F. Cap openings not connected to equipment or ductwork. Upon completion of fan installation, provide covering for fan to prevent entrance of dirt and construction debris until connections are completed.

3.03 ELECTRICAL CONNECTIONS:

A. Ensure fan units are wired properly, with rotation in direction indicated and intended for proper fan performance.

B. Provide positive electrical fan and motor grounding.

3.04 FIELD QUALITY CONTROL:

A. Upon completion of installation of fan, and after motor has been energized with normal power source, test fan to demonstrate compliance with requirements. Where possible, field correct malfunctioning units, then reset to demonstrate compliance. Replace units which cannot be satisfactorily corrected.

END OF SECTION 233400

SECTION 233700

AIR DISTRIBUTION DEVICES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK:

A. The extent of air distribution devices requirement is indicated by drawings, schedules, and the requirements of this section and Section 230100.

PART 2 PRODUCTS

2.01 GRILLES, REGISTERS AND DIFFUSERS:

A. Grilles, registers, and diffusers as indicated on the drawings have been selected from the catalog of the manufacturer scheduled. Sizes and performance of the manufacturer being furnished shall be coordinated to insure conformity with design basis.

B. Sidewall supply grilles and registers shall have vertical front blades; sidewall return grilles shall have horizontal blades.

C. Grilles and registers with borders shall have felt or rubber gaskets cemented to the back face and holding screws not over 18 inches on centers around the perimeter. Holding screws shall be counter-sunk to fit flush with face of grille or register.

D. Grilles passing air through partitions shall be as described for wall return grilles, one for each side of partition.

E. Register dampers shall be of the gang-operated, opposed blade type, operated through the face of the register. Operating mechanism shall not project through the register face.

F. Mounting frame shall be coordinated with architectural reflected ceiling plans unless noted otherwise.

G. Finish of grilles, registers, and diffusers shall be as indicated on plans unless noted otherwise. Ductwork, dampers, etc., visible through the face of the grille, shall be painted flat black.

H. Acceptable manufacturer shall be Price, Titus, Tempmaster, Krueger, Carnes, Anemostat, or Metal-Aire.

2.02 EXTRACTORS:

A. Extractors shall be provided at low pressure branch duct take-offs. Extractors shall be equipped with devices for locking in desired position; where located more than 18 inches from air outlet, provide an adjusting rod extending to within 12 inches of outlet.

B. Extractors shall be Price AE-2, Titus "AG45", Krueger "EX8", Carnes "RXVA", Metal-Aire "101-1", or approved equal.

PART 3 EXECUTION

3.01 INSPECTION

A. Installer must examine areas and conditions under which air distribution devices will be installed and notify Contractor in writing of conditions detrimental to proper installation.

3.02 FIELD QUALITY CONTROL

A. Touch up paint on damaged exposed parts of devices or replace if necessary.

3.03 INSTALLATION - GRILLES AND REGISTERS

A. Install wall grilles and registers with horizontal edges parallel to ceiling.

B. Install wall mounted grilles with blades angled to block sightline through grille.

END OF SECTION 233700

SECTION 238126

SPLIT SYSTEM HEAT PUMPS

PART 1 GENERAL

1.01 DESCRIPTION

A. Furnish and install factory assembled, piped and wired heat pump of the type operational characteristics, and capacity as shown and scheduled. The manufacturer shall have available factory trained service engineers and an inventory of replacement parts within a one hundred mile radius of the job site.

B. Acceptable manufacturers are Carrier, Trane, Lennox or York.

C. Compressor shall be warranted against parts failure for five (5) years.

D. Submit catalog cuts, certified performance data and dimensional data.

1.02 QUALITY ASSURANCE:

A. Codes and regulations referred to are minimum standards. Where the requirements of these specification or drawings exceed those of the codes and regulations, the drawings and specifications govern.

PART 2 PRODUCTS

2.01 HEAT PUMP OUTDOOR UNITS:

A. Factory assembled and tested, complete with prewired controls, motor, compressor, coils, fan and reversing valve.

B. Units shall be enclosed in a factory finished heavy gauge galvanized steel cabinet. Units shall have capacities as scheduled on drawings.

C. Compressor shall be hermetic with positive pressure lubrication system and reversible oil pump, vibration isolators, suction and discharge valves, oil filter and oil level sight glass, crankcase heater, discharge muffler, suction line strainer and relief valve. Speed shall not exceed 1750 RPM.

D. Unit safeties shall include protection for low power supply voltage and/or phase loss.

E. For each heat pump system provide wall mounted, commercial programmable thermostat with fan “ON/AUTO” control and automatic heat/cool changeover.

2.02 HEAT PUMP INDOOR UNITS:

A. Vertical cabinet type, for use with heat pump, complete with centrifugal fan, motor, MERV 11 filter in factory filter rack, electric heater, DX cooling coil, and coil drain pan, all housed in a finished casing with thermal insulation. Functional components shall be readily accessible for inspection and maintenance.

B. Coil: Copper tubes, nonferrous fins.

2.03 REFRIGERANT PIPE:

A. Type K copper, acid cleaned and sealed, with wrought copper sweat fittings.

B. Joints in refrigerant piping shall be made with "Sil-fos", or equivalent.

PART 3 EXECUTION

3.01 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Handle unit carefully to prevent damage, breaking, denting and scoring. Damaged units or damaged components shall not be installed. Replace all damaged parts with new parts from the manufacturer.

B. If unit is to be stored prior to installation store in a clean, dry place. Protect from weather, dirt, fumes, water, construction, and physical damage.

C. Comply with manufacturer's rigging and installation instructions for unloading the unit and moving it to the final location.

3.02 START UP

A. Factory start-up supervision and owner training shall be included. The installing Contractor’s technician shall also be present during this time period.

3.03 INSTALLATION

A. Execute the work in accordance with the specifications and in accordance with the manufacturer's instructions and only by workmen experienced in this type of work.

END OF SECTION 238126

SECTION 238239

ELECTRIC HEATING EQUIPMENT

PART 1 GENERAL

1.01 DESCRIPTION OF WORK:

A. The extent of electric heating equipment work is indicated by drawings and schedules, and by the requirements of this section and section 15050.

B. All electric heating equipment shall be listed and labeled by Underwriter's Laboratories.

C. Refer to electrical specifications and drawings for electrical characteristics and connections to all heating equipment. Coordinate all electrical equipment with the electrical documents.

D. Refer to Automatic Temperature Control section for control of heaters.

E. ARI Compliance: Comply with applicable portions of ARI 410, "Standard for Forced-Circulation Air-Cooling and Air-Heating Coils".

F. NFPA Compliance: Comply with applicable provisions of NFPA Standard No. 90A, "Air Conditioning and Ventilating Systems".

G. NEC Compliance: Comply with National Electrical Code (NFPA 70), as applicable to installation of electric duct heating coils and heating equipment.

PART 2 PRODUCTS:

2.01 ELECTRIC HEATERS:

A. Electric heaters shall be UL listed, tamper-resistant type designed for commercial usage. Heaters shall be of the type scheduled on the drawings.

B. Heaters shall be fan-forced type designed for horizontal or vertical discharge, as indicated on the drawings.

C. Thermostats for electric wall heaters, ceiling heaters and unit heaters shall be integral, tamper-proof single pole type, with a 40-90ºF range. Thermostat for electric duct heater shall be wall mounted.

D. Heaters shall be complete with fan control and thermal overload protection.

E. Heaters shall be manufactured by Q-Mark, Markel, Berko.

PART 3 EXECUTION:

3.01 INSTALLATION:

A. Heating equipment shall be installed and wired in accordance with the manufacturer's recommendations.

END OF SECTION 238239

SECTION 260500

COMMON WORK

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Special Conditions, Supplementary Conditions, and Division 00 and 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Description:
   1. Provide all materials, tools, and labor for a complete electrical installation as shown on the contract documents and indicated in the specifications.
   2. Procure all permits and licenses.
   3. Coordinate the electrical installation with the following:
      a. Architect
      b. Contractors of other trades.
      c. Local Electrical and Building Inspectors, or the authority having jurisdiction.

B. Related Documents:
   1. Electrical, "E-", drawings
   2. All working drawings included in the contract documents.
   3. Specifications of the following divisions/sections:
      a. Division 01: General Requirements
      b. Division 03: Concrete
      c. Division 11: Equipment
      d. Division 23: Mechanical

1.03 ABBREVIATIONS

A. The following abbreviations are used throughout Division 16 specifications:
   1. AFF: Above Finished Floor
   2. ANSI: American National Standards Institute
   3. ASTM: American Society for Testing and Materials
   4. HVAC: Heating, Ventilating and Air Conditioning
   5. IEEE: Institute of Electrical and Electronic Engineers
   6. IES: Illuminating Engineering Society
   7. ITL: Independent Testing Laboratories
   8. NEC: National Electrical Code
   9. NECA: National Electrical Contractor Association

10. NEMA: National Electrical Manufacturers Association
11. NFPA: National Fire Protection Association
12. NIC: Not in contract
13. UL: Underwriters Laboratories, Inc.
14. ADA: Americans with Disabilities Act

1.04 DEFINITIONS

A. "Provide" means to furnish and install.

B. “Wiring” means conduit, conductors, boxes, and connections.

1.05 CODES AND STANDARDS

A. The installation shall comply with all laws applicable to the electrical installation which are enforced by local authorities, the latest edition of the National Electrical Code and with the regulations of the Utility Company. The Contractor shall obtain and shall pay for all permits required by the local authorities, and after completion of the work, shall furnish to the Utility Company, for the Owner, a certificate of final review and approval from the inspection bureau having jurisdiction.

B. Where, in any specific, case, different sections of any of the aforementioned codes and regulations or these plans and specifications each specify different materials, methods of construction, or other requirements, the most restrictive shall govern. In the case of any conflict between a general provision and a special provision, the special provision shall govern.

1.06 STANDARDS FOR MATERIALS AND WORKMANSHIP

A. Use materials that are new and, where UL or ITL has established standards, listed and/or labeled.

B. Organize and execute work so that finished appearance is neat; mechanical, plumb when vertical and level when horizontal.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide equipment, products and materials shown on the drawings, as specified in the specifications or added by addendum.

2.02 SUBSTITUTION OF MATERIALS

A. Refer to Contract Conditions.

2.03 CONCRETE

A. Refer to Division 03 specifications.

2.40 PLYWOOD BACKBOARDS

A. 3/4"x size indicated on the drawings, A/D grade, paint two coats gray enamel.

PART 3 EXECUTION

3.01 VISIT TO SITE

A. Prior to submitting bid, visit site and become familiar with the existing conditions relating to Division 16 work.

3.02 PROTECTION OF MATERIALS

A. Cover fixtures, equipment and apparatus for protection against dirt, water, chemical or mechanical damage before and during construction.
B. Keep all conduit and other openings protected against entry of foreign matter.

C. Restore the original finish, including shop coat, of fixtures, apparatus or equipment that has been damaged prior to substantial completion.

3.03 CLEAN UP, DUST AND DIRT CONTROL FOR WORK INSIDE A NEW BUILDING

A. The entire Work area including the Contractor’s storage area must be isolated from the rest of the building during the construction period as directed by the Owner’s Project Manager.

B. All reasonable efforts shall be made to prevent dust from being generated. Do not allow dirt or dust to accumulate. The Work area shall be cleaned, including wet mopping or vacuuming as necessary, at least at the end of each day’s work. More frequent mopping and cleaning may be necessary at the discretion of the Owner’s Project Manager.

3.04 COORDINATION

A. Prior to rough-in of any materials, coordinate with subcontractors the physical clearances for and sequencing of Division 16 work as it interfaces with and relates to architectural, structural, plumbing and HVAC systems.

3.05 SHOP DRAWINGS AND PRODUCT DATA SUBMITTALS

A. Submit as prescribed in Section G shop drawings and/or product data for the electrical equipment and materials listed below. Check for compliance with contract documents and certify compliance by affixing Electrical Contractor's "Approved" stamp and signature.
   1. Shop drawings and product data:
      a. Panelboards
      b. Life Safety System (Fire Alarm)
      c. Emergency Generator
      d. Data Cabling and Suspension System
   2. Product data only:
      a. Conduits, Couplings, Connectors, and Fittings
      b. Wiring Devices and Coverplates (receptacles, switches)
      c. Fuses and Circuit Breakers
      d. Junction Boxes, Outlet Boxes, and Floor Boxes
      e. Lighting Fixtures and Lamps
      f. Disconnect Switches, Motor Starters, and Motor Switches
      g. Wire and Cable

B. Refer to respective sections for submittal instructions where instructions have been prescribed.

C. Obtain shop drawing review by engineer before purchase of any equipment requiring shop drawing submittals.

D. Include with the electrical distribution equipment submittal a plan view of each electrical room or area designated for electrical distribution equipment. Use 1/2" = 1' scale and show the submitted equipment laid out in each room/area. Label each piece of equipment and indicate the required maintenance clearance by a dashed line.

3.06 CERTIFICATION AND TEST REPORTS

A. Submit the following certifications and test reports to the Architect:
   1. Test Reports:
      a. Megger test for all feeders and Service Entrance conductors.
      b. Life Safety System (Fire Alarm)
      c. Emergency Generator
      d. Data Cabling and Suspension System

3.07 OPERATIONAL TEST

A. At the time of the Material completion job observation, perform a test of all light fixtures, electrical systems, equipment, machinery and appliances, in the presence of the Architect or his representative, which demonstrates that all of Division 16 systems are operational.

3.08 JOB OBSERVATION ASSISTANCE

A. During all job observations, provide an electrician with tools and volt/ammeter to accompany Architect and/or his representative.

B. Remove any covers, trims or wiring devices and open all cabinets, disconnect switches or other equipment served electrically and designated by the Architect or his representative.

C. Restore removed or opened equipment to its installed or closed position after the job observation.

3.09 OWNER INSTRUCTION AND ASSISTANCE

A. At Material job completion job observation, instruct the Owner's operating personnel in the operation, sequencing, maintenance and safety/emergency provisions of all the electrical systems.

3.10 AS-BUILT DRAWINGS

A. Record on one set of electrical drawings all changes, deviations and underground conduits. Transfer same to a reproducible sepia and deliver same to architect as per Section G; Record Document Submittal of “Section G – Supplemental Conditions.

END OF SECTION 260500

SECTION 260519

LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Special Conditions, Supplementary Conditions, and Division 00 and 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Description:
   1. Provide continuous color coded conductors beginning at service point to distribution equipment and to each outlet and each piece of electrical energy consuming equipment.
B. Related Sections:
   1. Section 260500: Basic Electrical Requirements

1.03 SUBMITTALS

A. Manufacturers Product Data Sheets.

PART 2 PRODUCTS

2.01 CONDUCTORS

A. Copper Conductors:
   1. Soft drawn annealed copper, 98 % conductivity, without weld, splice or joint throughout its length; uniform in cross section without flaws, scales, or other imperfections with THHN/THWN or XHHW insulation.
   2. Acceptable Manufacturers:
      a. Anaconda
      b. Okonite Cable
      c. Pirelli Cable
      d. American Insulated Wire Corp.
      e. Southwire
      f. General Cable

B. Aluminum Conductors:
   1. Soft drawn , compacted construction, XHHW insulation, 250 mcm and larger (*Use only on the service entrance conductors and only if given permission in writing*).
   2. Acceptable Product:
      a. Alcan "STABILOY".
      b. Pirelli "XLPE"
      c. Southwire

C. Configuration:
   1. No. 10 and smaller: Solid
   2. No. 8 and larger: Stranded

D. Insulation - 600 Volts:
   1. No. 6 and smaller: THHN, THWN
   2. No. 4 and larger: XHHW

E. Jacket Color:
   1. No. 8 and smaller: Uniform colored jacket
   2. No. 6 and larger: Black

F. Jacket Markings:
   1. Voltage
   2. Insulation type
   3. Conductor Size
   4. Conductor type

2.02 COLOR CODING TAPE

A. Vinyl 3/4" wide with uniform color and adhesive backing.

B. Acceptable Manufacturers:
   1. Brady
   2. 3M
   3. Plymouth
   4. Thomas & Betts

2.03 SPLICE AND TAP MATERIALS

A. No. 10 and smaller:
   1. Twist on: Inner spiral spring or threads for holding and making electrical contact between copper conductors and with outer long skirted insulated cover of nylon or plastic.

B. No. 8 and Larger:
   1. Set-screw or bolted type: Metal connectors for joining copper to copper, with bolts or set-screws to apply pressure to conductors. Insulate with nylon or plastic cover and with electrical tape.
   2. Pressure type: Metal connectors for joining copper to copper, copper to aluminum, or aluminum to aluminum with power operated crimping tool. Insulate with nylon or plastic cover and with electrical tape.

C. Acceptable Manufacturers:
   1. AMP
   2. Burndy
   3. Ideal
   4. Ilsco
   5. Panduit
   6. 3M
   7. Thomas & Betts

2.04 CONDUCTOR TERMINALS

A. Copper conductors: High conductivity copper terminal designed to hold conductor and make electrical contact by bolt, setscrew or power crimp and with spade to match equipment receiving conductor.

B. Aluminum conductors: High conductivity terminal designed to hold aluminum conductor and make electrical contact by crimping and with spade to match equipment receiving conductor in physical shape, physical size and material. *Use only where specifically given permission by the engineer.*

C. Acceptable Manufacturers:
   1. Burndy
   2. Ideal
   3. Ilsco
   4. Panduit
   5. Thomas & Betts

2.05 Plastic or nylon self-locking straps (commonly refered to as zip-ties or tie-wraps)

A. Acceptable Manufacturers:
   1. Panduit
   2. Thomas & Betts

2.06 WIRE PULLING LUBRICANT

A. Lubricating, insulating and chemically neutral to conductors, conductor insulation and conduits.

B. Acceptable Manufacturers:
   1. Greenlee
   2. Ideal
   3. Polywater

2.07 ELECTRICAL TAPE

A. Vinyl plastic; moisture tight, resistant to ultraviolet radiation, alkalies, acids and corrosion; chemically neutral to conductors and conductor insulation; fire retardant; and single thickness dielectric strength equal to or greater than 10,000V.

B. Acceptable Manufacturers:
   1. Scotch/3M
   2. Plymouth

2.08 ALUMINUM OXIDE INHIBITING COMPOUND

A. Compound shall inhibit the formation of aluminum oxide on clean aluminum conductors without deteriorating the conductors.
B. Acceptable Manufacturers:
   1. Burndy
   2. Thomas & Betts

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the number of copper conductors indicated with a minimum of two (2) conductors being installed in each conduit not prescribed to be empty.

B. Minimum Conductor Size: No. 12

C. Complete installation of raceway run prior to pulling conductors.

D. Install insulated bushings in conduit fittings prior to pulling conductors.

E. Use wire pulling lubricants to reduce stress on conductors. Pull all conductors of a run together. Use pulling methods which do not damage the raceway or conductors.

F. Color Coding:
   1. No. 8 and smaller: Uniform colored jacket with respective color below.
   2. No. 6 and larger: Two wraps of tape applied within 6" of each conductor end with respective color below.
   3. Conductor Color Code:

208Y/120 VOLT SYSTEM
Phase A – Black
Phase B – Red
Phase C – Blue
Neutral – White with cooresponding stripe to match the connected phase
Ground – Green

G. At outlets leave a minimum of 12" of conductor ends at each fixture outlet, device outlet and equipment outlet box.

H. Conductor Terminals:
   1. Single: Use terminals on conductors no. 8 and larger where equipment receiving conductors do not have conductor lugs with set-screw(s)
   2. Multiple: Install terminals on conductors where more than one conductor is connected to a single lug.

I. Route conductors in all switchboards, panelboards, motor control centers and terminal cabinets parallel to or at right angle to the enclosure's sides and tops. Group and harness conductors in those enclosures using conductor harness straps.

J. Prior to energizing conductor, megger test conductors for continuity and shorts. Correct deficiencies prior to energizing.

K. Tighten all bolted connections in and to mechanical lugs to torque rating specified per manufacturers recommendations.

L. Tighten all conductors with mechanical connections, torqued in accordance with the conductor and/or connector manufacturers markings as well as the values referenced in the following publications:
   1. Underwriters Laboratories Electrical Construction Directory (Green Book).
   2. Underwriters Laboratories Electrical General Information (White Book).

M. Use #10 AWG conductors for 20 ampere, 120 volt branch circuits longer than 100 feet.

3.02 FIELD QUALITY CONTROL AND CONDITIONS

A. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.

B. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

C. Inspect wire for physical damage and proper connection

D. Verify continuity of each branch circuit conductor

E. Verify condition of feeder insulation No. 6 and larger with a 1000-volt megger. Record all readings of all phase conductors

END OF SECTION 260519

SECTION 26 05 26

GROUNDING AND BONDING

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:
   1. Provide a grounding system for the pool building service and each separately derived system originating at the respective grounding electrode(s) and radiating to every electrical power controlling and consuming device in the system.

B. Related Sections:
   1. Section 26 05 00: Common Work
   2. Section 26 05 33: Raceways
   3. Section 26 05 19: Low Voltage Conductors and Cables

1.02 SUBMITTALS:

A. Manufacturers Product Data Sheets

PART 2 - PRODUCTS

2.01 DRIVEN GROUND RODS:

A. Provide two ten (10) feet long, 5/8 inch diameter copperclad steel ground rods spaced at 12' apart (minimum).

2.02 EXOTHERMIC WELDS:

A. Provide exothermic copper welds with materials and configuration to match application.

B. Acceptable Manufacturers:
   1. Cadweld

2.03 GROUND CLAMPS:

A. Bronze, U.L. listed, with configuration to match application.

B. Acceptable Manufacturers:
   1. Burndy
   2. Ilsco
   3. Thomas & Betts
   4. O.Z. Gedney

PART 3 - EXECUTION

3.01 SERVICE ENTRANCE GROUNDING ELECTRODES:

A. Driven Ground Rods: Install three driven ground rods minimum 12 feet apart, located outside of building, and as close as possible to the service switchboard but a minimum of 36" from the building foundation. Locate in non-paved area where feasible. Install so as to maintain accessibility to top of rod. Provide each with box with removable cover for inspecting ground rod connection. Install box so that top is flush with finished grade.

B. Building Steel: Select a connection point on the building steel as close as possible to the domestic water service entrance that will also remain exposed.

C. Domestic Water Pipe: Select a connection point on the domestic water pipe as close as possible to the point it enters the building and that will also remain exposed.

D. Sprinkler Water Pipe: Select a connection point on the sprinkler water pipe as close as possible to the point it enters the building and that will also remain exposed.

E. Footings: Ground to concrete encased electrode within or near the concrete foundation that is in direct contact with the earth. Refer to NEC 250.50(A)(3).

3.02 MAIN SERVICE GROUNDING ELECTRODES BONDING CONDUCTORS:

A. Install a 3/0 bare stranded copper conductor between each grounding electrode and its closest grounding electrode neighbor so that all electrodes are bonded together.

B. Exothermic weld each bonding connection both cable to cable and cable to grounding electrode.

3.03 MAIN SERVICE GROUNDING ELECTRODE CONDUCTOR:

A. Install a 3/0 bare stranded copper conductor from the closest driven ground rod to the service panelboard ground bus.

B. Exothermic weld the connection to the ground rod and ground bus.

3.04 SEPARATELY DERIVED SYSTEM GROUNDING ELECTRODE:

A. Select a local grounding electrode described by the National Electrical Code and make connection to a point permanently visible.

3.05 SEPARATELY DERIVED SYSTEM GROUNDING ELECTRODE CONDUCTOR:

A. Install a stranded bare copper conductor sized according to NEC between the local grounding electrode and the separately derived system grounded conductor.

B. Exothermic weld the grounding electrode conductor to the grounding electrode.

3.06 ADDITIONAL BONDS:

A. Gas Service Pipe: Bond gas service pipe at the first accessible point nearest its entry to the building to the nearest main service grounding electrode with a 3/0 bare stranded copper conductor. Exothermic weld the connection at grounding electrode and to a ground clamp at the gas pipe.

B. Roof Structure: Bond roof structure steel at its nearest accessible point to the building steel connection point with a 3/0 bare stranded copper conductor. Exothermic weld both connections.

C. Domestic Water Meter: Install bond across water meter with 3/0 stranded bare copper conductors of sufficient length to accommodate removal of meter. Exothermic weld both connections to water pipe.

D. Non-metallic Domestic Water Insulated Coupling: Install bond across insulated coupling with 3/0 stranded bare copper of sufficient length to accommodate removal of coupling. Exothermic weld both connections to water pipe.

E. Gas Meter: Install bond across gas meter with a 3/0 stranded bare copper conductor of sufficient length to accommodate removal of meter. Use ground clamps on pipes and exothermic weld cable to clamps.

F. Telephone Service: Provide a No. 6 bare stranded copper conductor bonded to the nearest exposed point on the grounding electrode system or the grounding electrode conductor to the telephone service backboard and leave six(6) feet slack at the backboard.

3.07 EQUIPMENT GROUNDING CONDUCTOR:

A. General: Utilize metallic conduit and equipment enclosures for continuous equipment grounding conductor where available . Where non-metallic conduit or enclosures are used, install a separate insulated copper conductor, color coded green, from respective switchboard or panelboard ground bus to controller and/or device.

B. All steel conduits entering the main switch shall have a threaded conduit insulated type "BLG" grounding busing bonded to gether and to the ground bus with a No. 4 bare stranded copper conductor.

3.08 ADDITIONAL EQUIPMENT GROUNDING CONDUCTORS:

A. Roof Top HVAC Units: Install an equipment grounding conductor from the respective switchboard or panelboard ground bus to the unit disconnect switch and from disconnect switch to equipment ground lug or to housing in absence of ground lug.

B. Install a separate copper equipment grounding conductor between the respective ground buses of the following:
   1. Main Distribution Panel and each Panelboard
   2. Main Distribution Panel and each Transformer
   3. Transformer and each Panelboard
   4. Panelboard and each Sub-panelboard

C. Isolated Ground Receptacles: Install a separate grounding conductor for each circuit from panelboard ground bus to isolated ground receptacles on that circuit.

D. Wiring Devices: At both switches and receptacles, provide a grounding jumper from the device to a screw on the device box.

3.09 EQUIPMENT GROUNDING CONDUCTOR ROUTING:

A. Route equipment grounding conductor with respective feeder, power wiring and branch circuit conductors.

3.10 CONDUITS:

A. All grounding electrode conductors, equipment grounding conductors and bonds where not internal to equipment enclosures shall be installed in conduit to within 6" of terminating clamp or exothermic weld.

END OF SECTION 260526

SECTION 260533

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Special Conditions, Supplementary Conditions, and Division 00 and 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Description:
   1. Provide continuous conduit systems - beginning at the service point, to all distribution equipment and to every outlet and piece of electrical equipment with conduits, couplers, supports, hangers, fittings, bushings and accessories.
   2. Provide electrical boxes or, where prescribed, conduit bodies for devices, outlets, splice connection points, raceway junction and conductor pulling points complete with supports, covers and accessories.

B. Related Sections:
   1. Section 260500: Basic Electrical Requirements

C. Standards:
   1. Underwriters Laboratories labeled and listed for application specified.

1.03 SUBMITTALS

A. Manufacturers Product Data Sheets

PART 2 PRODUCTS

2.01 RIGID GALVANIZED STEEL CONDUIT

A. Conduit:
   1. Rigid ferrous steel pipe, hot-dipped galvanized or sherardized with smooth interior.
   2. Acceptable Manufacturers:
      a. Allied
      b. Triangle
      c. Wheatland

B. Couplings and Connectors:
   1. Couplings:
      a. Hot-dipped galvanized or sherardized ferrous steel, threaded
   2. Connectors:
      a. Steel or malleable iron, threaded with throat bushing, lock nuts and, where prescribed, grounding lugs.
   3. Erickson:
      a. Malleable iron, concrete tight
   4. Acceptable Manufacturers:
      a. Appleton
      b. Crouse Hinds
      c. Steel City
      d. Thomas & Betts

C: Joint Compound:
   1. Anti-seize lubricant with rust and corrosion inhibitors and colloidal copper
   2. Acceptable Manufacturers:
      a. Thomas & Betts

D. Expansion Fittings:
   1. Steel with three cap nuts, phenolic bushing, packing ring, metallic copper grounding ring and copper bonding jumper.
   2. Acceptable Products:
      a. Crouse Hinds "XJ"
      b. O.Z. Gedney "AX" or "DX"
      c. Appleton "XJ"

2.02 ELECTRICAL METALLIC TUBING

A. Conduit:
   1. Thin wall ferrous steel tubing, hot-dipped galvanized, smooth interior, square and reamed ends
   2. Acceptable Manufacturers:
      a. Allied
      b. Wheatland
      c. Triangle

B. Couplings and Connectors:
   1. Couplings:
      a. Steel, compression type, installed where exposed to moisture
      b. Steel, setscrew type, when installed indoors
   2. Connectors:
      a. Steel, compression type with nylon insulated bushings, locknuts, and where prescribed, grounding lugs, installed where exposed to moisture.

b. Steel, setscrew type with nylon insulated bushings, locknuts, and where prescribed, grounding lugs, installed indoors.

C. Expansion Fittings:
1. Steel with three cap nuts, phenolic bushing, packing ring, metallic copper grounding ring and copper bonding jumper.
2. Acceptable Products:
a. Crouse Hinds "XJ"
b. O.Z. Gedney "AX" or "DX"
c. Appleton "XJ"

2.03 LIQUIDTIGHT FLEXIBLE CONDUIT

A. Conduit:
1. Galvanized steel single strip, interlocked, smooth inside and out, with liquid-tight flexible polyvinyl chloride outer jacket.
2. Acceptable Manufacturers:
a. Carlon
b. Wheatland
c. Allied

B. Fittings:
1. Threaded corrosion-resistant steel or malleable iron with insulated throat bushing, liquid tight, locknuts and external ground lugs.
2. Acceptable Manufacturers:
a. Appleton
b. O.Z. Gedney
c. Thomas & Betts

2.04 FLEXIBLE METAL CONDUIT

A. Conduit:
1. Galvanized steel single strip, interlocked, smooth inside and out.
2. Acceptable Manufacturers:
a. AFC
b. Alflex
c. General Cable

B. Fittings:
   1. Threaded corrosion-resistant steel or malleable iron with insulated throat bushing and lock nuts.
   2. Acceptable Manufacturers:
      a. Appleton
      b. O.Z. Gedney
      c. Thomas & Betts

2.05 RIGID NONMETALLIC CONDUIT

A. Conduit:
   1. Schedule 40 Polyvinyl chloride (PVC), resistant to crushing, moisture, low temperature, and corrosive agents in standard trade sizes.

B. Couplings and Connectors:
   1. Couplings: Schedule 40 PVC.
   2. Connectors: Schedule 40 PVC with lock nuts.

C. Expansion Fittings:
   1. Schedule 40 PVC with grommeted inner cylinder and outer sleeve.

D. Joint Cement:
   1. PVC solvent.

E. Acceptable Manufacturers:
   1. Carlon
   2. Cantex
   3. Wheatland

2.06 INTERIOR OUTLET BOXES AND EXTENSIONS

A. Galvanized steel, UL listed for application with conduit knockouts and threaded holes for mounting devices and/or coverplates.

B. Minimum Sizes:
   1. Single Device: 3"H x 2"W x 2"D
   2. Gang Device: 3"H x 2"W (per gang) x 2"D
   3. Octagonal: 4"W x 1-1/2"D
   4. Square: 4" Square x 1-1/2"D

C. Acceptable Manufacturers:
   1. Appleton
   2. Raco
   3. Steel City
   4. American Electric

2.07 CONCRETE BOXES

A. Galvanized steel for encasing in concrete with conduit knockouts and threaded holes for mounding devices and/or coverplates.

B. Acceptable Manufacturers:
   1. Appleton
   2. Crouse Hinds
   3. Raco
   4. Steel City

2.08 MASONRY BOXES

A. Galvanized steel for mounting in masonry walls with conduit knockouts and threaded holes for mounding devices and/or coverplates.

B. Acceptable Manufacturers:
   1. Appleton
   2. Raco
   3. Steel City
   4. Crouse Hinds

2.09 CAST BOXES

A. Cast malleable iron, cadmium/zinc plated finish, NEMA 3R, threaded conduit entries, neoprene coverplates gasket and threaded holes for mounting devices and/or coverplates.

B. Acceptable Manufacturers:
   1. Appleton
   2. Crouse Hinds
   3. Raco
   4. Steel City

2.10 JUNCTION AND PULL BOXES

A. Dry Locations: Galvanized sheet steel, NEMA 1, welded seams and cover held by stainless steel screws or bolts.

B. Damp or Wet Locations: Cast malleable iron with corrosion-resistant finish, NEMA 3R, threaded conduit entries, neoprene coverplate gasket, and coverplate held by stainless steel bolts.

C. Acceptable Manufacturers:
   1. Appleton
   2. Crouse Hinds
   3. Hoffman
   4. Killark

2.11 FLOOR BOXES

A. Floor boxes shall be as indicated on the drawing details. Coordinate with the Architect prior to ordering for color of coverplate and type of finish material to match the floor.

2.12 PLASTIC BOXES

A. Not Applicable.

Part 3 EXECUTION

3.01 RACEWAY APPLICATIONS

A. Provide Rigid Metal Conduit for areas where exposed to moisture, exposed on exterior surfaces, and exposed interior from floor to 10'-0" or where exposed to physical abuse. <u>This includes under panelboards from the slab to the enclosure.</u>

B. Provide Electrical Metallic Tubing (EMT) for interior power circuits, branch circuits and system circuits in walls, elevated concrete slabs (those not on grade), plenums, attics or exposed above 10'-0", where not exposed to moisture.

C. Provide Liquid-tight Flexible Metal Conduit for final connecting link (minimum of 12", maximum of 36") to the following:
   1. Plumbing equipment
   2. Exterior Mechanical equipment

D. Provide Flexible Metal Conduit for:
   1. Final connection link (minimum of 12", maximum of 36") to:
      a. Motors
      b. Transformers
      c. Mechanical equipment
   2. Connections between junction boxes and accessible recessed lighting fixtures.

3.02 RACEWAY SUPPORT

A. Intervals: Maximum 10 feet on center and within 3 feet of each outlet box, junction box, cabinet or fitting.

B. Conduits 3/4" and smaller:
   1. Method
      a. When single conduit: Attach directly to building structure or suspend with 1/4" rod.
      b. When multiple parallel and adjacent conduits and:
         1) When horizontal at structure: Attach directly to structure or to support framing attached to structure.
         2) When horizontally suspended: Attach to support framing, suspended from building structure.
         3) When vertical: Attach to support framing attached to building structure, wall structure or suspended from building structure.
   2. Conduit attachment:
      a. When direct to structure or single conduit suspended: Spring steel friction, spring steel latching or clamped with bolts or screws.
      b. When on support framing: Two section bolted conduit clamp.
   3. Structural steel attachment
      a. When single conduit: Spring steel friction, clamp with bolt or bolted
      b. When hanger rod: Clamp with bolt or bolted
   4. Concrete attachment: Steel preformed conduit clamp. Attach clamp with expansion anchor installed in drilled hole or with power fastening anchor designed to meet concrete specification. In either case, maintain design support of 300% or greater of load.
   5. Wood attachment: Wood screws or bolted with design support of 300% or greater of load.

C. For 1" or larger:
   1. Method:
      a. When single conduit: Attach directly to building structure or suspend with threaded rod.
      b. When multiple parallel and adjacent conduits: Attach to support framing attached to building structure, wall structure or suspended from building structure.
   2. Conduit attachment:
      a. When single conduit: Bolted clamp
      b. When on support framing: Two section bolted conduit clamp
   3. Structural steel attachment: Beam clamps with bolts or bolted directly to steel.
   4. Concrete attachment: Provide preset insert prior to concrete pour or coordinate drill locations with Architect. When drilling provide expansion anchors. In either case, maintain design support of 300% or greater of load.
   5. Wood attachment: Wood screws or bolted with design support of 300% or greater of load.

D. Framing:
   1. Attachment, suspension and bearing members capable of supporting 300% of load, steel support which is attached directly at each end to stud or joist by screw or bolt.

3.03 RACEWAY INSTALLATION

A. For conduit layout follow, generally, the diagrammatic layout shown on plans. Provide offsets and routing changes to avoid structural, architectural or equipment elements.

B. Provide 1/2" minimum size conduit.

C. Conceal all conduit except where shown to be exposed. Install conduit concealed above a lay-in ceiling with clearance to allow easy removal of ceiling panels.

D. Install all conduit parallel with or perpendicular to building walls at greatest height possible. Paint exposed conduit two coats of paint, color directed by Architect.

E. Extend homeruns from outlets shown to panel designated. Do not combine homeruns.

F. Use benders designed for the size and type of conduit. Limit each bend to 90 degrees or less with a radius 10 times conduit diameter or greater for telephone system and 6 times conduit diameter or greater for all other systems.

G. **Provide insulated bushings at each end of every conduit run**.

H. Provide joint compound on rigid steel conduit and intermediate metallic conduit joints.

I. Provide an Erickson type coupling where two segments of a conduit run must be joined and neither can be rotated.

J. Close all conduit ends during construction with plastic conduit plugs.

K. Install conduit no greater than 1" trade size in concrete slabs. Route conduit between top and bottom reinforcing steel and space parallel runs a minimum of 3" apart.

L. Install conduit above water and steam piping where possible.

M. Maintain grounding of metallic raceways with clean and tight connections. Provide grounding conductor in all conduit.

N. Provide ground lugs on all conduit connectors to service equipment enclosures.

O. Provide grounding wedge lugs or locknuts designed to bite metal on conduit connectors to panel cabinet or pullboxes.

P. Seal all conduits which extend from the interior to the exterior of the building to prevent the passage of air, water, or insects.

Q. Provide a thru wall waterproof seal on each conduit that penetrates a wall at a below grade level.

R. Provide an expansion fitting in building conduits exceeding 100 feet at intervals of 100 feet.

S. Where liquids are present, form drip loops in liquid-tight flexible conduit to prevent liquid from running into connections.

T. Blow out and swab all conduit clear of trash and water prior to pulling wire.

U. Provide a nylon pullcord in all empty conduits.

V. In mechanical equipment rooms where a piece of equipment is located more than 2 feet away from walls or columns, serve equipment from underfloor or provide a vertical Rigid conduit, minimum 1", attached to floor and ceiling with conductors entering and exiting conduit through conduit bodies.

W. Coordinate conduit supports in precast or cast-in-place concrete prior to pour.

X. Provide a fire rated seal on each conduit that penetrates any floor or fire rated partition. Match seal rating to floor or partition rating.

Y. Provide an explosion-proof seal in each conduit run where it enters and leaves a hazardous location.

Z. At each building expansion joint, install a junction box on each side of the joint. Connect the junction boxes with a piece of flexible conduit, through the joint.

AA. <u>All interior exposed conduit below 10’-0” shall be rigid steel conduit or intermediate metallic conduit.</u> Transition to EMT at that point.

3.04 UNDERGROUND RACEWAY INSTALLATION

A. Where exterior of building bury conduit a minimum of 30" below finished grade.

B. Encase conduit in 3" concrete envelope where it passes under driveways, roadways or entrances to parking lots.

C. When under interior slab on grade seal vapor barrier around conduit penetration.

D. Buried plastic trace tape at 12" below grade that reads "CAUTION ELECTRIC CABLE BURIED BELOW".

E. Provide Rigid Nonmetallic Conduit for service ground, in slab on grade, in direct contact with earth, exposed in corrosive environments above 10'-0" above floor, or service entrance when encased in concrete.

F. **NOTE:** Refer to the detail on the drawings for the transition from PVC conduit to Rigid prior to exiting the slab for exposed conduits. Failure to provide this transition will result in having to cut and remove the slab and installing the proper conduit types.

G. Provide a 2" conduit from the back of the existing gymnasium to the pool house office with junction boxes at each end and a pull string. Exact location to be determined in the field.

3.05 DEVICE APPLICATIONS

A. Boxes for switches, receptacles, dimmers (designed for device box mounting) and future devices:
   1. For dry Locations:
      a. When recessed:
         1) For construction other than concrete or masonry, use interior outlet box.
         2) For concrete: Concrete box
         3) For masonry: Masonry box or square interior outlet box with masonry extension.
      b. When surface: Cast box
   2. For Damp or Wet Locations:
      a. When recessed:
         1) For concrete: Concrete box
         2) For masonry: Masonry box or square interior outlet box with masonry extension.
      b. When surface: Cast box
   3. For hazardous Areas: Hazardous area boxes

3.06 BOX GENERAL APPLICATIONS

A. For lighting fixtures, equipment connections, pullboxes for conduit 1" and smaller, and junction boxes for conduits 1" and smaller.
   1. Recessed Interior Box:
      a. For construction other than concrete or masonry, use octagonal or square interior outlet box.
      b. For concrete: Concrete box
      c. For masonry: Concrete box or square interior box with masonry extension.
   2. Box Above an Accessible Ceiling: Octagonal or square interior outlet box.

3. Exposed Interior Box:
    a. Above 7'-0": Octagonal or square interior outlet box or conduit body.
    b. 7'-0" and below: Cast box or conduit body.
4. Exterior Box:
    a. When recessed in vertical element or ceiling:
        1) For concrete: Concrete box
        2) For masonry: Concrete box or square interior box with masonry extension.
        3) For construction other than concrete or masonry, provide square interior box.
    b. Flush mounted in ground: Cast junction box
    c. Exposed: Cast box or conduit body.

B. Integrally Mounted Boxes: Boxes which are an integral part of an equipment assembly from the manufacturer and are UL listed for the application may be used in lieu of the boxes prescribed above.

3.07 JUNCTION BOXES AND PULL BOXES (conduits larger than 1")

A. Junction boxes or conduit bodies where junction is exposed

3.08 BOX SUPPORT

A. General: Support each box from the building structure independently of conduit as follows, utilizing a support system capable of carrying 300% of load.
    1. Surface:
        a. Structural Steel: Bolted directly to steel member or bolted to spring clip which is clipped to steel member.
        b. Concrete: Power driven fastener or bolt to expansion anchor set in drilled hole.
        c. Wood: Screw or bolt to wood.
    2. Suspended: Bolted to engineered spring clip which is clipped to suspended ceiling system.
    3. Recessed:
        a. Concrete: Set in concrete prior to pour.
        b. Masonry: Set or cut into masonry during masonry erecting. Grout in around box.
        c. Drywall: Attach directly to stud or joist by screw or bolt; or directly to a galvanized
        d. Earth: Compact earth around box

3.09 BOX INSTALLATION

A. Outlet locations indicated on the plans are approximate. Coordinate and determine the exact location at the building. The architect reserves the right to shift the exact location of any outlet 10 feet before it is permanently installed.

B. Install boxes plumb when vertical, level when horizontal and flush adjacent surface when recessed.

C. Where an outlet occurs in an architectural feature, center the outlet in same.

D. Where the mounting height of a wall outlet is not shown, mount at height directed by Architect. Mounting heights are from finished floor to box centerline.

E. The contractor may, with Architect's approval, slightly vary an outlet's mounting height so that the box's top or bottom occurs at a masonry joint.

F. Where outlets at different levels are shown adjacent, install them on the same vertical line.

G. Space wall switch outlets with first gang box 4" from door trim on the installed strike side.

H. Locate boxes and conduit bodies so that covers are accessible and removable.

I. Limit masonry cuts from outlet boxes so that coverplate covers the cut.

J. Provide plaster rings for all boxes set in plaster walls or ceilings.

K. Match configuration to application.

L. Utilize box size (capacity) based upon NEC.

M. For devices, utilize boxes designed to support the device independently of coverplate and so install.

N. Cover unused conduit openings with plastic covers for sheet steel boxes and threaded plugs for cast boxes.

O. Prior to pulling conductors or installing devices, clean boxes of dirt, debris and water.

P. Cover all boxes and secure with screws or bolts.

Q. Install pull-boxes to limit pulling distance and/or pulling bends.

R. Mark all junction boxes with the circuit number which is in the box. Use a black or red permanent marker.

END OF SECTION OF 260533

SECTION 26 05 43

SERVICE ENTRANCE

PART 1 - GENERAL

1.01 Summary

A. Description

1. Provide electrical service entrance as shown on the drawings and specifications.

B. Related Sections

1. Section 26 05 00: Common Work
2. Section 26 05 33: Raceway and Boxes
3. Section 26 05 19: Low-Voltage Conductors and Cables

PART 3 - EXECUTION

2.01 Installation

A. Provide service entrance conductors and conduit duct bank as indicated on the drawings.

B. Concrete encase duct bank per NFPA 70, Article 310 where routed under drive paths.

2.02 Utility Company Coordination

A. Provide metering as indicated on the drawings. Obtain and comply with utility company metering requirements.

B. Obtain requirements for installation of utility company's transformers and primary cabling. Provide conduits, concrete pads, elbows, Etc. as required by utility company.

C. Coordinate connection requirements of service entrance conductors to utility company transformer.

END OF SECTION 260543

SECTION 260553

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 Drawings and general provisions of the Contract, including General Conditions, Special Conditions, Supplementary Conditions, and Division 00 and 01 Specification Sections, apply to this Section.

1.02 Summary

A. Description:
   1. Identify the following electrical equipment with a nameplate or directory indicating load served or equipment name:
      a) Automatic Transfer Switches
      b) Panelboards, Main and Branch Breakers
      c) Disconnect Switches and Motor Starters
      d) Contactors, Time Switches, and Relays

1.03 Submittals:

A. Sample of Nameplate

PART 2 PRODUCTS

1.01 Nameplates

A. 120 Volt, and 208 Volt - Bakelite Label, black face, white core.
B. 277 Volt and 480 Volt = Bakelite Label, red face, white core.
B. Lettering:
   1) See detail.

1.02 Panelboard Directory

A. Panelboard Manufacturers Directory in plastic sleeve on inside of panel cover door.

PART 3 EXECUTION

1.01 Installation

A. Securely mount each nameplate to its respective equipment with screws or epoxy type cement. Double sided foam core type tape is not acceptable.
B. Type in the branch breaker load information onto the manufacturers panel directory. **Mark all spares in pencil.** Install in plastic sleeve on inside of panel cover door.
C. Label all junction box covers with the circuit number installed in the box with a permanent marker.

END OF SECTION 260553

SECTION 260573

ARC FLASH HAZARD ANAYLSIS AND LABELING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Special Conditions, Supplementary Conditions, and Division 00 and 01 Specification Sections, apply to this Section.

1.02 SCOPE

A. Description:

1. Provide an arc flash hazard analysis of each switchboard, panelboard, transformer and disconnect switch. Determine in the analysis the personal hazard category and the associated flash protection boundary.
2. Submit all calculations to the Architect for review and comment prior to ordering affected equipment.
3. Provide an Arc Flash and Shock Hazard label on each switchboard, panelboard, transformer and disconnect switch based upon the arc flash hazard analysis with all appropriate information required by NFPA 70E reported on the label.

B. Codes:

1. NFPA 70
2. NFPA 70E

PART 2 PRODUCTS

2.01 LABELS

A. Provided non-paper labels with adhesive, both which will resist degradation due to sunlight and moisture.

PART 3 EXECUTION

3.01 ANALYSIS

A. The arc flash hazard analysis shall be performed by a registered professional engineer registered in the state where the project is located. The submittal to the Architect shall include the seal and signature of the professional engineer who performed the analysis.

B. The analysis shall include selection and coordination of all overcurrent devices as to operation to minimize both the arc fault level and nuisance tripping.

C. Include in the submittal all time-current curves of breakers and fuses, tabulation of adjustable trip settings and tabulation of current limiting fuses selected.

D. This analysis may be performed by the manufacturer of the equipment or by an independent registered engineer but is the responsibility of the contractor and not provided with these documents.

3.02 INSTALLATION

A. Install each label on the front of the equipment, in a prominent visible location and where possible, centered.

END OF SECTION 260573

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.01 Summary:

A. Description:
1. Provide panelboards complete with enclosure, circuit breakers, spaces, trims, covers, locks and accessories in configurations as indicated on the drawings.

B. Related Sections:
1. Section 26 05 00: Common Work

C. Standards:
1. Underwriters Laboratories #67
2. Underwriters Laboratories #489
3. Underwriters Laboratories #50
4. NFPA 70 (National Electrical Code)

1.02 Submittals:

A. Manufacturers Product Data Sheets

B. Shop Drawings
1. Dimensional Data
a. Enclosure Size
b. Gutter Space
c. Cover and Trim
2. Bussing Size
3. Lug Configuration and Ratings
4. Branch Breakers
5. Main Breakers

PART 2 - PRODUCTS

2.01 Manufacturer:

A. Acceptable Manufacturers
1. Products specified as standard of quality are manufactured by Square D Company referred to as Square D.
2. Products of manufacturers listed below meeting indicated standards and specified manufacturer's product data characteristics, except as modified below, are acceptable for use, subject to prior approval of proposed product list.
a. General Electric
b. Siemens/ITE

2.02 General:

A. Panelboards shall be of dead front construction, equipped with thermal magnetic molded case circuit breakers of frame size and trip ratings as shown on the schedule.

2.03 208Y/120 Volt Panelboards:

A. Circuit Breakers:
   1. Circuit breakers shall be Square D or QOB (bolt-on) thermal-magentic, molded case circuit breakers. Breakers shall be 1, 2, or 3-pole with an integral crossbar to assure simultaneous opening of all poles in multipole circuit breakers. Breakers shall have an overcenter, trip-free, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication. Handles shall have "ON", "OFF" and "TRIPPED" positions. Bolt-on (NOOB) circuit breakers shall be able to be installed in the panelboard without requiring additional mounting hardware.
   2. Circuit breakers shall be UL listed in accordance with UL Standard 489 and shall be rated 240 volts ac maximum with continuous current ratings as noted on the plans. Interrupting ratings shall be as schedule with a maximum of 65,000 rms symmetrical amperes at 240 volts ac. Single pole, 15 and 20 ampere circuit breakers intended to switch fluorescent lighting loads on a regular basis shall carry the SWD marking.

B. Bussing Assembly and Temperature Rise
   1. Panelboard bus structure and main lugs or main circuit breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests, conducted in accordance with UL Standard 67. Bus structure shall be insulated. Bus bar connections to the branch circuit breakers shall be the "distributed phase" or phase sequence type and shall accept bolt-on (NOOB) circuit breakers. All current carrying parts of the bus structure shall be plated.
   2. Panelboard bussing shall be copper or tin plated aluminum.

2.04 480Y/277 Volt Panelboards

A. Circuit Breakers:
   1. Circuit breakers shall be Square D type EHB (bolt-on) thermal-magnetic, molded case circuit breakers. Breakers shall be 1, 2, or 3-pole with an integral crossbar to assure simultaneous opening of all poles in multipole circuit breakers. Breakers shall have an overcenter, trip-free, toggle-type operating mechanism with quick-make, quick-break action and positive handle indication. Handles shall have "ON", "OFF" and "TRIPPED" positions. Circuit breakers shall be able to be installed in the panelboard without requiring additional mounting hardware.
   2. Circuit breakers shall be UL listed in accordance with UL Standard 489 and shall be rated 600 volts ac maximum with continuous current ratings as noted on the plans. Interrupting ratings shall be as schedule with a maximum of 65,000 rms symmetrical amperes at 600 volts ac. Single pole, 15 and 20 ampere circuit breakers intended to switch fluorescent lighting loads on a regular basis shall carry the SWD marking.

B. Bussing Assembly and Temperature Rise

1. Panelboard bus structure and main lugs or main circuit breaker shall have current ratings as shown on the panelboard schedule. Such ratings shall be established by heat rise tests, conducted in accordance with UL Standard 67. Bus structure shall be insulated. Bus bar connections to the branch circuit breakers shall be the "distributed phase" or phase sequence type and shall accept either plug-on (NQO) or bolt-on (NQOB) circuit breakers. All current carrying parts of the bus structure shall be plated.
2. Panelboard bussing shall be copper or tin plated aluminum.

2.05 Cabinets and Fronts:

A. The panelboard bus assembly shall be enclosed in a steel cabinet. The rigidity and gauge of steel to be as specified in UL Standard 67 for panelboards. The box shall be fabricated from galvanized steel or equivalent rust resistant steel. Each front shall include a door and have a flush, cylinder tumbler-type lock with catch and spring-loaded stainless steel door pull. All panelboard locks shall be keyed alike. Fronts shall have adjustable indicating trim clamps which shall be completely concealed when the doors are closed. Doors shall be mounted with completely concealed steel hinges. Fronts shall not be removable with door in the locked position. 600A panelboard fronts shall have exposed trim clamps. Column width fronts shall have exposed hinges and be screw cover type. A circuit directory frame and card with a clear plastic covering shall be provided on the inside of the door.

2.06 Integrated Equipment Short Circuit Rating

A. Each panelboard, as a complete unit, shall have a short current rating equal to or greater than the integrated equipment rating shown on the panelboard schedule or on the plans. This rating shall be established by testing with the overcurrent devices mounted in the panelboard. The short circuit tests on the overcurrent devices and on the panelboard structure shall be made simultaneously by connecting the fault to each overcurrent device the panelboard connected to its rated voltage source. Method of testing shall be per Underwriters Laboratories Standard UL 67. The source shall be capable of supplying the specified panelboard short circuit or greater. Testing of panelboard overcurrent devices for short circuit rating only while individually mounted is not acceptable. Also, testing of the bus structure by applying a fixed fault to the bus structure alone is not acceptable. Panelboards shall be marked with their maximum short circuit current rating at the supply voltage and shall be UL listed.

2.07 UL Listing

A. Panelboards shall be listed by Underwriters Laboratories and shall bear the UL label. When used as service entrance device, panelboards shall be listed for use as service equipment.

PART 3 - EXECUTION

3.01 Installation:

A. Mount panelboard flush or surface as prescribed with top 6'-6" A.F.F.

B. Key all locks alike and give owner two keys per panelboard.

C. For flush mounted panelboards, provide a minimum of three spare 3/4" conduits stubbed out into ceiling space.

D. Anchor enclosures firmly to walls and/or structural surfaces.

E. Where panelboards exceed 42 poles, provide multiple sections with equal size enclosures with 4" diameter openings with bushings between abutting enclosures.

END OF SECTION 264216

SECTION 262726

WIRING DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Special Conditions, Supplementary Conditions, and Division 00 and 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Description:
1. Provide switches, receptacles, dimmers and other strap mounted wiring devices as shown on the drawings.
2. Take note that the devices are **Décor series** devices. If standard devices are installed**, they will be removed at the contractors expense and replaced.**

B. Related Sections:
1. Section 260500: Basic Electrical Requirements
2. Section 260533: Raceway and Boxes

C. Standards:
1. Underwriters Laboratories listed and labeled.
2. NEMA (configurations as listed)

1.03 SUBMITTALS

A. Manufacturers Product Data Sheets.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Acceptable Manufacturers of Switches, Receptacles, and Coverplates:
1. Products specified as standard of quality are manufactured by Hubbell Incorporated, Wiring Device Division; referred to as Hubbell.
2. Products of manufacturers listed below meeting indicated standards and specified manufacturer's product data characteristics, except as modified below, are also acceptable for use, subject to prior approval of proposed product list.
a. Leviton
b. Pass and Seymor

3. Manufacturers product numbers listed below may not include color selection. Refer to Section 262726, 2.5 for device colors

B. Acceptable Manufacturers of Wallbox Dimmer Switches:
   1. Lutron or approved equal.

2.02 RECEPTACLES

A. Duplex Decorative series - 20A: 2-pole, 3-wire, 125 Volts, side wiring with ground screw, NEMA 5-20R.
   1. Hubbell # DR20.

B. Duplex Decorative series - 20A: 2-pole, 3-wire, 125 Volts, side wiring with ground screw, NEMA 5-20R. Tamper Resistant (child proof)
   1. Hubbell # DR20/TR.

C. Single - 20A: 2-pole, 3-wire, 125 Volts, side wiring with ground screw, NEMA 5-20R.
   1. Hubbell # 5361.

D. Duplex Ground Fault Circuit Interrupter - 20A: 2-pole, 3-wire, 125 Volts, pigtail wiring, thru wiring to protect receptacles downstream, test and reset buttons, NEMA 5-20R.
   1. Hubbell # GF5362.

2.03 SWITCHES

A. Single Pole Single Throw Decorative series: 20 Ampere, 277 Volt AC, maintained contacts, quiet operating toggle, side/back wiring and ground screw.
   1. Hubbell # DS120.

B. Dual Technology Motion Sensor: 1800 Watts, 277 Volt AC, digital sensing, manual on switch, single circuit, and ground screw.
   1. Hubbell # AD1277.
   2. Cooper Controls

C. Three Way Single Throw Decorative series: 20 Ampere, 277 Volt AC, maintained contacts, quiet operating toggle, side/back wiring and ground screw.
   1. Hubbell # DS320.

2.04 COVERPLATES

A. Stainless Steel Coverplates:
   1. Brushed stainless steel, oversize (3-1/8" x 4-7/8" , single gang), in configurations up to six (6) gang as indicated on the drawings, screws to match finish, and openings to match device.

B. Nylon Coverplates:
   1. Nylon, color to match device, oversize (3-1/8" x 4-7/8" , single gang), in configurations up to six (6) gang as indicated on the drawings, screws to match finish, and openings to match device.

C. Surface Mounted:
   1. Corrosion-resistant steel, rounded corners and edges, stainless steel screws, single or multiple gang as indicated on the drawings. Openings to match device(s) and construction to match box.

D. Weatherproof:
   1. Gasketed, hinged with spring loaded closers, secured with corrosion-resistant screws and UL listed for wet location.

2.05 DEVICE AND COVERPLATE COLOR/FINISH

A. All switches shall be gray with stainless steel coverplates where device is not mounted on a wood paneled wall.

B. All switches installed in wood paneled walls shall be brown or black in color with a matching nylon coverplate.

C. All receptacles, not connected to an emergency circuit, and not on a wood panel wall, shall be gray with stainless steel coverplates.

D. All receptacles installed in wood paneled walls shall be brown or black in color with a matching nylon coverplate.

E. All receptacles connected to an emergency circuit shall be red in color with a matching nylon coverplate.

F. All receptacles installed in a floor box shall be brown or black in color.

G. All receptacles mounted in an associated wall box, intended for TV use, shall match the TV backbox color.

H. Devices installed in surface mounted boxes shall be gray with Galvanized steel coverplates.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the type device indicated by symbol or legend at the location shown on the plans.

B. Install devices after conductors are pulled and painting is completed.

C. Install devices vertically, unless otherwise noted, with SPST switches having up as "ON" and receptacles having ground pin at bottom.

D. Where more than one device is indicated at a location, the devices shall be mounted in combined sectional gang boxes and covered with a single plate.

E. Coordinate location of devices with other trades and architectural features. Do not locate devices on two different finishes such as half on wall title and half on painted surface.

F. Take note that the devices are **Décor series** devices. If standard devices are installed**, they will be removed at the contractors expense and replaced.**

END OF SECTION 262726

SECTION 262813

FUSES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Special Conditions, Supplementary Conditions, and Division 00 and 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Provide fuses and circuit breakers of ampere rating and U.L. Classification as indicated on the drawings.

B. Related Sections:
1. Section 260500: Basic Electrical Requirements
2. Section 262816: Disconnect Switches
3. Section 226220: Panelboards

1.03 SUBMITTALS

A. Product Data
1. Manufacturers: Product Data Sheets
2. Time - Current Characteristic Curves (Average Melt)
3. Current Limitation Curves

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers - Fuses:
1. Products specified as standard of quality are manufactured by Cooper Industries, Bussmann Division, referred to as Bussmann.
2. Products of manufacturers listed below meeting indicated standards and specified manufacturer's product data characteristics, except as modified below, are acceptable for use, subject to prior approval of proposed product list.
    a. Gould Shawmut
3. All fuses shall be of the same manufacturer.

B. Acceptable Manufacturers - Circuit Breakers
   1. Products specified as standard of quality are manufactured by Square D Company, referred to as Square D.
   2. Products of manufacturers listed below meeting indicated standards and specified manufacturer's product data characteristics, except as modified below, are acceptable for use, subject to prior approval of proposed product list.
      a. General Electric
      b. Siemens/ITE
      c. Square D
   3. Circuit breakers shall be of the same manufacturer as the panelboard or enclosure in which they are installed.

2.02 FUSES

A. Mains, Feeders and Branch Circuits:
   1. Circuits 601 to 6000 amperes shall be protected by current limiting BUSSMANN LOW-PEAK time-delay fuses KRP-C(amp)SP. Fuses shall employ "0" rings as positive seals between the end bells and the glass melamine fuse barrel. Fuse links shall be pure silver (99.9% pure) to limit the short circuit current let-through values to low levels and comply with NEC Sections requiring component protection. The terminals shall be peened. Fuses shall be time-delay and shall hold 500% of rated current for a minimum of 4 seconds, clear 20 times rated current in .01 seconds or less and be listed by Underwriters Laboratories Inc. with an interrupting rating of 300,000 amperes RMS symmetrical. The fuses shall be UL Class L. Fuses shall be "LOW-PEAK YELLOW" in color.
   2. Circuits 0 to 600 amperes shall be protected by current limiting BUSSMANN LOW-PEAK dual-element fuses LPN-RK, LPS-RK, or LPJ. All dual-element fuses shall have separate overload and short-circuit elements. Fuses shall incorporate a spring activated thermal overload element having a 284 degree Fahrenheit melting point alloy and shall be independent of the short-circuit clearing chamber. The fuse shall hold 500% of rated current for a minimum of 10 seconds (30A, 250V Class RK1 case size shall be a minimum of 8 seconds at 500% of rated current) and be listed by Underwriters Laboratories, Inc with an interrupting rating of 300,000 amperes RMS symmetrical. The fuses shall be Time-Delay UL Class RK1 or J to maintain the engineered protection of the system components. Fuses shall be "LOW-PEAK YELLOW" in color.

B. Spares:
   1. Upon completion of the building, the electrical contractor shall provide the Owner with spare fuses as shown below:
      a. 10% (minimum of 3) of each type and rating installed fuses shall be supplied as spares.
   2. **BUSSMANN spare fuse cabinet** - Catalog No. SFC shall be provided to store the above spares. The spare fuse cabinet (SFC) shall include a supply of "LOW-PEAK YELLOW" NOTICE labels.
   3. Two fuse pullers,

2.03 MOLDED CASE CIRCUIT BREAKERS

A. Description:
   1. Circuit breakers shall be Square D FA, KA, LA, NH, PA and/or PC one, or two pole molded case circuit breakers rated 15 through 2500 amperes, 120V.ac, 240V.ac, , as specified on the drawings. Breakers shall have an interrupting rating to match the panel in which they are installed or as indicated on the drawings. All circuit breakers shall be UL and CSA listed, IEC 157-1 rated, meet NEMA standard AB1-1975 and Federal Specification W-C-375B/GEN, when applicable. Breakers covered under this specification may be installed in panelboards, switchboards, individual enclosures, motor control centers or, combination motor starters.
B. Construction:
   1. Molded case circuit breakers shall have over center toggle-type mechanisms, providing quick-make, quick-break action. Breakers shall be calibrated for operation in an ambient temperature of 40 degrees C. Each circuit breaker shall have trip indication by handle position and shall be trip-free. Two and three pole breakers shall be common trip. Each circuit breaker shall have a permanent trip unit containing individual thermal and magnetic trip elements in each pole. Circuit breakers with frame sizes greater than 100 amperes shall have variable magnetic trip elements which are set by a single adjustment (to assure uniform tripping characteristics in each pole). A push-to-trip button shall be provided on the cover for mechanically tripping the circuit breaker. the circuit breaker shall have reverse connection capability and be suitable for mounting and operating in any position.
C. Terminations:
   1. Circuit breakers shall have removable lugs. Lugs shall be UL listed for copper and aluminum conductors. Breakers shall be UL listed for installation of mechanical type or compression type lugs.

PART 3 EXECUTION

3.01 INSTALLATION - FUSES

A. Install fuses in all disconnect switches shown on the plans which require fuses.

B. Fuses shall not be installed in the switch until equipment is ready to be energized.

C. Install "LOW-PEAK YELLOW" NOTICE labels to alert the end user of the engineered level of protection of the electrical equipment. They shall be marked with the proper fuse rating, per the drawings, and placed in a conspicuous location on the enclosure. These labels are available with the spare fuse cabinet (SFC) and are also available upon request from Bussmann.

3.02 INSTALLATION – CIRCUIT BREAKERS

A. Install circuit breakers in panelboards, service panelboards, and enclosures as shown on the drawings.

B. Terminate wiring into circuit breaker lug. Tighten lug to torque level as marked on the lug.

END OF SECTION 262813

SECTION 262816

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Special Conditions, Supplementary Conditions, and Division 00 and 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Description
1. Provide disconnect switches in configurations as indicated on the drawings complete with enclosures and accessories.

B. Related Sections
1. Section 260500: Basic Electrical Requirements
2. Section 262813: Fuses and Circuit Breakers

1.03 SUBMITTALS

A. Manufacturers Product Data Sheets.

PART 2 PRODUCTS

1.01 MANUFACTURERS

A. Acceptable Manufacturers as Follows:
1. General Electric
2. Siemens/ITE
3. Square D

1.02 DISCONNECT SWITCHES

A. Disconnect switches shall be **heavy duty type** (NEMA Type HD) and Underwriters Laboratories Listed.

B. All switches shall have blades which are fully visible in the "OFF" position when the switch door is open. All current carrying parts shall be plated to resist corrosion and promote cool operation. Switches shall have removable arc suppressors where necessary to permit easy

access to line side lugs. Lugs shall be front removable, and UL listed for 75 degrees C, aluminum or copper wires.

C. Switches shall be quick-make, quick-break such that, during normal operation of the switch, the operation of the contacts shall not be capable of being restrained by the operating handle after the closing or opening action of the contacts has started. The operating handle shall be an integral part of the box, not the cover. Provisions for padlocking the switch in the "OFF" position shall be provided. Switches shall have a dual cover interlock to prevent unauthorized opening of the switch door when the handle is in the "ON" position, and to prevent closing of the switch mechanism with the door open. The handle position shall indicate whether the switch is "ON" or "OFF".

D. Switches shall be furnished in NEMA 1 general purpose enclosures unless shown to be used in a wet location on the plans. Covers on NEMA 1 enclosures shall be attached with pin type hinges, NEMA 3R covers shall be securable in the open position. NEMA 3R enclosures for switches thru 200 amperes shall have provisions for interchangeable bolt-on hubs. Hubs shall be as indicated on the plans. NEMA 3R enclosures shall be manufactured from galvanized steel. Enclosures shall have a gray baked enamel finish, electro-deposited on cleaned, phosphatized steel.

E. Switches shall be horsepower rated for ac and/or dc as indicated by the plans. All fusible switches rated 100 thru 600 amperes at 240 volts and 30 thru 600 amperes at 600 volts shall have a UL approved method of field conversion from standard Class H fuse spacing to Class J fuse spacing. The switch also must accept Class R fuses and have provisions for field installation of a UL listed rejection feature to reject all fuses except Class R. The UL listed short circuit rating of the switches shall be 200,000 rms symmetrical amperes when Class R or Class J fuses are used with the appropriate rejection scheme. The UL listed short circuit rating of the switch, when equipped with Class H fuses, shall be 10,000 rms symmetrical amperes. 800 and 1200 ampere switches shall have provisions for Class L fuses and shall have a UL listed short circuit rating of 200,000 rms symmetrical amperes.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install disconnect switch adjacent to equipment it serves or as located on the plans.

B. Anchor enclosures firmly to walls and/or structural surfaces. Coordinate mounting of disconnects to roof top mechanical equipment with supplier/installer.

END OF SECTION 262816

SECTION 265100

LIGHTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Special Conditions, Supplementary Conditions, and Division 00 and 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Description:
   1. Provide lighting fixtures as prescribed in the lighting fixture schedule complete with housing, junction boxes, ballasts, lamp sockets, lamps, lenses, baffles and trims installed with support from building structure. Verbal description of fixture in schedule will take precedence over manufacturer number. If there is any question about a fixture, submit an RFI prior to bid, for clarification.

B. Related Sections:
   1. Section 260500: Basic Electrical Requirements

C. Standards:
   1. Underwriters Laboratories labeled and listed.
   2. CBM Approved
   3. ANSI C82.2
   4. Current Georgia State energy code requirements.

1.03 SUBMITTALS

A. Manufacturers Product Data Sheets.

B. Shop Drawings for Custom Fixtures.

C. ITL certified photometric reports.

PART 2 PRODUCTS

2.01 LIGHT FIXTURES

See the lighting fixture schedule for the lighting fixtures to be used on this project. Substitutions of these fixtures will only be allowed by prior approval submitted to the engineer 10 business days prior to bid or 10 business days prior to the last issued addendum date. Any fixtures submitted that are approved as acceptable will be listed in an addendum. Only fixtures listed in a written addendum will be deemed acceptable, any others submitted in the shop drawings will be rejected and any other installed on the project will be removed at the contractor's expense.

PART 3 EXECUTION

3.01 INSTALLATION

A. Support:
   1. Support each fixture from the building structure.
   2. Support in a manner that ensures the fixture weight being equally distributed from each support and the fixture remaining in a level position.
   3. Provide support systems capable of carrying 300% of load imposed.

B. For pendant or suspended fixtures mounted to suspended ceilings provide 1/4" steel rods above the suspended ceiling from building structure to fixture. Provide a minimum of two supports for each chassis and spaced a maximum of 4 feet on center.

C. For recessed in a suspended ceiling, provide 2 #10 AWG. wire supports from building structure to fixture. Provide a minimum of two supports for each chassis spaced a maximum of 4 feet on center and located on diagonal corners of the fixture. Provide tie down clips to secure fixture to the ceiling grid.

D. For recessed single downlight style, provide #10 AWG steel hanging wire from building structure to fixture; minimum of 2 separate supports per fixture.

E. For each recessed fixture, provide a trim to match the type ceiling (plaster, grid, exposed panel, etc.) in which it is being installed.

F. Aim and adjust all fixtures with lamp position, tilt, shutters, rotation or other types of adjustment during installation. The Architect or his representative will determine the final aiming and adjustment of such fixtures during the substantial completion job visit. Fixtures serving areas where daylighting dominates will be adjusted after sunset.

G. Provide electrician with equipment and tools to execute aiming and adjustment instruction.

H. When fixture are installed recessed in ceilings where insulation is located at the ceiling level, the fixture shall be surrounded by a baffle to keep the insulation a minimum of 2" from the fixture to allow air circulation around the fixture. No insulation shall be allowed to touch or fall onto the fixture. The barrior shall be high enough to prevent the insulation from drooping onto the fixture and be strong enough to hold against the insulation settling over time and pushing onto the fixture. The barrior structure shall be approved by the engineer prior to rough-in.

END OF SECTION 265100

SECTION 266000

MOTOR AND EQUIPMENT CONNECTIONS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Special Conditions, Supplementary Conditions, and Division 00 and 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Description:
1. Provide power wiring to each motor, all mechanical equipment, and all miscellaneous equipment included in the contract documents. Power wiring is the system of conductors from the energy source to the equipment that conducts the electrical energy which does work or provides heat.
2. Provide a disconnect switch, fused where prescribed, for each motor or piece of equipment.

B. Related Sections:
1. Section 262816: Disconnect Switches
2. Section 262813: Fuses and Circuit Breakers
3. Section 260500: Basic Electrical Requirements

PART 2 PRODUCTS

2.01 STARTERS

A. Provided under other divisions except where specifically prescribed in Division 16 documents.

2.02 MOTORS AND EQUIPMENT

A. Motors, mechanical equipment, kitchen equipment, etc., provided under other divisions.

2.03 CONTROL AND INTERLOCK WIRING

A. Control wiring, (i.e., HVAC controls, remote pushbutton stations, thermostats, etc.), is excluded except where specifically prescribed in Division 16 documents. Coordinate closely with Division 15 documents.

PART 3 EXECUTION

3.01 INSTALLATION

A. Coordinate all rough-in and final power wiring and equipment connection with other subcontractors.

B. Install and connect individually mounted starters provided by other subcontractors.

C. Label each disconnect switch and starter with name of equipment it serves.

D. Coordinate overcurrent device rating with nameplate of motor or equipment which it protects.

END OF SECTION 266000

SECTION 27 05 00

COMMUNICATIONS – DATA/TELEPHONE

PART 1 - GENERAL

1.01 SUMMARY:

A. Description:
   1. Provide a complete telephone raceway distribution system including but not limited to conduits, from utility service location to telephone backboard in server room in mezzanine.

B. Work Excluded: Telephone, data, switches, coverplates and instruments.

C. Related Sections:
   1. Section 26 05 00: Common Work
   2. Section 26 05 33: Raceways and Boxes
   3. Section 26 05 26: Grounding

PART 2 - PRODUCTS

Refer to individual related sections for information on products.

PART 3 - EXECUTION

3.01 INSTALLATION:

A. Coordinate telephone service entrance with telephone company.

B. Install two 4 inch conduits from utility connection location, to telephone backboard, coordinate with the civil plan. Coordinate routing with utility company.

C. Install a #6 copper ground wire from main service ground to telephone cabinet, and telephone cabinet to telephone backboard in tenant space.

END OF SECTION 270500

SECTION 31 1000 - 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. Removing above- and below-grade site improvements.
6. Disconnecting, capping or sealing, and removing site utilities.
7. Temporary erosion and sedimentation control.

1.3 DEFINITIONS

A. Subsoil: Soil beneath the level of subgrade; soil beneath the topsoil layers of a naturally occurring soil profile, typified by less than 1 percent organic matter and few soil organisms.

B. Surface Soil: Soil that is present at the top layer of the existing soil profile. In undisturbed areas, surface soil is typically called "topsoil," but in disturbed areas such as urban environments, the surface soil can be subsoil.

C. Topsoil: Top layer of the soil profile consisting of existing native surface topsoil or existing in-place surface soil; the zone where plant roots grow.

D. 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.

E. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.

F. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction

G. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation 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 Construction Manager'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.

E. Burning: Documentation of compliance with burning requirements and permitting of authorities having jurisdiction. Identify location(s) and conditions under which burning will be performed.

1.7 QUALITY ASSURANCE

A. Topsoil Stripping and Stockpiling Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work. Include dimensioned diagrams for placement and protection of stockpiles.

1.8 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 trafficways 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. Utility Locator Service: Notify **Call Before You Dig** for area where Project is located before site clearing.

D. Do not commence site clearing operations until temporary erosion- and sedimentation-control measures are in place.

E. Tree- and Plant-Protection Zones: Protect according to requirements in Section 015639 "Temporary Tree and Plant Protection."

F. 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 31 2000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 01 5639 "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 Construction Manager.
   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

C. Retain one of two subparagraphs below.
   1. Arrange with utility companies to shut off indicated utilities.
   2. Owner will arrange to shut off indicated utilities when requested by Construction Manager.

D. Locate, identify, and disconnect utilities indicated to be abandoned in place.

E. 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.

F. Excavate for and remove underground utilities indicated to be removed.

G. 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 protection zones.
4. Chip removed tree branches and dispose of off-site

B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to depth of 6 inches in a manner to prevent intermingling with underlying subsoil or other waste materials.
1. Remove subsoil and nonsoil 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 72 inches.
2. Do not stockpile topsoil within protection zones.
3. Dispose of surplus topsoil. Surplus topsoil is that which exceeds quantity indicated to be stockpiled or reused.
4. Stockpile surplus topsoil to allow for respreading deeper topsoil.

3.7 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.

3.8 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 nonrecyclable 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 1000

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SECTION 312000 - EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:
1. Excavating and filling for rough grading the Site.
2. Preparing subgrades for slabs-on-grade, walks, pavements, and turf and grasses.
3. Excavating and backfilling for buildings and structures.
4. Drainage course for concrete slabs-on-grade.
5. Subbase course for concrete pavements.
6. Subbase course and base course for asphalt paving.
7. Subsurface drainage backfill for walls and trenches.
8. Excavating and backfilling trenches for utilities and pits for buried utility structures.
9. Excavating well hole to accommodate elevator-cylinder assembly.

B. Related Requirements:
1. Section 013200 "Construction Progress Documentation" for recording pre-excavation and earth-moving progress.
2. Section 033000 "Cast-in-Place Concrete" for granular course if placed over vapor retarder and beneath the slab-on-grade.
3. Section 311000 "Site Clearing" for site stripping, grubbing, stripping and stockpiling topsoil, and removal of above- and below-grade improvements and utilities.
4. Section 315000 "Excavation Support and Protection" for shoring, bracing, and sheet piling of excavations.
5. Section 329200 "Turf and Grasses" for finish grading in turf and grass areas, including preparing and placing planting soil for turf areas.

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices for earth moving specified in Section 012200 "Unit Prices."

B. Quantity allowances for earth moving are included in Section 012100 "Allowances."

1.4 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer placed over the excavated subgrade in a trench before laying pipe.

D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: Aggregate layer supporting the slab-on-grade that also minimizes upward capillary flow of pore water.

F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
   1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
   2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
   3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: Soil materials used to raise existing grades.

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

I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct pre-excavation conference at Project site.
   1. Review methods and procedures related to earthmoving, including, but not limited to, the following:
      a. Personnel and equipment needed to make progress and avoid delays.
      b. Coordination of Work with utility locator service.
      c. Coordination of Work and equipment movement with the locations of tree- and plant-protection zones.
      d. Extent of trenching by hand or with air spade.
      e. Field quality control.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of the following manufactured products required:
   1. Geotextiles.
   2. Controlled low-strength material, including design mixture.
   3. Geofoam.
   4. Warning tapes.

B. Samples for Verification: For the following products, in sizes indicated below:
   1. Geotextile: 12 by 12 inches.
   2. Warning Tape: 12 inches long; of each color.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified testing agency.

B. Material Test Reports: For each on-site and borrow soil material proposed for fill and backfill as follows:
   1. Classification according to ASTM D 2487.
   2. Laboratory compaction curve according to ASTM D 698 and ASTM D 1557.

C. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by earth-moving operations. Submit before earth moving begins.

1.8 QUALITY ASSURANCE

A. Blasting: Comply with applicable requirements in NFPA 495, "Explosive Materials Code," and prepare a blasting plan reporting the following:
   1. Types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
   2. Seismographic monitoring during blasting operations.

B. Seismic Survey Agency: An independent testing agency, acceptable to authorities having jurisdiction, experienced in seismic surveys and blasting procedures to perform the following services:
   1. Report types of explosive and sizes of charge to be used in each area of rock removal, types of blasting mats, sequence of blasting operations, and procedures that will prevent damage to site improvements and structures on Project site and adjacent properties.
   2. Seismographic monitoring during blasting operations.

C. Geotechnical Testing Agency Qualifications: Qualified according to ASTM E 329 and ASTM D 3740 for testing indicated.

1.9 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during earth-moving operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner 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 earth moving 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. Utility Locator Service: Notify **"Call Before You Dig** for area where Project is located before beginning earth-moving operations.

D. Do not commence earth-moving operations until temporary site fencing and erosion- and sedimentation-control measures specified in Section 311000 "Site Clearing" are in place.

E. Do not commence earth-moving operations until plant-protection measures specified in Section 015639 "Temporary Tree and Plant Protection" are in place.

F. The following practices are prohibited within protection zones:
   1. Storage of construction materials, debris, or excavated material.
   2. Parking vehicles or equipment.
   3. Foot traffic.
   4. Erection of sheds or structures.

5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

G. Do not direct vehicle or equipment exhaust towards protection zones.

H. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

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

C. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 294/D 2940M 0; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

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

E. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940/D 2940M; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Drainage Course: Narrowly graded mixture of washed stone or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and zero to 5 percent passing a No. 8 sieve.

G. 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 sieve and zero to 5 percent passing a No. 4 sieve.

H. Sand: ASTM C 33/C 33M; fine aggregate.

I. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.
1.

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; colored as follows:
1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

B. Detectable Warning Tape: Acid- and alkali-resistant, polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
   1. Red: Electric.
   2. Yellow: Gas, oil, steam, and dangerous materials.
   3. Orange: Telephone and other communications.
   4. Blue: Water systems.
   5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth-moving operations.

B. Protect and maintain erosion and sedimentation controls during earth-moving operations.

C. Protect subgrades and foundation soils from freezing temperatures and frost. Remove temporary protection before placing subsequent materials.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
   2. Remove rock to lines and grades indicated to permit installation of permanent construction without exceeding the following dimensions:
      a. 24 inches outside of concrete forms other than at footings.
      b. 12 inches outside of concrete forms at footings.
      c. 6 inches outside of minimum required dimensions of concrete cast against grade.
      d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
      e. 6 inches beneath bottom of concrete slabs-on-grade.

f. 6 inches beneath pipe in trenches and the greater of 24 inches wider than pipe or 42 inches wide.
g. wide.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
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.
2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

B. Excavations at Edges of Tree- and Plant-Protection Zones:
1. Excavate by hand or with an air spade to indicated lines, cross sections, elevations, and subgrades. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

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

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.
1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

B. Excavate trenches to uniform widths to provide the following 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 subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.
1. For pipes and conduit less than 6 inches in nominal diameter, hand-excavate trench bottoms and support pipe and conduit on an undisturbed subgrade.
2. For pipes and conduit 6 inches or larger in nominal diameter, shape bottom of trench to support bottom 90 degrees of pipe or conduit circumference. Fill depressions with tamped sand backfill.
3. For flat-bottomed, multiple-duct conduit units, hand-excavate trench bottoms and support conduit on an undisturbed subgrade.

4. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

D. Trenches in Tree- and Plant-Protection Zones:
1. Hand-excavate to indicated lines, cross sections, elevations, and subgrades. Use narrow-tine spading forks to comb soil and expose roots. Do not break, tear, or chop exposed roots. Do not use mechanical equipment that rips, tears, or pulls roots.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut and protect roots according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.8 SUBGRADE INSPECTION

A. Notify Architect when excavations have reached required subgrade.

B. If Architect determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

C. Proof-roll subgrade below walls, structures, pool, splash pad, building slabs and pavements with a pneumatic-tired and loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.

E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
1. Fill unauthorized excavations under other construction, pipe, or conduit as directed by Architect.

3.10 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.11 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:
1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.

5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Trenches under Footings: Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Section 033000 "Cast-in-Place Concrete".

D. Trenches under Roadways: Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase course. Concrete is specified in Section 033000 "Cast-in-Place Concrete".

E. Backfill voids with satisfactory soil while removing shoring and bracing.

F. Initial Backfill:
1. Soil Backfill: Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the pipe or conduit.
   a. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
2. Controlled Low-Strength Material: Place initial backfill of controlled low-strength material to a height of 12 inches over the pipe or conduit. Coordinate backfilling with utilities testing.

G. Final Backfill:
1. Soil Backfill: Place and compact final backfill of satisfactory soil to final subgrade elevation.
2. Controlled Low-Strength Material: Place final backfill of controlled low-strength material to final subgrade elevation.

H. Warning Tape: Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 SOIL FILL

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

B. Place and compact fill material in layers to required elevations as follows:
1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use Engineered fill.
4. Under building slabs, use Engineered fill.
5. Under footings and foundations, use Engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air dry, otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
   1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
   2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92 percent.
   3. Under turf or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85 percent.
   4. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.
   2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Rough Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to elevations required to achieve indicated finish elevations, within the following subgrade tolerances:
   1. Turf or Unpaved Areas: Plus or minus 1 inch.
   2. Walks: Plus or minus 1 inch.
   3. Pavements: Plus or minus 1/2 inch.

C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 SUBSURFACE DRAINAGE

A. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.

1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.

B. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with one layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698 with a minimum of two passes of a plate-type vibratory compactor.
2. Place and compact impervious fill over drainage backfill in 6-inch-thick compacted layers to final subgrade.

3.18 SUBBASE AND BASE COURSES UNDER PAVEMENTS AND WALKS

A. Place subbase course and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase course and base course under pavements and walks as follows:
1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place base course material over subbase course under hot-mix asphalt pavement.
3. Shape subbase course and base course to required crown elevations and cross-slope grades.
4. Place subbase course and base course 6 inches or less in compacted thickness in a single layer.
5. Place subbase course and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
6. Compact subbase course and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

C. Pavement Shoulders: Place shoulders along edges of subbase course and base course to prevent lateral movement. Construct shoulders, at least 12 inches wide, of satisfactory soil materials and compact simultaneously with each subbase and base layer to not less than 95 percent of maximum dry unit weight according to ASTM D 698

3.19 DRAINAGE COURSE UNDER CONCRETE SLABS-ON-GRADE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:
1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.20 FIELD QUALITY CONTROL

A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
1. Determine prior to placement of fill that site has been prepared in compliance with requirements.

2. Determine that fill material classification and maximum lift thickness comply with requirements.
3. Determine, during placement and compaction, that in-place density of compacted fill complies with requirements.

B. Testing Agency: Owner will engage a qualified geotechnical engineering testing agency to perform tests and inspections.

C. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earth moving only after test results for previously completed work comply with requirements.

D. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

E. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2937, and ASTM D 6938, as applicable. Tests will be performed at the following locations and frequencies:
1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 sq. ft. or less of paved area or building slab but in no case fewer than three tests.
2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for every 100 feet or less of wall length but no fewer than two tests.
3. Trench Backfill: At each compacted initial and final backfill layer, at least one test for every 150 feet or less of trench length but no fewer than two tests.

F. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil materials to depth required; recompact and retest until specified compaction is obtained.

3.21 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
1. Scarify or remove and replace soil material to depth as directed by Architect; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

B. Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Architect.

1. Remove waste materials, including unsatisfactory soil, trash, and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 2000

SECTION 31 2319 - DEWATERING

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 construction dewatering.

B. Related Sections:
1. Section 01 3200 "Construction Progress Documentation" for recording preexisting conditions and dewatering system progress.
2. Section 31 2000 "Earth Moving" for excavating, backfilling, site grading, and for site utilities.

1.3 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control hydrostatic pressures and to lower, control, remove, and dispose of ground water and permit excavation and construction to proceed on dry, stable subgrades.
1. Delegated Design: Design dewatering system, including comprehensive analysis by a qualified professional Design Professional, using performance requirements and design criteria indicated.
2. Continuously monitor and maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
3. Prevent surface water from entering excavations by grading, dikes, or other means.
4. Accomplish dewatering without damaging existing buildings, structures, and site improvements adjacent to excavation.
5. Remove dewatering system when no longer required for construction.

1.4 ACTION SUBMITTALS

A. Shop Drawings: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of risers, headers, filters, pumps, power units, and discharge lines; and means of discharge, control of sediment, and disposal of water.
1. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
2. Include a written plan for dewatering operations including control procedures to be adopted if dewatering problems arise.

B. Delegated-Design Submittal: For dewatering system indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified Design Professional responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer and Design Professional.

B. Other Informational Submittals:

1. Photographs or Videotape: Show existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer that has specialized in design of dewatering systems and dewatering work.

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

C. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to dewatering including, but not limited to, the following:
      a. Inspection and discussion of condition of site to be dewatered including coordination with temporary erosion control measures and temporary controls and protections.
      b. Geotechnical report.
      c. Proposed site clearing and excavations.
      d. Existing utilities and subsurface conditions.
      e. Coordination for interruption, shutoff, capping, and continuation of utility services.
      f. Construction schedule. Verify availability of Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
      g. Testing and monitoring of dewatering system.

1.7 PROJECT CONDITIONS

A. 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 Design Professional and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical Design Professional. 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 dewatering.
   2. The geotechnical report is referenced elsewhere in the Project Manual.

B. Survey Work: Engage a qualified land surveyor or Design Professional to survey adjacent existing buildings, structures, and site improvements, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
   1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not Used)

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 dewatering operations.
   1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
   2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system 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. Provide temporary grading to facilitate dewatering and control of surface water.

D. Monitor dewatering systems continuously.

E. Promptly repair damages to adjacent facilities caused by dewatering.

F. Protect and maintain temporary erosion and sedimentation controls, which are shown on the drawings.

G. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
   1. Space well points or wells at intervals required to provide sufficient dewatering.
   2. Use filters or other means to prevent pumping of fine sands or silts from the subsurface.

H. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed or until dewatering is no longer required.

I. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
   1. Do not permit open sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

J. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
   1. Maintain piezometric water level a minimum of 60 inches below surface of excavation.

K. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water and sediment in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

L. Provide standby equipment on site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.

1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches below overlying construction.

M. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

END OF SECTION 31 2319

SECTION 31 3116 - TERMITE CONTROL

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. Soil treatment with termiticide.

B. Related Sections:

1. Section 06 1000 "Rough Carpentry" for wood preservative treatment by pressure process.
2. Section 07 6200 "Sheet Metal Flashing and Trim" for custom-fabricated, metal termite shields.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of termite control product.

1. Include the EPA-Registered Label for termiticide products.

1.4 INFORMATIONAL SUBMITTALS

A. Product Certificates: For termite control products, from manufacturer.

B. Soil Treatment Application Report: After application of termiticide is completed, submit report for Owner's records and include the following:

1. Date and time of application.
2. Moisture content of soil before application.
3. Termiticide brand name and manufacturer.
4. Quantity of undiluted termiticide used.
5. Dilutions, methods, volumes used, and rates of application.
6. Areas of application.
7. Water source for application.

C. Warranties: Sample of special warranties.

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Formulate and apply termiticides and termiticide devices according to the EPA-Registered Label.

B. Source Limitations: Obtain termite control products from single source from single manufacturer.

C. Preinstallation Conference: Conduct conference at Project site.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated or frozen. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

B. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.7 WARRANTY

A. Soil Treatment Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor, certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

1. Warranty Period: Five years from date of Material Completion.

1.8 MAINTENANCE SERVICE

A. Continuing Service: Beginning at Material Completion, provide 12 months' continuing service including monitoring, inspection, and re-treatment for occurrences of termite activity. Provide a standard continuing service agreement. State services, obligations, conditions, terms for agreement period, and terms for future renewal options.

PART 2 - PRODUCTS

2.1 SOIL TREATMENT

A. Termiticide: Provide an EPA-Registered termiticide, complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. BASF Corporation, Agricultural Products; Termidor.
b. Bayer Environmental Science; Premise 75.
c. FMC Corporation, Agricultural Products Group; Dragnet FT, Talstar, Prevail.
d. Syngenta; Demon TC, Prelude, Probuild TC.

2. Service Life of Treatment: Soil treatment termiticide that is effective for not less than five years against infestation of subterranean termites.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil per termiticide label requirements, interfaces with earthwork, slab and foundation work, landscaping, utility installation, and other conditions affecting performance of termite control.

B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.

B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.

1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

3.3 APPLICATION, GENERAL

A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

3.4 APPLYING SOIL TREATMENT

A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade and Basement Slabs: Under ground-supported slab construction, including footings, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
2. Foundations: Adjacent soil, including soil along the entire inside perimeter of foundation walls; along both sides of interior partition walls; around plumbing pipes and electric conduit penetrating the slab; around interior column footers, piers, and chimney bases; and along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
3. Crawlspaces: Soil under and adjacent to foundations as previously indicated. Treat adjacent areas including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
4. Masonry: Treat voids.
5. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.

B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.

C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

D. Post warning signs in areas of application.

E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION 31 3116

SECTION 32 1216 - ASPHALT PAVING

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. Cold milling of existing hot-mix asphalt pavement.
2. Hot-mix asphalt patching.
3. Hot-mix asphalt paving.
4. Hot-mix asphalt paving overlay.
5. Asphalt surface treatments.
6. Pavement-marking paint.

B. Related Sections:
1. Section 02 4116 "Structure Demolition" for demolition, removal, and recycling of existing asphalt pavements, and for geotextiles that are not embedded within courses of asphalt paving.
2. Section 31 2000 "Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.
3. Section 32 1373 "Concrete Paving Joint Sealants" for joint sealants and fillers at paving terminations.

1.3 DEFINITION

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
1. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
2. Job-Mix Designs: For each job mix proposed for the Work.

B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Samples: For each paving fabric, 12 by 12 inches minimum.

D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
1. Each paving fabric, 12 by 12 inches minimum.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified manufacturer and Installer.

B. Material Certificates: For each paving material, from manufacturer.

C. Material Test Reports: For each paving material.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: A paving-mix manufacturer registered with and approved by authorities having jurisdiction or the DOT of state in which Project is located.

B. Installer Qualifications: Imprinted-asphalt manufacturer's authorized installer who is trained and approved for installation of imprinted asphalt required for this Project.

C. Testing Agency Qualifications: Qualified according to ASTM D 3666 for testing indicated.

D. Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of the Georgia Department of Transportation for asphalt paving work.
   1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

E. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
      a. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
      b. Review condition of subgrade and preparatory work.
      c. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
      d. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.8 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met:
   1. Prime Coat: Minimum surface temperature of 60 deg F.
   2. Tack Coat: Minimum surface temperature of 60 deg F.
   3. Slurry Coat: Comply with weather limitations in ASTM D 3910.
   4. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
   5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials or 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 AGGREGATES

A. General: Use materials and gradations that have performed satisfactorily in previous installations.

B. Coarse Aggregate: ASTM D 692, sound; angular crushed stone, crushed gravel, or cured, crushed blast-furnace slag.

C. Fine Aggregate: ASTM D 1073, sharp-edged natural sand or sand prepared from stone, gravel, cured blast-furnace slag, or combinations thereof.
   1. For hot-mix asphalt, limit natural sand to a maximum of 20 percent by weight of the total aggregate mass.

D. Mineral Filler: ASTM D 242, rock or slag dust, hydraulic cement, or other inert material.

2.2 ASPHALT MATERIALS

A. Asphalt Binder: AASHTO M 320 or AASHTO MP 1a, PG 64-22

B. Asphalt Cement: ASTM D 3381 for viscosity-graded material or ASTM D 946 for penetration-graded material.

C. Prime Coat: ASTM D 2027, medium-curing cutback asphalt, MC-30.

D. Prime Coat: Asphalt emulsion prime coat complying with Georgia DOT requirements.

E. Tack Coat: ASTM D 977 emulsified asphalt, or ASTM D 2397 cationic emulsified asphalt, slow setting, diluted in water, of suitable grade and consistency for application.

F. Fog Seal: ASTM D 977 emulsified asphalt, or ASTM D 2397 cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

G. Water: Potable.

H. Undersealing Asphalt: ASTM D 3141, pumping consistency.

2.3 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

B. Sand: ASTM D 1073, Grade Nos. 2 or 3.

C. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.

D. Joint Sealant: ASTM D 6690 Type I, hot-applied, single-component, polymer-modified bituminous sealant.

E. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, Type N; colors complying with FS TT-P-1952.
   1. Color: As indicated.

F. Pavement-Marking Paint: MPI #32 Alkyd Traffic Marking Paint.
   1. Color: As indicated.

G. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.

1. Color: As indicated.

H. Pavement-Marking Paint: MPI #97 Latex Traffic Marking Paint.
1. Color: As indicated.

2.4 MIXES

A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction; designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types" or Georgia Dept. of Transportation's "Section 828 – Hot Mix Asphaltic Concrete Mixtures" latest edition; and complying with the following requirements:
1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
2. Subgrade 100% Compacted: 12"
3. Base Course: 6-8"
4. Surface Course: 2" 12.5 mm Superpave.
5. Surface Course: 1.5" 9.5 mm Superpave.
6. Binder Course: 2.5" 19 mm Superpave.

B. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes approved by authorities having jurisdiction and designed according to procedures in AI MS-2, "Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types."
1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
2. Provide mixes complying with composition, grading, and tolerance requirements in ASTM D 3515 for the following nominal, maximum aggregate sizes:
a. Base Course: 1 inch.
b. Surface Course: 1/2 inch.

C. Emulsified-Asphalt Slurry: ASTM D 3910, Type 1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to begin paving.

B. Proof-roll subgrade below pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction]. Limit vehicle speed to 3 mph.
2. Proof roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

D. Verify that utilities, traffic loop detectors, and other items requiring a cut and installation beneath the asphalt surface have been completed and that asphalt surface has been repaired flush with adjacent asphalt prior to beginning installation of imprinted asphalt.

3.2 PATCHING

A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.

B. Portland Cement Concrete Pavement: Break cracked slabs and roll as required to reseat concrete pieces firmly.
   1. Pump hot undersealing asphalt under rocking slab until slab is stabilized or, if necessary, crack slab into pieces and roll to reseat pieces firmly.
   2. Remove disintegrated or badly cracked pavement. Excavate rectangular or trapezoidal patches, extending into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Recompact existing unbound-aggregate base course to form new subgrade.

C. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd..
   1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
   2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

D. Patching: Fill excavated pavements with hot-mix asphalt base mix for full thickness of patch and, while still hot, compact flush with adjacent surface.

E. Patching: Partially fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact. Cover asphalt base course with compacted, hot-mix surface layer finished flush with adjacent surfaces.

3.3 REPAIRS

A. Leveling Course: Install and compact leveling course consisting of hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.
   1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

B. Crack and Joint Filling: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch.
   1. Clean cracks and joints in existing hot-mix asphalt pavement.
   2. Use emulsified-asphalt slurry to seal cracks and joints less than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.
   3. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch wide. Fill flush with surface of existing pavement and remove excess.

3.4 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.
   1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

C. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
2. Protect primed substrate from damage until ready to receive paving.

D. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.
1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
1. Place hot-mix asphalt base course in number of lifts and thicknesses indicated.
2. Place hot-mix asphalt surface course in single lift.
3. Spread mix at minimum temperature of 250 deg F.
4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.6 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat to joints.
2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
3. Offset transverse joints, in successive courses, a minimum of 24 inches.
4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to AI MS-22, for both "Ending a Lane" and "Resumption of Paving Operations."
5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.
6. Compact asphalt at joints to a density within 2 percent of specified course density.

3.7 COMPACTION

A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
   1. Complete compaction before mix temperature cools to 185 deg F.

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
   1. Average Density: 96 percent of reference laboratory density according to ASTM D 6927, but not less than 94 percent nor greater than 100 percent.
   2. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 INSTALLATION TOLERANCES

A. Pavement Thickness: Compact each course to produce the thickness indicated within the following tolerances:
   1. Base Course: Plus or minus 1/2 inch.
   2. Surface Course: Plus 1/4 inch, no minus.

B. Pavement Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
   1. Base Course: 1/4 inch
   2. Surface Course: 1/8 inch
   3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

C. Traffic-Calming Devices: Compact and form asphalt to produce the contour indicated and within a tolerance of plus or minus 1/8 inch of height indicated above pavement surface.

3.9 SURFACE TREATMENTS

A. Fog Seals: Apply fog seal at a rate of 0.10 to 0.15 gal./sq. yd. to existing asphalt pavement and allow to cure. With fine sand, lightly dust areas receiving excess fog seal.

B. Slurry Seals: Apply slurry coat in a uniform thickness according to ASTM D 3910 and allow to cure.
   1. Roll slurry seal to remove ridges and provide a uniform, smooth surface.

3.10 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow paving to age for the longer of 30 days or period recommended by paint manufacturer before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
   1. Broadcast glass beads uniformly into wet pavement markings at a rate of 6 lb/gal.

3.11 WHEEL STOPS

A. Install wheel stops in bed of adhesive as recommended by manufacturer.

B. Securely attach wheel stops to pavement with not less than two galvanized-steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.

C. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.

D. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D 979.

   1. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D 2041, and compacted according to job-mix specifications.
   2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.
      a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
      b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

E. Replace and compact hot-mix asphalt where core tests were taken.

F. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.13 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.
   1. Do not allow milled materials to accumulate on-site.

END OF SECTION 32 1216

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SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Section Includes:
1. Driveways.
2. Parking lots.
3. Curbs and gutters.
4. Walks.

C. Related Sections:
1. Section 03 3000 "Cast-in-Place Concrete" for general building applications of concrete.
1. Division 31 Section "Earth Moving" for subgrade preparation, grading, and subbase course.
2. Section 32 1373 "Concrete Paving Joint Sealants" for joint sealants in expansion and contraction joints within concrete paving and in joints between concrete paving and asphalt paving or adjacent construction.

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 ACTION SUBMITTALS

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

B. Shop Drawings: Indicate pavement markings, lane separations, and defined parking spaces. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

C. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color selection.

D. Samples for Verification: For each type of product or exposed finish, prepared as Samples of size indicated below:
1. Wheel Stops: Per detail on drawings.

E. Other Action Submittals:
1. Design Mixtures: For each concrete paving mixture. Include alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified ready-mix concrete manufacturer.

B. Material Certificates: For the following, from manufacturer:
1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Curing compounds.
4. Joint fillers.

C. Material Test Reports: For each of the following:
   1. Aggregates. Include service-record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.

1.5 QUALITY ASSURANCE

A. Detectable Warning Installer Qualifications: An employer of workers trained and approved by manufacturer of stamped concrete paving systems.

B. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that 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" (Quality Control Manual - Section 3, "Plant Certification Checklist").

C. Concrete Testing Service: Engage a qualified testing agency to perform material evaluation tests and to design concrete mixtures.

D. ACI Publications: Comply with ACI 301 unless otherwise indicated.

E. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
   1. Build mockups of full-thickness sections of concrete paving to demonstrate typical joints; surface finish, texture, and color; curing; and standard of workmanship.
   2. Build mockups of concrete paving in the location and of the size indicated or, if not indicated, build mockups where directed by Architect and not less than 96 inches by 96 inches.
   3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   4. Approved mockups may become part of the completed Work if undisturbed at time of Material Completion.

F. Preinstallation Conference: Conduct conference at Project site.
   1. Review methods and procedures related to concrete paving, including but not limited to, the following:
      a. Concrete mixture design.
      b. Quality control of concrete materials and concrete paving construction practices.
   2. Require representatives of each entity directly concerned with concrete paving to attend, including the following:
      a. Construction Manager's superintendent.
      b. Independent testing agency responsible for concrete design mixtures.
      c. Ready-mix concrete manufacturer.
      d. Concrete paving subcontractor.
      e. Manufacturer's representative of stamped concrete paving system used for detectable warnings.

1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for oil-based materials or 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 FORMS

A. Form Materials: Plywood, metal, metal-framed plywood, or other approved panel-type materials to provide full-depth, continuous, straight, and smooth exposed surfaces.
   1. Use flexible or uniformly curved forms for curves with a radius of 100 feet or less. Do not use notched and bent forms.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.2 STEEL REINFORCEMENT

A. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Hook Bolts: ASTM A 307, Grade A internally and externally threaded. Design hook-bolt joint assembly to hold coupling against paving form and in position during concreting operations, and to permit removal without damage to concrete or hook bolt.

C. Zinc Repair Material: ASTM A 780.

2.3 CONCRETE MATERIALS

A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source throughout Project:
   1. Portland Cement: ASTM C 150, gray portland cement Type I.

B. Normal-Weight Aggregates: ASTM C 33, Class 4S, uniformly graded. Provide aggregates from a single source with documented service-record data of at least 10 years' satisfactory service in similar paving applications and service conditions using similar aggregates and cementitious materials.
   1. Maximum Coarse-Aggregate Size: 1-1/2 inches nominal.
   2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Water: Potable and complying with ASTM C 94/C 94M.

D. Air-Entraining Admixture: ASTM C 260.

2.4 CURING MATERIALS

A. Water: Potable.

B. Evaporation Retarder: Waterborne, monomolecular, film forming, manufactured for application to fresh concrete.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Axim Italcementi Group, Inc.; Caltexol CIMFILM.
      b. BASF Construction Chemicals, LLC; Confilm.
      c. ChemMasters; Spray-Film.

d. Conspec by Dayton Superior; Aquafilm.
e. Dayton Superior Corporation; Sure Film (J-74).
f. Edoco by Dayton Superior; BurkeFilm.
g. Euclid Chemical Company (The), an RPM company; Eucobar.
h. Kaufman Products, Inc.; VaporAid.
i. Lambert Corporation; LAMBCO Skin.
j. L&M Construction Chemicals, Inc.; E-CON.
k. Meadows, W. R., Inc.; EVAPRE.
l. Metalcrete Industries; Waterhold.
m. Nox-Crete Products Group; MONOFILM.
n. Sika Corporation, Inc.; SikaFilm.
o. SpecChem, LLC; Spec Film.
p. Symons by Dayton Superior; Finishing Aid.
q. TK Products, Division of Sierra Corporation; TK-2120 TRI-FILM.
r. Unitex; PRO-FILM.
s. Vexcon Chemicals Inc.; Certi-Vex EnvioAssist.

C. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Anti-Hydro International, Inc.; A-H Curing Compound #2 DR WB.
b. ChemMasters; Safe-Cure Clear.
c. Conspec by Dayton Superior; DSSCC Clear Resin Cure.
d. Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W).
e. Edoco by Dayton Superior; DSSCC Clear Resin Cure.
f. Euclid Chemical Company (The), an RPM company; Kurez W 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 SERIES.
k. Nox-Crete Products Group; Resin Cure E.
l. SpecChem, LLC; PaveCure Rez.
m. Symons by Dayton Superior; Resi-Chem Clear.
n. Tamms Industries, Inc., Euclid Chemical Company (The); TAMMSCURE WB 30C.
o. TK Products, Division of Sierra Corporation; TK-2519 WB.
p. Vexcon Chemicals Inc.; Certi-Vex Enviocure 100.

2.5 RELATED MATERIALS

A. Joint Fillers: ASTM D 1751, asphalt-saturated cellulosic fiber in preformed strips.

2.6 PAVEMENT MARKINGS

A. Pavement-Marking Paint: Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248, **Type N**; colors complying with FS TT-P-1952.
1. Color: White, Yellow, Blue, and Green.

B. Pavement-Marking Paint: MPI #32 Alkyd Traffic Marking Paint.
1. Color: White, Yellow, Blue, and Green.

C. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II, with drying time of less than 45 minutes.
   1. Color: White, Yellow, Blue, and Green.

D. Pavement-Marking Paint: MPI #97 Latex Traffic Marking Paint.
   1. Color: White, Yellow, Blue, and Green.

2.7 WHEEL STOPS

A. Wheel Stops: Precast, air-entrained concrete, 2500-psi minimum compressive strength, 4-1/2 inches high by 9 inches wide by 72 inches long. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.
   1. Dowels: #4 rebar, 18-inch minimum length.

2.8 CONCRETE MIXTURES

A. Prepare design mixtures, proportioned according to ACI 301, for each type and strength of normal-weight concrete, and as determined by either laboratory trial mixtures or field experience.
   1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.
   2. When automatic machine placement is used, determine design mixtures and obtain laboratory test results that meet or exceed requirements.

B. Proportion mixtures to provide normal-weight concrete with the following properties:
   1. Compressive Strength (28 Days): 3000 psi.
   2. Maximum Water-Cementitious Materials Ratio at Point of Placement: 0.46
   3. Slump Limit: 3 inches, plus or minus one inch.

C. 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: 5 percent plus or minus 1.0 percent for 1-1/2-inch nominal maximum aggregate size.

2.9 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Furnish batch certificates for each batch discharged and used in the Work.
   1. When air temperature is between 85 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 subgrades and subbase surfaces for compliance with requirements for dimensional, grading, and elevation tolerances.

B. Proof-roll prepared subbase surface below concrete paving to identify soft pockets and areas of excess yielding.
   1. Completely proof-roll subbase in one direction and repeat in perpendicular direction. Limit vehicle speed to 3 mph.
   2. Proof-roll with a pneumatic-tired and loaded, 10-wheel, tandem-axle dump truck weighing not less than 15 tons.

3. Correct subbase with soft spots and areas of pumping or rutting exceeding depth of 1/2 inch according to requirements in Section 31 2000 "Earth Moving."

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides 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.

3.5 JOINTS

A. General: Form construction, isolation, and contraction joints and tool edges 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 paving, place transverse joints to align with previously placed joints unless otherwise indicated.

B. Construction Joints: Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than one-half hour unless paving terminates at isolation joints.
   1. Continue steel reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of paving strips unless otherwise indicated.
   2. Provide tie bars at sides of paving strips where indicated.
   3. Keyed Joints: Provide preformed keyway-section forms or bulkhead forms with keys unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete.

C. Isolation Joints: Form isolation joints of preformed joint-filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
   1. Locate expansion joints at intervals of 20 feet unless otherwise indicated.
   2. Extend joint fillers full width and depth of joint.
   3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated.
   4. Place top of joint filler flush with finished concrete surface if joint sealant is not indicated.
   5. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.

6. During concrete placement, protect top edge of joint filler with metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.

D. 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 paving:
   1. Grooved Joints: Form contraction joints after initial floating by grooving and finishing each edge of joint with grooving tool to a 1/4-inch radius. Repeat grooving of contraction joints after applying surface finishes. Eliminate grooving-tool marks on concrete surfaces.
      a. Tolerance: Ensure that grooved joints are within 3 inches either way from centers of dowels.

E. Edging: After initial floating, tool edges of paving, gutters, curbs, and joints in concrete with an edging tool to a 1/4-inch radius. Repeat tooling of edges after applying surface finishes. Eliminate edging-tool marks on concrete surfaces.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, inspect and complete formwork installation and items to be embedded or cast-in.

B. Remove snow, ice, or frost from subbase surface before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase 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. Do not add water to fresh concrete after testing.

F. 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.

G. Consolidate concrete according to ACI 301 by mechanical vibrating equipment supplemented by hand spading, rodding, or tamping.

H. Screed paving surface with a straightedge and strike off.

I. 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.

J. Curbs and Gutters: Use design mixture for automatic machine placement. Produce curbs and gutters to required cross section, lines, grades, finish, and jointing.

K. Slip-Form Paving: Use design mixture for automatic machine placement. Produce paving to required thickness, lines, grades, finish, and jointing.
   1. Compact subbase and prepare subgrade of sufficient width to prevent displacement of slip-form paving machine during operations.

L. Cold-Weather Placement: Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Comply with ACI 306.1 and the following:

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 design mixtures.

M. 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 in total amount of mixing water. Using liquid nitrogen to cool concrete is Construction Manager'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 and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FINISHING

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots and fill low spots. Refloat surface immediately to uniform granular texture.
1. Medium-to-Fine-Textured Broom Finish: Draw a soft-bristle broom across float-finished concrete surface perpendicular to line of traffic to provide a uniform, fine-line texture.

C. Trowel Finish: Apply trowel finish to concrete surfaces to be exposed as required on the drawings.
1. After floating, consolidate concrete surface by hand-troweling operation, free of trowel marks, uniform in texture and appearance.

3.8 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. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete but before float finishing.

D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

E. Curing Methods: Cure concrete by curing compound as follows:
1. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas that have been subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.9 PAVING TOLERANCES

A. Comply with tolerances in ACI 117 and as follows:
   1. Elevation: 3/4 inch
   2. Thickness: Plus 3/8 inch, minus 1/4 inch
   3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/2 inch.
   4. Alignment of Tie-Bar End Relative to Line Perpendicular to Paving Edge: 1/2 inch per 12 inches of tie bar.
   5. Joint Spacing: 3 inches.
   6. Contraction Joint Depth: Plus 1/4 inch, no minus.
   7. Joint Width: Plus 1/8 inch, no minus.

3.10 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Architect.

B. Allow concrete paving to cure for a minimum of 28 days and be dry before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.
   1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to concrete surface. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.

3.11 WHEEL STOPS

A. Install wheel stops in bed of adhesive applied as recommended by manufacturer.

B. Securely attach wheel stops to paving with not less than two # 4 rebars located at one-quarter to one-third points. Install dowels in drilled holes in the paving and bond dowels to wheel stop. Recess head of dowel beneath top of wheel stop.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
   1. Testing Frequency: Obtain at least one composite sample for each 5000 sq. ft. or fraction thereof of each concrete mixture placed each day.
      a. 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 mixture. 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 mixture.
   4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and when it is 80 deg F and above, and one test for each composite sample.

5. Compression Test Specimens: ASTM C 31/C 31M; cast and laboratory cure one set of three standard cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen at seven days and two specimens at 28 days.
    a. A compressive-strength test shall be the average compressive strength from two specimens obtained from same composite sample and tested at 28 days.

C. Strength of each concrete mixture will be satisfactory if average of any three-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.

D. Test results shall be reported in writing to Architect, concrete manufacturer, and Construction Manager 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.

E. 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.

F. 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.

G. Concrete paving will be considered defective if it does not pass tests and inspections.

H. Additional testing and inspecting, at Construction Manager's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

I. Prepare test and inspection reports.

3.13 REPAIRS AND PROTECTION

A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.

B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.

C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Material Completion inspections.

END OF SECTION 321313

SECTION 32 1373 - CONCRETE PAVING JOINT SEALANTS

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. Cold-applied joint sealants.
2. Hot-applied joint sealants.

B. Related Sections:
1. Section 07 9200 "Joint Sealants" for sealing nontraffic and traffic joints in locations not specified in this Section.
2. Section 32 1216 "Asphalt Paving" for constructing joints between concrete and asphalt pavement.
3. Section 32 1313 "Concrete Paving" for constructing joints in concrete pavement.

1.3 PRECONSTRUCTION TESTING

A. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, Samples of materials that will contact or affect joint sealants.
1. Use ASTM C 1087 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 no fewer than eight pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
4. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
5. Testing will not be required if joint-sealant manufacturers submit joint-preparation data that are based on previous testing, not older than 24 months, of sealant products for compatibility with and adhesion to joint substrates and other materials matching those submitted.

1.4 ACTION SUBMITTALS

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants 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. Pavement-Joint-Sealant Schedule: Include the following information:
1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified Installer.

B. Product Certificates: For each type of joint sealant and accessory, from manufacturer.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for joint sealants.

D. Preconstruction Compatibility and Adhesion Test Reports: From joint-sealant manufacturer, indicating the following:
   1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility with and adhesion to joint sealants.
   2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

B. Source Limitations: Obtain each type of joint sealant from single source from single manufacturer.

C. Product Testing: Test joint sealants using a qualified testing agency.
   1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated.

D. Preinstallation Conference: Conduct conference at Project site.

1.7 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 or are below 40 deg F.
   2. When joint substrates are wet.
   3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
   4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MATERIALS

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.

2.2 COLD-APPLIED JOINT SEALANTS

A. Single-Component, Nonsag, Silicone Joint Sealant for Concrete: ASTM D 5893, Type NS.
   1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
      a. Crafco Inc., an ERGON company; RoadSaver Silicone.

b. Dow Corning Corporation; 888.
c. Pecora Corporation; 301 NS.

B. Single-Component, Self-Leveling, Silicone Joint Sealant for Concrete: ASTM D 5893, Type SL.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
a. Crafco Inc., an ERGON company; RoadSaver Silicone SL.
b. Dow Corning Corporation; 890-SL.
c. Pecora Corporation; 300 SL.

2.3 JOINT-SEALANT BACKER MATERIALS

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.

B. Backer Strips for Cold-Applied Joint Sealants: ASTM D 5249; Type 2; of thickness and width required to control joint-sealant depth, prevent bottom-side adhesion of sealant, and fill remainder of joint opening under sealant.

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.

B. 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.

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. Joint-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 joint-sealant backings of kind indicated to support joint 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 joint-sealant backings.
2. Do not stretch, twist, puncture, or tear joint-sealant backings.
3. Remove absorbent joint-sealant backings that have become wet before sealant application and replace them with dry materials.

D. Install joint sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place joint sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in 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 Joint Sealants: Immediately after joint-sealant application and before skinning or curing begins, tool sealants according to the following requirements 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 joint sealant from surfaces adjacent to joints.
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.

3.4 CLEANING

A. Clean off excess joint sealant or sealant smears adjacent to joints as the Work progresses, by methods and with cleaning materials approved in writing 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 in repaired areas are indistinguishable from the original work.

3.6 PAVEMENT-JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Joints within cement concrete pavement.
1. Joint Location:
   a. Expansion and isolation joints in cast-in-place concrete pavement.
   b. Contraction joints in cast-in-place concrete slabs.
2. Silicone Joint Sealant for Concrete: Single component, nonsag and Single component, self-leveling.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full rang.

B. Joint-Sealant Application: Joints between cement concrete and asphalt pavement.
1. Joint Location:
   a. Joints between concrete and asphalt pavement.
   b. Joints between concrete curbs and asphalt pavement.
2. Cold-Applied Joint Sealant for Concrete and Asphalt: Single component.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range.

END OF SECTION 32 1373

SECTION 321723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

Section includes painted markings applied to asphalt and concrete pavement.

1.2 PREINSTALLATION MEETINGS

Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to marking pavement including, but not limited to, the following:
   a. Pavement aging period before application of pavement markings.
   b. Review requirements for protecting pavement markings, including restriction of traffic during installation period.

1.3 ACTION SUBMITTALS

Product Data: For each type of product.

1. Include technical data and tested physical and performance properties.

Shop Drawings: For pavement markings.

2. Indicate pavement markings, colors, lane separations, defined parking spaces, and dimensions to adjacent work.
3. Indicate, with international symbol of accessibility, spaces allocated for people with disabilities.

1.4 QUALITY ASSURANCE

Regulatory Requirements: Comply with materials, workmanship, and other applicable requirements of Sections 652, 653, and 657 of the Georgia Department of Transportation for pavement-marking work within a State or County ROW.

1.5 FIELD CONDITIONS

Environmental Limitations: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F for alkyd materials, 55 deg F for water-based materials, and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 PAVEMENT-MARKING PAINT

Formulated for use as a pavement marking material. Alkyd-resin type, lead and chromate free, ready mixed, complying with AASHTO M 248; colors complying with FS TT-P-1952.

Be VOC compliant and lead chromate free.

Yellow paints must use organic yellow pigments Color Index Pigment Yellow 65 (C.I. 11740) and/or 74 (C.I. 11741).

Blue paints must meet or exceed ADA requirements. Color: PMS 293C.

Green paint color: PMS 355C.

Display no bleeding on the surface upon which the paint is applied.

Conform to current Federal, State and Local air pollution regulations, including those for the control (emission) of volatile organic compounds (VOC) as established by the U.S. EPA, and the GAEPD.

% Pigment. (ASTM D3723) 58.0% – 62.0%

% Total Solids. (ASTM D3723) 76.0 % minimum

% Vehicle Non-Volatile. (ASTM D3723) 43.0 % minimum

Directional Reflectance (ASTM E1347)

1. White: 84% minimum
2. Yellow: 54% minimum

2.2 DETECTABLE WARNING TRUNCATED DOMES

A. Vanguard ADA Systems: www.VanguardOnline.com.

B. Detectable Warning (Truncated Dome) by Vanguard ADA Systems. Or approved equal.

1. Substrate Requirements: 2) Asphalt:
    a. Skid Resistance: 0.80 minimum in accordance with ASTM F1679.
    b. UV Resistance: 99% minimum Fade Resistance, Color Retention in accordance with ASTM G155.
    c. Chemical Resistance: Tested for 7 days. 1) Road Salts: no effect. 2) Anti-freeze: no effect. 3) Diesel fuel: no effect. 4) Gasoline: no effect.
    d. Color: Yellow
    e. Seamless installation

PART 3 - EXECUTION

3.1 EXAMINATION

Verify that pavement is dry and in suitable condition to begin pavement marking according to manufacturer's written instructions.

Proceed with pavement marking only after unsatisfactory conditions have been corrected.

3.2 PAVEMENT MARKING

Do not apply pavement-marking paint until layout, colors, and placement have been verified with Owner’s Representative.

Allow paving to age for a minimum of 30 days before starting pavement marking, unless approved in writing by Owner’s Representative.

Sweep and clean surface to eliminate loose material and dust.

Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates.

1. Apply graphic symbols and lettering with paint-resistant, die-cut stencils, firmly secured to pavement. Mask an extended area beyond edges of each stencil to prevent paint application beyond stencil. Apply paint so that it cannot run beneath stencil.

3.3 PROTECTING AND CLEANING

Protect pavement markings from damage and wear until completely dry, as recommended by paint manufacturer.

Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 321723

SECTION 323113 - CHAIN LINK FENCES AND GATES

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. Chain-link fences.
2. Swing gates.

B. Related Requirements:
1. Section 033000 "Cast-in-Place Concrete" for cast-in-place concrete and post footings.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
1. Inspect and discuss electrical roughing-in, equipment bases, and other preparatory work specified elsewhere.
2. Review sequence of operation for each type of gate operator.
3. Review coordination of interlocked equipment specified in this Section and elsewhere.
4. Review required testing, inspecting, and certifying procedures.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
a. Fence and gate posts, rails, and fittings.
b. Chain-link fabric, reinforcements, and attachments.
c. Gates and hardware.
d. Gate operators, including operating instructions and motor characteristics.

B. Shop Drawings: For each type of fence and gate assembly.
1. Include plans, elevations, sections, details, and attachments to other work.
2. Include accessories, hardware, gate operation, and operational clearances.
3. Gate Operator: Show locations and details for installing operator components, switches, and controls. Indicate motor size, electrical characteristics, drive arrangement, mounting, and grounding provisions.
4. Wiring Diagrams: For power, signal, and control wiring.

C. Samples for Initial Selection: For each type of factory-applied finish.

D. Samples for Verification: For each type of component with factory-applied finish, prepared on Samples of size indicated below:
1. Polymer-Coated Components: In 6-inch lengths for components and on full-sized units for accessories.

E. Delegated-Design Submittal: For structural performance of chain-link fence and gate frameworks, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Product Data: Submit technical data and installation instructions for metal fencing, fabric, gates, posts, and accessories.

B. Details showing details of fences, posts, and post installation, gate swing, hardware, and accessories. Design must conform to the Chain Link Fence Manufacturer's Institute.

C. Samples for verification of PVC color in form of 6-inch lengths of actual fabric wire to be used in color selection.
   1. Include similar samples of polymer coating applied on posts, rails, and accessories in color selected. Color shall be Black.

D. Product Certificates: For each type of chain-link fence and gate.

E. Product Test Reports: For framework strength according to ASTM F 1043, for tests performed by manufacturer and witnessed by a qualified testing agency or a qualified testing agency.

F. Field quality-control reports.

G. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For gate operators to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: For testing fence grounding; member company of NETA or an NRTL.
   1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

B. Mockups: Build mockups to set quality standards for fabrication and installation.
   1. Build mockup for typical chain-link fence and gate, including accessories.
      a. Size: 10-foot length of fence.
   2. Provide chain link fences as complete units provided by a single contractor including necessary erection accessories, fittings, and fastenings.
   3. Installer Qualifications: Engage an experienced Installer who has at least (3) three years of experience and has completed at least five chain link fence projects with same material and of similar scope to that indicated for this project with a successful construction record of in-service performance.
   4. Reference Standard: Fencing shall be installed in accordance with the Standards and Quality specified by the Chain link Fence Manufacturer's Institute.

1.8 FIELD CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

1.9 WARRANTY

A. Special Warranty: Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure to comply with performance requirements.

b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
c. Faulty operation of gate operators and controls.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Chain-link fence and gate frameworks shall withstand the effects of gravity loads and the following design wind loads and stresses for fence height(s) and under exposure conditions indicated according to:

1. Minimum Post Size and Maximum Spacing for Wind Velocity Pressure: Determine based on mesh size and pattern specified, and on the following minimum design wind pressures and according to CLFMI WLG 2445:
   a. Design Wind Load: 100 mph.
   b. Fence Height: As indicated on Drawings.
   c. Line Post Group: IA, ASTM F 1043, Schedule 40 steel pipe.
   d. Wind Exposure Category: C.

2. Determine minimum post size, group, and section according to ASTM F 1043 for framework up to 12 feet high, and post spacing not to exceed 10 feet.

B. Lightning Protection System: Maximum resistance-to-ground value of 25 ohms at each grounding location along fence under normal dry conditions.

2.2 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with ASTM A 392, CLFMI CFL 2445, and requirements indicated below:
   1. Fabric Height: As indicated on Drawings.
   2. Steel Wire for Fabric: See Drawings for gauge of core wire.
      a. Mesh Size:
         1) Pool perimeter and interior fencing: 1-1/4 inches.
         2) All other fencing: 2 inches.
      b. Weight of Metallic (Zinc) Coating: ASTM A 392, Type II, Class 2, 2.0 oz./sq. ft. with zinc coating applied before weaving.
      c. Polymer Coating: ASTM F 668, Class 2b over zinc-coated steel wire.
         1) Fusion-bonded PVC
         2) Color: Black, according to ASTM F 934.
      d. Coat selvage ends of metallic-coated fabric before the weaving process with manufacturer's standard clear protective coating.
   3. Selvage: Knuckled at both selvages.

2.3 FENCE FRAMEWORK

A. Posts and Rails: Comply with ASTM F 1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 or ASTM F 1083 based on the following:

1. Fence Height: As indicated on Drawings.
2. Material Strength: Group IA, round steel pipe, Schedule 40.
   a. Line Post: As indicated on Drawings.
   b. End, Corner, and Pull Posts: As indicated on Drawings.
3. Horizontal Framework Members: Intermediate, top, and bottom rails according to ASTM F 1043.
   a. Top Rail: As indicated on Drawings.
4. Brace Rails: ASTM F 1043.
5. Metallic Coating for Steel Framework:
   a. Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film.
   b. External, Type B: Zinc with organic overcoat, consisting of a minimum of 0.9 oz./sq. ft. of zinc after welding, a chromate conversion coating, and a clear, verifiable polymer film. Internal, Type D, consisting of 81 percent, not less than 0.3-mil-thick, zinc-pigmented coating.
   c. Type C: Zn-5-Al-MM alloy, consisting of not less than 1.8-oz./sq. ft. coating.
   d. Coatings: Any coating above.
6. Polymer coating over metallic coating.

   a. Color: Black, according to ASTM F 934.

2.4 SWING GATES

A. General: ASTM F 900 for single and double swing gate posts.
   1. Gate Leaf Width: As indicated on Drawings.
   2. Framework Member Sizes and Strength: As indicated on Drawings.

B. Pipe and Tubing:
   1. Zinc-Coated Steel: ASTM F 1043 and ASTM F 1083; protective coating and finish to match fence framework.
   2. Gate Posts: Round tubular steel.
   3. Gate Frames and Bracing: Round tubular steel.

C. Frame Corner Construction: Assembled with corner fittings.

D. Hardware:
   1. Hinges:
      a. Single Gates:
         1) Self-Closing hinges.
         2) 180-degree outward swing.
      b. Double Gates:
         1) Standard Hinges.
         2) 180-degree outward swing.
   2. Latch: Fabricate latches with integral eye openings for padlocking; padlock accessible from both sides of the gate.
      a. Single Gates:
         1) Child-proof latch.
         2) Self-latching.
      b. Double Gates:
         1) Manual latch.
         2) Center gate stops and keepers for each leaf.

2.5 FITTINGS

A. Provide fittings according to ASTM F 626.

B. Post Caps: Provide for each post.
   1. Provide line post caps with loop to top rail.

C. Rail and Brace Ends: For each gate, corner, pull, and end post.

D. Rail Fittings: Provide the following:
   1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches long.
   2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails to posts.

E. Tension and Brace Bands: Pressed steel.

F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Steel, hot-dipped galvanized after threading rod and turnbuckle or other means of adjustment.

H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
   1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, according to the following:
      a. Hot-Dip Galvanized Steel: 0.148-inch-diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

I. Finish:
   1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz./sq. ft. of zinc.
      a. Polymer coating over metallic coating.
   2. Aluminum: Mill finish.

2.6 POLYMER FINISHES

A. Supplemental Color Coating: In addition to specified metallic coatings for steel, provide fence components with polymer coating.

B. Metallic-Coated Steel Framing and Fitting: Comply with ASTM F 626 and ASTM F 1043 for polymer coating applied to exterior surfaces and, except inside cap shapes, to exposed interior surfaces.

C. Polymer Coating: Not less than 10-mil-thick PVC finish.

D. Color: Match chain-link fabric, complying with ASTM F 934.

2.7 GROUNDING MATERIALS

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Connectors and Grounding Rods: Listed and labeled for complying with UL 467.
   1. Connectors for Below-Grade Use: Exothermic welded type.
   2. Grounding Rods: Copper-clad steel, 5/8 by 96 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.
   1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 CHAIN-LINK FENCE INSTALLATION

A. Install chain-link fencing according to ASTM F 567 and more stringent requirements specified.
   1. Install fencing as indicated in Drawings.

B. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
   1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
   2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
      a. Exposed Concrete: Extend 2 inches above grade; shape and smooth to shed water.

D. Terminal Posts: Install terminal end, corner, and gate posts according to ASTM F 567 and terminal pull posts at a maximum of 50 feet o.c.

E. Line Posts: Space line posts uniformly at 5 feet o.c.

F. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.
   1. Locate horizontal braces at mid-height of fabric 6 feet or higher, on fences with top rail, and at two-third fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.

G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fence posts. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

H. Intermediate and Bottom Rails: Secure to posts with fittings.

I. Chain-Link Fabric: Apply fabric as indicated in Drawings of enclosing framework. Leave 1-inch bottom clearance between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

J. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts, with tension bands spaced not more than 15 inches o.c.

K. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric according to ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
   1. Maximum Spacing: Tie fabric to line posts at 12 inches o.c. and to braces at 12 inches o.c.

L. Fasteners: Install nuts for tension bands and carriage bolts on the side of fence opposite the fabric side.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation.

3.5 GROUNDING AND BONDING

A. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fence and Gate Grounding:
   1. Ground for fence and fence posts shall be a separate system from ground for gate and gate posts.
   2. Install ground rods and connections at maximum intervals of 500 feet.
   3. Fences within 100 Feet of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 250.
   4. Ground fence on each side of gates and other fence openings.
      a. Bond metal gates to gate posts.
      b. Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches below finished grade.

C. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.
   1. Make grounding connections to each barbed wire strand with wire-to-wire connectors designed for this purpose.
   2. Make grounding connections to each barbed tape coil with connectors designed for this purpose.

D. Connections:
   1. Make connections with clean, bare metal at points of contact.
   2. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
   3. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
   4. Make above-grade ground connections with mechanical fasteners.
   5. Make below-grade ground connections with exothermic welds.
   6. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

E. Bonding to Lightning Protection System: Ground fence and bond fence grounding conductor to lightning protection down conductor or lightning protection grounding conductor according to NFPA 780.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests.

B. Grounding Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.

C. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.

D. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

3.7 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate, and maintain chain-link fences and gates.

END OF SECTION 323113

SECTION 323223 - SEGMENTAL RETAINING WALLS

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. The Segmental Retaining Walls are to be designed and installed by the Contractor. The Contractor will engage a qualified professional engineer to design all segmented walls in this project who will determine the wall depths and soil reinforcement required.

B. Related Sections include the following:

1. Division 03 Section "Cast-in-Place Concrete" for retaining wall footings.
2. Division 04 Section "Unit Masonry" for decorative concrete masonry units with faces required to match segmental retaining wall units.
3. Division 31 Section "Earth Moving" for excavation for segmental retaining walls.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide segmental retaining walls capable of withstanding the effects of gravity loads due to soil pressures resulting from grades indicated and determined according to NCMA's "Design Manual for Segmental Retaining Walls" and applicable local codes.

1. Include the effects of sloped backfill as indicated on Drawings.
2. Include the effects of superimposed loads (surcharge) as indicated on Drawings.

B. Seismic Performance: Provide segmental retaining walls capable of withstanding the effects of earthquake motions determined according to NCMA's "Segmental Retaining Walls--Seismic Design Manual".

C. Drainage: Provide segmental retaining wall drainage system capable of preventing accumulation of groundwater in retained soils and in retaining wall foundation soils.

1.4 SUBMITTALS

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

1. For installed systems indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

B. Samples for Initial Selection: For concrete units.

C. Samples for Verification: For each color and texture of concrete unit required. Submit full-size units.

1. Include one full-size unit for each type of concrete unit required.

D. Qualification Data: For Installer, professional engineer, and testing agency.

E. Preconstruction Test Reports: For segmental retaining wall system.

F. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency or by manufacturer and witnessed by a qualified testing agency, for segmental retaining wall units and soil reinforcement.

1. Include test data for freeze-thaw durability of segmental retaining wall units.

G. Product Certificates: For segmental retaining wall units and soil reinforcement, signed by product manufacturer.

1. Include test data for shear strength between segmental retaining wall units according to NCMA SRWU-2.
2. Include test data for connection strength between segmental retaining wall units and soil reinforcement according to NCMA SRWU-1.

H. Research/Evaluation Reports: For segmental retaining wall units and soil reinforcement.

1.5 QUALITY ASSURANCE

A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform the following preconstruction testing:

1. Testing Agency Qualifications: An independent agency qualified according to ASTM E 329 for testing indicated, as documented according to ASTM E 548.
2. Test soil reinforcement and backfill materials for pullout behavior according to GRI GG5 or GRI GT6.
3. Test soil reinforcement and backfill materials for coefficient of friction according to ASTM D 5321.

B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects.

1. Build mockups of typical segmental retaining wall as shown on Drawings.
2. Build mockups for each type of segmental retaining wall in sizes approximately 72 inches (1800 mm) long by 36 inches (900 mm) high above finished grade at front of wall.

a. Include typical base and cap or finished top construction.
b. Include backfill to typical finished grades at both sides of wall.
c. Include typical end construction at one end of mockup.
d. Include 36-inch (900-mm) return at 1 end of mockup, with typical corner construction.

3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store and handle concrete units and accessories to prevent deterioration or damage due to moisture, temperature changes, contaminants, breaking, chipping, or other causes.

B. Store geosynthetics in manufacturer's original packaging with labels intact. Store on elevated platforms, protected from moisture, sunlight, chemicals, flames, temperatures above 160 deg F (71 deg C) or below 32 deg F (0 deg C), and other conditions that might damage them. Verify identification of geosynthetics before using and examine them for defects as material is placed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Segmental Retaining Wall Units:

a. Licensees of Allan Block Corporation.
b. Licensees of Anchor Wall Systems, Inc.
c. Licensees of Geo Western, Inc.
d. Licensees of ICD Corporation.
e. Licensees of Keystone Retaining Wall Systems, Inc.
f. Licensees of Reinforced Earth Company (The).
g. Licensees of Risi Stone Systems; a division of Rothbury International Inc.
h. Licensees of Rockwood Retaining Wall Systems.
i. Licensees of Tensar Earth Technologies, Inc.
j. Licensees of Versa-Lok Retaining Wall Systems; a division of Kiltie Corp.

2. Soil Reinforcement:

a. Civil Engineering Fabrics; a division of BP Amoco Chemicals.
b. Colbond Geosynthetics.
c. HUESKER, Inc.
d. Luckenhaus, Inc.
e. Strata Systems, Inc.
f. TC Mirafi.
g. TENAX Corporation.
h. Tensar Earth Technologies, Inc.
i. Versa-Lok Retaining Wall Systems; a division of Kiltie Corp.

2.2 SEGMENTAL RETAINING WALL UNITS

A. Concrete Units: ASTM C 1372, Normal Weight, except that units shall not differ in height more than plus or minus 1/16 inch (1.6 mm) from specified dimension.

1. Provide units that comply with requirements for freeze-thaw durability.
2. Provide units that interlock with courses above and below by means of integral lugs or lips, pins, clips, or hollow cores filled with drainage fill.
3. Minimum Peak Shear Strength Between Units: As determined by qualified professional engineer responsible for the wall design and when tested according to NCMA SRWU-2.
4. Minimum Peak Connection Strength Between Units and Soil Reinforcement: As determined by qualified professional engineer responsible for the wall design and when tested according to NCMA SRWU-1.

B. Colors: As selected by Architect from manufacturer's full range.

C. Shapes: Provide units of basic shape and dimensions indicated with machine-split textured exposed faces.

D. Shapes: Provide units matching basic shape, dimensions, and face texture indicated by referencing manufacturer's pattern designation.

E. Shapes: Provide units of any basic shape and dimensions that will produce segmental retaining walls of dimensions and profiles indicated without interfering with other elements of the Work and as follows:

1. Exposed Face: Machine-split textured.
2. Batter: Provide units that offset from course below to provide at least 1:16 batter.

F. Cap Units: Provide rectangular cap units with smooth, as-cast top surfaces without holes or lugs.

G. Special Units: Provide corner units, end units, and other shapes as needed to produce segmental retaining walls of dimensions and profiles indicated and to provide texture on exposed surfaces matching face.

2.3 INSTALLATION MATERIALS

A. Pins: Product supplied by segmental retaining wall unit manufacturer for use with units provided, made from nondegrading polymer reinforced with glass fibers.

B. Clips: Product supplied by segmental retaining wall unit manufacturer for use with units provided, made from nondegrading polymer reinforced with glass fibers.

C. Cap Adhesive: Product supplied or recommended by segmental retaining wall unit manufacturer for adhering cap units to units below.

D. Leveling Base: Comply with requirements in Division 31 Section "Earth Moving" for base material.

E. Drainage Fill: As determined by qualified professional engineer responsible for the wall design.

F. Reinforced Soil Fill: As determined by qualified professional engineer responsible for the wall design and comply with requirements in Division 31 Section "Earth Moving" for satisfactory soils.

G. Reinforced Soil Fill: ASTM D 2487; GW, GP, SW, SP, and SM soil classification groups or a combination of these groups; free of debris, waste, frozen materials, vegetation, and other deleterious matter; meeting the following gradation according to ASTM C 136: 20 to 100 percent passing No. 4 sieve, 0 to 60 percent passing No. 40 sieve, 0 to 35 percent passing No. 200 sieve; and with fine fraction having a plasticity index of less than 20.

H. Nonreinforced Soil Fill: Comply with requirements in Division 31 Section "Earth Moving" for satisfactory soils.

I. Filter Fabric: As determined by a qualified professional engineer responsible for the wall design.

J. Drainage Pipe: As determined by a qualified professional engineer responsible for the wall design.

K. Soil Reinforcement: Product specifically manufactured for use as soil reinforcement and as follows:

1. As determined by a qualified professional engineer responsible for the wall design.

2.4 SOURCE QUALITY CONTROL

A. Direct manufacturer to test and inspect each roll of soil reinforcement at factory for minimum average roll values for geosynthetic index property tests including the following:

1. Weight.
2. Roll size.
3. Grab or single-rib strength.
4. Aperture opening.
5. Rib or yarn size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for excavation tolerances, condition of subgrades, and other conditions affecting performance of segmental retaining walls.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 RETAINING WALL INSTALLATION

A. General: Place units according to NCMA's "Segmental Retaining Wall Installation Guide" and segmental retaining wall unit manufacturer's written instructions. Lay units in running bond.

1. Form corners and ends by **using special units, cutting units with motor-driven saw, or splitting units with mason's hammer and chisel**.

B. Leveling Base: Place and compact base material to thickness as determined by a qualified professional engineer responsible for the wall design.

C. Leveling Course: Place unreinforced lean concrete over base course to thickness as determined by a qualified professional engineer responsible for the wall design; compact and screed to a smooth, level surface.

D. First Course: Place first course of segmental retaining wall units on leveling base/course for full length of wall. Place units in firm contact with each other, properly aligned and level.

1. Tamp units into leveling base as necessary to bring tops of units into a level plane.
2. Place and compact fill, either drainage or soil fill as indicated, to top of first course. Place fill on both sides of wall at same time without disturbing alignment of units. Fill voids between and within units with drainage fill.

E. Subsequent Courses: Remove excess fill and debris from tops of units in course below. Place units in firm contact, properly aligned, and directly on course below.

1. For units with lugs designed to fit into holes in adjacent units, lay units so lugs are accurately aligned with holes, and bedding surfaces are firmly seated on beds of units below.
2. For units with lips at front of units, slide units as far forward as possible for firm contact with lips of units below.
3. For units with pins, install pins and align units according to manufacturer's written instructions.
4. For units with clips, install clips and align units according to manufacturer's written instructions.
5. Place fill on both sides of wall at same time, where both sides are indicated to be filled.
6. Fill voids between and within units with drainage fill.

F. Cap Units: Place cap units and secure with cap adhesive according to manufacturer's written instructions.

3.3 FILL PLACEMENT

A. General: Comply with requirements in Division 31 Section "Earth Moving," NCMA's "Segmental Retaining Wall Installation Guide," and segmental retaining wall unit manufacturer's written instructions.

B. Place, spread, and compact fill in uniform lifts for full width and length of embankment as wall is laid. Begin at back of wall and place and spread fill toward embankment.

1. Use only hand-operated compaction equipment within 48 inches (1200 mm) of wall, or one-half of height above bottom of wall, whichever is greater.
2. Compact drainage fill as determined by a qualified professional engineer responsible for the wall design.
3. Compact reinforced soil fill as determined by a qualified professional engineer responsible for the wall design.

    a. In areas where only hand-operated compaction equipment is allowed, compact as determined by a qualified professional engineer responsible for the wall design.

4. Compact nonreinforced soil fill to comply with Division 31 Section "Earth Moving."

C. Place filter fabric against back of wall and place layer of drainage fill at least 12 inches (300 mm) deep behind filter fabric to within 12 inches (300 mm) of finished grade. Place another layer of filter fabric between drainage fill and soil fill.

D. Place a layer of drainage fill at least 12 inches (300 mm) deep behind wall to within 12 inches (300 mm) of finished grade. Place a layer of filter fabric between drainage fill and soil fill.

1. Wrap drainage pipe with filter fabric and place in drainage fill as determined by a qualified professional engineer responsible for the wall design, sloped to drain.
2. Place impervious fill over top edge of drainage fill layer.

E. Place soil reinforcement in horizontal joints of retaining wall as determined by a qualified professional engineer responsible for the wall design and according to soil reinforcement manufacturer's written instructions. Embed reinforcement a minimum of 8 inches (200 mm) into retaining wall and stretch tight over compacted backfill. Anchor soil reinforcement before placing fill on it.

1. Place additional soil reinforcement at corners and curved walls to provide continuous reinforcement and to comply with manufacturer's written instructions.
2. Place geosynthetics with seams, if any, oriented perpendicular to segmental retaining walls.
3. Do not dump fill material directly from trucks onto geosynthetics.
4. Place at least 6 inches (150 mm) of fill over reinforcement before compacting with tracked vehicles or 4 inches (100 mm) before compacting with rubber-tired vehicles.
5. Do not turn vehicles on fill until first layer of fill is compacted and second layer is placed over each soil-reinforcement layer.

3.4 CONSTRUCTION TOLERANCES

A. Variation from Level: For bed-joint lines along walls, do not exceed 1-1/4 inches in 10 feet (32 mm in 3 m), 3 inches (75 mm) maximum.

B. Variation from Indicated Batter: For slope of wall face, do not vary from indicated slope by more than 1-1/4 inches in 10 feet (32 mm in 3 m).

C. Variation from Indicated Wall Line: For walls indicated as straight, do not vary from straight line by more than 1-1/4 inches in 10 feet (32 mm in 3 m).

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Comply with requirements in Division 31 Section "Earth Moving" for in-place compaction testing.

1. In each compacted backfill layer, perform at least 1 field in-place compaction test for each 150 feet (50 m) or less of segmental retaining wall length.

3.6 ADJUSTING AND CLEANING

A. Remove and replace segmental retaining wall construction of the following description:

1. Broken, chipped, stained, or otherwise damaged units. Units may be repaired if methods and results are approved by Architect.
2. Segmental retaining walls that do not match approved Samples **and mockups**.
3. Segmental retaining walls that do not comply with other requirements indicated.

B. Replace units so segmental retaining wall matches approved Samples and mockups, complies with other requirements, and shows no evidence of replacement.

END OF SECTION 323223

SECTION 328400 – LANDSCAPE IRRIGATION

PART 1- GENERAL

1.1 SYSTEM DESCRIPTION

A. The sprinkler system shall include sprinklers, valves, piping fittings, controller, wiring, all of sizes and types as shown on the drawings and specified. The system shall be constructed to grades and conform to areas and locations as shown on the drawings.

B. Sprinkler lines shown on the drawings are essentially diagrammatic. Spacing of the sprinkler heads or quick coupling valves are shown on the drawings and shall be exceeded only with written permission of the Designer.

C. Unless otherwise specified or indicated on the drawings, the construction of the sprinkler system shall include the furnishing, installing, and testing of all mains, laterals, risers and fittings, sprinkler heads, gate valves, control valves, controllers, electric wire, controls, backflow preventers, enclosures, and other necessary specialties and the removal and/or restoration of existing improvements, excavating and backfill, and all other work in accordance with the plans and specifications a required for a complete system.

1.2 QUALITY ASSURANCE

A. Installer Qualifications: Irrigation Contractor shall have successfully completed five (5) projects similar in material, size, scope and complexity to that indicated for this Project that have resulted in construction with a record of successful in-service performance. This requirement includes Pump installation Contractor.

1. Firm Experience Period: Five (5) years of experience

2. Field Foreman Experience: Five (5) years of experience with installing firm.

B. Conference: Before any work is started a conference shall be held between the Contractor and the Owner concerning the work under this contract.

B. The Contractor shall maintain continuously a competent superintendent, satisfactory to the Owner, on the work during progress with authority to act or him in all matter pertaining to the work.

C. It is the Irrigation Contractor’s responsibility to coordinate and cooperate with the other Contractors to enable work to proceed rapidly and efficiently.

D. The Contractor shall confine his operations to the area to be improved and to the areas allotted him by the Designer and General Contractor for material and equipment.

E. Contractor shall take all necessary to protect the existing site conditions and vegetation.

1.3 SUBMITTALS

A. General: Submit in accordance with Shop Drawings, Product Data, and Samples.

B. Shop Drawings and Equipment Product Information:

1. Prior to purchasing materials, submit product information on all sprinkler heads, automatic valves, quick coupling valves, controller, and pipe to be used on the project.

2. Contractor shall review drawings and data to supply actual precipitation rates and times for each zone in maintenance package.

3. Prior to trenching, Contractor shall submit proposed trenching equipment to Designer for approval.

C. Record Drawings and Instructions

1. Upon completion of installation, Contractor shall produce as-built drawings in Autocad 2017 format and furnish one set of reproducible and one set of printed record drawings showing all sprinkler heads, valves, drains, and pipelines to scale with dimensions. These drawings shall have dimensions from easily located stationary points (cross measured) as they relate to all valves, mainlines, and wire. Clearly note all approved substitutions of size, material, etc. Complete, concise instruction sheets and parts lists covering all operating equipment and weathering techniques shall be bound into folders and furnished to the Owner in three (3) copies. Submission of this information is a requirement for final acceptance.

1.4 SITE CONDITIONS

A. The Contractor shall examine the site, plans and specifications (i.e. system requirements).

B. It shall be the Contractor's responsibility to report in writing to the Designer any deviations between drawings, specification, and actual site conditions. Failure to do so prior to the installing of equipment shall be done at the Contractor's expense.

C. Adjustment of the sprinkler heads and automatic equipment will be done by the Contractor, upon completion of installation, to provide optimum performance.

D. After completion, testing, and acceptance of the system, the Contractor shall verbally instruct the Owner's personnel in the operation and maintenance of the system. All written instruction shall be included in the bound maintenance package as stated in Paragraph 1.3 - Submittals.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Pipe sizes shall conform to those shown on the drawings. No substitutions of smaller pipe sizes will be permitted, but substitutions of larger size may be approved. All pipe damaged or rejected because of defects shall be removed from the site at the time of said rejection.

B. All piping downstream of electric valves, sizes (3) inches and smaller, shall be rigid unplasticized PVC 200 PSI working pressure extruded from virgin parent material of the type specified on the drawings. The pipe shall be homogeneous throughout and free from visible cracks, holes, foreign materials, blisters, wrinkles and permanently marked with the manufacture's name, material, size, and schedule type. Pipe must bear the NFS seal.

C. All mainline piping and underground piping under continuous pressure shall be rigid unplasticized PVC-Class 200 PSI working pressure extruded from virgin parent material of the type specified on the drawings. The pipe shall be homogeneous throughout and free from visible cracks, holes, and foreign materials, blisters, wrinkles and dents.

D. All plastic fittings to be installed shall be molded fittings manufactured of the same material as the pipe and shall be suitable for solvent weld, slip joint ring tight seal, or screwed connections NO fitting made of other material shall be used except as hereinafter specified.

E. Slip fitting socket tapers shall be so sized that a dry unsoftened pipe end conforming to these special provisions can be inserted no more than halfway into the socket. Plastic saddle and flange fittings will not be permitted. Only Schedule 80 pipe may be threaded.

2.2 SLEEVES

A. All sleeves shall be Class 200 PVC or stronger. All sleeves are required at every crossing indicated on drawings. (Size Noted)

B. All sleeves shall be installed under proposed pavement areas prior to subgrade and base construction.

C. Sleeves shall have a minimum horizontal separation of 18" and a maximum of twenty-four (24) inch clearance below bottom of curb.

D. All sleeves shall have a minimum horizontal separation of twenty-four (24) and maximum of thirty-six inches from center to center.

E. Stub up sleeve pipe twelve (12) inches above ground surface and cap. Paint cap with fluorescent orange paint for easy identification.

F. The location of all sleeves shown on the plans is schematic. The contractor shall make any adjustments necessary to accommodate existing vegetation, utilities, or other existing conditions.

G. If the road crossings are designated as being bore locations the bore must be ample size to accommodate the size sleeve specified.

2.3 CONTROL SYSTEM

A. The Controller shall be two-wire, decoder based system (as stated on plans).

B. The automatic controllers shall be as shown on the plans and shall be made by the same manufacturer as valves.

C. Install Rain Check or Mini-Click type shut off device to override the control timer in the event of rain.

2.4 CONTROL WIRE

A. Two-wire Control wire shall be type UF, UL approved, for direct burial and shall be # #12-2 or 14-2/MAXI, solid copper, double jacked, insulated. Wire to be sized as per manufacturer's specifications related to wire run, valve/decoder loads, etc.

B. Joining of underground wires shall be made with watertight connectors in valve boxes. No splicing between boxes is acceptable. Utilize 3M DBR/Y-6 Connections unless directed otherwise.

C. All wire connections in valve boxes; first example shall stay open until the Designer approves.

D. Install LSP-1 Surge Protection Device every 300 feet or every 6 decoders, whichever is less, with Ground Rod, on two-wire path and at end of wire run that terminates in field (star configuration).

2.5 IRRIGATION VALVES

A. Zone Control Valves

1. Globe-type diaphragm valves of normally closed design, with bronze bodies or heavy-duty plastic and covers (type noted on drawings). Operation accomplished by means of an integrally mounted heavy-duty 24 volt AC solenoid complying with National Electrical Code, Class II Circuit, solenoid coil potted in epoxy resign within a plastic-coated stainless steel housing. Solenoids shall be completely waterproof, suitable for direct underground burial. Provide a flow stem adjustment in each valve.

2. To be installed with Single Station Decoder (as specified on plans).

2.6 VALVE BOXES

A. All valves shall be installed in thermoplastic valve access boxes of the size required to permit access to the valve. Valve boxes shall include black thermoplastic locking covers. Manufacturer - Carson or approved equal.

B. All valve boxes shall be installed on at least a two (2) cubic foot gravel base to provide foundation and drainage.

C. All valve box elevations shall be ½" below finished grade.

2.7 THRUST BLOCKS

A Place one cubic ft. of concrete for each inch of pipe diameter for thrust block. Thrust shall not allow vertical or horizontal movement of pipe in any direction unless otherwise noted on design. Thrust blocking shall be provided on all piping three (3) inch diameter and larger.

2.8 DRIP IRRIGATION

A. Drip irrigation equipment shall be as specified on plans (emitter types, emitter flow rates, etc).

PART 3 - EXECUTION

3.1 EXCAVATION AND BACKFILL

A. Trenches for pipe sprinkler lines shall be excavated of sufficient depth and width to permit proper handling and installation by any other method the Contractor may desire if approved by the Owner, pipe manufacturer, and Designer. The backfill shall be thoroughly compacted and evened off with the adjacent soil level. Selected fill dirt or sand shall be used if soil conditions are rocky. In rocky areas the trenching depth shall be two (2) inches below normal trenching depth to allow for this bedding. The fill dirt or sand shall be used in filling (4) inches above the pipe. The remainder of the backfill shall contain no lumps or rocks larger than three (3) inches. The top twelve (12) inches of backfill shall be topsoil, free of rocks, subsoil, or trash. Any open trenches or partially backfilled trenches left overnight or left unsupervised shall be barricaded to prevent undue hazard to the public.

B. The Contractor shall backfill in six (6) inch compacted lifts as needed to bring the soil to its original density.

C. In the spring following the year of installation, the Contractor shall repair any settlement of the trenches by bringing them to grade with topsoil, and seeding with the existing lawn type(s). Watering and maintenance of the repaired areas shall be the Owner's responsibility.

3.2 INSTALLATION OF PLASTIC PIPE

A. Plastic pipe shall be installed in a manner that permits expansion and contraction as recommended by the manufacturer.

B. Plastic pipe shall be cut with a handsaw or hacksaw with the assistance of a square in sawing vice or in a manner so as to ensure a square cut. Burrs at cut ends shall be removed prior to installation so that a smooth unobstructed flow will be obtained.

C. All plastic-to-plastic joints shall be solvent weld joints or slip seal joints. Only the solvent recommended for the pipe and fittings shall be installed as outlined and instructed by the pipe manufacturer. The Contractor shall assume full responsibility for the correct installation.

D. The joints shall be allowed to set at least twenty-four (24) hours before pressure is applied to the system on PVC pipe.

3.3 CONTROLLER AND ELECTRICAL CONNECTIONS

A. All electrical connections shall conform to the National Electrical Code, latest edition.

B. Control wires installed beneath walks, drives, or other permanent surfaces shall be placed in sleeves.

C. Wires shall be spliced only at valve boxes.

D. Leave twenty-four (24) inch loop of wire at each valve for expansion/contraction and servicing.

E. Controllers and valves shall be from the same company e.g. (Rain Bird, Toro or approved equal).

F. 120 VAC electrical power supply to the controller location shall be supplied by others.

3.4 FLUSHING AND TESTING

A. After all new sprinkler piping and risers are in place and connected for a given section and all necessary division work has been completed and prior to the installation of sprinkler heads all control valves shall be opened and a full head of water used to flush out the system.

B. Sprinkler main shall be pressure tested as follows:
1. Two (2) hour pressure test at 1.5 times the system operating pressure
2. Twenty four (24) hour pressure test at the system operating pressure
If leaks occur, repair and repeat the test until no leaks occur (pressure does not drop). Give Designer twenty-four hours notice prior to testing.

C. Testing of the system shall be performed after completion of the entire installation and any necessary repairs shall be made at the Contractor's expense to put the system in good working order before final payment by the Owner.

D. Adjustment of the sprinkler heads, and automatic equipment, will be done by the Contractor upon completion of installation to provide optimum performance. Minor adjustments during the guarantee period will be made by the Owner.

E. After completion, testing, and acceptance of the system, the Contractor will instruct the Owner's personnel in the operation and maintenance of the system.

3.5 CLEAN UP AND PROTECTION

A. During irrigation work, Contractor shall keep project site clean and orderly

B. Upon Completion of Work, clear grounds of debris, superfluous materials and all equipment. Remove from site to satisfaction of the Owner's Representative.

3.6 WINTERIZING THE SYSTEM

A. Contractor's responsibility to winterize the irrigation system the first winter following Substantial Completion of the Project.

3.7 INSPECTION

A. Periodic Inspections will be made by the Landscape Architect/Owner's Representative to review the quality and progress of the work. Work found to be unacceptable must be corrected within a timely mater (to be determined by Owner's Representative). Remove rejected materials promptly from the project site.

B. It will be the responsibility of the Irrigation Contractor to provide a reliable communication system (i.e. Two way radios or remote radio control activation system) for Substantial Completion and all periodic inspections.

PART 4 – CODES, PERMITS, WARRANTY, AND GUARANTEE

4.1 CODES AND ORDINANCES

A. All materials, installation parameters, and operations shall conform to all applicable codes and ordinances. It is the Contractor's responsibility to investigate and follow all regulations. Contractor is responsible to verify applicable codes and ordinances prior to submitting bid. Before bid submittal, it is the Contractor's responsibility to notify the Irrigation Consultant/Designer at least 5 days before bid submittal, of any changes due to code or ordinance discrepancies. If the Contractor does not comply with this process and notification, the Contractor shall be responsible for the necessary installation change and redesign costs for non-compliance.

4.2 PERMITS AND FEES

A. The Contractor shall obtain, at his expense, all required permits and shall pay all required fees. Any penalties imposed due to failure to obtain any permit or pay any fee shall be the responsibility of the Contractor.

4.3 WARRANTY AND GUARANTEE

A. The Contractor shall furnish a certificate of warranty registration and a written guarantee of work and materials for a one year period from the date of final acceptance of the Irrigation System by the Owner and the Designer.

END OF SECTION 328400

SECTION 32 9113 - SOIL PREPARATION

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 planting soils and layered soil assemblies specified by composition of the mixes.

B. Related Requirements:

1. Section 311000 "Site Clearing" for topsoil stripping and stockpiling.
2. Section 329200 "Turf and Grasses" for placing planting soil for turf and grasses.

1.3 DEFINITIONS

A. AAPFCO: Association of American Plant Food Control Officials.

B. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.

C. CEC: Cation exchange capacity.

D. Compost: The product resulting from the controlled biological decomposition of organic material that has been sanitized through the generation of heat and stabilized to the point that it is beneficial to plant growth.

E. Duff Layer: A surface layer of soil, typical of forested areas, that is composed of mostly decayed leaves, twigs, and detritus.

F. Imported Soil: Soil that is transported to Project site for use.

G. Layered Soil Assembly: A designed series of planting soils, layered on each other, that together produce an environment for plant growth.

H. Manufactured Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.

I. NAPT: North American Proficiency Testing Program. An SSSA program to assist soil-, plant-, and water-testing laboratories through interlaboratory sample exchanges and statistical evaluation of analytical data.

J. Organic Matter: The total of organic materials in soil exclusive of undecayed plant and animal tissues, their partial decomposition products, and the soil biomass; also called "humus" or "soil organic matter."

K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified as specified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.

L. RCRA Metals: Hazardous metals identified by the EPA under the Resource Conservation and Recovery Act.

M. SSSA: Soil Science Society of America.

N. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

O. 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.

P. 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.

Q. USCC: U.S. Composting Council.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include recommendations for application and use.
2. Include test data substantiating that products comply with requirements.
3. Include sieve analyses for aggregate materials.
4. Material Certificates: For each type of structural fill and topsoil before delivery to the site, according to the following:

    a. Manufacturer's qualified testing agency's certified analysis of standard products.
    b. Analysis of fertilizers, by a qualified testing agency, made according to AAPFCO methods for testing and labeling and according to AAPFCO's SUIP #25.
    c. Analysis of nonstandard materials, by a qualified testing agency, made according to SSSA methods, where applicable.

B. Samples: For each bulk-supplied material, 1-gal. volume of each in sealed containers labeled with content, source, and date obtained. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of composition, color, and texture.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For each testing agency.

B. Preconstruction Test Reports: For preconstruction soil analyses specified in "Preconstruction Testing" Article.

C. Field quality-control reports.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent, state-operated, or university-operated laboratory; experienced in soil science, soil testing, and plant nutrition; with the experience and capability to conduct the testing indicated; and that specializes in types of tests to be performed.

1. Laboratories: Subject to compliance with requirements,

a. registered geotechnical Design Professional.

2. Multiple Laboratories: At Construction Manager's option, work may be divided among qualified testing laboratories specializing in physical testing, chemical testing, and fertility testing.

1.8 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Construction Manager will engage a qualified testing agency to perform preconstruction soil analyses on existing, on-site soil.

1. Notify Design Professional seven days in advance of the dates and times when laboratory samples will be taken.

B. Preconstruction Soil Analyses: For each unamended soil type, perform testing on soil samples and furnish soil analysis and a written report containing soil-amendment and fertilizer recommendations by a qualified testing agency performing the testing according to "Soil-Sampling Requirements" and "Testing Requirements" articles.

1. Have testing agency identify and label samples and test reports according to sample collection and labeling requirements.

1.9 SOIL-SAMPLING REQUIREMENTS

A. General: Extract soil samples according to requirements in this article.

B. Sample Collection and Labeling: Have samples taken and labeled by registered geotechnical Design Professional.

1. Number and Location of Samples: Minimum of three representative soil samples where indicated on Drawings each soil to be used or amended for landscaping purposes.

2. Procedures and Depth of Samples: According to USDA-NRCS's "Field Book for Describing and Sampling Soils."
3. Division of Samples: Split each sample into two, equal parts. Send half to the testing agency and half to Owner for its records.
4. Labeling: Label each sample with the date, location keyed to a site plan or other location system, visible soil condition, and sampling depth.

1.10 TESTING REQUIREMENTS

A. General: Perform tests on soil samples according to requirements in this article.

B. Physical Testing:

1. Soil Texture: Soil-particle, size-distribution analysis by one of the following methods according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods":

    a. Sieving Method: Report sand-gradation percentages for very coarse, coarse, medium, fine, and very fine sand; and fragment-gradation (gravel) percentages for fine, medium, and coarse fragments; according to USDA sand and fragment sizes.
    b. Hydrometer Method: Report percentages of sand, silt, and clay.

2. Total Porosity: Calculate using particle density and bulk density according to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
3. Water Retention: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods."
4. Saturated Hydraulic Conductivity: According to SSSA's "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods"; at 85% compaction according to ASTM D 698 (Standard Proctor).

C. Chemical Testing:

1. CEC: Analysis by sodium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."
2. Clay Mineralogy: Analysis and estimated percentage of expandable clay minerals using CEC by ammonium saturation at pH 7 according to SSSA's "Methods of Soil Analysis - Part 1- Physical and Mineralogical Methods."
3. Metals Hazardous to Human Health: Test for presence and quantities of RCRA metals including aluminum, arsenic, barium, copper, cadmium, chromium, cobalt, lead, lithium, and vanadium. If RCRA metals are present, include recommendations for corrective action.
4. Phytotoxicity: Test for plant-available concentrations of phytotoxic minerals including aluminum, arsenic, barium, cadmium, chlorides, chromium, cobalt, copper, lead, lithium, mercury, nickel, selenium, silver, sodium, strontium, tin, titanium, vanadium, and zinc.

D. Fertility Testing: Soil-fertility analysis according to standard laboratory protocol of SSSA NAPT NCR-13 including the following:

1. Percentage of organic matter.
2. CEC, calcium percent of CEC, and magnesium percent of CEC.

3. Soil reaction (acidity/alkalinity pH value).
4. Buffered acidity or alkalinity.
5. Nitrogen ppm.
6. Phosphorous ppm.
7. Potassium ppm.
8. Manganese ppm.
9. Manganese-availability ppm.
10. Zinc ppm.
11. Zinc availability ppm.
12. Copper ppm.
13. Sodium ppm
14. Soluble-salts ppm.
15. Presence and quantities of problem materials including salts and metals cited in the Standard protocol. If such problem materials are present, provide additional recommendations for corrective action.
16. Other deleterious materials, including their characteristics and content of each.

E. Organic-Matter Content: Analysis using loss-by-ignition method according to SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods."

F. Recommendations: Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated to produce satisfactory planting soil suitable for healthy, viable plants indicated. Include, at a minimum, recommendations for nitrogen, phosphorous, and potassium fertilization, and for micronutrients.

1. Fertilizers and Soil Amendment Rates: State recommendations in weight per 1000 sq. ft. for 6-inch depth of soil.
2. Soil Reaction: State the recommended liming rates for raising pH or sulfur for lowering pH according to the buffered acidity or buffered alkalinity in weight per 1000 sq. ft. for 6-inch depth of soil.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and compliance with state and Federal laws if applicable.

B. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Do not move or handle materials when they are wet or frozen.
4. Accompany each delivery of bulk fertilizers and soil amendments with appropriate certificates.

PART 2 - PRODUCTS

2.1 MATERIALS

2.2 PLANTING SOILS SPECIFIED BY COMPOSITION

A. General: Soil amendments, fertilizers, and rates of application specified in this article are guidelines that may need revision based on testing laboratory's recommendations after preconstruction soil analyses are performed.

B. Planting-Soil Type: Imported, naturally formed soil from off-site sources and consisting of sandy loam, loam, silt loam, or loamy sand] soil according to USDA textures; and modified to produce viable planting soil.

1. Sources: Take imported, unamended soil from sources that are naturally well-drained sites where topsoil occurs at least 4 inches deep, not from agricultural land**,** bogs, or marshes; and that do not contain undesirable organisms; disease-causing plant pathogens; or obnoxious weeds and invasive plants including, but not limited to, quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass.
2. Additional Properties of Imported Soil before Amending: Soil reaction of pH 6 to 7 and minimum of 4 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration.
3. Unacceptable Properties: Clean soil of the following:

    a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.
    b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of 8 percent by dry weight of the imported soil.
    c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 3 inches in any dimension.

C. Planting-Soil Type: Manufactured soil consisting of manufacturer's basic topsoil blended in a manufacturing facility with sand, stabilized organic soil amendments, and other materials to produce viable planting soil.

1. Additional Properties of Manufacturer's Basic Soil before Amending: Soil reaction of pH 6 to 7 and minimum of 4 percent organic-matter content, friable, and with sufficient structure to give good tilth and aeration.
2. Unacceptable Properties: Manufactured soil shall not contain the following:

    a. Unacceptable Materials: Concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

b. Unsuitable Materials: Stones, roots, plants, sod, clay lumps, and pockets of coarse sand that exceed a combined maximum of **5** percent by dry weight of the manufactured soil.
c. Large Materials: Stones, clods, roots, clay lumps, and pockets of coarse sand exceeding 2 inches in any dimension.

2.3 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:

1. Class: T, with a minimum of 99 percent passing through a No. 8 sieve and a minimum of 75 percent passing through a No. 60 sieve.
2. Class: O, with a minimum of 95 percent passing through a No. 8 sieve and a minimum of 55 percent passing through a No. 60 sieve.
3. Form: Provide lime in form of ground dolomitic limestone or calcitic limestone.

B. Sulfur: Granular, biodegradable, and containing a minimum of 90 percent elemental sulfur, with a minimum of 99 percent passing through a No. 6 sieve and a maximum of 10 percent passing through a No. 40 sieve.

C. Iron Sulfate: Granulated ferrous sulfate containing a minimum of 20 percent iron and 10 percent sulfur.

D. Perlite: Horticultural perlite, soil amendment grade.

E. Agricultural Gypsum: Minimum 90 percent calcium sulfate, finely ground with 90 percent passing through a No. 50 sieve.

F. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C 33/C 33M

2.4 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter produced by composting feedstock, and bearing USCC's "Seal of Testing Assurance," and as follows:

1. Feedstock: Limited to leaves
2. Reaction: pH of 5.5 to 8
3. Soluble-Salt Concentration: Less than 4 dS/m.
4. Moisture Content: 35 to 55 percent by weight.
5. Organic-Matter Content: 30 to 40 percent of dry weight.
6. Particle Size: Minimum of 98 percent passing through a 2-inch sieve.

B. Sphagnum Peat: Partially decomposed sphagnum peat moss, finely divided or of granular texture with 100 percent passing through a 1/2-inch sieve, a pH of 3.4 to 4.8, and a soluble-salt content measured by electrical conductivity of maximum 5 dS/m.

C. Muck Peat: Partially decomposed moss peat, native peat, or reed-sedge peat, finely divided or of granular texture with 100 percent passing through a 1/2-inch sieve, a pH of 6 to 7.5, a soluble-salt content measured by electrical conductivity of maximum 5 dS/m, having a water-absorbing capacity of 1100 to 2000 percent, and containing no sand.

D. Wood Derivatives: Shredded and composted, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture and free of chips, stones, sticks, soil, or toxic materials.

1. Partially Decomposed Wood Derivatives: In lieu of shredded and composted wood derivatives, mix shredded and partially decomposed wood derivatives with ammonium nitrate at a minimum rate of 0.15 lb/cu. ft. of loose sawdust or ground bark, or with ammonium sulfate at a minimum rate of 0.25 lb/cu. ft. of loose sawdust or ground bark.

E. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, debris, and material harmful to plant growth.

2.5 FERTILIZERS

A. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.

B. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

C. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified testing agency.

D. Chelated Iron: Commercial-grade FeEDDHA for dicots and woody plants, and commercial-grade FeDTPA for ornamental grasses and monocots.

PART 3 - EXECUTION

3.1 GENERAL

A. Place planting soil and fertilizers according to requirements in other Specification Sections.

B. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in planting soil.

C. Proceed with placement only after unsatisfactory conditions have been corrected.

3.2 PREPARATION OF UNAMENDED, ON-SITE SOIL BEFORE AMENDING

A. Excavation: Excavate soil from designated area(s) to a depth of 6 inches and stockpile until amended.

B. Unacceptable Materials: Clean soil of concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials that are harmful to plant growth.

C. Unsuitable Materials: Clean soil to contain a maximum of 8 percent by dry weight of stones, roots, plants, sod, clay lumps, and pockets of coarse sand.

D. Screening: Pass unamended soil through a 3-inch sieve to remove large materials.

3.3 PLACING AND MIXING PLANTING SOIL OVER EXPOSED SUBGRADE

A. General: Apply and mix unamended soil with amendments on-site to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Subgrade Preparation: Till subgrade to a minimum depth of 8 inches. Remove stones larger than 3 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply, add soil amendments, and mix approximately half the thickness of unamended soil over prepared, loosened subgrade according to "Mixing" Paragraph below. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil.

C. Mixing: Spread unamended soil to total depth of 6 inches, but not less than required to meet finish grades after mixing with amendments and natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.

1. Amendments: Apply soil amendments and fertilizer, if required, evenly on surface, and thoroughly blend them with unamended soil to produce planting soil.

    a. Mix lime with dry soil before mixing fertilizer.
    b. Mix fertilizer with planting soil no more than seven days before planting.

2. Lifts: Apply and mix unamended soil and amendments in lifts not exceeding 8 inches in loose depth for material compacted by compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

D. Compaction: Compact each blended lift of planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698 and tested in-place except where a different compaction value is indicated on Drawings.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.4 PLACING MANUFACTURED PLANTING SOIL OVER EXPOSED SUBGRADE

A. General: Apply manufactured soil on-site in its final, blended condition. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Subgrade Preparation: Till subgrade to a minimum depth of 8 inches. Remove stones larger than 3 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Apply approximately half the thickness of planting soil over prepared, loosened subgrade. Mix thoroughly into top 4 inches of subgrade. Spread remainder of planting soil.

C. Application: Spread planting soil to total depth of 6 inches, but not less than required to meet finish grades after natural settlement. Do not spread if soil or subgrade is frozen, muddy, or excessively wet.

1. Lifts: Apply planting soil in lifts not exceeding 8 inches in loose depth for material compacted by compaction equipment, and not more than 6 inches in loose depth for material compacted by hand-operated tampers.

D. Compaction: Compact each lift of planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698 except where a different compaction value is indicated on Drawings].

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.5 BLENDING PLANTING SOIL IN PLACE

A. General: Mix amendments with in-place, unamended soil to produce required planting soil. Do not apply materials or till if existing soil or subgrade is frozen, muddy, or excessively wet.

B. Preparation: Till unamended, existing soil in planting areas to a minimum depth of of 8 inches. Remove stones larger than 3 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

C. Mixing: Apply soil amendments and fertilizer, if required, evenly on surface, and thoroughly blend them into full depth of unamended, in-place soil to produce planting soil.

1. Mix lime with dry soil before mixing fertilizer.
2. Mix fertilizer with planting soil no more than seven days before planting.

D. Compaction: Compact blended planting soil to 75 to 82 percent of maximum Standard Proctor density according to ASTM D 698 except where a different compaction value is indicated on Drawings.

E. Finish Grading: Grade planting soil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Design Professional will engage a qualified testing agency to perform tests and inspections.

B. Perform the following tests:

1. Compaction: Test planting-soil compaction after placing each lift and at completion using a densitometer or soil-compaction meter calibrated to a reference test value based on laboratory testing according to ASTM D 698. Space tests at no less than one for each 2000 sq. ft. of in-place soil or part thereof.
2. PH test. Space tests at no less than one for each 2000 sq. ft. of in-place soil or part thereof.

C. Soil will be considered defective if it does not pass tests.

D. Prepare test reports.

E. Label each sample and test report with the date, location keyed to a site plan or other location system, visible conditions when and where sample was taken, and sampling depth.

3.7 PROTECTION

A. Protection Zone: Identify protection zones according to Section 015639 "Temporary Tree and Plant Protection."

B. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Vehicle traffic.
4. Foot traffic.
5. Erection of sheds or structures.
6. Impoundment of water.
7. Excavation or other digging unless otherwise indicated.

C. If planting soil or subgrade is over compacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by Design Professional and replace contaminated planting soil with new planting soil.

3.8 CLEANING

A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.

1. Dispose of excess subsoil and unsuitable materials on-site where directed by Owner.

END OF SECTION 32 9113

SECTION 329200 - TURF AND GRASSES

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. Seeding.
2. Hydroseeding.
3. Sodding.
4. Meadow grasses and wildflowers.
5. Turf renovation.
6. Erosion-control material(s).

B. Related Requirements:

1. Section 329300 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.

1.3 DEFINITIONS

A. Finish Grade: Elevation of finished surface of planting soil.

B. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.

C. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

D. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Drawing Sheet L200, Planting Soil Mix.

E. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture, stating the botanical and common name, percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

1. Certification of each seed mixture for turfgrass sod. Include identification of source and name and telephone number of supplier.

C. Product Certificates: For fertilizers, from manufacturer.

D. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf during a calendar year. Submit before expiration of required maintenance periods.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf establishment.

1. Professional Membership: Installer shall be a member in good standing of either the National Association of Landscape Professionals or AmericanHort.
2. Experience: Five years' experience in turf installation in addition to requirements in Section 014000 "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the National Association of Landscape Professionals:

    a. Landscape Industry Certified Technician - Exterior.
    b. Landscape Industry Certified Lawn Care Manager.
    c. Landscape Industry Certified Lawn Care Technician.

5. Pesticide Applicator: State licensed, commercial.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws, as applicable.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" sections in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod within 24 hours of harvesting and in time for planting promptly. Protect sod from breakage and drying.

C. Bulk Materials:

1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

1.9 FIELD CONDITIONS

A. Planting Restrictions: Plant during the following period. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of Substantial Completion.
1. Sod Planting: October 1 through April 1.

B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species:

1. Quality: State-certified seed of grass species as listed below for solar exposure.
2. Quality: Seed of grass species as listed below for solar exposure, with not less than 85 percent germination, not less than 95 percent pure seed, and not more than 0.5 percent weed seed:
3. Full Sun: Bermudagrass (Cynodon dactylon).
4. Full Sun: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars.
5. Sun and Partial Shade: Proportioned by weight as follows:

a. 50 percent Kentucky bluegrass (Poa pratensis).
b. 30 percent chewings red fescue (Festuca rubra variety).

c. 10 percent perennial ryegrass (Lolium perenne).
d. 10 percent redtop (Agrostis alba).

6. Shade: Proportioned by weight as follows:

a. 50 percent chewings red fescue (Festuca rubra variety).
b. 35 percent rough bluegrass (Poa trivialis).
c. 15 percent redtop (Agrostis alba).

2.2 TURFGRASS SOD

A. Turfgrass Sod: Certified, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.

B. Turfgrass Species: TifGrand Bermudagrass (Cynodon dactylon x C. transvaalensis).

C. Sod shall consist of a live, dense, well-rooted growth of turf grass species as noted on the Drawings. The sod shall be free from Johnson grass, nut grass and other obnoxious grasses and shall be of suitable character for the purpose intended and for the soil in which it is to be planted. It shall be un-injured at the time of planting.

D. Sod shall be uniform in thickness, having not over 2-inches or less than 1-inch of soil.

E. Sod strips shall have a consistent width of 12 or 18-inches.

2.3 FERTILIZERS

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: (10-10-10) used in connection with sodding, shall contain 10 percent nitrogen, 10 percent phosphoric acid and 10 percent potash. The fertilizer shall be furnished in standard containers with the name, weight and guaranteed analysis of the contents clearly marked. The containers shall ensure proper protection in handling and transporting the fertilizer. All commercial fertilizer shall comply with local, state and federal fertilizer laws.
2. Ammonium nitrate shall be a standard commercial product, shall conform to the requirements for other commercial fertilizers as specified above, and shall have a minimum of 32-1/2 percent nitrogen.

B. Slow-Release Fertilizer: Granular or pelleted fertilizer consisting of 50 percent water-insoluble nitrogen, phosphorus, and potassium in the following composition:

1. Composition: 20 percent nitrogen, 10 percent phosphorous, and 10 percent potassium, by weight.
2. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.4 PESTICIDES

A. General: Pesticide, registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

2.5 PLANTING SOILS

A. Planting Soil Mix: Mix topsoil with the following soil amendments and fertilizers in the following quantities:
   1. 60% Topsoil as specified.
   2. 40% prepared additives (by volume as follows):
      a) 2 parts humus and/ or peat
      b) 1 part shredded pine bark (bark pieces between ½ and 2 inches in length)
      c) 1 part sterilized composted cow manure
   3. Commercial fertilizer as recommended in soil report
   4. Lime as recommended in soil report.

C. Pre-manufactured planting soil mixes may be used if similar in content to soil mixes shown above. See submittal requirements for required pre-approval.

2.6 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Hardwood Mulch: Double-ground cypress, air-dry, clean, mildew- and seed-free.

2.7 LIME

1. Agricultural limestone shall be dolomitic and contain not less than 85 percent of calcium carbonate and magnesium carbonate combined and shall be crushed so that at least 85 percent will pass the No. 10 mesh sieve and 50 percent will pass a No. 40 mesh screen.

2.8 EROSION-CONTROL MATERIALS: See Drawing Specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to be planted for compliance with requirements and other conditions affecting installation and performance of the Work.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
3. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Architect and replace with new planting soil.

3.2 PREPARATION

A. Protect structures; utilities; sidewalks; pavements; and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding and hydromulching overspray.
2. Protect grade stakes set by others until directed to remove them.

B. Install 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.

3.3 TURF AREA PREPARATION

A. General: After the area to be grassed has been brought to finished grade, prepare the soil by thoroughly loosening the area by plowing, discing, harrowing, or scarifying until these areas are friable, well pulverized and acceptable to the Landscape Architect. Any irregularities in the surface resulting from the above operation or from other operations by the contractor, shall be smoothed out before any subsequent operations are begun. All roots and stones larger than 1 1/2" in any dimension, stumps and other foreign material detrimental to final grading, proper bonding, the rise of capillary moisture, or the proper growth of the desired plantings shall be removed.
1. The completed surface shall conform to the finished grades or subgrades shown and shall have a smooth pulverized surface at the time of planting. Any irregularities shall be corrected before the lime and fertilizer are placed.
2. Spread lime and fertilizer over the prepared surface before turning. Fertilizer and lime shall be sufficient to correct irregularities in the soil based on soil tests for the specified turf. Turn the soil one last time the day before planting or placing sod.

B. Sodding:
1. Prepare planting bed as described above. Fine graded soil shall be 1 inch below finished grade established by the grading plan.
2. Sod of the species required in the schedule shall be kept moist prior to laying. Wet all areas prior to sodding.
3. Wet all areas immediately prior to sodding.
4. Unroll the sod on the prepared soil. Lay the strips parallel with the strip ends staggered as in bricklayers' running bond pattern. Press each successively laid strip snugly up against

the one next to it. Fill cracks, holes, joints with clean, loose sand, free of all grass and plant seeds.

5. Watering, fertilizing and rolling shall be done by the Contractor as described under "Maintenance of Sodded Areas" below.

C. Maintenance of Sodded Areas: The Contractor shall be responsible for maintaining sodded areas by properly watering, weeding and mowing the grass until an acceptable stand has been produced, and been accepted by the Owner and a minimum of 30 days thereafter.

1. A stand shall be considered acceptable when 95% of the total sodded area has been covered with grass and no bare areas greater than one square foot exist. All cracks, joints, dips, pits and other irregularities in the surface must have been corrected by top dressing with sand.
2. The Contractor shall be responsible for re-sodding all bare areas greater than one square foot with the specified mixture and for repairing and re-sodding washouts and eroded areas to the original finished grade.
3. Sodded areas shall be mowed when the grass attains a height of 2 inches and as required thereafter until the acceptance of the stand. Reel type mowers, kept well sharpened, shall be used. Turf shall not be accepted until all sod has knitted together and tacked to the soil.
4. All lawn areas shall be given a top dressing of fertilizer to provide 100 pounds available nitrogen per acre when the grass has attained a satisfactory growth and the first mowing has been performed. Nitrogen shall be derived from Ammonium Nitrate or Nitrate of Soda.
5. Contractor shall be responsible to administer a final top dressing of sand to the turf to fix all dips, pits, cracks, etc., for up to 6 months after final acceptance of a lawn field of play.

D. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

E. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

A. Prepare area as specified in "Turf Area Preparation" Article.

B. For erosion-control mats, install planting soil in two lifts, with second lift equal to thickness of erosion-control mats. Install erosion-control mat and fasten as recommended by material manufacturer.

C. Fill cells of erosion-control mat with planting soil and compact before planting.

D. For erosion-control blanket or mesh, install from top of slope, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.

E. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.

1. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
2. Do not use wet seed or seed that is moldy or otherwise damaged.
3. Do not seed against existing trees. Limit extent of seed to outside edge of planting saucer.

B. Sow seed at a total rate of 5 to 8 lb/1000 sq. ft.

C. Rake seed lightly into top 1/8 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:4 with erosion-control blankets and 1:6 with erosion-control fiber mesh installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas with erosion-control mats where indicated on Drawings; install and anchor according to manufacturer's written instructions.

F. Protect seeded areas with slopes not exceeding 1:6 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose thickness over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Anchor straw mulch by crimping into soil with suitable mechanical equipment.
2. Bond straw mulch by spraying with asphalt emulsion at a rate of 10 to 13 gal./1000 sq. ft. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

G. Protect seeded areas from hot, dry weather or drying winds by applying planting soil within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

3.6 SODDING

A. The area to be sodded shall be constructed to the lines and grades indicated on the Drawings or as directed by the Engineer, and the surface loosened to a depth of not less than 3-inches with a rake or other device. If necessary, it shall be sprinkled until saturated at least 1-inch in depth and kept moist until the sod is place thereon. Immediately before placing the sod, the fertilizer shall be uniformly applied at the rate of 12 pounds of Grade 10-10-10, or equivalent, per 1,000 square feet. Agricultural limestone shall be applied at the rate of 50 pounds per 1,000 square feet.

B. The entire area shall be thoroughly covered with sod. The sod shall be placed on the prepared surface with the edges in close contact and, as far as possible, with staggered joints.

C. The sod shall be maintained moist from time of removal until reset but shall be placed as soon as practicable after removal from place where growing. Immediately after placing it shall be rolled with a light- weight roller or hand tamped to the satisfaction of the Landscape Architect.

D. Lay sod within 24 hours of harvesting unless a suitable preservation method is accepted by Architect prior to delivery time. Do not lay sod if dormant or if ground is frozen or muddy.

E. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod; do not stretch or overlap. Stagger sod strips or pads to offset joints in adjacent courses. Avoid damage to soil or sod during installation. Tamp and roll lightly to ensure contact with soil, eliminate air pockets,

and form a smooth surface. Work sifted soil or fine sand into minor cracks between pieces of sod; remove excess to avoid smothering sod and adjacent grass.

1. Lay sod across slopes exceeding 1:3.
2. Anchor sod on slopes exceeding 1:6 with steel staples spaced as recommended by sod manufacturer but not less than two anchors per sod strip to prevent slippage.

F. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.7 TURF RENOVATION

A. Renovate existing turf where indicated.

B. Renovate turf damaged by Contractor's operations, such as storage of materials or equipment and movement of vehicles.

1. Reestablish turf where settlement or washouts occur or where minor regrading is required.
2. Install new planting soil as required.

C. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

D. Remove topsoil containing foreign materials, such as oil drippings, fuel spills, stones, gravel, and other construction materials resulting from Contractor's operations, and replace with new planting soil.

E. Mow, dethatch, core aerate, and rake existing turf.

F. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

G. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

H. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

I. Apply initial fertilizer required for establishing new turf and mix thoroughly into top 4 inches of existing soil. Install new planting soil to fill low spots and meet finish grades.
1. Initial Fertilizer: Commercial fertilizer applied according to manufacturer's recommendations.

J. Apply sod as required for new turf.

K. Water newly planted areas and keep moist until new turf is established.

3.8 TURF MAINTENANCE

A. General: Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll,

regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.

1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.

B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.

1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.

C. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than one-third of grass height. Remove no more than one-third of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:
1. Mow bermudagrass to a height of 1/2 to 1 inch.

D. Turf Postfertilization: Apply slow-release fertilizer after initial mowing and when grass is dry.

1. Use fertilizer that provides actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.9 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Landscape Architect:

1. Satisfactory Seeded Turf: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.
2. Satisfactory Sodded Turf: At end of maintenance period, a healthy, well-rooted, even-colored, viable turf has been established, free of weeds, open joints, bare areas, and surface irregularities.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.10 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to requirements of authorities having jurisdiction and manufacturer's written recommendations.

Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.11 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

C. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

D. Remove nondegradable erosion-control measures after grass establishment period.

E. The Contractor shall not allow any equipment or material to be placed on any planted area and shall erect suitable barricades and guards to prevent Contractor's equipment, labor or the public from traveling on or over any area planted with sod.

F. It shall be the obligation of the Contractor to secure a satisfactory growth of grass before final acceptance of the Project.

3.12 MAINTENANCE SERVICE

A. The sod shall be watered as directed by the Landscape Architect for a period of two weeks after which ammonium nitrate shall be applied at the rate of three pounds per 1,000 square feet and the sod given a final watering.

B. Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Turf Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable turf is established, but for not less than the following periods:

1. Seeded Turf: 60 days from date of Substantial Completion.

    a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

2. Sodded Turf: 60 days from date of Substantial Completion.

END OF SECTION 329200

SECTION 329300 - PLANTS

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. Plants.
2. Tree stabilization.
3. Tree-watering devices.

B. Related Requirements:
1. Section 015639 "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
2. Section 329200 "Turf and Grasses" for turf (lawn) and meadow planting, hydroseeding, and erosion-control materials.

1.3 UNIT PRICES

A. Work of this Section is affected by unit prices specified in Section 012200 "Unit Prices".

B. Unit prices apply to authorized work covered by quantity allowances.

C. Unit prices apply to additions to and deletions from the Work as authorized by Change Orders.

1.4 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.

B. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with a ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

C. Balled and Potted Stock: Plants dug with firm, natural balls of earth in which they are grown and placed, unbroken, in a container. Ball size is not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required.

D. Bare-Root Stock: Plants with a well-branched, fibrous-root system developed by transplanting or root pruning, with soil or growing medium removed, and with not less than the minimum root spread according to ANSI Z60.1 for type and size of plant required.

E. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

F. Fabric Bag-Grown Stock: Healthy, vigorous, well-rooted plants established and grown in-ground in a porous fabric bag with well-established root system reaching sides of fabric bag. Fabric bag size is not less than diameter, depth, and volume required by ANSI Z60.1 for type and size of plant.

G. Finish Grade: Elevation of finished surface of planting soil.

H. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. Pesticides include insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. They also include substances or mixtures intended for use as a plant regulator, defoliant, or desiccant. Some sources classify herbicides separately from pesticides.

I. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. Pests include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

J. Planting Area: Areas to be planted.

K. Planting Soil: Existing, on-site soil; imported soil; or manufactured soil that has been modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth. See Drawing Sheet L200, Planting Soil Mix.

L. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.

M. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots; the area of transition between the root system and the stem or trunk.

N. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

O. Subgrade: The surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.

1.5 COORDINATION

A. Coordination with Turf Areas (Lawns): Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
   1. When planting trees, shrubs, and other plants after planting turf areas, protect turf areas, and promptly repair damage caused by planting operations.

1.6 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.7 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.
      a. It is the responsibility of the Contractor, before ordering or purchasing materials, to provide (2) color photographs of each tree type in digital format to the Landscape Architect for review and approval. Identify each photograph with the full scientific name of the plant, plant size, and name of the growing nursery. Take photographs from an angle depicting true size and condition of the typical plant to be furnished. Include a scale rod or other measuring device in each photograph. Contractor shall tag and deliver trees that match approved sample photographs. For species where more than 20 plants are required, include a minimum of three photographs showing the average plant, the best quality plant, and the worst quality plant to be furnished. Landscape Architect will decide final approval of all plant material on site.
      b. The Contractor is to submit certification tags from trees, shrubs, seed, and sod verifying type and purity.

c. Plants shall be subject to inspection and approval at the place of growth, or upon delivery to the site, as determined by the Landscape Architect, for quality, size and variety. Such prior approval will not impair the right of inspection and rejection at the site during progress of the work or after completion, for size and conditions of balls or roots, latent defects or injuries. Rejected plants shall be removed immediately from the site. Notice requesting inspection should be submitted by the Contractor at least one week prior to anticipated date.

B. Samples for Verification: Samples of materials as listed below shall be submitted for inspection on the job site, or as otherwise determined by the Landscape Architect for each of the following:
1. Shrubs: Three samples of each variety and size delivered to site for review. Maintain approved Samples on-site as a standard for comparison.
2. Pinestraw Mulch: 1 Bale.
3. Proprietary Root-Ball-Stabilization Device: One unit.
4. Slow-Release, Tree-Watering Device: One unit of each size required.
5. Peat Moss: 1 Bale.
6. Top Dressing Sand: 1 Cup.
7. Topsoil: 1 Gallon.
8. Typical samples shall be furnished from each separate source of supply. Approved samples shall be stored on the site and protected until furnishing of material is completed. Plant samples may be planted in permanent positions but labeled as samples.
9. Upon approval of samples by the Landscape Architect, delivery of materials may begin.

1.8 INFORMATIONAL SUBMITTALS

A. Qualification Data: For landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

B. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:
1. Manufacturer's certified analysis of standard products.
2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

C. Pesticides and Herbicides: Product label and manufacturer's application instructions specific to Project.

D. Sample Warranty: For special warranty.

1.9 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before expiration of required maintenance periods.

1.10 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful establishment of plants.
1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
2. Experience: Five years' experience in landscape installation in addition to requirements in Section 014000 "Quality Requirements."
3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:
   a. Landscape Industry Certified Technician - Exterior.
   b. Landscape Industry Certified Interior.
   c. Landscape Industry Certified Horticultural Technician.
5. Pesticide Applicator: State licensed, commercial.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
   1. Selection of plants purchased under allowances is made by Landscape Architect, who tags plants at their place of growth before they are prepared for transplanting.

C. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
   1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container-grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
   2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

D. Plant Material Observation: Landscape Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Landscape Architect may also observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and may reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
   1. Notify Landscape Architect of sources of planting materials seven days in advance of delivery to site.

E. Plants shall in all cases conform with requirements of the following:
   1. Georgia State Plant Board Codes and Standards.
   2. Georgia Nurseryman and Grower's Association Approved Planting Practices.
   3. Bailey, Hortus III
   4. American Standard for Nursery Stock with the latest versions of rules and grading adopted by the American Association of Nurserymen, Inc.

F. Unless specifically noted otherwise, all plants shall be of selected specimen quality, exceptionally heavy, symmetrical, tightly knit, so trained or favored in their development and appearance as to be superior in form, number of branches, compactness and symmetry. All plants shall have a normal growth habit, be free of disease, show vigorous health and have a well-developed root system.

G. Plants shall be free of disease, insect pests, effs, or larvae.

H. Plants shall not be pruned before delivery.

I. Trees with abrasion of the bark, sunscalds, disfiguring knots or fresh cuts of limbs over one and one-fourth inches (1-1/4") which have not completely callused shall be rejected.

J. All plants shall be typical of their species or variety and shall have a normal habit of growth and be legibly tagged with the proper name. All plants shall have been grown under climatic conditions similar to those in the locality of the site of the project under construction or have been acclimated to such condition for at least two (2) years.

K. The root system of each shall be well provided with fibrous roots. All parts shall be sound, healthy, vigorous, well branched and densely foliated when in leaf.

L. Container stock shall be delivered to the site in first class condition. Plants shall have stakes in containers where required to support the plants. Plants furnished in containers shall not be handled by the stem, but only by the containers. Plants that are root bound by their containers shall not be accepted.

M. Balled and burlapped (B&B) shall be dug with firm, natural balls of soil and of sufficient size to encompass the fibrous and feeding roots of the plants. No plants moved with a ball shall be planted if the ball is cracked or broken, except upon special approval. Plants balled and burlapped shall be handled by the stems.

N. Plants marked "BR" in the Plant List shall be dug with bare roots. The roots shall not be cut within the minimum spread specified in the Plant List. Care shall be exercised that the roots do not dry out in moving.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of compliance with state and Federal laws if applicable.

B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.
2. Provide erosion-control measures to prevent erosion or displacement of bulk materials; discharge of soil-bearing water runoff; and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk materials with appropriate certificates.

C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of plants during shipping and delivery. Do not drop plants during delivery and handling.

D. Handle planting stock by root ball.

E. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

F. Retain one of first two paragraphs below; revise to suit Project.

G. Apply antidesiccant to trees and shrubs using power spray to provide an adequate film over trunks (before wrapping), branches, stems, twigs, and foliage to protect during digging, handling, and transportation.
1. If deciduous trees or shrubs are moved in full leaf, spray with antidesiccant at nursery before moving and again two weeks after planting.

H. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

I. Deliver plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
1. Heel-in bare-root stock. Soak roots that are in less than moist condition in water for two hours. Reject plants with dry roots.
2. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
3. Do not remove container-grown stock from containers before time of planting.

4. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

J. Unless otherwise authorized by the Landscape Architect, the Contractor shall notify the Landscape Architect at least 48 hours in advance of the anticipated delivery date of any plant materials.

1.12 PERCOLATION TEST

A. The Contractor shall be responsible for determining existing sub-surface drainage conditions for areas to be planted or sodded. The Contractor shall include as a part of his proposal the cost for making the following percolation tests in any area where he is uncertain about adequate sub-surface drainage. Report unacceptable areas to Landscape Architect/Owner's Representative for instructions.

B. Percolation tests shall be made as follows:
1. Wait at least 24 hours after rain and dig test pit 12 inches square or 13 1/2 inches in diameter to depth of bottom of plant bed and remove all loose soil. (If standing water is visible, notify Landscape Architect).
2. Quickly fill pit bottom with 6 inches (approximately 3 1/4 gallons) of water.
3. Compare 1-inch time with following table:
   a. 1 inch in 0 - 3 minutes indicates rapid absorption.
   b. 1 inch in 3- minutes indicates medium absorption.
   c. 1 inch in 5-30 minutes indicates slow absorption.
   d. 1 inch in over 30 minutes indicates impervious soil.
4. In plant bed areas where sub-soil conditions do not percolate or the bed is enclosed by pavement, curbs, walks or other hard construction, the contractor shall install a 4" drain line that allows the sub-surface of the bed to drain to the storm system or out to day light on the nearest slope.

C. Planting shall not begin until planting area drainage has been approved by owner's representative.

1.13 FIELD CONDITIONS

A. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.

B. Planting Restrictions: Plant during the following period. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
1. Trees and Shrubs: October 1 through April 1.
2. Planting of grass shall be accomplished during recommended season dependent of specified grass and planting method.
3. Protect roots, or balls of plants, at all times from sun and drying winds, water and freezing, as necessary until planting.

C. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements. Contractor to notify Landscape Architect immediately if directed to commence planting operations in conditions detrimental to plant health.

1.14 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner.
   b. Structural failures including plantings falling or blowing over.
   c. Faulty performance of tree stabilization.
   d. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Warranty Periods: From date of Final Acceptance.
   a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
   b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.
   c. Annuals: Three months.
   d. All plants, grass, and trees shall be guaranteed to be alive and healthy one year after the date of final acceptance. Contractor shall be responsible for maintaining the plant installations for 30 days after final acceptance. The Contractor is responsible for providing adequate maintenance for one year to any plant, including grass, or tree that is dead or not showing satisfactory growth. After a 90-day period, it shall be replaced, or conditions contributing to unsatisfactory growth corrected. All replacements shall be of the original quality and shall be of a size equal to that attained by adjacent plants or trees of the same species. Replacement plant material shall be guaranteed to be alive at the beginning of the following growing season. Only one replacement will be required for each dead grass area. The number of replacements for other plant materials is not limited.
   e. The guarantee may become void if it is determined that plant material kill or unsatisfactory growth results from Owner negligence. The decision for determination of responsibility for damage shall rest solely with the Owner's representative.
3. Include the following remedial actions as a minimum:
   a. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
   b. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
   c. A limit of one replacement of each plant is required except for losses or replacements due to failure to comply with requirements.
   d. Provide extended warranty for period equal to original warranty period, for replaced plant material.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: See Planting Plan and Plant List for plants required. Quantities necessary to complete the work shown on the drawings shall be furnished. Although quantity estimates have been carefully made, the Landscape Architect assumes no liability for omissions or errors.

B. Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant List, Plant Schedule, or Plant Legend indicated on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in

leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 3/4 inch in diameter; or with stem girdling roots are unacceptable.
2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

C. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Architect, with a proportionate increase in size of roots or balls.

D. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which begins at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

E. Labeling: Label at least one plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant.

F. If formal arrangements or consecutive order of plants is indicated on Drawings, select stock for uniform height and spread, and number the labels to assure symmetry in planting.

G. Annuals and Biennials: Provide healthy, disease-free plants of species and variety shown or listed, with well-established root systems reaching to sides of the container to maintain a firm ball, but not with excessive root growth encircling the container. Provide only plants that are acclimated to outdoor conditions before delivery and that are in bud but not yet in bloom.

H. Plant Material Size and Measurement

1. Plants shall be measured when branches are in their normal position.
2. Shrubs shall meet the size requirements stated in the Plant List. The measurements are to be taken from the ground level to the average height of the shrub and not to the longest branch. Height and spread dimensions specified refer to the main body of the trees (measured from the crown of the roots to the tip of the top branch) and shall be not less than the minimum size designated.
3. Caliper measurements shall be taken at a point on the trunk six inches (6") above natural ground line for trees up to four inches (4") in caliper, and at a point 12 inches (12") above the natural ground line for trees exceeding four inches (4") in caliper.
4. If a range of size is given, no plant shall be less than the minimum size, and not less than 50% of the plants shall be as large as the upper half of the range specified.
5. The measurements specified are the minimum size acceptable and, where pruning is required, are the measurements after pruning.
6. All dimensions on Schedule shall be the minimum acceptable size. Plants larger in size than specified in the Plant List may be used if approved by the Landscape Architect. If the use of larger plants is approved, the ball of earth or spread of roots shall be increased in proportion to the size of the plant.
7. The minimum acceptable ball size for trees shall be 11" diameter per 1" caliper taken 6" above the ground for trees up to and including 4" caliper. Caliper shall be measured 12" above the ground for trees larger than 4" caliper. In special cases the ball size may be reduced as directed or approved by the Landscape Architect.

I. Sod shall be grown in a nursery equipped for the production of such sod and capable of meeting the published State Standards for Certification. It shall have been mowed regularly, fertilized and fumigated and shall be free of diseases and harmful insects at the time of delivery. Sod shall be

delivered in strips one foot wide and two feet or longer as soil and species permit or in rolls not over six feet long. Sod shall have a minimum of one-inch thickness including roots and soil. Sod bearing holes or thinned root pad, i.e. less than ½" shall be rejected. Sod shall be free of weeds, nut grass, crab grass and other invasive plants.

J. Right of Rejection: The Landscape Architect reserves the right to inspect and reject plants at any time and at any place. Plants held on site for longer than 2 months must be approved by Landscape Architect before installation.

2.2 WATER

1. All water necessary for planting and maintenance shall be of satisfactory quality to sustain the growth of plants and shall not contain harmful, natural or man-made elements detrimental to plants. Water meeting the above standard shall be furnished by the Contractor and all arrangements for securing water and any expenses of transporting to the site and dispersal on the site shall be the responsibility of the Contractor.

2.3 FERTILIZERS

A. Planting Tablets: Tightly compressed chip-type, long-lasting, slow-release, commercial-grade planting fertilizer in tablet form. Tablets shall break down with soil bacteria, converting nutrients into a form that can be absorbed by plant roots.
   1. Size: 5-gram tablets.
   2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

B. Provide a complete fertilizer, uniform in composition, dry and free flowing, delivered to the site in the original unopened containers, each bearing the manufacturer's statement of analysis, meeting the following requirements:
   1. 12% nitrogen, 5% phosphoric acid, 8% potash; with nitrogen derived from 6.6% uramite, 3% sewage sludge and 2.4% ammonium nitrate or approximate equal.

C. Lime: Shall be agricultural grade high calcium ground limestone and shall be of such fineness that 90% will pass through a No. 10 sieve and not less than 50% through a No. 50 sieve.

D. Soil Test: Revise fertilizer analysis, quantities of fertilizer and lime as dictated by soil tests made prior to planting.

2.4 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:
   1. Type: Pine Straw and Hardwood.
   2. Size Range: 4 inches maximum, 3 inch minimum.
   3. Color: Natural.

2.5 PESTICIDES / HERBICIDES

A. General: Pesticide registered and approved by the EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent Herbicide (Selective and Nonselective): Effective for controlling the germination or growth of weeds within planted areas at the soil level directly below the mulch layer.

C. Post-Emergent Herbicide (Selective and Nonselective): Effective for controlling weed growth that has already germinated.

D. Contractor to have a licensed herbicide applicator with a minimum three years experience performing all herbicide applications to lawns, trees and shrubs. Herbicides shall be utilized as necessary to control weeds in bed, tree plantings and turf areas unless applicable codes or ordinances stipulate otherwise. Contractor is responsible to be familiar with all applicable local, state and federal codes, ordinances and regulations.

2.6 TOPSOIL

A. Where required, Topsoil shall be a natural, fertile, friable soil, possessing characteristics of representative productive soils in the vicinity. It shall be obtained from naturally well-drained areas, free from substances harmful to plant growth, and free from clay lumps, stones, stumps, roots, or similar substances two inches or more in diameter. The source and material shall be approved by the Landscape Architect before placing on site. Topsoil shall be free from noxious grass and weeds.

2.7 TREE-STABILIZATION MATERIALS

A. Rootball Stabilization Materials:
   1. Rootball Staples: Rough-sawn, sound, new untreated pine or douglas fir stakes.
   2. Wood Screws: ASME B18.6.1.

2.8 TREE-WATERING DEVICES

A. Watering Pipe: PVC pipe 4 inches in diameter, site-cut to length as required, and with snug-fitting removable cap.

B. Slow-Release Watering Device: Standard product manufactured for drip irrigation of plants and emptying its water contents over five to nine hours, manufactured from UV-light-stabilized nylon-reinforced polyethylene sheet, PVC, or HDPE plastic.
   1. Spectrum Products, Inc., Youngsville, NC, (866) 873-3428.
   2. Color: green or tan.

2.9 MISCELLANEOUS PRODUCTS

A. Wood Pressure-Preservative Treatment: AWPA U1, Use Category UC4a; acceptable to authorities having jurisdiction, and containing no arsenic or chromium.

B. Antidesiccant: Water-insoluble emulsion, permeable moisture retarder, film forming, for trees and shrubs. Deliver in original, sealed, and fully labeled containers and mix according to manufacturer's written instructions.

C. Burlap: Non-synthetic, biodegradable.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants, with Installer present, for compliance with requirements and conditions affecting installation and performance of the Work.
   1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint

thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.

2. Verify that plants and vehicles loaded with plants can travel to planting locations with adequate overhead clearance.
3. Suspend planting operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable or which is dusty.

B. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Landscape Architect and replace with new planting soil.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install 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.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Landscape Architect's acceptance of layout before excavating or planting. Make minor adjustments as required.

3.3 PLANTING AREA ESTABLISHMENT

A. General: Prepare planting area for soil placement and mix planting soil according to Drawing, “Landscape Details” sheet.

B. Placing Planting Soil: Blend planting soil in place.

C. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits.

1. Excavate planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are unacceptable. Trim perimeter of bottom leaving center area of bottom raised slightly to support root ball and assist in drainage away from center. Do not further disturb base. Ensure that root ball will sit on undisturbed base soil to prevent settling. Scarify sides of planting pit smeared or smoothed during excavation.
2. Excavate approximately three times as wide as ball diameter for balled and burlapped and container-grown stock.
3. Excavate at least 12 inches wider than root spread and deep enough to accommodate vertical roots for bare-root stock.
4. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
5. If area under the plant was initially dug too deep, add soil to raise it to the correct level and thoroughly tamp the added soil to prevent settling.
6. Maintain angles of repose of adjacent materials to ensure stability. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
7. Maintain supervision of excavations during working hours.

8. Keep excavations covered or otherwise protected when unattended by Installer's personnel.

B. Backfill Soil: Subsoil removed from excavations may not be used as backfill soil unless otherwise indicated. Topsoil removed from excavations may be used as backfill soil unless otherwise indicated.

C. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.
1. Hardpan Layer: Drill 6-inch-diameter holes, 24 inches apart, into free-draining strata or to a depth of 10 feet, whichever is less, and backfill with free-draining material.

D. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

E. Fill excavations with water and allow to percolate away before positioning trees and shrubs.

3.5 TREE, SHRUB, AND VINE PLANTING

A. Inspection: At time of planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Roots: Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Balled and Burlapped Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.
1. Backfill: Planting Mix as described in Drawings. For trees, use excavated soil mixed 50% with Planting Mix as described in Drawings for backfill.
2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets from tops of root balls and from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
   a. Quantity: Two per plant.
5. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Balled and Potted and Container-Grown Stock: Set each plant plumb and in center of planting pit or trench with root flare 1 inch above adjacent finish grades.
1. Backfill: Planting Mix as described in Drawings.
2. Carefully remove root ball from container without damaging root ball or plant.
3. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
4. Place planting tablets equally distributed around each planting pit when pit is approximately one-half filled. Place tablets beside the root ball about 1 inch from root tips; do not place tablets in bottom of the hole.
   a. Quantity: Two per plant.

5. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. Slopes: When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.6 MECHANIZED TREE-SPADE PLANTING

A. Trees may be planted with an approved mechanized tree spade at the designated locations. Do not use tree spade to move trees larger than the maximum size allowed for a similar field-grown, balled-and-burlapped root-ball diameter according to ANSI Z60.1, or larger than manufacturer's maximum size recommendation for the tree spade being used, whichever is smaller.

B. Use the same tree spade to excavate the planting hole as will be used to extract and transport the tree.

C. When extracting the tree, center the trunk within the tree spade and move tree with a solid ball of earth.

D. Cut exposed roots cleanly during transplanting operations.

E. Plant trees following procedures in "Tree, Shrub, and Vine Planting" Article.

F. Where possible, orient the tree in the same direction as in its original location.

3.7 TREE, SHRUB, AND VINE PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees, shrubs, and vines as directed by Landscape Architect.

C. Prune, thin, and shape trees, shrubs, and vines according to standard professional horticultural and arboricultural practices. Unless otherwise indicated by Landscape Architect, do not cut tree leaders; remove only injured, dying, or dead branches from trees and shrubs; and prune to retain natural character.

D. Do not apply pruning paint to wounds.

3.8 TREE STABILIZATION

A. Root-Ball Stabilization: Install at- or below-grade stabilization system to secure each new planting by the root ball unless otherwise indicated.

1. Wood Hold-Down Method: Place vertical stakes against side of root ball and drive them into subsoil; place horizontal wood hold-down stake across top of root ball and screw at each end to one of the vertical stakes.
   a. Install stakes of length required to penetrate at least to the dimension indicated on Drawings below bottom of backfilled excavation. Saw stakes off at horizontal stake.
   b. Install screws through horizontal hold-down and penetrating at least 1 inch into stakes. Predrill holes if necessary to prevent splitting wood.
   c. Install second set of stakes on other side of root trunk for larger trees.

3.9 ROOT-BARRIER INSTALLATION

A. Install root barrier where trees are planted within 48 inches of paving or other hardscape elements, such as walls, curbs, and walkways, unless otherwise indicated on Drawings.

B. Align root barrier vertically with bottom edge angled at 20 degrees away from the paving or other hardscape element and run it linearly along and adjacent to the paving or other hardscape elements to be protected from invasive roots.

C. Install root barrier continuously for a distance of 60 inches in each direction from the tree trunk, for a total distance of 10 feet per tree. If trees are spaced closer, use a single continuous piece of root barrier.
   1. Position top of root barrier according to manufacturer's written recommendations.
   2. Overlap root barrier a minimum of 12 inches at joints.
   3. Do not distort or bend root barrier during construction activities.
   4. Do not install root barrier surrounding the root ball of tree.

3.10 GROUND COVER AND PLANT PLANTING

A. Set out and space ground cover and plants other than trees, shrubs, and vines as indicated on Drawings in even rows with triangular spacing.

B. Use Planting Mix as described in Drawings for backfill.

C. Dig holes large enough to allow spreading of roots.

D. For rooted cutting plants supplied in flats, plant each in a manner that minimally disturbs the root system but to a depth not less than two nodes.

E. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.

F. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

G. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.

3.11 FINISH GRADING

1. Prior to applying mulch, plant beds and pine straw covered areas shall be stirred 4” deep to loosen soil mixture. Fine grade areas until all bumps and depressions are removed and until the grade conforms to requirements of the grading plan. Eliminate any water pockets and verify surfaces drain away from all buildings. The minimum surface slope of plant beds shall be four percent. Minimum surface slope in lawn areas shall be two percent.

3.12 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.
   1. Trees and Treelike Shrubs in Turf Areas: Apply organic mulch ring of 4-inch average thickness, with 36-inch radius around trunks or stems. Do not place mulch within 3 inches of trunks or stems.
   2. Organic Mulch in Planting Areas: Apply 4-inch average thickness of organic mulch extending 12 inches beyond edge of individual planting pit or trench and over whole planting bed surface. Do not place mulch within 3 inches of trunks or stems.

3.13 WEED CONTROL

A. Immediately after planting and applying the mulch, apply 2% granular “Chipco” Ronstar at the rate of 3 pounds per 1,000 square feet. This is slightly more than 2 1/2 pounds of active ingredient per acre. Apply to all plant beds, ground cover and pine straw ground cover. Protect lawns and any susceptible plants.

3.14 GRASSING

A. General: Includes soil preparation, applying fertilizer, planting and maintenance as required to produce an acceptable stand of grass on areas shown on planting plan. See Section 329200 “Turf and Grasses.

1. Any damage to planting soil by erosion, construction equipment, construction operations, or other damage shall be repaired prior to application of fertilizer. Finished surface shall be smooth and even.

3.15 INSTALLING SLOW-RELEASE WATERING DEVICE

A. Provide one device for each tree.

B. Place device on top of the mulch at base of tree stem and fill with water according to manufacturer's written instructions.

3.16 PLANT MAINTENANCE

A. Maintain plantings by pruning, cultivating, watering, weeding, fertilizing, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.

B. Fill in, as necessary, soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated pest management practices when possible to minimize use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

D. All planting shall be protected and maintained by the Contractor until time of final acceptance as defined in the guarantee. Maintenance shall include but is not limited to watering, weeding, cultivating, removal of dead material, resetting plants to proper grades or upright position, lawn mowing, fertilizing, and other necessary operations. The Contractor will be responsible for maintenance until 90 days after the time of acceptance. The Contractor shall submit, in writing, maintenance instructions for use by the Owner in caring for the plants.

3.17 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents according to authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.

B. Pre-Emergent Herbicides (Selective and Nonselective): Apply to tree, shrub, and ground-cover areas according to manufacturer's written recommendations. Do not apply to seeded areas.

C. Post-Emergent Herbicides (Selective and Nonselective): Apply only as necessary to treat already-germinated weeds and according to manufacturer's written recommendations.

3.18 REPAIR AND REPLACEMENT

A. General: Repair or replace existing or new trees and other plants that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed pruning and repairs.
2. Perform repairs of damaged trunks, branches, and roots within 24 hours, if approved.

3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.

B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Landscape Architect determines are incapable of restoring to normal growth pattern.
1. Provide new trees of same size as those being replaced for each tree of 6 inches or smaller in caliper size.
2. Provide two new tree(s) of 6-inch caliper size for each tree being replaced that measures more than 6 inches in caliper size.
3. Species of Replacement Trees: Species selected by Landscape Architect.

3.19 CLEANING AND PROTECTION

A. During planting, keep adjacent paving and construction clean and work area in an orderly condition. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

C. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

D. After installation and before Substantial Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

E. At time of Substantial Completion, verify that tree-watering devices are in good working order and leave them in place. Replace improperly functioning devices.

F. Before commencing work, all trees and shrubs which are to be saved must be protected from damage by the placement of fencing flagged for visibility or some other suitable protective procedure approved by the Owner. No work may begin until this requirement is fulfilled.

G. In order to avoid damage to roots, bark or lower branches, no truck or other equipment shall be driven or parked within the drip line of any tree, unless the tree overspreads a paved way.

H. The Contractor shall use any and all precautionary measures when performing work around trees, walks, pavements, utilities, and any other features either existing or previously installed under this Contract.

I. The Contractor shall adjust depth of earthwork and loaming when working immediately adjacent to any of the features in order to prevent disturbing tree roots, undermining walks and pavements, and damage in general to any existing or newly incorporated item.

J. Plants transported to the project in open vehicles shall be covered with tarpaulins or other suitable covers securely fastened to the body of the vehicle to prevent injury to the plants. Closed vehicles shall be adequately ventilated to prevent overheating of the plants. Evidence of inadequate protection following digging, carelessness while in transit, or improper handling or storage shall be cause for rejection. All plants shall be kept moist, fresh, and protected. Such protection shall encompass the entire period during which the plants are in transit, being handled, or are in temporary storage.

3.20 DAMAGED/DISTURBED AREAS

1. Plant or grassed areas damaged during the process of work by other contractors shall be called to the attention of the General Contractor and Landscape Architect in writing within one week of the occurrence, to settle disputes over party responsible for damages.
2. Damaged areas will be repaired within a timely period to Landscape Architect's satisfaction.

3.21 FINAL APPROVAL

1. The Landscape Architect shall have the final approval for acceptance of the landscaping.

3.22 MAINTENANCE SERVICE

A. Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
   1. Maintenance Period: 12 months from date of Substantial Completion.

B. Maintenance Service for Ground Cover and Other Plants: Provide maintenance by skilled employees of landscape Installer. Maintain as required in "Plant Maintenance" Article. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established, but for not less than maintenance period below:
   1. Maintenance Period: 12 months from date of Substantial Completion.

END OF SECTION 329300

SECTION 33 0500 - COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. This Section includes the following:

1. Piping joining materials.
2. Transition fittings.
3. Dielectric fittings.
4. Sleeves.
5. Identification devices.
6. Grout.
7. Flowable fill.
8. Piped utility demolition.
9. Piping system common requirements.
10. Equipment installation common requirements.
11. Painting.
12. Concrete bases.
13. Metal supports and anchorages.

1.2 DEFINITIONS

A. Exposed Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions.

B. Concealed Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

C. ABS: Acrylonitrile-butadiene-styrene plastic.

D. CPVC: Chlorinated polyvinyl chloride plastic.

E. PE: Polyethylene plastic.

F. PVC: Polyvinyl chloride plastic.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:

1. Dielectric fittings.
2. Identification devices.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

A. Steel Support Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Steel Piping Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.7 COORDINATION

A. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

B. Coordinate installation of identifying devices after completing covering and painting if devices are applied to surfaces.

C. Coordinate size and location of concrete bases. Formwork, reinforcement, and concrete requirements are specified in Section 033000 "Cast-in-Place Concrete.".

PART 2 - PRODUCTS

2.1 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness, unless otherwise indicated.

    a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

E. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

F. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

G. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

H. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.2 TRANSITION FITTINGS

A. Transition Fittings, General: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

B. Transition Couplings NPS 1-1/2 and Smaller:

1. Underground Piping: Manufactured piping coupling or specified piping system fitting.
2. Aboveground Piping: Specified piping system fitting.

C. AWWA Transition Couplings NPS 2 and Larger:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Cascade Waterworks Mfg. Co.
    b. Dresser, Inc.; DMD Div.
    c. Ford Meter Box Company, Inc. (The); Pipe Products Div.
    d. JCM Industries.
    e. Smith-Blair, Inc.
    f. Viking Johnson.

3. Description: AWWA C219, metal sleeve-type coupling for underground pressure piping.

D. Plastic-to-Metal Transition Fittings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Spears Manufacturing Co.

3. Description: CPVC and PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint or threaded end.

E. Plastic-to-Metal Transition Unions:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Colonial Design Professionaling, Inc.
   b. NIBCO INC.
   c. Spears Manufacturing Co.

3. Description: MSS SP-107, CPVC and PVC four-part union. Include brass or stainless-steel threaded end, solvent-cement-joint or threaded plastic end, rubber O-ring, and union nut.

F. Flexible Transition Couplings for Underground Nonpressure Drainage Piping:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Cascade Waterworks Mfg. Co.
   b. Fernco, Inc.
   c. Mission Rubber Company.
   d. Plastic Oddities.

3. Description: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

2.3 DIELECTRIC FITTINGS

A. Dielectric Fittings, General: Assembly of copper alloy and ferrous materials or ferrous material body with separating nonconductive insulating material suitable for system fluid, pressure, and temperature.

B. Dielectric Unions:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Capitol Manufacturing Co.
   b. Central Plastics Company.
   c. Epco Sales, Inc.

d. Hart Industries, International, Inc.
e. Watts Water Technologies, Inc.
f. Zurn Plumbing Products Group; Wilkins Div.

3. Description: Factory fabricated, union, NPS 2 and smaller.

a. Pressure Rating: 250 psig at 180 deg F.
b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded ferrous.

C. Dielectric Flanges:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Epco Sales, Inc.
d. Watts Water Technologies, Inc.

3. Description: Factory-fabricated, bolted, companion-flange assembly, NPS 2-1/2 to NPS 4 and larger.

a. Pressure Rating: minimum 300 psig.
b. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Kits:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

3. Description: Nonconducting materials for field assembly of companion flanges, NPS 2-1/2 and larger.

a. Pressure Rating: 150 psig minimum.
b. Gasket: Neoprene or phenolic.
c. Bolt Sleeves: Phenolic or polyethylene.
d. Washers: Phenolic with steel backing washers.

E. Dielectric Couplings:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Calpico, Inc.
    b. Lochinvar Corporation.

3. Description: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining, NPS 3 and smaller.

    a. Pressure Rating: 300 psig at 225 deg F.
    b. End Connections: Threaded.

F. Dielectric Nipples:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Perfection Corporation.
    b. Precision Plumbing Products, Inc.
    c. Victaulic Company.

3. Description: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining.

    a. Pressure Rating: 300 psig at 225 deg F.
    b. End Connections: Threaded or grooved.

2.4 SLEEVES

A. Mechanical sleeve seals for pipe penetrations are specified in Section 220000 "Plumbing".

B. Galvanized-Steel Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

C. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized, plain ends.

D. Cast-Iron Sleeves: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

E. Molded PVC Sleeves: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe Sleeves: ASTM D 1785, Schedule 40.

G. Molded PE Sleeves: Reusable, PE, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.5 IDENTIFICATION DEVICES

A. General: Products specified are for applications referenced in other utilities Sections. If more than single type is specified for listed applications, selection is Installer's option.

B. Equipment Nameplates: Metal permanently fastened to equipment with data engraved or stamped.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and essential data.
2. Location: Accessible and visible.

C. Stencils: Standard stencils prepared with letter sizes complying with recommendations in ASME A13.1. Minimum letter height is 1-1/4 inches for ducts, and 3/4 inch for access door signs and similar operational instructions.

1. Material: Brass.
2. Stencil Paint: Exterior, oil-based, alkyd-gloss black enamel, unless otherwise indicated. Paint may be in pressurized spray-can form.
3. Identification Paint: Exterior, oil-based, alkyd enamel in colors according to ASME A13.1, unless otherwise indicated.

D. Snap-on Plastic Pipe Markers: Manufacturer's standard preprinted, semirigid, snap-on type. Include color-coding according to ASME A13.1, unless otherwise indicated.

E. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, color-coded, pressure-sensitive-vinyl type with permanent adhesive.

F. Pipes with OD, Including Insulation, Less Than 6 Inches: Full-band pipe markers, extending 360 degrees around pipe at each location.

G. Pipes with OD, Including Insulation, 6 inches and larger: Either full-band or strip-type pipe markers, at least three times letter height and of length required for label.

H. Lettering: Manufacturer's standard preprinted captions as selected by Architect.

I. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.

1. Arrows: Either integrally with piping system service lettering to accommodate both directions of flow, or as separate unit on each pipe marker to indicate direction of flow.

J. Plastic Tape: Manufacturer's standard color-coded, pressure-sensitive, self-adhesive vinyl tape, at least 3 mils thick.

1. Width: 1-1/2 inches on pipes with OD, including insulation, less than 6 inches; 2-1/2 inches for larger pipes.
2. Color: Comply with ASME A13.1, unless otherwise indicated.

K. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch sequenced numbers. Include 5/32-inch hole for fastener.

1. Material: 0.032-inch-thick, polished brass.
2. Material: 0.0375-inch-thick stainless steel.
3. Material: 3/32-inch- thick plastic laminate with 2 black surfaces and a white inner layer.
4. Material: Valve manufacturer's standard solid plastic.
5. Size: 1-1/2 inches in diameter, unless otherwise indicated.
6. Shape: As indicated for each piping system.

L. Valve Tag Fasteners: Brass, wire-link or beaded chain; or brass S-hooks.

M. Engraved Plastic-Laminate Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.

1. Engraving: Engraver's standard letter style, of sizes and with terms to match equipment identification.
2. Thickness: 1/8 inch, unless otherwise indicated.
3. Thickness: 1/16 inch, for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
4. Fasteners: Self-tapping, stainless-steel screws or contact-type permanent adhesive.

N. Plastic Equipment Markers: Manufacturer's standard laminated plastic, in the following color codes:

1. Green: Cooling equipment and components.
2. Yellow: Heating equipment and components.
3. Brown: Energy reclamation equipment and components.
4. Blue: Equipment and components that do not meet criteria above.
5. Hazardous Equipment: Use colors and designs recommended by ASME A13.1.
6. Terminology: Match schedules as closely as possible. Include the following:

    a. Name and plan number.
    b. Equipment service.
    c. Design capacity.
    d. Other design parameters such as pressure drop, entering and leaving conditions, and speed.

7. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

O. Plasticized Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with mat finish suitable for writing.

1. Size: 3-1/4 by 5-5/8 inches.
2. Fasteners: Brass grommets and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.

P. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in piped utility identification with corresponding designations indicated. Use numbers, letters, and terms indicated for proper identification, operation, and maintenance of piped utility systems and equipment.

1. Multiple Systems: Identify individual system number and service if multiple systems of same name are indicated.

2.6 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post hardening, volume adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

2. Design Mix: 5000-psi, 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

2.7 FLOWABLE FILL

A. Description: Low-strength-concrete, flowable-slurry mix.

1. Cement: ASTM C 150, Type I, portland.
2. Density: 115- to 145-lb/cu. ft..
3. Aggregates: ASTM C 33, natural sand, fine and crushed gravel or stone, coarse.
4. Aggregates: ASTM C 33, natural sand, fine.
5. Admixture: ASTM C 618, fly-ash mineral.
6. Water: Comply with ASTM C 94/C 94M.
7. Strength: 100 to 200 psig at 28 days.

PART 3 - EXECUTION

3.1 PIPED UTILITY DEMOLITION

A. Refer to Section 02 4116 "Structure Demolition" for general demolition requirements and procedures.

B. Disconnect, demolish, and remove piped utility systems, equipment, and components indicated to be removed.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Piping to Be Abandoned in Place: Drain piping. Fill abandoned piping with flowable fill, and cap or plug piping with same or compatible piping material.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.

C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 DIELECTRIC FITTING APPLICATIONS

A. Dry Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 and Smaller: Dielectric unions.
2. NPS 2-1/2 to NPS 12: Dielectric flanges.

B. Wet Piping Systems: Connect piping of dissimilar metals with the following:

1. NPS 2 and Smaller: Dielectric nipples.
2. NPS 2-1/2 to NPS 4: Dielectric nipples.
3. NPS 2-1/2 to NPS 8 : Dielectric nipples.
4. NPS 10 and NPS 12: Dielectric flange kits.

3.3 PIPING INSTALLATION

A. Install piping according to the following requirements and utilities Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on the Coordination Drawings.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping to permit valve servicing.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Select system components with pressure rating equal to or greater than system operating pressure.

I. Sleeves are not required for core-drilled holes.

J. Permanent sleeves are not required for holes formed by removable PE sleeves.

K. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

1. Cut sleeves to length for mounting flush with both surfaces.

    a. Exception: Extend sleeves installed in floors of equipment areas or other wet areas 2 inches above finished floor level.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.

    a. PVC Pipe Sleeves: For pipes smaller than NPS 6.
    b. Steel Sheet Sleeves: For pipes NPS 6 and larger, penetrating gypsum-board partitions.

L. Verify final equipment locations for roughing-in.

M. Refer to equipment specifications in other Sections for roughing-in requirements.

3.4 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and utilities Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

G. Grooved Joints: Assemble joints with grooved-end pipe coupling with coupling housing, gasket, lubricant, and bolts according to coupling and fitting manufacturer's written instructions.

H. Soldered Joints: Apply ASTM B 813 water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B 32.

I. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

J. Pressure-Sealed Joints: Assemble joints for plain-end copper tube and mechanical pressure seal fitting with proprietary crimping tool to according to fitting manufacturer's written instructions.

K. Plastic Piping Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

L. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

M. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

N. Plastic Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End PE Pipe and Fittings: Use butt fusion.
2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

O. Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.5 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Install dielectric fittings at connections of dissimilar metal pipes.

3.6 EQUIPMENT INSTALLATION

A. Install equipment level and plumb, unless otherwise indicated.

B. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference with other installations. Extend grease fittings to an accessible location.

C. Install equipment to allow right of way to piping systems installed at required slope.

3.7 PAINTING

A. Painting of piped utility systems, equipment, and components is specified in Section 099100 "Painting".

B. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.8 IDENTIFICATION

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Stenciled Markers: According to ASME A13.1.
2. Plastic markers, with application systems. Install on insulation segment if required for hot non-insulated piping.
3. Locate pipe markers on exposed piping according to the following:

    a. Near each valve and control device.
    b. Near each branch, excluding short takeoffs for equipment and terminal units. Mark each pipe at branch if flow pattern is not obvious.
    c. Near locations where pipes pass through walls or floors or enter inaccessible enclosures.
    d. At manholes and similar access points that permit view of concealed piping.
    e. Near major equipment items and other points of origination and termination.

B. Equipment: Install engraved plastic-laminate sign or equipment marker on or near each major item of equipment.

1. Lettering Size: Minimum 1/4 inch high for name of unit if viewing distance is less than 24 inches, 1/2 inch high for distances up to 72 inches, and proportionately larger lettering for greater distances. Provide secondary lettering two-thirds to three-fourths of size of principal lettering.
2. Text of Signs: Provide name of identified unit. Include text to distinguish among multiple units, inform user of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

C. Adjusting: Relocate identifying devices that become visually blocked by work of this or other Divisions.

3.9 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of base.
3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
5. Install anchor bolts to elevations required for proper attachment to supported equipment.
6. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 4000-psi, 28-day compressive-strength concrete and reinforcement as specified in Section 033000 "Cast-in-Place Concrete."

3.10 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor piped utility materials and equipment.

B. Field Welding: Comply with AWS D1.1/D1.1M.

3.11 GROUTING

A. Mix and install grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 33 0500

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SECTION 33 4100 - STORM UTILITY DRAINAGE PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

B. Georgia DOT Standards and Specifications, Latest Edition.

1.2 SUMMARY

A. This Section includes gravity-flow, non-pressure storm drainage outside the building, with the following components:
   1. Adjust list below to suit Project.
   2. Pipe
   3. Cleanouts
   4. Inline drains and drain basins
   5. Catch Basins

1.3 DEFINITIONS

A. Retain abbreviations that remain after this Section has been edited.

B. CPP: Corrugated polyethylene plastic.

C. PVC: Polyvinyl chloride plastic.

D. SICPP: Smooth Interior corrugated polyethylene plastic

E. HDPE: High-Density Polyethylene

F. RCP: Reinforced concrete pipe

1.4 PERFORMANCE REQUIREMENTS

A. Gravity-Flow, Non-pressure, Drainage-Piping Pressure Rating: 10-Foot head of water. Pipe joints shall be at least silttight, unless otherwise indicated.

1.5 SUBMITTALS

A. Product Data: For the following:
   1. Pipe.
   2. Cleanouts
   3. Drain inlets.
   4. Catch Basin

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic pipe and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

1.7 PROJECT CONDITIONS

A. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:

1. Notify Owner's Representative no fewer than two days in advance of proposed interruption of service.
2. Do not proceed with interruption of service without Owner's Representative written permission.

PART 2 - PRODUCTS

All products shall meet the more stringent of the requirement contained herein or the latest edition of the Georgia DOT Standards and Specifications.

2.1 SICPP AND PCPP PIPE AND FITTINGS

A. Smooth interior corrugated polyethylene drainage pipe (SICPP) or corrugated polyethylene pipe (CPP) and Fittings: AASHTO M 252M or M 294M, Type S, with smooth waterway for coupling joints.
   1. Soiltight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.

B. Perforated corrugated polyethylene drainage pipe (PCPP) and fittings.

2.2 CONCRETE PIPE AND FITTINGS

A. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76.
   1. Bell-and-spigot ends and gasketed joints with ASTM C 443, rubber gaskets
   2. Class III.

2.3 CLEANOUTS

A. Gray-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.
   1. Top-Loading Classification: Heavy duty.
   2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.4 INLINE DRAIN AND DRAIN BASINS

A. PVC Inline Drains and Drain Basis
   1. Size as designated on Contract Drawings
   2. Thermo-molded configuration.
   3. Watertight connection to pipe system conforming with ASTM D3034.
   4. Manufacturer: Nyloplast or approved equal.

B. Ductile Iron Grate, integral to the surface drain inlet, and furnished by a single manufacturer as a system.
   1. Size designated on the Contract Drawings.
   2. Bottom grate flange matching the internal pipe diameter.
   3. AASHTO H-20 loading
   4. Grates shall be painted black.
   5. Manufacturer: Nyloplast or approved equal.

2.5 MANHOLES

A. Standard Precast Concrete Manholes:
   1. Description: ASTM C 913; designed according to ASTM C 890 for A-16 (AASHTO HS20-44), heavy-traffic, structural loading; of depth, shape, and dimensions indicated, with provision for sealant joints.

2. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
3. Diameter: 48 inches minimum unless otherwise indicated.
4. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
5. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
6. Riser Sections: 4-inch minimum thickness, and lengths to provide depth indicated.
7. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
8. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
9. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
10. Steps: Individual FRP steps; ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than [36 inches].
11. Retain one of two subparagraphs below if required to raise top of manhole to grade.
12. Adjusting Rings: Interlocking HDPE rings with level or sloped edge in thickness and diameter matching manhole frame and cover, and of height required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
13. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

B. Manhole Frames and Covers:
1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch-minimum width flange and 26-inch-diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."
2. Material: In accordance with NCDOT specifications.

2.6 CATCH BASINS

A. Standard Precast Concrete Catch Basins: Precast, reinforced concrete, AASHTO HS20-44, heavy-traffic, structural loading, of depth indicated, with provision for sealant joints.
1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having separate base slab or base section with integral floor.
2. Catch basins shall be 3-foot by 3-foot (nominal internal dimension) with one foot deep sump below lowest invert.
3. Riser Sections: 4-inch minimum thickness and lengths to provide depth indicated.
4. Top Section: Flat-slab-top type.
5. Joint Sealant: ASTM 990 bitumen or butyl rubber.
6. Grade Rings: Include matching reinforced-concrete rings.
7. Steps: Provide steps wide enough to allow worker to place both feet on 1 step and designed to prevent lateral slippage off of step. Cast or anchor steps into sidewalls at 12 to 16-inch intervals. Omit steps if total depth from floor of catch basin to finished grade is less than 60 inches.
8. Pipe Connectors: ASTM C 923, resilient, of size required, for each pipe connecting to base section.

B. Frames and Grates: ASTM A 536, Grade 60-40-18, ductile iron designed for A-16, structural loading. Include flat grate with small square or short-slotted drainage openings as designated on Contract Drawings.

PART 3 - EXECUTION

All installations shall meet the more stringent of the requirement contained herein or the latest edition of the Georgia DOT Standards and Specifications.

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 2 Section "Earthwork".

3.2 PIPING INSTALLATION

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

E. Tunneling: Install pipe under streets or other obstructions that cannot be disturbed by tunneling, jacking, or a combination of both.

3.3 CLEANOUT INSTALLATION

A. Install cleanouts and riser extension from sewer pipe to cleanout at grade. Use cast-iron soil pipe fittings in sewer pipes at branches for cleanouts and cast-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

B. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.4 IN LINE DRAIN AND DRAIN BASINS

A. Install in line drains and drain basin in line with sewer piping in accordance with the contract documents and the manufacturer's recommendations.

B. Set rim frames and covers in concrete as recommended by manufacturer, with grates flush with surface.

3.5 CATCH BASIN INSTALLATION

A. Construct catch basins to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.6 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
   1. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
      c. Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leakage into piping.
      e. Exfiltration: Water leakage from or around piping.
   2. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
   3. Reinspect and repeat procedure until results are satisfactory.

3.7 CLEANING

A. Following installation, all installed storm drainage piping shall be flushed clean with potable water to clean interior of piping of dirt and superfluous materials. Contractor is responsible for appropriate disposal of any materials flushed from the storm piping system.

END OF SECTION 33 4100

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TECHNICAL SPECIFICATIONS

APPENDIX A

FOR

LYNWOOD PARK

Matrix Engineering Group, Inc.
engineers | special inspectors | construction consultants

4358 Chamblee Tucker Rd, Ste 3
Tucker, GA 30084
Tel. (770) 448-3124, Fax (770) 448-5324

EARTHWORK

Matrix Report # 1

Project Name: Lynwood Park (Geotechnical)
Date: 5/21/2020 **Day:** Thursday

Project No: 302402
Weather: Overcast

Representative: Ryan Woodcum, PE
Temperature: 70 - 90°

General Contractor: -
Evaluation Type: Earthwork

Rainfall Amount: 0 inch

Location: Infiltration Testing

Matrix Engineering Group completed the authorized infiltration testing at Lynwood Park on May 21, 2020. Please find attached the infiltration report with the investigative findings.

The field testing was performed by Mr. Ryan Woodcum, P.E. of Ahlberg Engineering, Inc. at the designated locations provided by the City of Brookhaven. Refer to the attached plan for the approximate locations. The following was our findings:

- Infiltration Rate at Test No. 1 at the planned depth of 5.5' Below Ground Surface (BGS) was 20 minutes per inch [**0.36 inches per hr**]
- Infiltration Rate at Test No. 2 at the planned depth of 8' Below Ground Surface (BGS) was 24 minutes per inch [**0.30 inches per hr**]
- Infiltration Rate at Test No. 3 at the planned depth of 8' Below Ground Surface (BGS) was 30 minutes per inch [**0.19 inches per hr**]
- Infiltration Rate at Test No. 4 at the planned depth of 8' Below Ground Surface (BGS) was 24 minutes per inch [**0.25 inches per hr**]
- Infiltration Rate at Test No. 5 at the planned depth of 8' Below Ground Surface (BGS) was 5 minutes per inch [**0.83 inches per hr**]

Nick Ackall
Prepared By

Sam Al Yateem, P.E.
Reviewed By

Respectfully submitted
MATRIX ENGINEERING GROUP, INC.

Matrix Engineering Group, Inc.
engineers | special inspectors | construction consultants

4358 Chamblee Tucker Rd, Ste 3
Tucker, GA 30084
Tel. (770) 448-3124, Fax (770) 448-5324

EARTHWORK

Project Name: Lynwood Park (Geotechnical) **Date:** 5/21/2020 **Day:** Thursday

Project No: 302402 **Weather:** Overcast

Representative: Ryan Woodcum, PE **Temperature:** 70 - 90°

General Contractor: - **Rainfall Amount:** 0 inch

For action items found during this evaluation					
Ref#	**Deficiency(Action Item)**	**Location**	**Addressed By**	**Date**	**Action Taken**
There are no corrective action items for this report.					
Additional Comments:					

Matrix Reviewer

AEI Ahlberg Engineering Inc. 525 Webb Industrial Drive Suite A Marietta, GA 30062 Telephone (770) 919-9968 Fax (770) 919-9964

May 22, 2020

Mr. Naser Ackall
Matrix Engineering Group, Inc.
4358 Chamblee Tucker Road
Suite 3
Tucker, GA 30084

via email – naser@matrixengineeringgroup.com

Re: Percolation Tests
Lynwood Park
3360 Osborne Road, NE
Brookhaven, GA 30319
Project No. 01-204011

Dear Mr. Ackall:

In compliance with your instructions, we have performed percolation tests for the referenced project. The results are to be found in the accompanying report.

This report presents the results of the percolation tests for the Lynwood Park project, conducted for Matrix Engineering Group, Inc. The work was performed in accordance with our Proposal No. P-20038 dated May 22, 2020. Authorization to perform this exploration and analysis was given in the form of a verbal agreement.

The purpose of the percolation tests was to evaluate the soil and groundwater conditions at the site as well as to provide the Design Engineer a percolation rate.

The scope of the percolation tests included a reconnaissance of the immediate site, the subsurface exploration, field testing, and an engineering analysis and evaluation of the subsurface materials.

The data submitted are based on the available soil information and the preliminary design details. The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein, have been presented after being prepared in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics and engineering geology. No other warranties are implied or expressed.

This report has been prepared for the exclusive use of Matrix Engineering Group, Inc. for the specific application to the Lynwood Park project.

The field exploration included a reconnaissance of the project site and performing five (5) percolation tests at depths ranging from approximately five and one half (5 ½) feet to approximately eight (8) feet below the existing ground surface. The borings were made in locations determined by others; and were located in the field and performed by Matrix Engineering Group, Inc.

Of exception and due to shallow hand auger refusal, AEI attempted to offset Boring P-1. The percolation test at Boring P-1 was performed at an approximate depth of five and one half (5 ½) feet below the existing ground surface. The locations are shown on the accompanying Percolation Test Location Plan. The excavations were backfilled with excavated soil.

The percolation rate measurements were made in accordance with the Modified Taft Engineering Center Method. The percolation test holes were bored with vertical sides and a minimum diameter of four (4) inches. Approximately two (2) inches of gravel were added to protect the bottom of the percolation test holes from sediment. The percolation test holes were filled with water. Water was allowed to stand in the test holes until the soil was saturated. A fixed point at the ground surface was established and repeated measurements made of the distance in inches from that point to the water surface. Approximately the same time interval was used between measurements. Successive measurements were continued at approximately equal time intervals until a constant rate of percolation was demonstrated by the water surface dropping the same distance per time interval.

The measured percolation rates were adjusted for each test according to the following formula found in City of Atlanta, Georgia's Green Infrastructure Practices for Small Commercial Development APPENDIX C – Infiltration Testing Parameters:

Infiltration Rate = (Percolation Rate) / (Reduction Factor), where the Reduction Factor is given by:

$Rf = (2d1-\Delta d)/DIA + 1$, with:

$d1$ = initial water depth, in.

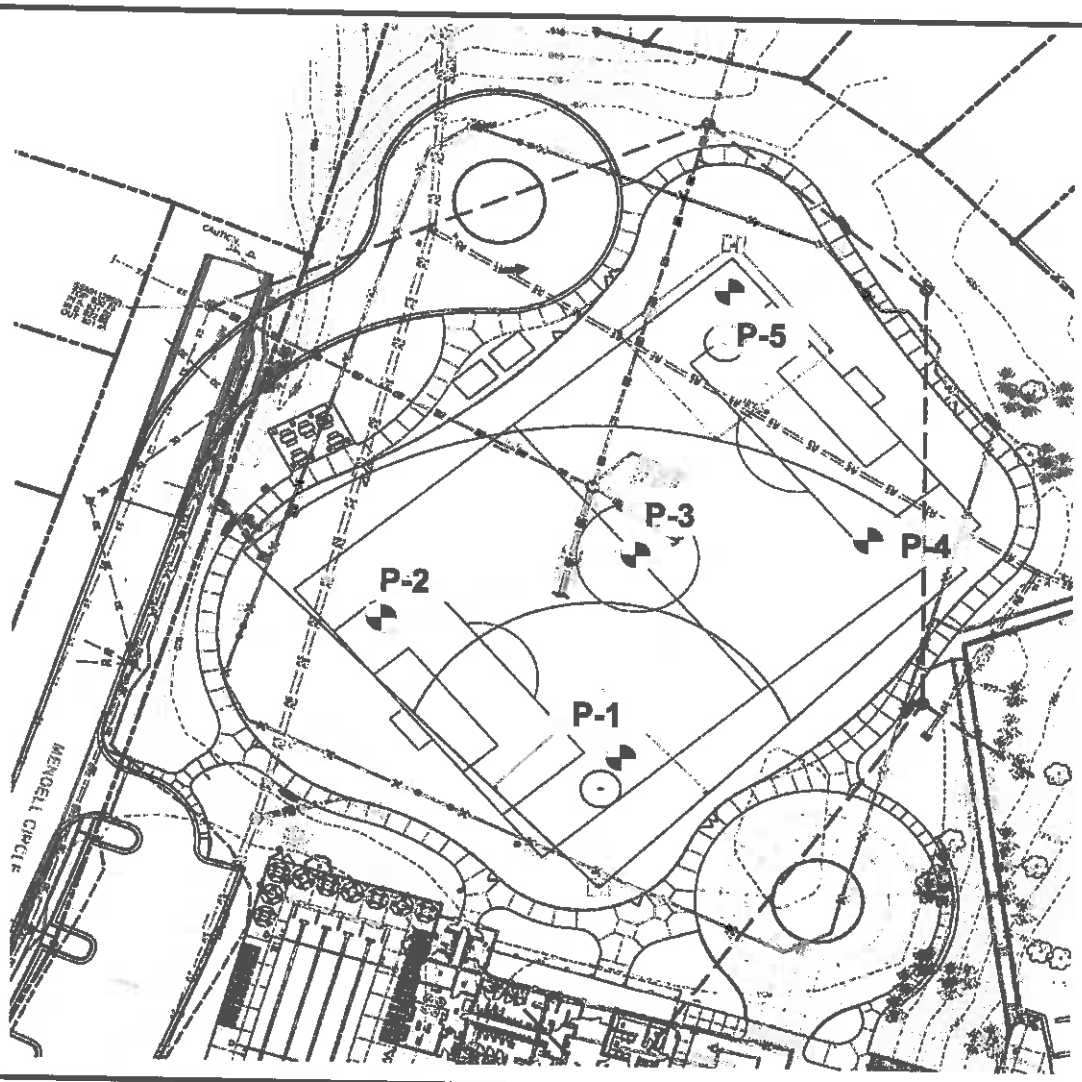
Δd = average/final water level drop, in.

DIA = diameter of the percolation test hole, in.

A percolation rate of twenty (20) minutes per inch was measured in location P-1 at a depth of approximately five and one half (5 ½) feet below existing grade. An infiltration rate of 0.36 inches per hour was calculated. A percolation rate of twenty-four (24) minutes per inch was measured in location P-2 at a depth of approximately eight (8) feet below existing grade. An infiltration rate of 0.30 inches per hour was calculated. A percolation rate of thirty (30) minutes per inch was measured in location P-3 at a depth of approximately eight (8) feet below existing grade. An infiltration rate of 0.19 inches per hour was calculated. A percolation rate of twenty-four (24) minutes per inch was measured in location P-4 at a depth of approximately eight (8) feet below existing grade. An infiltration rate of 0.25 inches per hour was calculated. A percolation rate of five (5) minutes per inch was measured in location P-5 at a depth of approximately eight (8) feet below existing grade. An infiltration rate of 0.83 inches per hour was calculated.

Respectfully submitted,
AHLBERG ENGINEERING, INC.

Ryan D. Woodcum, PE
Principal Engineer



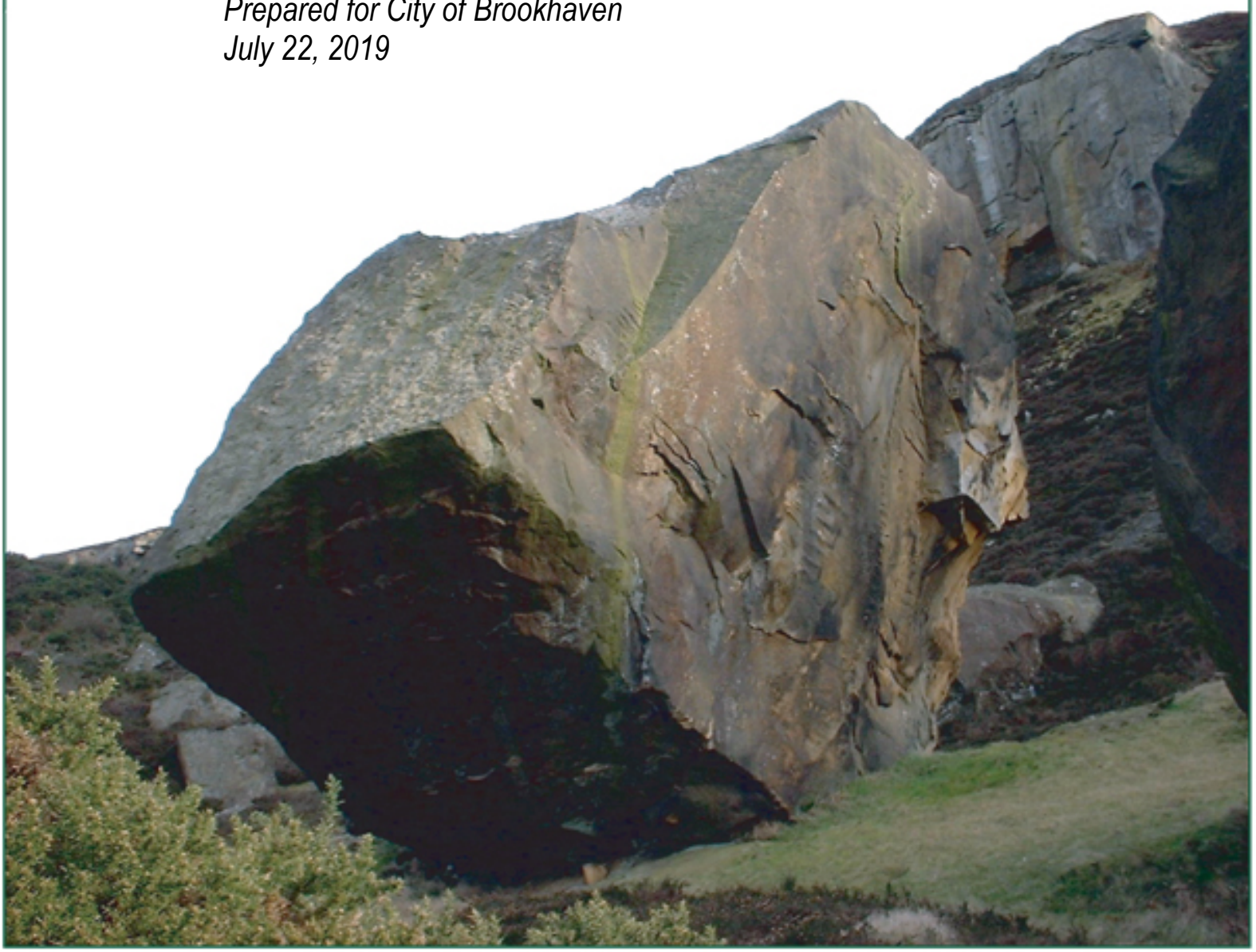
PROJECT NAME		PROJECT NO.	LEGEND
Lynwood Park 3360 Osborne Road, NE Brookhaven, Georgia 30319	**Percolation Test Location Plan** **AHLBERG ENGINEERING, INC.**	01-204011 DATE 5/21/2020	Percolation Test Location

GEO HYDRO ENGINEERS

Report of Subsurface Exploration and Geotechnical Engineering Evaluation

Lynwood Park Improvements
Brookhaven, Georgia
Geo-Hydro Project Number 190665.20

Prepared for City of Brookhaven
July 22, 2019



Mr. Lee Croy, P.E.
City of Brookhaven
4362 Peachtree Road
Brookhaven, Georgia 30319

July 22, 2019

Report of Subsurface Exploration and Geotechnical Engineering Evaluation
Lynwood Park Improvements
Brookhaven, Georgia
Geo-Hydro Project Number 190665.20

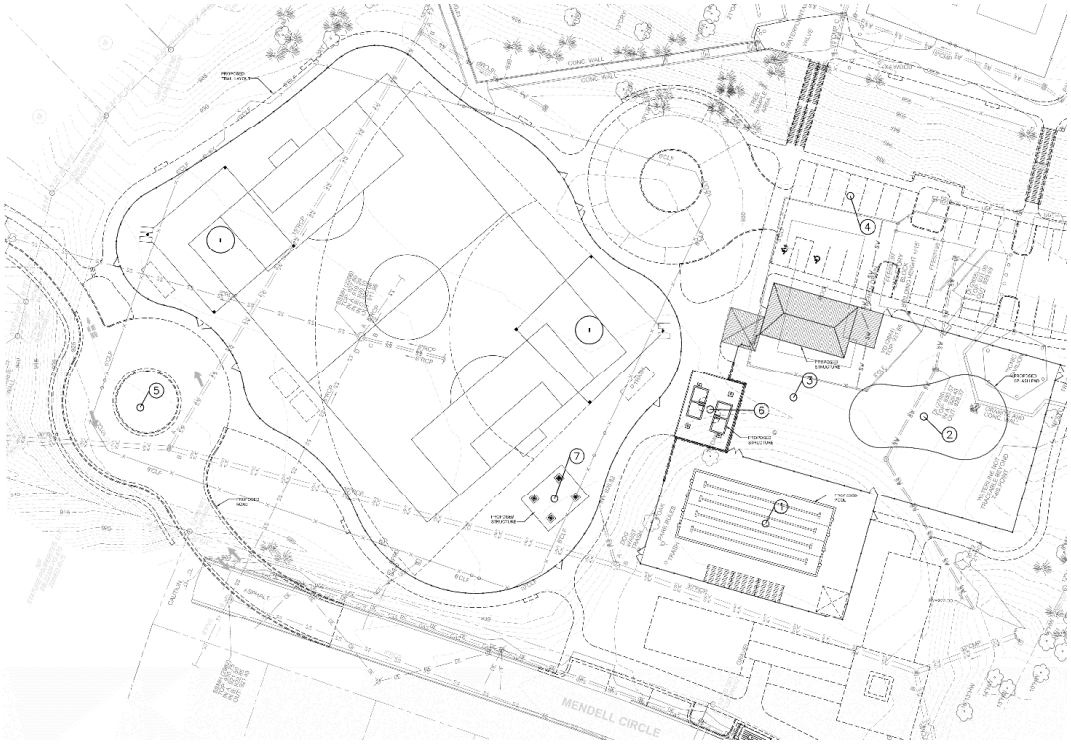
Dear Mr. Croy:

Geo-Hydro Engineers, Inc. has completed the authorized subsurface exploration for the above referenced project. The scope of services for this project was outlined in our proposal number 23389.2 dated June 6, 2019.

Project Information

The project site is located at 3360 Osborne Road NE in Brookhaven, Georgia. Figure 1 in the Appendix shows the approximate site location.

We understand that the park improvements will include the construction of a new swimming pool, splash pad, bathhouse, restroom building, and road extension/infrastructure improvements. We anticipate that the buildings will be single-story masonry structures with a slab-on-grade floor system. Specifics regarding the planned construction, site grading, or utility plans have not been provided to us at the time of this report. We understand that the maximum column load for new structures will not exceed 50 kips.



1000 Cobb Place Boulevard, Suite 290 • Kennesaw, Georgia 30144
o: 770.426.7100 • *f*: 770.426.5209 • *www.geohydro.com*

The site is mostly grassed and contains asphalt and gravel parking areas and some hardscapes. The site plan excerpt on the previous page illustrates the planned park improvements.

Exploratory Procedures

The subsurface exploration consisted of seven machine-drilled soil test borings performed at the approximate locations shown on Figure 2 included in the Appendix. The test borings were located in the field by Geo-Hydro by measuring angles and distances from existing site features. Elevations shown on the test boring records were interpolated from the topographic site plan provided to us and have been rounded to the nearest foot. In general, the boring locations and elevations should be considered approximate.

Standard penetration testing, as provided for in ASTM D-l586, was performed at select intervals in the soil test borings. Soil samples obtained from the drilling operation were examined and classified in general accordance with ASTM D-488 (Visual-Manual Procedure for Description of Soils). Soil classifications include the use of the Unified Soil Classification System described in ASTM D2487 (Classification of Soils for Engineering Purposes). The soil classifications also include our evaluation of the geologic origin of the soils. Evaluations of geologic origin are based on our experience and interpretation and may be subject to some degree of error.

Descriptions of the soils encountered, groundwater conditions, standard penetration resistances, and other pertinent information are provided in the test boring records included in the Appendix.

Regional Geology

The project site is located in the Southern Piedmont Geologic Province of Georgia. Soils in this area have been formed by the in-place weathering of the underlying crystalline rock, which accounts for their classification as “residual” soils. Residual soils near the ground surface that have experienced advanced weathering frequently consist of red brown clayey silt (ML) or silty clay (CL). The thickness of this surficial clayey zone may range up to roughly 6 feet. For various reasons, such as erosion or local variation of mineralization, the upper clayey zone is not always present.

With increased depth, the soil becomes less weathered, coarser grained, and the structural character of the underlying parent rock becomes more evident. These residual soils are typically classified as sandy micaceous silt (ML) or silty micaceous sand (SM). With a further increase in depth, the soils eventually become quite hard and take on an increasing resemblance to the underlying parent rock. When these materials have a standard penetration resistance of l00 blows per foot or greater, they are referred to as partially weathered rock. The transition from soil to partially weathered rock is usually a gradual one, and may occur at a wide range of depths. Lenses or layers of partially weathered rock are not unusual in the soil profile.

Partially weathered rock represents the zone of transition between the soil and the indurated metamorphic rocks from which the soils are derived. The subsurface profile is, in fact, a history of the weathering process that the crystalline rock has undergone. The degree of weathering is most advanced at the

ground surface, where fine-grained soil may be present. Conversely, the weathering process is in its early stages immediately above the surface of relatively sound rock, where partially weathered rock may be found.

The thickness of the zone of partially weathered rock and the depth to the rock surface have both been found to vary considerably over relatively short distances. The depth to the rock surface may frequently range from the ground surface to 80 feet or more. The thickness of partially weathered rock, which overlies the rock surface, may vary from only a few inches to as much as 40 feet or more.

Geologic conditions in parts of at the site have been modified by previous grading activities.

Soil Test Boring Summary

Starting at the ground surface, all borings encountered topsoil ranging in thickness from about 2 to 6 inches. Measurements necessary for detailed quantity estimation were not part of our work scope. For budgeting purposes, we suggest using an average surface material thicknesses of 10 inches.

Beneath the surface materials, borings L-1, L-5, L-6, and L-7 encountered fill materials extending to depths ranging from about 3 to 22 feet. The fill was classified as silty clay and sandy silt with varying amounts of rock fragments and organics. Boring L-5 was terminated within the fill at a depth of 20 feet. Standard penetration resistances recorded in the fill ranged from 4 to greater than 100 blows per foot. Based on our visual classification of the soil samples obtained during drilling, it is likely that penetration resistance values were amplified by rock fragments and organics and such elevated penetration resistance values should not be considered indicative of the consistency of the fill.

Beneath surface or fill materials, all of the borings except L-5 encountered residual soils typical of the Piedmont region. The residual soils were classified as sandy clay and silty sand. Standard penetration resistances in the residual soils ranged from 6 to 44 blows per foot.

Partially weathered rock was encountered in boring L-4 at a depth of about 3 feet. Partially weathered rock is locally defined as residual material having a standard penetration resistance of 100 blows per foot or greater.

Auger refusal was only encountered in boring L-4 at a depth of 7 feet. Auger refusal is the condition that prevents advancement of the boring using conventional soil drilling techniques. The material causing auger refusal may consist of a boulder, a lens or layer of rock, the upper surface of relatively massive rock, or other hard material.

At the time of drilling, groundwater was encountered in borings L-1, L-2, L-6, and L-7 at depths ranging from 13 to 23 feet. For safety reasons the borings were backfilled upon completion. It should be noted that groundwater levels will fluctuate depending on yearly and seasonal rainfall variations and other factors, and may rise in the future.

For more detailed descriptions of subsurface conditions, please refer to the test boring records included in the Appendix.

Summary of Subsurface Conditions

Boring	Approx. Ground Elevation	Bottom of Fill Material		Top of PWR		Depth to Auger Refusal		Groundwater*	
		Depth (feet)	Approx. Elevation	Depth (feet)	Approx. Elevation	Depth (feet)	Approx. Elevation	Depth (feet)	Approx. Elevation
L-1	936	22	914	NE	---	NE	---	23	913
L-2	931	NE	---	NE	---	NE	---	13	918
L-3	931	NE	---	NE	---	NE	---	NE	---
L-4	931	NE	---	3	928	7	924	NE	---
L-5	926	>20	<906	NE	---	NE	---	NE	---
L-6	929	3	926	NE	---	NE	---	15	914
L-7	928	12	916	NE	---	NE	---	18	910

Depths and Elevations in this Summary Table are Approximate
NE: Not Encountered
PWR: Partially Weathered Rock
*: Groundwater measured at time of drilling only

Evaluations and Recommendations

The following evaluations and recommendations are based on the information available on the proposed construction, the data obtained from the test borings, and our experience with soils and subsurface conditions similar to those encountered at this site. Because the test borings represent a statistically small sampling of subsurface conditions, it is possible that conditions may be encountered during construction that are substantially different from those indicated by the test borings. In these instances, adjustments to the design and construction may be necessary.

Geotechnical Considerations

The following geotechnical characteristics of the site should be taken into account for planning and design:

- Borings L-1, L-5, L-6, and L-7 encountered fill materials extending to depths ranging from about 3 to 22 feet. The fill was classified as silty clay and sandy silt with varying amounts of rock fragments and organics. Boing L-1 encountered about 22 of fill that contained varying amounts of organics and wood. All fill containing organics should be removed from the proposed construction and drive areas and replaced with well-compacted structural fill material in accordance with the *Structural Fill* section of this report. Boring L-5 was terminated within the fill at a depth of 20 feet.

  Based on our visual classification of the soil samples obtained during drilling, it is likely that penetration resistance values were amplified by rock fragments and organics and such elevated penetration resistance values should not be considered indicative of the consistency of the fill. Variations within fill materials should be expected, and poor quality fill may be encountered intermediate of the areas directly explored. Remedial measures such as excavation and replacement of poor quality fill materials will be necessary. Thorough subgrade evaluations will be required during grading and construction.

- Boring L-4 encountered partially weathered rock at a depth of about 3 feet and auger refusal was encountered at a depth of 7 feet. With the exception of L-4, the test borings encountered materials which should be readily removable using conventional excavation equipment such as loaders and backhoes. No grading or utility plans have been provided to us at the time of this report. Depending on the layout of new underground utilities, partially weathered rock and mass rock may be encountered during construction in the area of boring L-4. If encountered, we expect that impact hammers will be necessary to remove partially weathered rock from trench excavations. Blasting is typically required for rock excavation, but impact hammers can also be used in small rock excavations.

- At the time of drilling, groundwater was encountered in borings L-1, L-2, L-6, and L-7 at depths ranging from 13 to 23 feet. It is important to note that the groundwater level will fluctuate over time depending on local rainfall amounts and other factors and may be encountered at higher elevations. No site grading or utility plans have been provided to us at this time. Once grading and utility plans have been developed, the potential effects of groundwater should be reevaluated.

- Contingent upon proper site preparation and thorough evaluation of the foundation excavations, it is our opinion that the proposed buildings can be supported using conventional shallow foundations and concrete slab-on-grade floors. For design purposes, we recommend an allowable soil bearing pressure of 2,500 psf or less.

- Based on the results of the test borings and following the calculation procedure in the 2018 International Building Code (Chapter 20, ASCE 7-16), the *Site Class* for the site is D. The mapped and design spectral response accelerations are as follows: S_S=0.194, S_1=0.087, S_{DS}=0.207, S_{D1}=0.139.

The following sections provide recommendations regarding these issues and other geotechnical aspects of the project.

Existing Fill Materials

Existing fill materials were encountered in borings L-1, L-5, L-6, and L-7 extending to depths ranging from about 3 to 22 feet. Boing L-1 encountered about 22 of fill that contained varying amounts of organics and wood. All fill containing organics should be removed from the proposed construction and drive areas and replaced with well-compacted structural fill material in accordance with the *Structural Fill* section of this report. Boring L-5 was terminated without fully penetrating the fill. There are several important facts that should be considered regarding existing fill materials and the limitations of subsurface exploration.

- The quality of existing fill materials can be highly variable, and test borings are often not able to detect all of the zones or layers of poor quality fill materials.

- Layers of poor quality fill materials that are less than about 2.5 to 5 feet thick may often remain undetected by soil test borings due to the discrete-interval sampling method used in this exploration.

- The interface between existing fill materials and the original ground surface may include a layer of organic material that was not properly stripped off during the original grading. Depending on its relationship to the foundation and floor slab bearing surfaces, an organic layer might adversely affect support of footings and floor slabs. If such organic layers are encountered during construction, it may be necessary to “chase out” the organic layer by excavating the layer along with overlying soils.

- The construction budget should include funds for management of poor quality existing fill materials.

- Subsurface exploration is simply not capable of disclosing all conditions that may require remediation.

General Site Preparation

Topsoil, roots, pavements, demolition debris, and other deleterious materials should be removed from the proposed construction areas. All existing utilities should be excavated and removed unless they are to be incorporated into the new construction. Additionally, site clearing, grubbing, and stripping should be performed only during dry weather conditions. Operation of heavy equipment on the site during wet conditions could result in excessive subgrade degradation. All excavations resulting from rerouting of underground utilities or demolition of underground structures should be backfilled in accordance with the *Structural Fill* section of this report.

We recommend that areas to receive structural fill be proofrolled prior to placement of structural fill. Areas of proposed excavation should be proofrolled after rough finished subgrade is achieved. Proofrolling should be performed with multiple passes in at least two directions using a fully loaded tandem axle dump truck weighing at least 18 tons. Proofrolling must be avoided within 10 feet of buildings and hardscapes to remain. If low consistency soils are encountered that cannot be adequately densified in place, such soils should be removed and replaced with well compacted fill material placed in accordance with the *Structural Fill* section of this report. Proofrolling should be observed by Geo-Hydro to determine if remedial measures are necessary.

For budgeting purposes, we suggest considering that approximately 30 percent of the planned buildings, pavement, and new hardscape areas will require undercutting and replacement extending to a depth of 3 feet below current grades in fill areas or 3 feet below target grades in cut areas. The suggested stabilization approach is intended only as a tool to estimate a cost associated with ground stabilization. Ground stabilization can be achieved by using geosynthetics, crushed stone, cement stabilization, etc. The need for, extent of, location, and optimal method of ground stabilization should be determined by Geo-Hydro at the time of construction based on actual site conditions. The extent and cost of ground stabilization may exceed the suggested budgetary estimate.

Boring L-1, located in the proposed swimming pool area, encountered soils containing organics and wood. Depending on the bottom-of-pool elevation, it may be necessary to either “chase” and remove highly organic soils and organic debris or stabilize the pool excavation bottom as needed to support the pool. We suggest excavating a few test pits within the pool footprint to better evaluate the existing fill materials and develop a plan to manage organic-laden fill or debris within the pool excavation.

During site preparation, burn pits or trash pits may be encountered. On sites located in or near developed areas, this is not an unusual occurrence. All too frequently such buried material occurs in isolated areas which are not detected by the soil test borings. Any buried debris or trash found during the construction operation should be thoroughly excavated and removed from the site.

Excavation Characteristics

Boring L-4 encountered partially weathered rock at a depth of about 3 feet and encountered conditions causing auger refusal at a depth of 7 feet. With the exception of L-4, the test borings encountered materials which should be readily removable using conventional excavation equipment such as loaders

and backhoes. However, it is important to note that the depth to rock or partially weathered rock may vary drastically over relatively short distances. It would not be unusual for rock pinnacles, boulders, or rock lenses to occur at higher elevations between or around some of the soil test borings.

For construction bidding and field verification purposes it is common to provide a verifiable definition of rock in the project specifications. The following are typical definitions of mass rock and trench rock:

- Mass Rock: Material which cannot be excavated with a single-tooth ripper drawn by a crawler tractor having a minimum draw bar pull rated at 56,000 pounds (Caterpillar D-8K or equivalent), and occupying an original volume of at least one cubic yard.

- Trench Rock: Material occupying an original volume of at least one-half cubic yard which cannot be excavated with a hydraulic excavator having a minimum flywheel power rating of 123 kW (165 hp); such as a Caterpillar 322C L, John Deere 230C LC, or a Komatsu PC220LC-7; equipped with a short tip radius bucket not wider than 42 inches.

The foregoing definitions are based on large equipment typically utilized for mass grading. Subsequent excavations for building foundations and underground utilities are often performed with smaller equipment such as rubber-tired backhoe/loaders or even mini-excavators. Small equipment will encounter difficult excavation during building construction and utility installation, and contractors will often request additional payment for mobilizing larger equipment than that which was anticipated during preparation of their construction bid. The amount of additional compensation, if any, and the minimum equipment size necessary to qualify for any additional compensation should be defined before the start of construction

Blasting

In most cases rock excavation is performed by blasting. Standard blasting procedures include drilling through the materials to be blasted to introduce the explosives and covering up the area to be blasted to prevent flying debris. The area to be blasted is typically covered with several feet of soil or a blast mat. Alternatively, the existing soil overburden can be left in place, which in most cases will eliminate the need for a soil cover or a blast mat.

Blasting generates ground vibrations that can be detrimental to adjacent structures. Research by the United States Bureau of Mines and other organizations provides limits for safeguarding adjacent structures during blasting operations. A peak particle velocity of 2 inches per second is generally recognized as a conservative limit, and is the maximum peak particle velocity allowed by the Georgia Blasting Standards Act of 1978.

State and local laws require that precondition surveys of neighboring properties be performed prior to conducting blasting activities. Typical requirements are to conduct a precondition survey of structures and facilities within a 1,000-foot radius of the blast site. Vibration monitoring is also required in all four compass directions at the nearest structure not owned by the developer/owner. Some municipalities have

variations of these requirements, and the local requirements should be reviewed prior to beginning blasting activities.

Reuse of Excavated Materials

Based on the results of test boring and our observations, most of the existing fill materials and residual soils appear to be suitable for reuse as structural fill. However, all of the fill encountered in boring L-1 contained highly organic soils that will not be suitable for use as structural fill. Any excavated fill material containing organics, construction debris, or other debris in quantities that cannot be readily removed should be considered unsuitable for reuse. Geo-Hydro should observe the excavation of existing fill materials to evaluate their suitability for reuse. Soft, unstable fill soils free of deleterious materials may be reusable after routine moisture adjustment.

It is important to establish as part of the construction contract whether soils having elevated moisture content will be considered suitable for reuse. We often find this issue to be a point of contention and a source of delays and change orders. From a technical standpoint, soils with moisture contents wet of optimum as determined by the standard Proctor test (ASTM D698) can be reused provided that the moisture is properly adjusted to within the workable range. From a practical standpoint, wet soils can be very difficult to dry in small or congested sites and such difficulties should be considered during planning and budgeting. A clear understanding by the general contractor and grading subcontractor regarding the reuse of excavated soils will be important to avoid delays and unexpected cost overruns.

If generated during construction, partially weathered rock materials will be suitable for reuse as structural fill only if they break down into a reasonably well-graded material that can be satisfactorily compacted. The presence of cobble size or boulder size material, which does not break down under the action of compaction equipment, will limit the suitability of partially weathered rock materials. Engineering judgment will be required in the field to evaluate the acceptability of partially weathered rock materials for reuse as structural fill.

Partially weathered rock materials will be suitable for reuse as structural fill only if they break down into a reasonably well-graded material that can be satisfactorily compacted. The presence of cobble size or boulder size material, which does not break down under the action of compaction equipment, will limit the suitability of partially weathered rock materials. Engineering judgment will be required in the field to evaluate the acceptability of partially weathered rock materials for reuse as structural fill.

For planning purposes, blast rock should be considered unsuitable for reuse as structural fill.

Structural Fill

Materials selected for use as structural fill should be free of organic debris, waste construction debris, and other deleterious materials. The material should not contain rocks having a diameter over 4 inches. It is our opinion that the following soils represented by their USCS group symbols will typically be suitable for use as structural fill and are usually found in abundance in the Piedmont: (SM), (ML), and (CL). The following soil types are typically suitable but are not abundant in the Piedmont: (SW), (SP),

(SC), (SP-SM), and (SP-SC). The following soil types are considered unsuitable: (MH), (CH), (OL), (OH), and (Pt).

Laboratory Proctor compaction tests and classification tests should be performed on representative samples obtained from the proposed borrow material to provide data necessary to determine acceptability and for quality control. The moisture content of suitable borrow soils should generally be no more than 3 percentage points below or above optimum at the time of compaction. Tighter moisture limits may be necessary with certain soils.

It is possible that highly micaceous soils could be utilized as structural fill material. The use of such materials will require very close attention to quality control of moisture content and density. Additionally, it is our experience that highly micaceous soils tend to rut under rubber-tired vehicle traffic. Continuous maintenance of areas subjected to construction traffic is typically required until construction is completed.

Suitable fill material should be placed in thin lifts. Lift thickness depends on the type of compaction equipment, but a maximum loose-lift thickness of 8 inches is generally recommended. The soil should be compacted by a self-propelled sheepsfoot roller. Within small excavations such as in utility trenches, around manholes, above foundations, or behind retaining walls, we recommend the use of "wacker packers" or "Rammax" compactors to achieve the specified compaction. Loose lift thicknesses of 4 to 6 inches are recommended in small area fills.

We recommend that structural fill be compacted to at least 95 percent of the standard Proctor maximum dry density (ASTM D-698). The upper 12 inches of floor slab subgrade soils should be compacted to at least 98 percent of the standard Proctor maximum dry density. Additionally, the maximum dry density of structural fill should be no less than 90 pcf. Following Georgia DOT guidelines, the upper 12 inches of pavement subgrade soils should be compacted to at least 100 percent of the standard Proctor maximum dry density. Geo-Hydro should perform density tests during fill placement.

Groundwater

At the time of drilling, groundwater was encountered in borings L-1, L-2, L-6, and L-7 at depths ranging from 13 to 23 feet. It is important to note that the groundwater level will fluctuate over time depending on local rainfall amounts and other factors and may be encountered at higher elevations. No grading or utility plans have been provided to us at this time. Once grading and utility plans have been developed, the potential effects of groundwater should be reevaluated. Regardless of the groundwater conditions encountered in the borings, waterproofing and subsurface drainage is required for all retaining walls and building walls below grade.

Earth Slopes

Temporary construction slopes should be designed in strict compliance with OSHA regulations. The exploratory borings indicate that most soils at the site are Type B as defined in 29 CFR 1926 Subpart P.

This dictates that temporary construction slopes be no steeper than 1H:1V for excavation depths of 20 feet or less. *Temporary excavation slopes in fill materials or below the groundwater level must be no steeper than 1.5H:1V.* Temporary construction slopes should be closely observed on a daily basis by the contractor's "competent person" for signs of mass movement: tension cracks near the crest, bulging at the toe of the slope, etc. The responsibility for excavation safety and stability of construction slopes should lie solely with the contractor.

We recommend that extreme caution be observed in trench excavations. Several cases of loss of life due to trench collapses in Georgia point out the lack of attention given to excavation safety on some projects. We recommend that applicable local and federal regulations regarding temporary slopes, and shoring and bracing of trench excavations be closely followed.

Formal analysis of slope stability was beyond the scope of work for this project. Based on our experience, permanent cut or fill slopes should be no steeper than 2H:1V to maintain long term stability and to provide ease of maintenance. The crest or toe of cut or fill slopes should be no closer than 10 feet to any foundation. The crest or toe should be no closer than 5 feet to the edge of any pavements. Erosion protection of slopes during construction and during establishment of vegetation should be considered an essential part of construction.

Earth Pressure (Cast-in-Place Structures)

Three earth pressure conditions are generally considered for retaining wall design: "at rest", "active", and "passive" stress conditions. Retaining walls which are rigidly restrained at the top and will be essentially unable to rotate under the action of earth pressure (such loading dock walls) should be designed for "at rest" conditions. Retaining walls which can move outward at the top as much as 0.5 percent of the wall height (such as free-standing walls) should be designed for "active" conditions. For the evaluation of the resistance of soil to lateral loads the "passive" earth pressure must be calculated. It should be noted that full development of passive pressure requires deflections toward the soil mass on the order of l.0 percent to 4.0 percent of total wall height.

Earth pressure may be evaluated using the following equation:

$$p_h = K\,(D_w Z + q_s) + W_w(Z-d)$$

where: p_h = horizontal earth pressure at any depth below the ground surface (Z).
W_w = unit weight of water
Z = depth to any point below the ground surface
d = depth to groundwater surface
D_w = wet unit weight of the soil backfill (depending on borrow sources). The wet unit weight of most residual soils may be expected to range from approximately 115 to 125 pcf. Below the groundwater level, D_w must be the buoyant weight.
q_s = uniform surcharge load (add equivalent uniform surcharge to account for construction equipment loads)
K = earth pressure coefficient as follows:

Earth Pressure Condition	Coefficient
At Rest (K_o)	0.5
Active (K_a)	0.33
Passive (K_p)	3.0

The groundwater term, $W_w(Z-d)$, should be used if no drainage system is incorporated behind retaining walls. If a drainage system is included which will not allow the development of any water pressure behind the wall, then the groundwater term may be omitted. The development of excessive water pressure is a common cause of retaining wall failures. Drainage systems should be carefully designed to ensure that long term permanent drainage is accomplished.

The above design recommendations are based on the following assumptions:

- Horizontal backfill
- 95 percent standard Proctor compactive effort on backfill (ASTM D698)
- No safety factor is included

For convenience, equivalent fluid densities are frequently used for the calculation of lateral earth pressures. For "at rest" stress conditions, an equivalent fluid density of 63 pcf may be used. For the "active" state of stress an equivalent fluid density of 42 pcf may be used. These equivalent fluid densities are based on the assumptions that drainage behind the retaining wall will allow *no* development of hydrostatic pressure; that native sandy silts or silty sands will be used as backfill; that the backfill soils will be compacted to 95 percent of standard Proctor maximum dry density; that backfill will be horizontal; and that no surcharge loads will be applied.

For analysis of sliding resistance of the base of a cast-in-place concrete retaining wall, the coefficient of friction may be taken as 0.4 for the soils at the project site. This is an ultimate value, and an adequate factor of safety should be used in design. The force which resists base sliding is calculated by multiplying the normal force on the base by the coefficient of friction. Full development of the frictional force could require deflection of the base of roughly 0.1 to 0.3 inches.

Foundation Design

We understand that the maximum column load for new structures will not exceed 50 kips. If actual loads are greater, please let us know so we can confirm that the allowable bearing pressure is still applicable.

After general site preparation and site grading have been completed in accordance with the recommendations of this report, it is our opinion that the proposed buildings and site wall can be supported using conventional shallow foundations. We recommend that footings be designed for an allowable soil bearing pressure of 2,500 psf. In addition, we recommend a minimum width of 24 inches for column footings and 18 inches for continuous wall footings to prevent general bearing capacity failure. Footings should bear at a minimum depth of 18 inches below the prevailing exterior ground surface elevation to avoid potential problems due to frost heave.

The recommended allowable soil bearing pressure is based on an estimated maximum total foundation settlement no greater than approximately 1 inch, with anticipated differential settlement between adjacent columns not exceeding about ½ inch. If the architect or structural engineer determine that the estimated total or differential settlement cannot be accommodated by the proposed structure, please contact us.

Foundation bearing surface evaluations should be performed in all footing excavations prior to placement of reinforcing steel. These evaluations should be performed by Geo-Hydro to confirm that the design allowable soil bearing pressure is available. Foundation bearing surface evaluations should be performed using a combination of visual observation, hand augering, and portable dynamic cone penetrometer testing (ASTM STP-399).

Because of natural variation, it is possible that some of the soils at the project site may have an allowable bearing pressure less than the recommended design value. Likewise, existing fill materials are highly variable, and may have an allowable bearing pressure less than the recommended design value. Therefore, foundation bearing surface evaluations will be critical to aid in the identification and remediation of these situations.

Remedial measures should be based on actual field conditions. However, in most cases we expect the use of the stone replacement technique to be the primary remedial measure. Stone replacement involves the removal of soft or loose soils, and replacement with well-compacted graded aggregate base (GAB) meeting Georgia Department of Transportation specifications for gradation. Stone replacement is generally performed to depths ranging from a few inches to as much as 2 times the footing width, depending on the actual conditions. For budgeting purposes, we suggest considering a contingency to treat approximately 25 percent of the foundation excavations using stone replacement extending to a depth of 3 feet below bearing elevation. The actual quantity of stone replacement will be different and may exceed the suggested estimate.

Seismic Design

Based on the results of the test borings and following the calculation procedure in the 2018 International Building Code (Chapter 20, ASCE 7-16), the Site Class for the site is D. The mapped and design spectral response accelerations are as follows: S_S=0.194, S_1=0.087, S_{DS}=0.207, S_{D1}=0.139.

Based on the information obtained from the soil test borings, it is our opinion that the potential for liquefaction of the residual soils at the site due to earthquake activity is relatively low.

Floor Slab Subgrade Preparation

The soil subgrade in the area of concrete slab-on-grade support is often disturbed during foundation excavation, plumbing installation, and superstructure construction. We recommend that the floor slab subgrade be evaluated by Geo-Hydro immediately prior to beginning floor slab construction. If low consistency soils are encountered that cannot be adequately densified in place, such soils should be removed and replaced with well-compacted fill material placed in accordance with the *Structural Fill* section of this report or with well-compacted graded aggregate base (GAB).

Assuming that the top 12 inches of floor slab subgrade soils are compacted to at least 98 percent of the standard Proctor maximum dry density, we recommend that a modulus of subgrade reaction of 120 pci be used for design.

Moisture Control for Concrete Slabs

To prevent the capillary rise of groundwater from adversely affecting the concrete slab-on-grade floor, we recommend that slab-on-grade floors be underlain by a minimum 4-inch thickness of open-graded stone. Use of #57 crushed stone meeting Georgia DOT specifications for gradation is suggested. The stone must be covered by a vapor retarder. We suggest polyethylene sheeting at least 10 mils thick as a minimum vapor retarder.

In areas were floor slabs may be subjected to vehicular traffic including forklifts, trucks, or other relatively heavy wheeled equipment, we recommend that slab-on-grade floors be underlain by a minimum 5-inch thickness of graded aggregate base (GAB) compacted to at least 100 percent of the modified Proctor maximum dry density (ASTM D1557). The GAB must be covered by a vapor retarder as suggested above.

Flexible Pavement Design

Based on our experience with similar projects, assuming standard pavement design parameters, and contingent upon proper pavement subgrade preparation, we recommend the following pavement sections:

Entrance/Exit Driveways, Main Drive Lanes, and Truck Traffic Areas

Material	Thickness (inches)
Asphaltic Concrete 9.5mm Superpave	2
Asphaltic Concrete 19mm Superpave	2
Graded Aggregate Base (GAB) (Base Course)	6
Subgrade compacted to at least 100% standard Proctor maximum dry density (ASTM D698)	12

Automobile Parking and Automobile Traffic Only

Material	Thickness (inches)
Asphaltic Concrete 9.5mm Superpave	2
Graded Aggregate Base (GAB) (Base Course)	6
Subgrade compacted to at least 100% standard Proctor maximum dry density (ASTM D698)	12

A concrete thickness of 7 inches is recommended for the approach and collection zone in front of the dumpster and in designated truck turn-around areas. Please refer to the *Concrete Pavement* section of this report for concrete pavement recommendations.

Similar to floor slab subgrades, pavement subgrades generally deteriorate due to constructions activities between the time of general site preparation and pavement construction. The top 12 inches of pavement

subgrade soils should be compacted to at least 100 percent of the standard Proctor maximum dry density (ASTM D698). Scarification and moisture adjustment will likely be required to achieve the recommended subgrade compaction level. Allowances for pavement subgrade preparation should be considered for budgeting and scheduling.

GAB must be compacted to at least 100 percent of the modified Proctor maximum dry density (ASTM D1557).

All pavement construction should be performed in general accordance with Georgia DOT specifications. Proper subgrade compaction, adherence to Georgia DOT specifications, and compliance with project plans and specifications, will be critical to the performance of the constructed pavement.

Concrete Pavement

A rigid portland cement concrete pavement may be considered. Although usually more costly, a portland cement concrete pavement is typically more durable and requires less maintenance throughout the life cycle of the facility. We recommend concrete thicknesses of 5 inches in automobile parking areas and 6 inches in driveways, traffic lanes, and truck traffic areas. A concrete thickness of 7 inches is recommended for the approach and collection zone in front of the dumpster and in designated truck turn-around areas.

A 600-psi flexural strength concrete mix (approximately 4,500 psi compressive strength) with 4 to 6 percent air entrainment should be used. The concrete pavement should be underlain by no less than 5 inches of compacted graded aggregate base (GAB). GAB should be compacted to at least 100 percent the modified Proctor maximum dry density (ASTM D1557). The top 12 inches of soil subgrade should be compacted to at least 100 percent of the standard Proctor maximum dry density (ASTM D698).

The concrete pavement may be designed as a “plain concrete pavement” with no reinforcing steel, or reinforcing steel may be used at joints. Construction joints and other design details should be in accordance with guidelines provided by the Portland Cement Association and the American Concrete Institute.

In general, all pavement construction should be in accordance with Georgia DOT specifications. Proper subgrade compaction, adherence to Georgia DOT specifications, and compliance with project plans and specifications will be critical to the performance of the constructed pavement.

Pavement Design Limitations

The pavement sections discussed above are based on our experience with similar type developments. After traffic information has been developed, we recommend that you allow us to review the traffic data and revise our recommendations as necessary.

Pavement Materials Testing

To aid in verifying that the pavement system is installed in general accordance with the design considerations, the following materials testing services are recommended:

- Density testing of subgrade materials.
- Proofrolling of pavement subgrade materials immediately prior to placement of graded aggregate base (GAB). This proofrolling should be performed the same day GAB is installed.
- Density testing of GAB and verification of GAB thickness. In-place density should be verified using the sand cone method (ASTM D1556).
- Coring of the pavement to verify thickness and density (asphalt pavement only).
- Preparation and testing of beams and cylinders for flexural and compressive strength testing (portland cement concrete only). The total number of test specimens required will depend on the number of concrete placement events necessary to construct the pavement.

******

We appreciate the opportunity to serve as your geotechnical consultant for this project and are prepared to provide any additional services you may require. If you have any questions concerning this report or any of our services, please call us.

Sincerely,

GEO-HYDRO ENGINEERS, INC..

John T. Redding, E.I.T.
Staff Engineer
jredding@geohydro.com

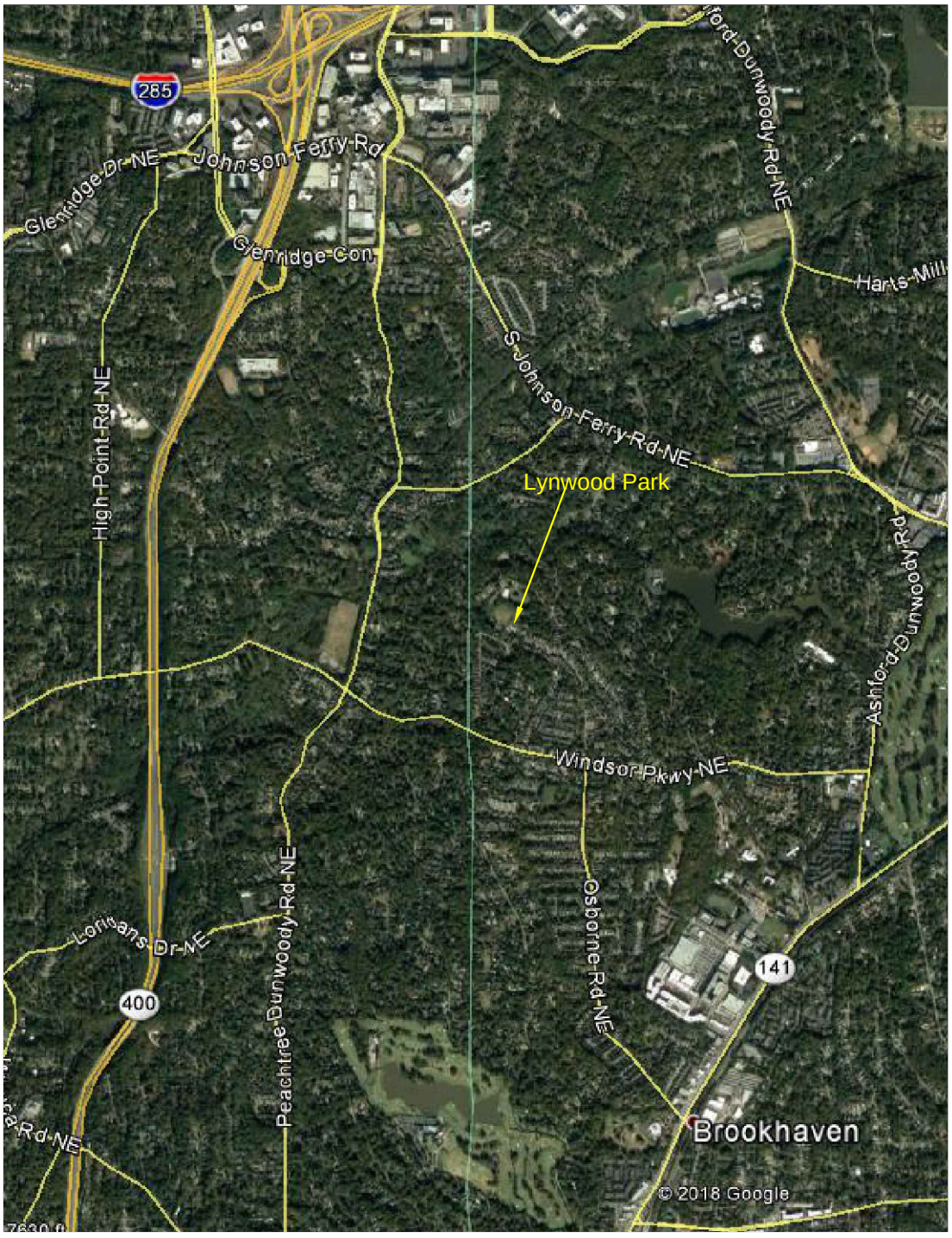
Luis E. Babler, P.E.
Chief Engineer
luis@geohydro.com

GEORGIA REGISTERED No. 021308 PROFESSIONAL ENGINEER LUIS E. BABLER

JTR/LEB/190665.20 Lynwood Park Improvements

GEO HYDRO ENGINEERS

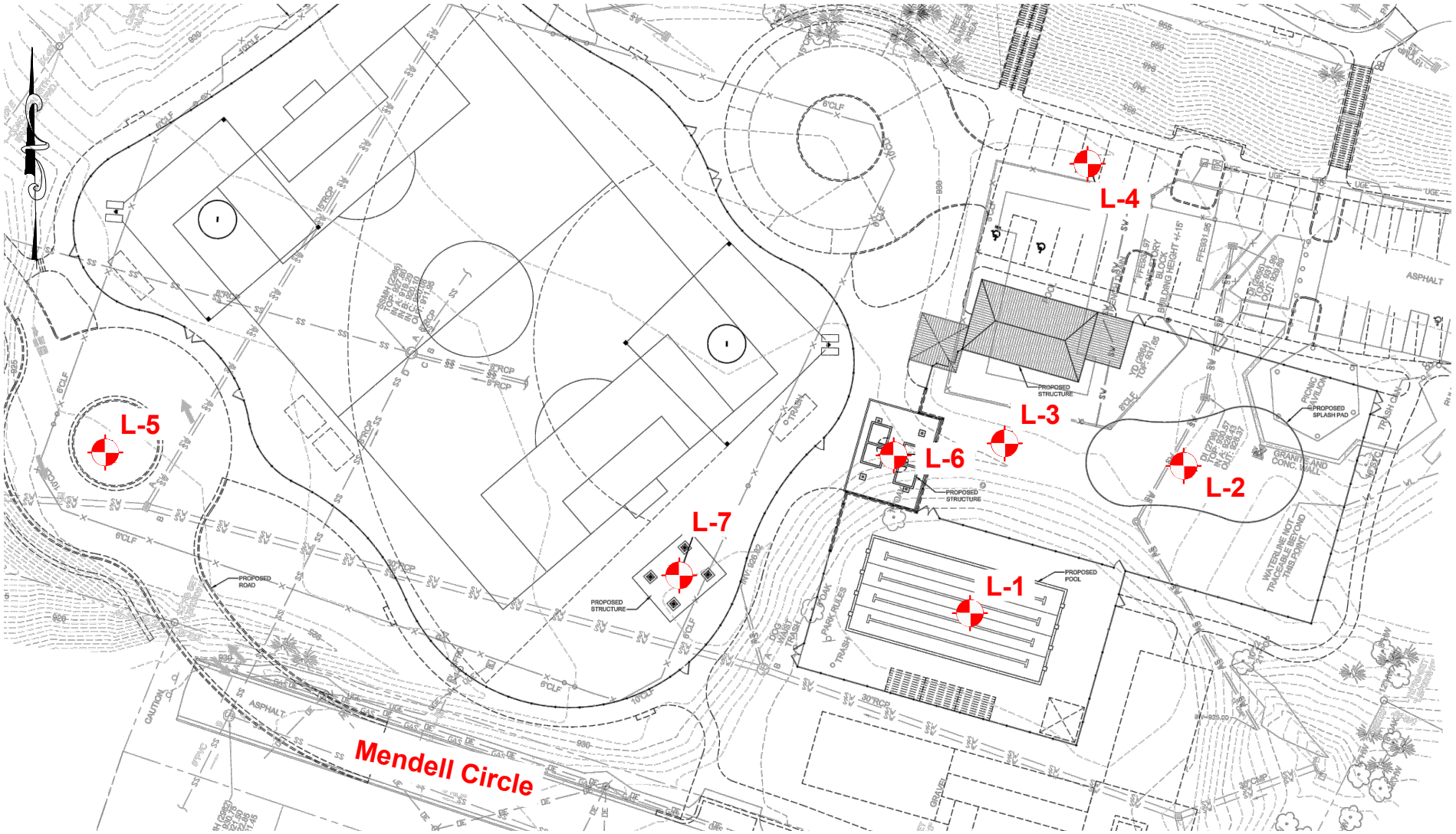
APPENDIX



0 0.25 0.5 1 1.5

Approximate Scale, Miles

Figure 1: Site Location Plan	Lynwood Park Improvements Brookhaven, Georgia Geo-Hydro Project Number 190665.20



Approximate Scale: 1"=60'

LEGEND: Soil Test Boring

Figure 2: Boring Location Plan

Lynwood Park Improvements
Brookhaven, Georgia
Geo-Hydro Project Number 190665.20

Symbols and Nomenclature

Symbols

▌	Thin-walled tube (TWT) sample recovered
▯	Thin-walled tube (TWT) sample not recovered
●	Standard penetration resistance (ASTM D1586)
50/2”	Number of blows (50) to drive the split-spoon a number of inches (2)
65%	Percentage of rock core recovered
RQD	Rock quality designation - % of recovered core sample which is 4 or more inches long
GW	Groundwater
	Water level at least 24 hours after drilling
	Water level one hour or less after drilling
ALLUV	Alluvium
TOP	Topsoil
PM	Pavement Materials
CONC	Concrete
FILL	Fill Material
RES	Residual Soil
PWR	Partially Weathered Rock
SPT	Standard Penetration Testing

Penetration Resistance Results	Number of Blows, N	Approximate Relative Density
Sands	0-4	very loose
	5-10	loose
	11-20	firm
	21-30	very firm
	31-50	dense
	Over 50	very dense

	Number of Blows, N	Approximate Consistency
Silts and	0-1	very soft
Clays	2-4	soft
	5-8	firm
	9-15	stiff
	16-30	very stiff
	31-50	hard
	Over 50	very hard

Drilling Procedures

Soil sampling and standard penetration testing performed in accordance with ASTM D 1586. The standard penetration resistance is the number of blows of a 140-pound hammer falling 30 inches to drive a 2-inch O.D., 1.4-inch I.D. split-spoon sampler one foot. Rock coring is performed in accordance with ASTM D 2113. Thin-walled tube sampling is performed in accordance with ASTM D 1587.

GEO HYDRO ENGINEERS

L-1

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Lynwood Park Improvements**		Project No: **190665.20**
Location: **Brookhaven, Georgia**		Date: **7/15/19**
Method: **HSA- ASTM D1586**	GWT at Drilling: **23 feet**	G.S. Elev: **936**
Driller: **HD (Auto-Hammer)**	GWT at 24 hrs: **N/A (Boring Backfilled)**	Logged By: **CJA**

Elev. (Ft)	Depth (Ft)	Description	N
935	0	Topsoil (Approximately 3 inches)	
		Firm brown silty clay (CL) with organics (FILL)	6
930	5		8
			7
		Brown silty clay (CL) with wood fragments (FILL)*	
925	10		50/5"
		Firm brown silty clay (CL) with organics (FILL)	
920	15		5
915	20		5
		Firm tan fine to medium sandy clay (CL) (RESIDUUM) ▽	
910	25	Boring Terminated at 25 feet	7
	30		

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: *Penetration resistance not considered representative due to wood debris in fill

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 7/22/19

L-2

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Lynwood Park Improvements**		Project No: **190665.20**
Location: **Brookhaven, Georgia**		Date: **7/15/19**
Method: **HSA- ASTM D1586**	GWT at Drilling: **13 feet**	G.S. Elev: **931**
Driller: **HD (Auto-Hammer)**	GWT at 24 hrs: **N/A (Boring Backfilled)**	Logged By: **CJA**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
930	0			Topsoil (Approximately 4 inches)	
				Loose to firm red-gray to gray-tan and brown silty fine to medium sand (SM) (RESIDUUM)	8
925	5				9
					14
920	10	▽			12
	15			Boring Terminated at 15 feet	20
915					
910	20				
905	25				
	30				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 7/22/19

L-3

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Lynwood Park Improvements**		Project No: **190665.20**
Location: **Brookhaven, Georgia**		Date: **7/15/19**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev: **931**
Driller: **HD (Auto-Hammer)**	GWT at 24 hrs: **N/A (Boring Backfilled)**	Logged By: **CJA**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
930	0			Topsoil (Approximately 2 inches)	
				Firm red-brown to tan and brown silty fine to medium sand (SM) (RESIDUUM)	15
925	5				12
					17
920	10			Boring Terminated at 10 feet	15
915	15				
910	20				
905	25				
	30				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 7/22/19

L-4

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Lynwood Park Improvements**		Project No: **190665.20**
Location: **Brookhaven, Georgia**		Date: **7/15/19**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev: **931**
Driller: **HD (Auto-Hammer)**	GWT at 24 hrs: **N/A (Boring Backfilled)**	Logged By: **CJA**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
930	0			Topsoil (Approximately 3 inches)	
				Dense tan silty fine to medium sand (SM) (RESIDUUM)	44
				Partially weathered rock sampled as brown silty fine to medium sand (SM)	
925	5				50/2"
				Auger Refusal at 7 feet	50/3"
920	10				
915	15				
910	20				
905	25				
	30				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 7/22/19

L-5

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Lynwood Park Improvements**		Project No: **190665.20**
Location: **Brookhaven, Georgia**		Date: **7/15/19**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev: **926**
Driller: **HD (Auto-Hammer)**	GWT at 24 hrs: **N/A (Boring Backfilled)**	Logged By: **CJA**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
925	0			Topsoil (Approximately 5 inches)	
				Stiff red silty clay (CL) with rock fragments (FILL)	9
	5			Soft red-brown fine to medium sandy silt (ML) (FILL)	4
920				Firm to stiff red-brown fine to medium sandy silt (ML) with rock fragments (FILL)	10
	10				12
915					
	15				7
910					
	20			Boring Terminated at 20 feet	13
905					
	25				
900					
	30				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 7/22/19

L-6

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Lynwood Park Improvements**		Project No: **190665.20**
Location: **Brookhaven, Georgia**		Date: **7/15/19**
Method: **HSA- ASTM D1586**	GWT at Drilling: **15 feet**	G.S. Elev: **929**
Driller: **HD (Auto-Hammer)**	GWT at 24 hrs: **N/A (Boring Backfilled)**	Logged By: **CJA**

Elev. (Ft)	Depth (Ft)	GWT	Description	N
	0		Topsoil (Approximately 6 inches)	
			Red silty clay (CL) with rock fragments (FILL)*	25
925	5		Firm red-tan silty fine to medium sand (SM) (RESIDUUM)	19
			Dense brown silty fine to medium sand (SM)	43
920	10		Firm gray to brown silty fine to medium sand (SM)	16
915	15	▽		11
910	20		Boring Terminated at 20 feet	16
905	25			
900	30			

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks: *Penetration resistance not considered representative due to rock fragments in fill

TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 7/22/19

L-7

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Lynwood Park Improvements**		Project No: **190665.20**
Location: **Brookhaven, Georgia**		Date: **7/15/19**
Method: **HSA- ASTM D1586**	GWT at Drilling: **18 feet**	G.S. Elev: **928**
Driller: **HD (Auto-Hammer)**	GWT at 24 hrs: **N/A (Boring Backfilled)**	Logged By: **CJA**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
928	0			Topsoil (Approximately 4 inches)	
				Firm to stiff red-brown fine to medium sandy silt (ML) (FILL)	9
925					
	5				8
					8
920					
	10				6
915				Firm to stiff tan and gray fine to medium sandy clay (CL) (RESIDUUM)	
	15				6
910		▽			
	20			Boring Terminated at 20 feet	12
905					
	25				
900					
	30				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks:

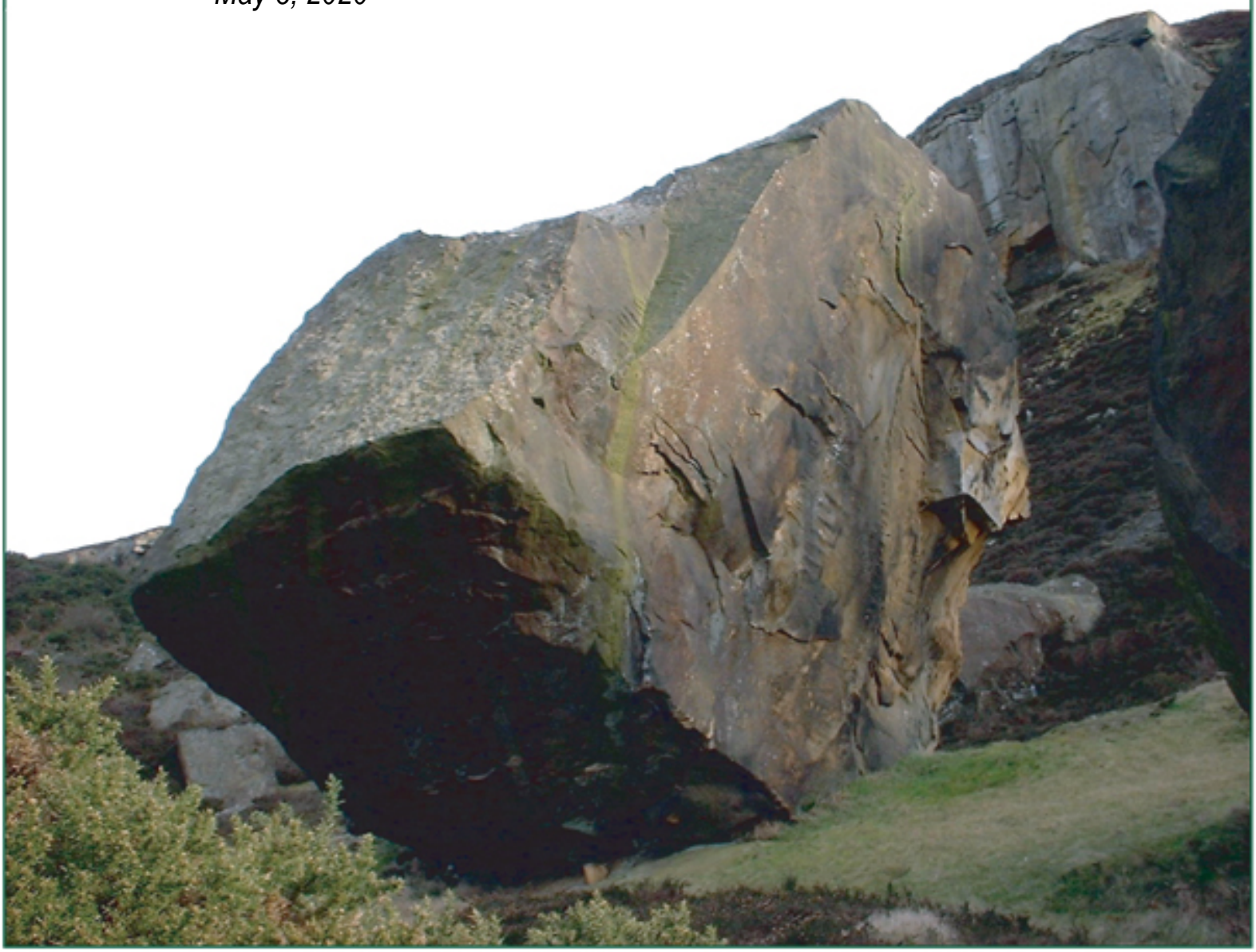
TEST BORING RECORD BORING LOGS.GPJ GEO HYDRO.GDT 7/22/19

GEO HYDRO ENGINEERS

Report of Supplemental Test Pit Exploration

Lynwood Park
Brookhaven, Georgia
Geo-Hydro Project Number 200383.20

Prepared for City of Brookhaven
May 8, 2020



Mr. Lee Croy, P.E.
City of Brookhaven
4362 Peachtree Road
Brookhaven, Georgia 30319

May 8, 2020

Report of Supplemental Test Pit Exploration
Lynwood Park
Brookhaven, Georgia
Geo-Hydro Project Number 200383.20

Dear Mr. Croy:

Geo-Hydro Engineers, Inc. has completed the authorized test pit exploration for the above reference project. The scope of services for this project was outlined in proposal 24430.2 dated February 17, 2020.

PROJECT INFORMATION

Geo-Hydro previously performed a subsurface exploration for the project, the results of which can be found in our *Report of Subsurface Exploration and Geotechnical Engineering Evaluation* dated July 22, 2019 (Geo-Hydro Project Number 190665.20). Samples obtained from boring L-1 during our exploration in the area of the new pool contained organics and wood fragments extending to a depth of about 22 feet. The purpose of this test pit exploration was to evaluate in more detail the fill materials and find the approximate limits of the weak, organic soils.

TEST PIT SUMMARY

The test pit exploration consisted of three test pit excavations (TP-1 through TP-3) performed at the approximate locations shown on Figure 2 in the Appendix. The test pits were performed with a Caterpillar 318C excavator. Geo-Hydro observed the test pit excavations and documented the materials and conditions observed in each test pit. The test pit excavations ranged in depth from about 18 to 19 feet.

Starting at the ground surface, all of the test pits encountered fill materials exceeding the range depth of the excavator. An initial layer of silty sand was encountered in the excavations followed by silty sand and sandy clay containing rock fragments, boulders, construction demolition debris, and organic debris including stumps, large wood refuse, topsoil, and colloidal organics.

For detailed test pit results and photos please see the enclosed test pit logs and photo plates.

CONCLUSIONS

The test pits encountered fill materials of variable quality and composition. Based on our observations and soil classifications, the upper 2 to 3 feet of fill materials can be reused as structural fill. Fill materials containing rock fragments, boulders, construction demolition debris, and organic debris including stumps, large wood refuse, topsoil, and colloidal organics cannot remain in place to support the pool or be reused as structural fill. During grading, such materials should be wasted off site. Alternatively, debris-laden fill could be wasted in designated areas within the site such as green spaces where no hardscapes, pavements,

or buildings will be constructed. However, such disposal must be documented and memorialized to facilitate future planning and development of the park.

Supplemental borings should be performed throughout the pool area to map the approximate depth and areal extent of the debris-laden fill materials.

* * * * * * *

We appreciate the opportunity to serve as your geotechnical consultant for this project, and are prepared to provide any additional services you may require. If you have any questions concerning this report or any of our services, please call us.

Sincerely,

GEO-HYDRO ENGINEERS, INC.

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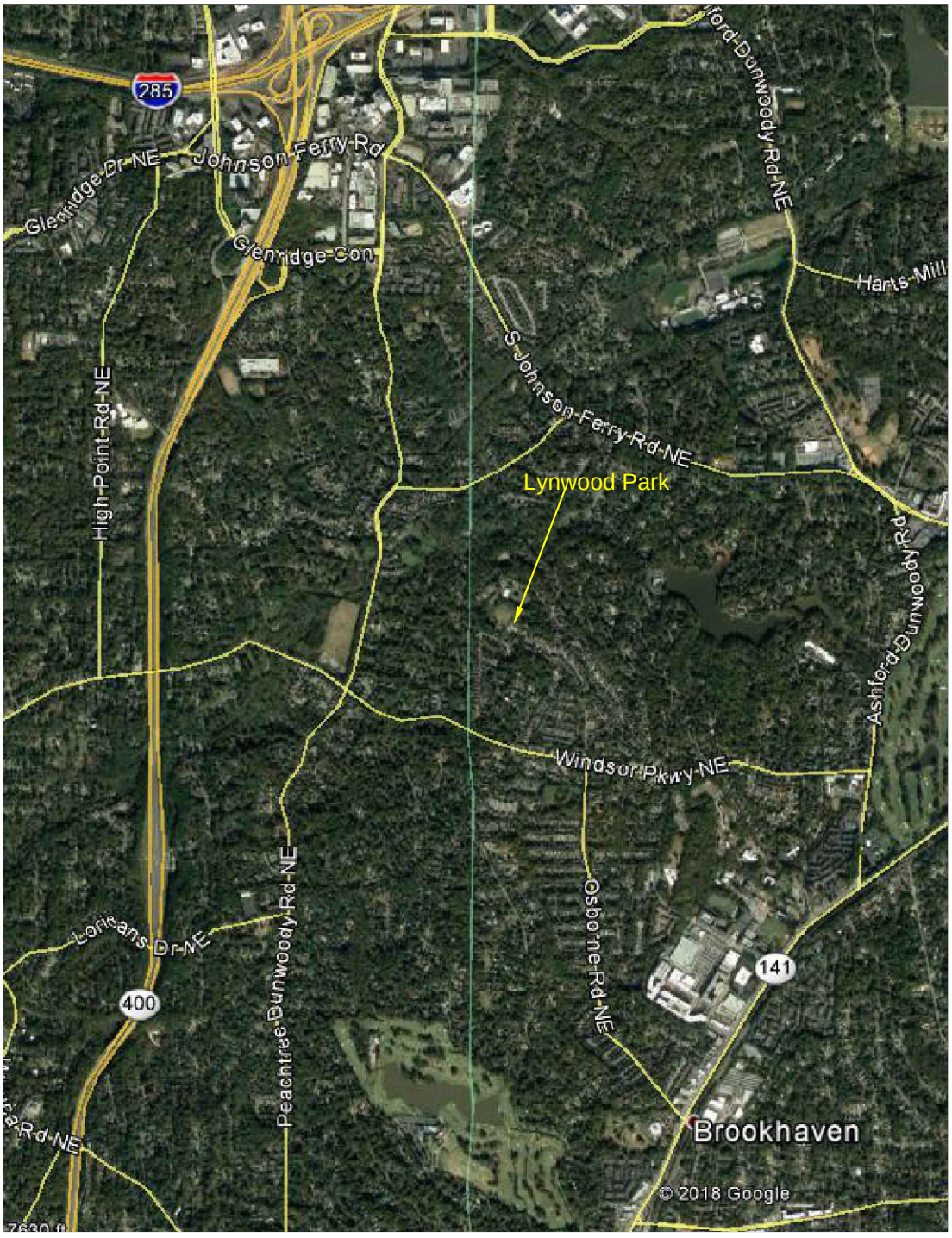
GEORGIA REGISTERED No. 021308 PROFESSIONAL ENGINEER LUIS E. BABLER

JTR/LEB/200383.20 Supplemental Test Pit Exploration - Lynwood Park - Brookhaven, GA

APPENDIX



0 0.25 0.5 1 1.5

Approximate Scale, Miles

Figure 1: Site Location Plan	Supplemental Test Pit Exploration Lynwood Park Brookhaven, Georgia Geo-Hydro Project Number 200383.20

0 30 60 120 180

Approximate Scale: 1"=60'

LEGEND: Test Pit Location

Figure 2: Test Pit Location Plan

Supplemental Test Pit Exploration
Lynwood Park
Brookhaven, Georgia
Geo-Hydro Project Number 200383.20

TEST PIT LOG TP-1

Date Excavated: 4/28/20 Logged by: JTR

Equipment: CAT 318C Elevation(ft):

GEO HYDRO ENGINEERS

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST *	MOISTURE (%)	DRY UNIT WT. (pcf)	LAB TESTS
2		Brown silty fine sand (SM) (FILL)					
4		Black and brown fine sandy clay (CL) with organics, wood, stumps, rock fragments, and construction debris (FILL)					
6							
8							
10							
12							
14							
16							
18		Gray silty fine sand (SM) with organics, wood, stumps, rock fragments, and construction debris (FILL)					
20		Test Pit Terminated at 19 feet No Groundwater Encountered					
22							
24							

TEST PIT LOG TP-2

Date Excavated: 4/28/20 Logged by: JTR

Equipment: CAT 318C Elevation(ft):

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST *	MOISTURE (%)	DRY UNIT WT. (pcf)	LAB TESTS
2		Brown silty fine sand (SM) (FILL)					
4		Black and brown fine sandy clay (CL) with organics, wood, stumps, rock fragments, and construction debris (FILL)					
6							
8							
10							
12							
14							
16							
18		Test Pit Terminated at 18 feet No Groundwater Encountered					
20							
22							
24							

Supplemental Test Pit Exploration - Lynwood Park
Brookhaven, Georgia
200383.20

TEST PIT LOG TP-3

Date Excavated: 4/28/20 Logged by: JTR

Equipment: CAT 318C Elevation(ft): _____

GEO HYDRO ENGINEERS

DEPTH (feet)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE	PEN. RESIST *	MOISTURE (%)	DRY UNIT WT. (pcf)	LAB TESTS
2		Brown silty fine sand (SM) (FILL)					
4		Black and brown fine sandy clay (CL) with organics, wood, stumps, rock fragments, and construction debris (FILL)					
6							
8							
10							
12							
14							
16							
18		Test Pit Terminated at 18 feet Groundwater Encountered at 18 feet					
20							
22							
24							

Supplemental Test Pit Exploration - Lynwood Park
Brookhaven, Georgia
200383.20

TEST PIT PHOTOGRAPHS

Excavated material from TP-1.

TP-1 - Approximately 2 feet of “clean” fill cover followed by debris-laden soil and organic refuse. No groundwater encountered.

Excavated material from TP-2.

TP-2 - Approximately 3 feet of “clean” fill cover followed by debris-laden soil and organic refuse. No groundwater encountered.

Excavated material from TP-3.

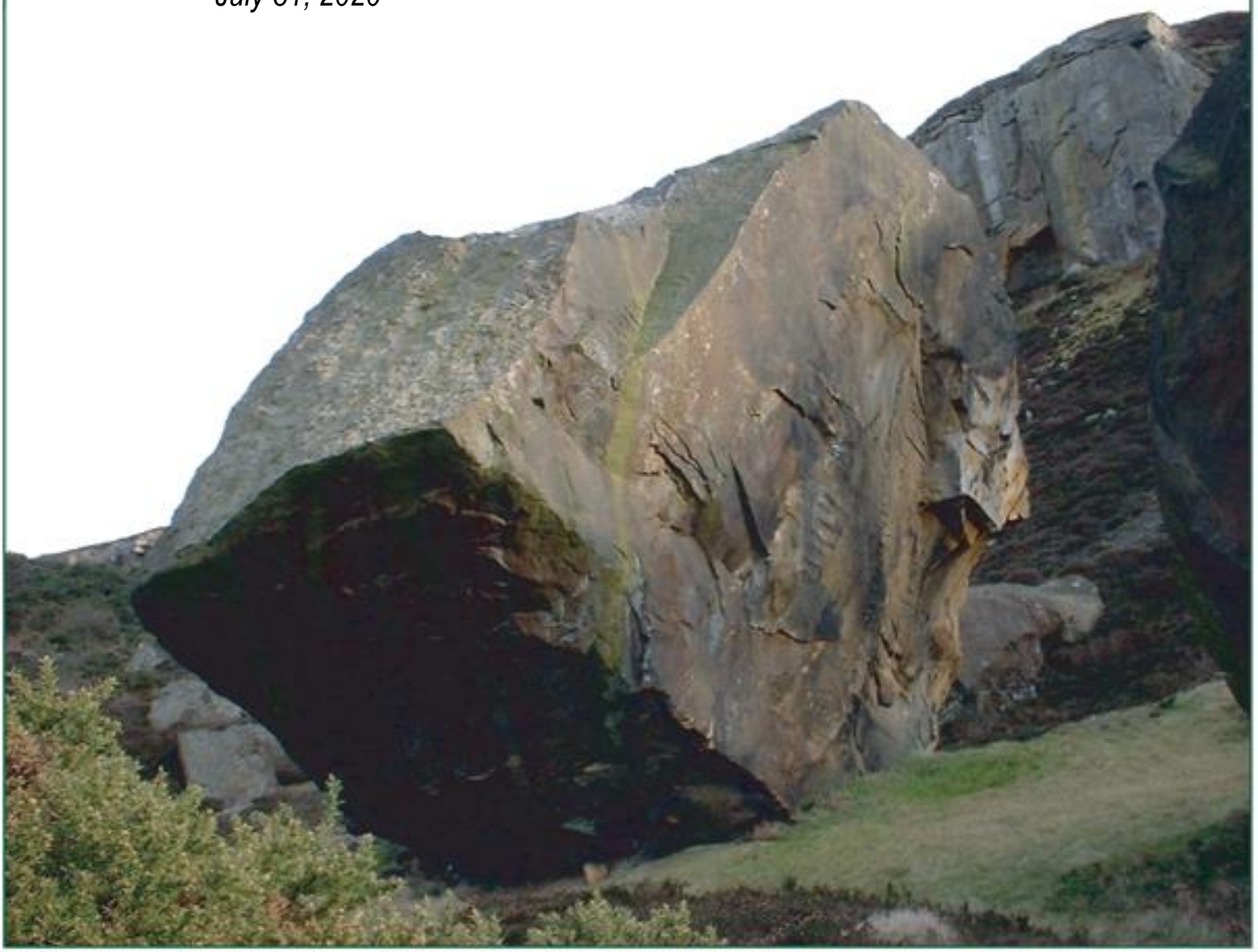
TP-3 - Approximately 2½ feet of "clean" fill cover followed by debris-laden soil and organic refuse. Groundwater encountered at 18 feet.

GEO HYDRO ENGINEERS

Report of Supplemental Exploration

Lynwood Park
Brookhaven, Georgia
Geo-Hydro Project Number 200383.20

Prepared for City of Brookhaven
July 31, 2020



Mr. Lee Croy, P.E.
City of Brookhaven
4362 Peachtree Road
Brookhaven, Georgia 30319

July 31, 2020

Report of Supplemental Test Pit Exploration
Lynwood Park
Brookhaven, Georgia
Geo-Hydro Project Number 200383.20

Dear Mr. Croy:

Geo-Hydro Engineers, Inc. has completed the authorized test pit exploration for the above reference project. The scope of services for this project was outlined in proposal 24430.21 dated June 22, 2020.

PROJECT INFORMATION

Geo-Hydro performed an initial subsurface exploration, the results of which can be found in our *Report of Subsurface Exploration and Geotechnical Engineering Evaluation* dated July 22, 2019 (Geo-Hydro Project Number 190665.20). Geo-Hydro also performed a supplemental test pit exploration to further evaluation conditions encountered in boring L-1. The results of supplemental test pit exploration can be found in our *Report of Supplemental Test Pit Exploration* dated February 17, 2020 (Geo-Hydro Project Number 200383.20). Since the issuance of our reports, updated civil drawings have been provided and old fill soils consisting of organic soils and other deleterious materials may be encountered during grading operations thus this exploration was performed.

EXPLORATORY PROCEDURES AND RESULTS

The subsurface exploration consisted of twelve machine-drilled soil test borings (designated P-1 to P-12) and twelve test pits (designated TP-1 to TP-12) performed at the approximate locations shown on Figure 1 included in the Appendix. The test borings were located in the field by Geo-Hydro by measuring angles and distances from existing site features. Elevations shown on the test boring records were interpolated from the topographic site plan provided to us and have been rounded to the nearest foot. In general, the boring locations and elevations should be considered approximate.

Standard penetration testing, as provided for in ASTM D1586, was performed at select intervals in the soil test borings. Soil samples obtained from the drilling operation were examined and classified in general accordance with ASTM D2488 (Visual-Manual Procedure for Description of Soils). Soil classifications include the use of the Unified Soil Classification System described in ASTM D2487 (Classification of Soils for Engineering Purposes). The soil classifications also include our evaluation of the geologic origin of the soils. Evaluations of geologic origin are based on our experience and interpretation and may be subject to some degree of error.

Descriptions of the soils encountered, groundwater conditions, standard penetration resistances, and other pertinent information are provided in the test boring records included in the Appendix.

SOIL TEST BORING SUMMARY

Starting at the ground surface, all borings encountered topsoil ranging in thickness from about 2 to 6 inches. Measurements necessary for detailed quantity estimation were not part of our work scope.

Beneath the surface materials, all of the borings encountered fill materials extending to depths ranging from about 12 to greater than 25 feet. The fill was classified as silty sand, clayey sand, sandy clay, and sandy silt with varying amounts of rock fragments, organics, and other deleterious materials. Boring P-11 was terminated within the fill at a depth of 25 feet. Standard penetration resistances recorded in the fill ranged from 4 to 35 blows per foot. Based on our visual classification of the soil samples obtained during drilling, it is likely that penetration resistance values were amplified by rock fragments and organic refuse. Such elevated penetration resistance values should not be considered indicative of the consistency of the fill.

Beneath surface or fill materials, all of the borings except P-11 encountered residual soils typical of the Piedmont region. The residual soils were classified as sandy silt. Standard penetration resistances in the residual soils ranged from 9 to 44 blows per foot.

At the time of drilling, groundwater was encountered in all of the borings at depths ranging from 18 to 22 feet. For safety reasons the borings were backfilled upon completion. It should be noted that groundwater levels will fluctuate depending on yearly and seasonal rainfall variations and other factors, and may rise in the future.

For more detailed descriptions of subsurface conditions, please refer to the test boring records included in the Appendix.

Summary of Subsurface Conditions

Boring	Approx. Ground Elevation	Bottom of Fill Material		Top of PWR		Depth to Auger Refusal		Groundwater*	
		Depth (feet)	Approx. Elevation	Depth (feet)	Approx. Elevation	Depth (feet)	Approx. Elevation	Depth (feet)	Approx. Elevation
P-1	936	17	919	NE	---	NE	---	21	915
P-2	936	17	919	NE	---	NE	---	21	915
P-3	936	13	924	NE	---	NE	---	20	916
P-4	936	12	924	NE	---	NE	---	19	917
P-5	936	17	919	NE	---	NE	---	20	916
P-6	936	17	919	NE	---	NE	---	19	917
P-7	936	17	919	NE	---	NE	---	20	916
P-8	936	22	914	NE	---	NE	---	18	918
P-9	936	22	914	NE	---	NE	---	19	917
P-10	936	>25	<911	NE	---	NE	---	22	914
P-11	936	12	924	NE	---	NE	---	21	915
P-12	928	17	919	NE	---	NE	---	22	919

Depths and Elevations in this Summary Table are Approximate

NE: Not Encountered - PWR: Partially Weathered Rock - *Groundwater measured at time of drilling only

TEST PIT SUMMARY

The test pit exploration consisted of three test pit excavations (TP-1 through TP-12) performed at the approximate locations shown on Figure 1 in the Appendix. The test pits were performed with a Caterpillar 305 excavator. Geo-Hydro observed the test pit excavations and documented the materials and conditions observed in each test pit. The test pit excavations ranged in depth from about 7 to 10 feet.

Starting at the ground surface, all the test pits encountered fill materials extending to depths ranging from about 2½ feet to greater than the range depth of the excavator (10 feet). An initial layer of silty sand (SM) relatively free of debris was encountered in the excavations, typically followed by sandy silt and clayey silt containing rock fragments, boulders, construction demolition debris, and organic debris including stumps, large wood refuse, topsoil, and colloidal organics. Beneath the fill, 8 of the 12 test pits encountered relatively firm residual soils and/or partially weathered rock. The materials and conditions encountered in the test pits are summarized in the following table.

Summary of Subsurface Conditions

Test Pit	Fill Materials	Residual Materials
1	0'-4'. Tan/Brown SM/ML (suitable fill material)	4'-7' Partially weathered rock (PWR). Refusal at 7'.
2	0-8' Tan/Brown SM/ML with mica (suitable fill material). 8'-9.5' organics (topsoil & thick roots)	9.5'-10' Red/Brown SM/ML. Test Pit Terminated at 10'.
3	0'-10' Tan/Brown SM/ML with mica (suitable fill material) Test Pit Terminated at 10'.	---
4	0'-9' Tan/Brown SM/ML with mica (suitable fill material) 9'-10' Organics (topsoil & tree roots). Test Pit Terminated at 10'.	---
5	0'-4' Tan/Brown SM/ML with mica (suitable fill material)	5'-10' PWR (excavatable) Test Pit Terminated at 10'.
6	0'-10' Tan/Brown SM/ML with mica (suitable fill material). No discernable transition from fill to residual.	Test Pit Terminated at 10'.
7	0'-7.5' Tan/Brown SM/ML with mica (suitable fill material). 7.5'-9.5' Organics (Topsoil & tree roots)	9.5'-10' Red/Brown SM/ML Test Pit Terminated at 10'.
8	0'-3' Tan/Brown SM/ML with mica (suitable fill material).	3'-5' Red/Brown SM/ML with mica PWR (excavatable) 5'-10' Test Pit Terminated at 10'.
9	0'-2.5' Tan/Brown SM/ML with mica (suitable fill material)	2.5'-5' Red/Brown SM/ML with mica 5'-10' PWR (excavatable) Test Pit Terminated at 10'.
10	0'-4.5'. Soft and saturated Tan/Red/Brown SM/ML.	4.5'-10' Red/Brown SM/ML with mica Test Pit Terminated at 10'
11	0'-10'. Soft and saturated Tan/Rd/Brown SM/ML. Test Pit Terminated at 10'	---
12	0'-10'. Soft and saturated Tan/Rd/Brown SM/ML. Test Pit Terminated at 10'	---

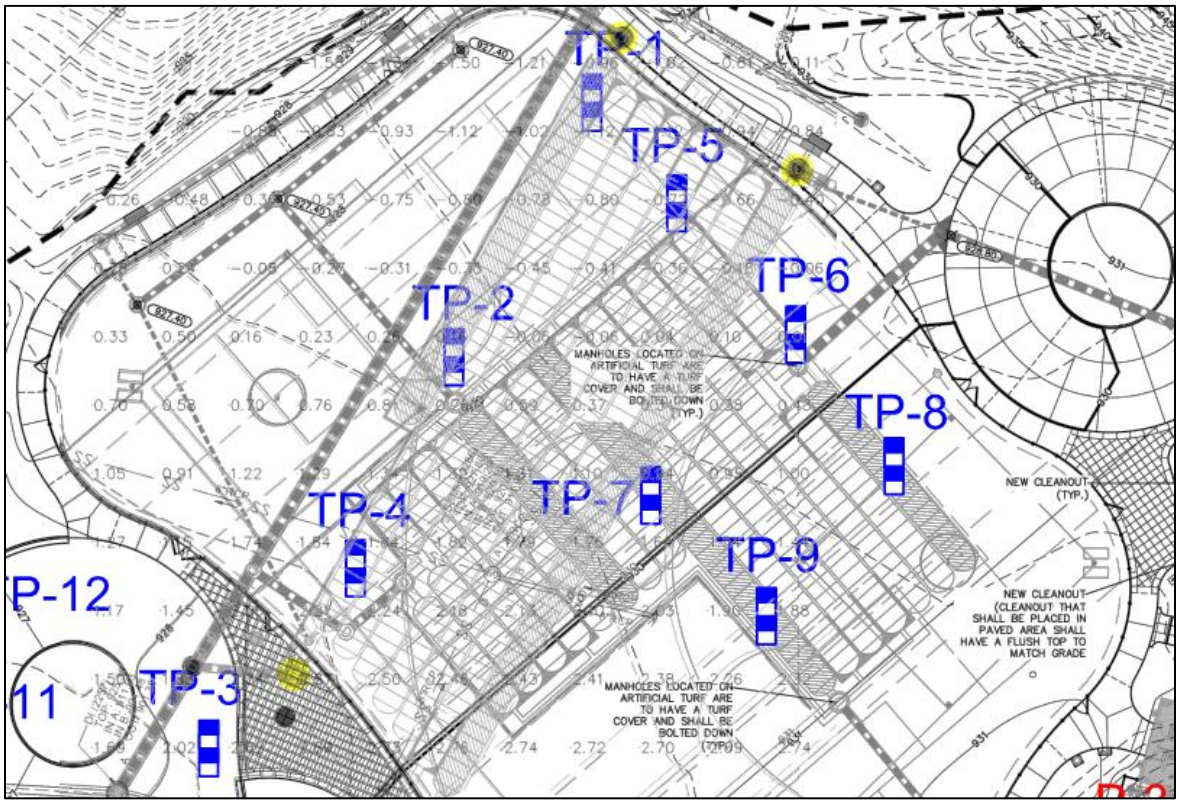
SM: Silty Sand
ML: Sandy Silt or Clayey Silt

EVALUATIONS AND RECOMMENDATIONS

The following evaluations and recommendations are based on the information available on the proposed construction, the data obtained from the test borings, and our experience with soils and subsurface conditions similar to those encountered at this site. Because the test borings and test pits represent a statistically small sampling of subsurface conditions, it is possible that conditions may be encountered during construction that are substantially different from those indicated by the test borings and test pits. In these instances, adjustments to the design and construction may be necessary. The recommendations found in our *Report of Subsurface Exploration and Geotechnical Engineering Evaluation* dated July 22, 2019 (Geo-Hydro Project Number 190665.20) should also be considered in addition to the following considerations and recommendations.

Underground Detention Facility

Test pits TP-1 through TP-9 encountered fill materials extending to depths ranging from about 4 to greater than 10 feet. Based on the results of test pits and our observations, most of the existing fill materials and residual soils appear to be suitable for reuse as structural fill. Any excavated fill material containing organics, construction debris, or other debris in quantities that cannot be readily removed should be considered unsuitable for reuse.



Test pits TP-1, TP-5, TP-8, and TP-9 encountered partially weathered rock at depths ranging from about 3 to 5 feet, and equipment refusal was encountered at a depth of 7 feet in TP-1. Except for TP-1, the materials should be readily removable using conventional excavation equipment such as loaders and backhoes.

However, it is important to note that the depth to rock or partially weathered rock may vary drastically over relatively short distances. To remove the material below 7 feet at TP-1, blasting may be required but impact hammers can also be used in small rock excavations.

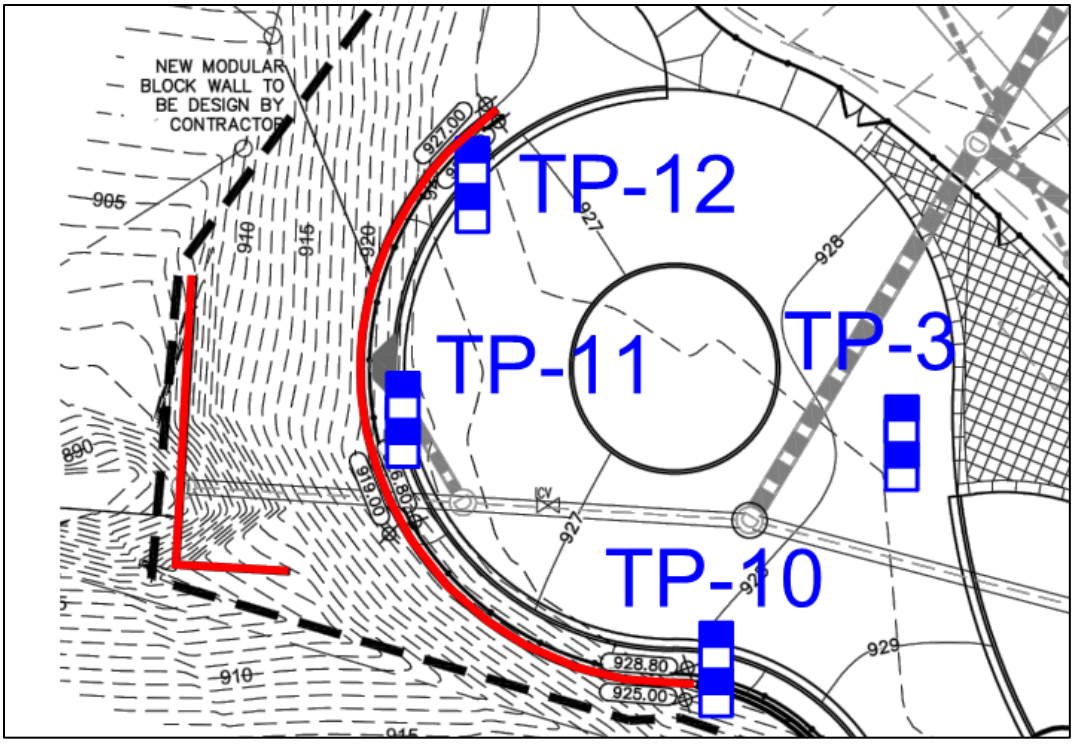
In test pits TP-2, TP-6, and TP-7, the interface between fill materials and the original ground surface appeared to include a layer of organic material that was not properly stripped off during the original grading. Depending on its relationship to the bottom of the underground detention facility, an organic layer might adversely affect support. If such organic layers are encountered during construction, it may be necessary to "chase out" the organic layer by excavating the layer along with overlying soils.

Retaining Walls - Mechanically Stabilized Earth (MSE)

Test pits TP-10, TP-11, and TP-12 encountered fill materials extending to depths ranging from about 4.5 to greater than 10 feet. In test pits TP-11 and TP-12, the consistency of the fill was observed to be soft at the anticipated bearing elevation of the proposed retaining wall. The construction budget should include funds for management of poor-quality existing materials.

To create a budget, we recommend a remediation for the upper wall to include undercutting the bearing soils to a depth of 5 feet below the planned bottom of wall elevation and include the area from 5 feet in front of the wall to the back of the reinforcing grid (approximately 15 feet in width). Backfill the resulting excavation with crushed stone wrapped with a woven geotextile fabric such as Mirafi HP370 or equivalent.

The lower wall was not accessible at the time of our exploration; however, some amount of remediation should be anticipated for this wall at the lowest bearing elevations.



Pool and Pool Deck Area

Borings P-1 through P-5 and P-9 through P-12 encountered fill materials extending to depths ranging from about 12 to greater than 25 feet. The fill was classified as silty sand, clayey sand, sandy clay, and sandy silt with varying amounts of rock fragments, organics, and other deleterious material. The top 3 feet of existing fill materials appear to be suitable for reuse as structural fill. Below a depth of 3 feet, most of the fill is not suitable for reuse due to the presence of debris and organic refuse.

Based on the grading plan by Clark Patterson Lee dated April 30, 2020, we understand that the approximate pool deck elevation will be 932, and the proposed bottom-of-pool elevation will be 927. Due to the materials encountered in our borings below these elevations, we recommend the following options for support of the pool and pool deck.

Aggregate Pier Soil Improvement

This option would leave the majority of the existing fill materials in place and improve the stress-strain characteristics of the materials by installing aggregate piers spread out over an area encompassing both the footprint of the pool and pool deck. The area would be cut to an elevation approximately 2 feet below bottom-of-pool elevation, aggregate piers installed, and a load transfer platform (LTP) would be installed over the aggregate piers encompassing the pool footprint only (not the deck). The LTP would be constructed by placing a layer of woven geotextile fabric (Mirafi HP570 or equivalent) followed by 2 feet of #57 stone.

After installing the LTP, the area would then be backfilled with structural fill up to the pool deck subgrade elevation. Conceptually, the aggregate piers would be installed on an 8-foot by 8-foot grid pattern extending to depths ranging from 10 to 20 feet across the treated footprint (pool + pool deck).

Currently, aggregate piers are proprietary systems that are procured on a design-build basis. The selected aggregate pier contractor will provide the final allowable bearing pressure based on their design. Geopier Foundation Company and Keller (fka Hayward Baker) are the dominant aggregate pier specialty contractors in the North Georgia area, with Wurster Engineering and Construction, Earth Tech, and Helitech recently entering the Georgia market for installation of aggregate piers.

The number, depth, and configuration of aggregate piers will be determined by the aggregate pier design-build company. It will be the sole responsibility of the selected design-build specialty contractor to verify that the available subsurface information is suitable and sufficient to develop their aggregate pier design, and that their design will perform in accordance with their own calculations, predictions, and the owner's expectations.

Soil Excavation, Modification, and Replacement as Structural Fill

This option would require excavating all the existing material from an area encompassing the pool and pool deck footprint and modifying the excavated materials with chemical products such as Calciment® or Portland cement. The general steps to accomplish this are as follows.

1. Excavate the existing fill material and stockpile, spread across the playfield.
2. Rake and/or screen the material to remove large organic debris (greater than 6 inches in size).
3. Spread Calciment or Portland cement and thoroughly mix with the screened soil. Replace the mixed material as structural fill back in the excavation up to the planned proposed subgrade elevations.

We recommend that structural fill be compacted to at least 95 percent of the standard Proctor maximum dry density (ASTM D698). The upper 12 inches of pool and floor slab subgrade soils should be compacted to at least 98 percent of the standard Proctor maximum dry density. Moisture conditioning may be required to bring the mixed material within the workable range, which for this project will be approximately between 1 percent below optimum and 3 percent above optimum.

The above procedures can be accomplished in many ways. Using root rakes similar to those used in clearing and grubbing or screening with grizzly bars have been successful in the past. Mixing the material with Calciment® or Portland cement can be quickly accomplished using pulvimixer/soil stabilizer equipment.

Based on the grading plan by Clark Patterson Lee dated April 30, 2020 and the results of our borings, we anticipate that the volume of existing fill to be removed, modified, and replaced will be on the order of 4,000 cubic yards. We anticipate that roughly 4 percent by dry weight of the material (approximately 225 tons) of Calciment® or Portland cement will be needed to modify and stabilize the material.

Soil Excavation, Export, and Import of Structural Fill

This option would involve excavating the existing fill material from the pool and pool deck footprint and replacing with structural fill. The majority of the structural fill would likely have to be imported and the excess poor-quality material will be removed from the site. The import/export option will require greater truck traffic on the surrounding roads for a longer period of time, and that scenario should be considered in the evaluations of pros and cons if this option is selected.

* * * * * * *

We appreciate the opportunity to serve as your geotechnical consultant for this project, and are prepared to provide any additional services you may require. If you have any questions concerning this report or any of our services, please call us.

Sincerely,

GEO-HYDRO ENGINEERS, INC.

Michael C. Woody, P.E.
KCMT Manager
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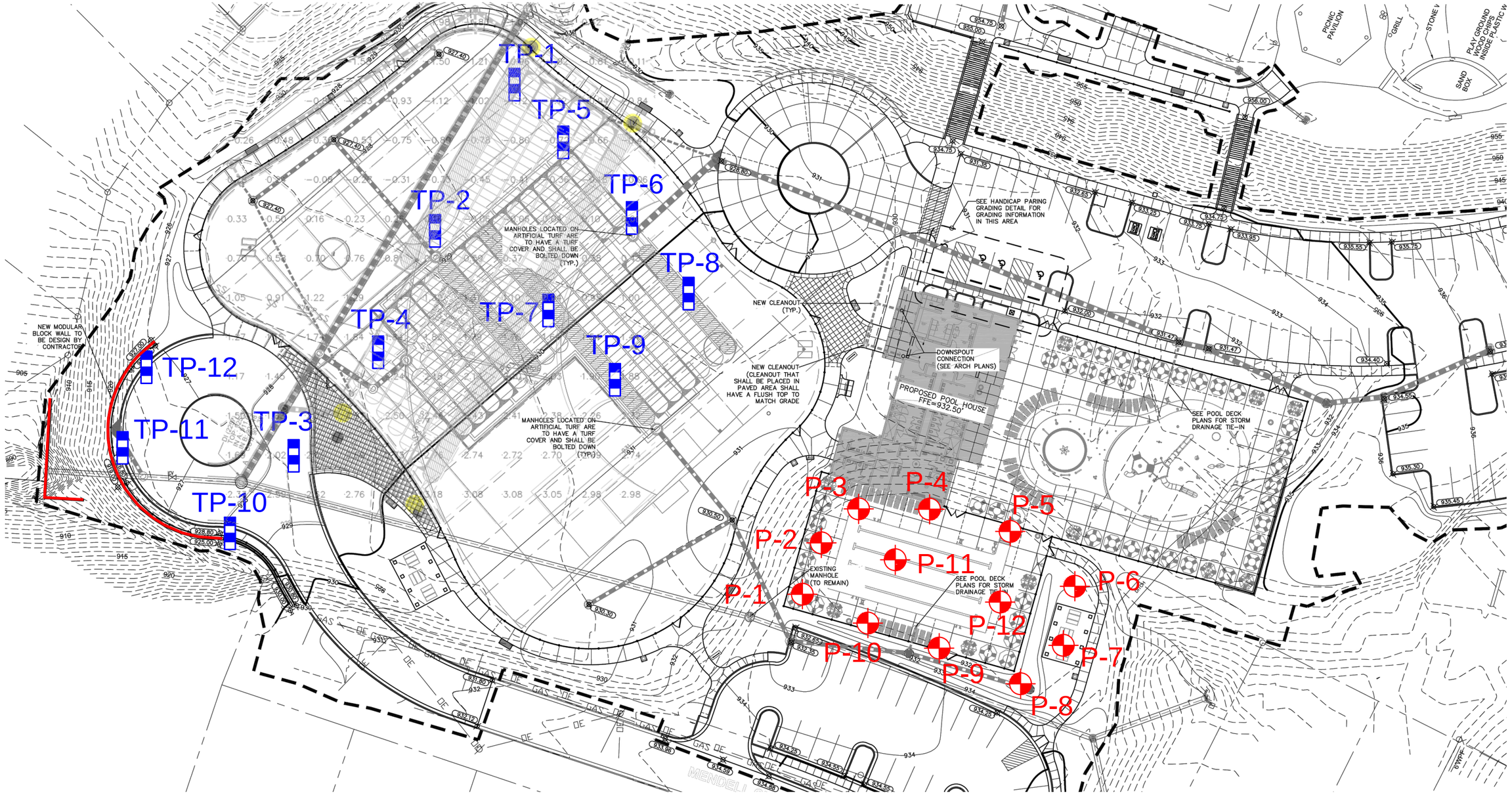
Luis E. Babler, P.E.
Chief Engineer
luis@geohydro.com

GEORGIA REGISTERED No. 021308 PROFESSIONAL ENGINEER * LUIS E. BABLER *

MCW/LEB/200383.20 Supplemental Exploration - Lynwood Park - Brookhaven, GA leb

APPENDIX



LEGEND: Soil Test Boring

Test Pit

Figure 1: Boring Location Plan

Lynwood Park Improvements
Brookhaven, Georgia
Geo-Hydro Project Number 200383.20

Symbols and Nomenclature

Symbols

▌	Thin-walled tube (TWT) sample recovered
▯	Thin-walled tube (TWT) sample not recovered
●	Standard penetration resistance (ASTM D1586)
50/2”	Number of blows (50) to drive the split-spoon a number of inches (2)
65%	Percentage of rock core recovered
RQD	Rock quality designation - % of recovered core sample which is 4 or more inches long
GW	Groundwater
▼	Water level at least 24 hours after drilling
▽	Water level one hour or less after drilling
ALLUV	Alluvium
TOP	Topsoil
PM	Pavement Materials
CONC	Concrete
FILL	Fill Material
RES	Residual Soil
PWR	Partially Weathered Rock
SPT	Standard Penetration Testing

Penetration Resistance Results

	Number of Blows, N	Approximate Relative Density
Sands	0-4	very loose
	5-10	loose
	11-20	firm
	21-30	very firm
	31-50	dense
	Over 50	very dense

	Number of Blows, N	Approximate Consistency
Silts and	0-1	very soft
Clays	2-4	soft
	5-8	firm
	9-15	stiff
	16-30	very stiff
	31-50	hard
	Over 50	very hard

Drilling Procedures

Soil sampling and standard penetration testing performed in accordance with ASTM D 1586. The standard penetration resistance is the number of blows of a 140-pound hammer falling 30 inches to drive a 2-inch O.D., 1.4-inch I.D. split-spoon sampler one foot. Rock coring is performed in accordance with ASTM D 2113. Thin-walled tube sampling is performed in accordance with ASTM D 1587.

P-1

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Lynwood Park Improvements**		Project No: **200383.20**
Location: **Brookhaven, Georgia**		Date: **6/29/20**
Method: **HSA- ASTM D1586**	GWT at Drilling: **21 feet**	G.S. Elev: **936**
Driller: **Georgia Contract Drilling**	GWT at 24 hrs: **Cave at 22 feet**	Logged By: **LS**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
935	0			Firm red-brown silty fine sand (SM) (FILL)	19
	5			Stiff black fine sandy silt (ML) (FILL) with rock fragments, bricks, metal, glass	13
930					12
	10				14
925					
	15				12
920				Stiff gray and tan fine sandy silt (ML) (RESIDUUM)	
	20	▽			15
915				Very stiff dark gray silty fine sand (SM)	
	25			Boring Terminated at 25 feet	19
910					
	30				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD LYNWOOD PARK BORING LOGS.GPJ GEO HYDRO.GDT 7/22/20

P-2

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Lynwood Park Improvements**		Project No: **200383.20**
Location: **Brookhaven, Georgia**		Date: **6/29/20**
Method: **HSA- ASTM D1586**	GWT at Drilling: **21 feet**	G.S. Elev: **936**
Driller: **Georgia Contract Drilling**	GWT at 24 hrs: **Cave at 22 feet**	Logged By: **LS**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
935	0			Very firm red-brown silty fine sand (SM) (FILL)	21
	5			Stiff gray to black fine sandy silt (ML) (FILL) with mulch	9
930					9
	10				10
925					
	15				7
920				Stiff gray and tan fine sandy silt (ML) (RESIDUUM)	
	20	▽			15
915				Stiff white and red-brown silty fine sand (SM)	
	25			Boring Terminated at 25 feet	18
910					
	30				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD LYNWOOD PARK BORING LOGS.GPJ GEO HYDRO.GDT 7/22/20

P-3

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Lynwood Park Improvements**		Project No: **200383.20**
Location: **Brookhaven, Georgia**		Date: **6/29/20**
Method: **HSA- ASTM D1586**	GWT at Drilling: **20 feet**	G.S. Elev: **936**
Driller: **Georgia Contract Drilling**	GWT at 24 hrs: **Cave at 21 feet**	Logged By: **LS**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
935	0			Very firm red-brown clayey fine to medium sand (SC) (FILL) with rock fragments	26
	5			Stiff to very stiff dark ray fine sandy silt (ML) (FILL) with mulch, rock fragments	15
930					23
	10				20
925				Stiff white and tan fine sandy silt (ML) (RESIDUUM)	15
	15				
920				Very stiff to hard white to dark gray fine sandy silt (ML)	
	20	▽			24
915					
	25			Boring terminated at 25 feet	37
910					
	30				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD LYNWOOD PARK BORING LOGS.GPJ GEO HYDRO.GDT 7/22/20

P-4

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Lynwood Park Improvements**		Project No: **200383.20**
Location: **Brookhaven, Georgia**		Date: **6/29/20**
Method: **HSA- ASTM D1586**	GWT at Drilling: **19 feet**	G.S. Elev: **936**
Driller: **Georgia Contract Drilling**	GWT at 24 hrs: **Cave at 20 feet**	Logged By: **LS**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
935	0			Very firm red-brown clayey fine to medium sand (SC) (FILL)	21
	5			Stiff dark gray fine sandy silt (ML) (FILL) with brick, rock fragments, mulch	11
930					10
	10			Stiff red-brown fine sandy clay (CL) (FILL)	11
925					
	15			Very stiff to hard gray to white fine sandy silt (ML) (RESIDUUM)	18
920		▽			
	20				24
915					
	25			Boring Terminated at 25 feet	44
910					
	30				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD LYNWOOD PARK BORING LOGS.GPJ GEO HYDRO.GDT 7/22/20

P-5

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Lynwood Park Improvements**		Project No: **200383.20**
Location: **Brookhaven, Georgia**		Date: **6/29/20**
Method: **HSA- ASTM D1586**	GWT at Drilling: **20 feet**	G.S. Elev: **936**
Driller: **Georgia Contract Drilling**	GWT at 24 hrs: **Cave at 21 feet**	Logged By: **LS**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
935	0			Firm red-brown clayey fine to medium sand (SC) (FILL)	20
	5			Stiff to very stiff dark gray fine sandy silt (ML) (FILL) with mulch	20
930					13
	10			Stiff to very stiff tan and white fine sandy silt (ML) (FILL)	17
925					
	15				13
920				Very stiff gray and white fine sandy silt (ML) (RESIDUUM)`	
	20	▽			16
915					
	25			Boring Terminated at 25 feet	18
910					
	30				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD LYNWOOD PARK BORING LOGS.GPJ GEO HYDRO.GDT 7/22/20

P-6

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Lynwood Park Improvements**		Project No: **200383.20**
Location: **Brookhaven, Georgia**		Date: **6/29/20**
Method: **HSA- ASTM D1586**	GWT at Drilling: **19 feet**	G.S. Elev: **936**
Driller: **Georgia Contract Drilling**	GWT at 24 hrs: **Cave at 20 feet**	Logged By: **LS**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
935	0			Loose red-brown clayey fine sand (SC) (FILL)	9
	5			Firm dark gray clayey silt (ML) (FILL) with mulch	5
930				Stiff to very stiff gray and orange fine sandy silt (ML) (FILL)	13
	10				17
925					
	15				14
920					
		▽		Very stiff tan to gray fine sandy silt (ML) (RESIDUUM)	
	20				18
915					
	25			Boring Terminated at 25 feet	19
910					
	30				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD LYNWOOD PARK BORING LOGS.GPJ GEO HYDRO.GDT 7/22/20

P-7

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Lynwood Park Improvements**		Project No: **200383.20**
Location: **Brookhaven, Georgia**		Date: **6/29/20**
Method: **HSA- ASTM D1586**	GWT at Drilling: **20 feet**	G.S. Elev: **936**
Driller: **Georgia Contract Drilling**	GWT at 24 hrs: **Cave at 21 feet**	Logged By: **LS**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
935	0			Firm red-brown clayey fine to medium sand (SC) (FILL)	20
	5			Very firm to dense black and dark brown silty fine sand (SM) (FILL) with rock fragments, mulch, plastic	30
930					30
	10				35
925				Stiff tan fine sandy silt (ML) (FILL)	
	15				15
920				Very stiff tan to white fine sandy silt (ML) (RESIDUUM)	
	20	▽			17
915					
	25			Boring Terminated at 25 feet	18
910					
	30				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD LYNWOOD PARK BORING LOGS.GPJ GEO HYDRO.GDT 7/22/20

P-8

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Lynwood Park Improvements**		Project No: **200383.20**
Location: **Brookhaven, Georgia**		Date: **6/29/20**
Method: **HSA- ASTM D1586**	GWT at Drilling: **18 feet**	G.S. Elev: **936**
Driller: **Georgia Contract Drilling**	GWT at 24 hrs: **Cave at 19 feet**	Logged By: **LS**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
935	0			Firm red-brown clayey fine to medium sand (SC) (FILL)	20
	5			Firm dark gray fine sandy silt (ML) (FILL) with concrete	7
930				Stiff dark gray fine sandy silt (ML) (FILL) with burnt wood	11
	10				16
925					
	15				16
920		▽		No sample recovered at 20 feet (FILL)	
	20				4
915				Very stiff light gray fine sandy silt (ML) (RESIDUUM)	
	25			Boring Terminated at 25 feet	16
910					
	30				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD LYNWOOD PARK BORING LOGS.GPJ GEO HYDRO.GDT 7/22/20

P-9

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Lynwood Park Improvements**		Project No: **200383.20**
Location: **Brookhaven, Georgia**		Date: **6/29/20**
Method: **HSA- ASTM D1586**	GWT at Drilling: **19 feet**	G.S. Elev: **936**
Driller: **Georgia Contract Drilling**	GWT at 24 hrs: **Cave at 20 feet**	Logged By: **LS**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
935	0			Firm red-brown clayey fine to medium sand (SC) (FILL)	20
	5			Firm to stiff gray fine sandy silt (ML) (FILL) with rock fragments, plastic, mulch, burnt wood	9
930					11
	10				13
925					
	15				13
920					
	20	▽			5
915					
	25			Very stiff gray fine sandy silt (ML) (RESIDUUM)	17
910				Boring Terminated at 25 feet	
	30				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD LYNWOOD PARK BORING LOGS.GPJ GEO HYDRO.GDT 7/22/20

P-10

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Lynwood Park Improvements**		Project No: **200383.20**
Location: **Brookhaven, Georgia**		Date: **6/29/20**
Method: **HSA- ASTM D1586**	GWT at Drilling: **Not Encountered**	G.S. Elev: **936**
Driller: **Georgia Contract Drilling**	GWT at 24 hrs: **Cave at 22 feet**	Logged By: **LS**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
935	0			Stiff red-brown and black silty fine sand (SM) (FILL)	15
	5			Stiff to very stiff gray fine sandy silt (ML) (FILL) with rock fragments, brick, mulch, burnt wood	13
930					14
	10				15
925					
	15				9
920					
	20				11
915					
	25			Boring Terminated at a 25 feet	6
910					
	30				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD LYNWOOD PARK BORING LOGS.GPJ GEO HYDRO.GDT 7/22/20

P-11

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Lynwood Park Improvements**		Project No: **200383.20**
Location: **Brookhaven, Georgia**		Date: **6/29/20**
Method: **HSA- ASTM D1586**	GWT at Drilling: **21 feet**	G.S. Elev: **936**
Driller: **Georgia Contract Drilling**	GWT at 24 hrs: **Cave at 22 feet**	Logged By: **LS**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
935	0			Firm red-brown clayey fine sand (SC) (FILL)	19
	5			Stiff gray fine sandy silt (ML) (FILL) with wood, rock fragments	15
930					10
	10				11
925				Very stiff tan and gray fine sandy silt (ML) (RESIDUUM)	
	15				17
920					
	20	▽			17
915					
	25			Boring Terminated at 25 feet	17
910					
	30				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD LYNWOOD PARK BORING LOGS.GPJ GEO HYDRO.GDT 7/22/20

P-12

Test Boring Record

GEO HYDRO ENGINEERS

Project: **Lynwood Park Improvements**		Project No: **200383.20**
Location: **Brookhaven, Georgia**		Date: **6/29/20**
Method: **HSA- ASTM D1586**	GWT at Drilling: **22 feet**	G.S. Elev: **936**
Driller: **Georgia Contract Drilling**	GWT at 24 hrs: **Cave at 23 feet**	Logged By: **LS**

Elev. (Ft)	Depth (Ft)	GWT	Symbol	Description	N
935	0			Firm red-brown and gray clayey fine to medium sand (SC) (FILL)	13
	5			Stiff to very stiff dark gray fine sandy silt (ML) (FILL) with mulch, rock fragments, brick	13
930					15
	10				17
925				Firm dark gray fine sandy silt (ML) (FILL) with burnt wood	
	15				8
920				Stiff tan and gray to white fine sandy silt (ML) (RESIDUUM)	
	20	▽			9
915					
	25			Boring Terminated at 25 feet	19
910					
	30				

Standard Penetration Test (Blows/Foot)

0 10 20 30 40 50 60 70 80 90 100

Remarks:

TEST BORING RECORD LYNWOOD PARK BORING LOGS.GPJ GEO HYDRO.GDT 7/22/20